



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°700191



## Safeguarding Cultural Heritage through Technical and Organisational Resources Management

### D7.3: Implementation of the collaboration and knowledge sharing infrastructure and tools

#### STORM Project

H2020- DRS-11-2015: Disaster Resilience & Climate Change

Ethical/Societal Dimension Topic 3: Mitigating the impacts of climate change and natural hazards on Cultural Heritage sites, structures and artefacts

Grant Agreement n°: 700191

Start date of project: 1 June 2016

Duration: 36 months

Document. ref.: D7.3: Implementation of the collaboration and knowledge sharing infrastructure and tools/ENG/WP7/v1.0



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<b>PROGRAMME NAME:</b>	<b>DRS-11-2015</b>
<b>PROJECT NUMBER:</b>	<b>700191</b>
<b>PROJECT TITLE:</b>	<b>STORM</b>
<b>RESPONSIBLE PARTNER:</b>	Engineering – Ingegneria Informatica S.p.A.
<b>INVOLVED PARTNERS:</b>	
<b>DOCUMENT NUMBER:</b>	D7.3
<b>DOCUMENT TITLE:</b>	Implementation of the collaboration and knowledge sharing infrastructure and tools
<b>WORK-PACKAGE:</b>	WP7
<b>DELIVERABLE TYPE:</b>	Demonstrator
<b>CONTRACTUAL DATE OF DELIVERY:</b>	M32
<b>LAST UPDATE:</b>	7 <sup>th</sup> March 2019
<b>DISSEMINATION LEVEL:</b>	PU

**Dissemination level:**

**PU** = *Public*,

**CO** = *Confidential, only for members of the STORM Consortium (including the Commission Services)*

## Document History

Version	Date	Status	Authors, reviewer	Description
v.0.1	19/10/2018	Draft	ENG	Table of contents definition and document structure
v0.2	11/01/2019	Draft	ENG	First Draft
v0.3	17/01/2019	Draft	ENG	Improvement of section 1
v0.4	25/01/2019	Draft	ENG	Improvement of section 2 – Collaborative Services
v0.5	11/02/2019	Draft	ENG	Improvement of section 2 – Operative Services
v0.6	19/02/2019	Draft	ENG	Executive Summary and Conclusion
v0.7	20/02/2019	Ready for review	ENG	Internal review by ENG and ready for peer review
v0.8	26/02/2019	Draft after peer review	TRO	Results from TROIA peer review
v0.9	27/02/2019	Draft after peer review	NCRS	Results from NCRS peer review
v1.0	07/03/2019	Final	ENG	Final version readu to be submitted

## **Definitions and Acronyms**

<b>Acronyms</b>	<b>Description</b>
CH	Cultural Heritage
CWE	Collaborative Working Environment
DRM	Disaster Risk Management
HVAC	Heating, Ventilation and Air-Conditioning
ICTs	Information and Communication Technologies
IT	Information Technology
KMS	Knowledge Management System
OWE	Operational Working Environment

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## **Executive Summary**

This deliverable provides the description of the prototype implementation of the collaborative framework defined in *T7.1 - Collaboration and knowledge-sharing services and tools*. In particular, the deliverable explains in detail, and from a practical point of view, the result of the work done in task *T7.1*. The effective approach and the steps followed for the implementation of the collaborative framework along with the set of collaborative and operative services are illustrated. In this deliverable, each service is described in terms of its functionalities and graphical layout, considering the previous work done in *D7.1 - Collaboration and knowledge-sharing infrastructure definition* and *D7.2 - Definition of Knowledge Sharing Tools* where a first mock-up of these services has been provided.

The deliverable consists of the following sections:

- Section 1 reports the importance of a *Collaboration and Knowledge-Sharing Framework*. It is fundamental to develop a framework able to manage knowledge and, most specifically, to foster knowledge creation and sharing in order to be innovative, more effective, and more efficient. In this perspective, knowledge sharing plays a central role during disasters, allowing the access to and availability of critical information regarding heritage risks and disasters. In the context of STORM, the proposed dashboard vectored through technology is expected to enhance collaboration, co-ordination and support decision making among stakeholders. This will be a result of having faster access to information and knowledge, increasing the chances of having the right people making better/more informed decisions in disaster situations.
- In Section 2, the *STORM Collaborative Decision-Making Dashboard* is presented, along with the set of *Collaborative and Operative Services*. The *collaborative services* encourage, capture, and organise free and open interaction among actors to create and exploit the collective knowledge. These services support several actions and operations related to information and knowledge management, offering a set of customisable features. The *operative services* support decision making in extreme or high-pressure environments, establishing necessary and useful functionalities for representing the critical situation and providing information for decision-making support. Specifically, they assist decision makers to enhance their understanding and ability to manage a critical situation in a collaborative manner. Users need to make informed and consensual decisions, working together and sharing information and, therefore, different services are provided. For each service, all the functionalities, the graphical layouts and the specific user interactions are described in detail.

## 1 Collaboration and Knowledge Sharing Infrastructure

The ICT revolution along with the spread of different and faster channels have become important drivers to disseminate knowledge and information. In this changing landscape, knowledge is considered one of the most valuable assets, able to generate growth and competitive advantage. The current world is increasingly supported by a knowledge-based economy, where technological, economic, political, social and cultural changes strongly impact the nature of human relationships. According to Martensson (2000), in a knowledge-based economy, having access to the right data at the right time is viewed as a prerequisite for higher productivity and flexibility. To maintain a leading position, all available knowledge must be utilised. For this reason, it is fundamental to develop a framework able to manage knowledge and, more specifically, to foster knowledge creation and sharing in order to create economic and social value, to remain innovative and perform better, to be updated and to enhance sustainability (Carrizo Moreira and Zimmermann 2012). Managing knowledge involves both the process of knowledge creation and of knowledge sharing, two opposite sides of the same coin, since knowledge is valuable if it is shared and knowledge sharing implies knowledge transformation and, therefore, creation of knowledge (Maimone 2018). Knowledge sharing constitutes the whole process of exchanging knowledge regarding information, skills or expertise through people, communities or organisations (Pardalis and Xygkogianni 2014). It is an intrinsically human and cooperative process, directly related to the environment's features that must be conducive to collaboration. Knowledge culture is guided by knowledge transfer, because knowledge becomes ineffective if not used or shared (Bolisani and Handzic 2018).

Knowledge sharing is fundamentally about people, not technology. But, in order to share knowledge effectively, *Information Technology* (IT) plays a new revised role. Specifically, IT support can be classified into the use of proper repository for storing and sharing knowledge and the use of channels for communicating and facilitating the sharing of knowledge among individuals. As for the first approach, IT can be used to capture knowledge, categorise, search, subscribe relevant content or information and present it in more meaningful formats across multiple contexts of use. In the second approach, IT-based systems such as intranets, web portals, groupware, video-conferencing, wikis, blogs, etc., can be used to support interactions, direct communication and contact amongst individuals. The creation of a favourable environment for communication, collaboration, knowledge sharing and transfer has become essential and technology plays a crucial role and is a key part of this changing environment. A key element in order to be ahead in today's knowledge economy and that, at the same time, enables the knowledge process is technology. The current innovations in Information and Communication Technologies (ICTs) facilitate activities involving knowledge exchanges among people and organisations (Bolisani and Handzic 2018). With the development of new technologies, new forms of interaction and collaboration along with the use of various collaborative tools have spread. Although IT plays an important role in facilitating the flow of knowledge, it should support knowledge processes. Upon the implementation of these tools, taking advantage of novel technologies, the access to information will become much easier, cheaper and more efficient (Hassandoust and Kazerouni 2011). New technologies are suitable for increasing communication channels within the same organisation or among groups of people. Information technology has improved the effectiveness of information transfer.

Moreover, the concepts of knowledge sharing, networking and collaboration are considered key strategic priorities. A collaborative environment allows to bring together people and organisations along with information and knowledge resources; to coordinate complementary competences; and to exploit synergies (Dalkir 2019). In order to be really effective, the implementation of a collaboration and knowledge-sharing framework should be not confined to technology solely but has to foster the creation of an environment able to allow collaborative work. According to Hackbarth (1998) and Davenport and Prusak (1998), a Knowledge Management System (KMS) can support an organisation in planning for and dealing with crises

(Murray and Murali 2011). During a crisis, flexible structures are needed, and decisions have to be taken in a short time and under pressure. Information about disaster context is of valuable importance and knowledge sharing is a key process: all the people involved in a crisis need to collaborate and coordinate their efforts. It should be a critical need to gather and access critical real-time information and share knowledge resources in order to make fast and efficient decisions. This depends on efficient sharing and exchange of updated information by the involved stakeholders, enabling a shared and mutual situational awareness. Collaboration is a key aspect of every crisis management initiative. Moreover, crisis response management is a collaborative activity which requires a high level of cooperation among all the involved actors in order to face and recover from the risks of crisis and disasters events (Benali and Ghomari 2017).

## **1.1 The importance of Collaboration and Knowledge Sharing during disasters**

Frequency and magnitude of natural disasters has been steadily increasing in recent decades. The need to promptly face disasters, reduce risks, and develop a resilient infrastructure have become an increasing concern. A crisis occurs unpredictably and causes individuals and organisations to shift their focus immediately to deal with the situation. In this perspective, knowledge sharing plays a central role allowing, when required, the access to and availability of critical information regarding risks and disasters. Despite this, often, knowledge on disaster management seems to be fragmented due to the lack in knowledge sharing and coordination. According to Tatham and Spens (2011), knowledge management is generally seen as a strategy to collect, store and retrieve knowledge in a systematic way, and then distribute the results to those who need it in a timely manner. This means to have the right knowledge at the right time and in the right place. Anyway, a knowledge sharing process alone is not the solution because, during an emergency, the real actors are the people involved whose role is to make the best decision. Knowledge provides decision support in order to help people to make more informed decision. The lack of effective knowledge sharing on disaster management strategies can be identified as one of the major reasons behind the unsatisfactory performance levels of current disaster management practices. The lack of a continuous and efficient coordination among all the stakeholders involved in preserving and securing cultural heritage assets is one of the main concerns raised during crisis. All these highlight the importance of embracing knowledge management within the context of disaster management. After a disaster, information is the most valuable asset. Information is vital for early warning, planning, rehabilitation and reconstruction. Lack of information complicates the efficient management of catastrophes and makes the decision-making process a difficult task (Pathirage et al. 2014).

In the management of the disasters, traditional knowledge management systems may not offer the right support. In this regard, traditional approaches, characterised by hierarchy and centralisation, that often imply long response time and complex procedures, have to be replaced by decentralised emergency management systems. This change was especially fostered by the need to collaborate during all the phases occurring when extreme events and catastrophic disasters happen. Communication and decision-making during disaster must occur in a compressed timeline since faster than usual response is needed to stabilise dangerous situations, prevent further losses, and begin reconstruction. In particular:

- Activities performed during emergency are out of the ordinary or emergent;
- Resource constraints require new ways to think about existing responsibilities and functions;

- Knowledge availability varies more extremely than in normal situations and sometimes little information is available to make better informed decisions.

The dynamic environment of disasters needs co-operation and co-ordination. Collaborative emergency management requires a networked co-ordination, collaboration and partnerships in crisis, disaster and emergency. This means decentralised and flexible structures. Collaboration and knowledge-sharing is an important part for all the phases of the Disaster Risk Management (DRM) process. For a given DRM activity, there are often numerous stakeholders and one of the main challenges is to harness and share knowledge among all the parties involved to timely and effectively manage the situation. Based on the detected critical situations, all the involved and relevant stakeholders will need to collaborate and co-operate. Adequate disaster risk communication and management requires the collaboration of a variety of stakeholders including policy makers, practitioners and citizens. The communication of disaster risk is inherently a social process. It aims to prevent and mitigate harm caused by disasters, prepare the population for a disaster, disseminate information during disasters and nurture the recovery.

Crisis and disaster management requires the sharing of complex information among numerous entities and individuals. Information and knowledge are at the heart of disaster preparation, response, mitigation and recovery.

Indeed, decision-making efficiency, awareness of the situation, and taking advantage of the available knowledge resources depend upon a good communication and collaboration infrastructure among all the actors involved in crisis response. Making fast and efficient decisions needs supporting tools allowing a prompt situational picture and critical information sharing and this is based on the effective use and coordination of resources, people, and information, where information and knowledge are distributed. From this variety and large volume of data and information, decision makers need to obtain the most relevant and accurate ones, having a clear view of the situations in order to make the right judgments.

An effective toolbox with the aim to assist in responding to an emergency situation, supporting communications, data gathering and analysis, and decision making has a fundamental role in any DRM sector. The goals of such a system are to facilitate clear communications, improve collaboration among users, improve the efficiency and effectiveness of decision-making. A specific toolbox providing real-time information, valuable data, in order to quickly find and display knowledge relevant to the situation in a format that facilitates the decision maker in making decisions is a key tool (Murray 2006). For this reason, in STORM it was built a collaborative dashboard where, at any moment, the relevant actors can have a clear situational picture to better act in pre- and in post-impact phases, to mitigate the consequences of disasters caused by natural hazards.

In the context of STORM, the proposed tools vectored through technology are expected to enhance collaboration, co-ordination and to support decision making amongst stakeholders. Collaborative knowledge sharing will be advantageous to STORM by speeding up response times where the right people with the relevant skills are identified more quickly and disaster events dealt with in a timelier manner.

In the following section, some technical details about the implementation approach and the guidelines to be followed have been illustrated.

## 1.2 Front-end Implementation Requirements

The front-end is developed as a web interface, inside of the *STORM Collaborative and Decision-Making Dashboard*. From a technological point of view, it has been decided to work with HTML (standard mark-up language for creating web pages), CSS (for styling the look and pages presentation, including colours, layouts and fonts) and JavaScript (for handling

interactive effects). A development method used is *material design* by Google, a visual language that synthesises the classic principles of good design with the innovation of technology and science. Material design offers the user physical edges and surfaces to work with. However, it’s not simply a visual approach. With it comes an inherent implementation structure in the form of a front-end component library which draws from that design toolkit (Bergin and Gates 2019; Wikipedia 2019).

For the implementation of the collaborative and operative services, a standards-based technology for incorporating the applications into Liferay Portal<sup>1</sup>, namely *Portlet*, has been used. The portlets can be written using any of the Java web frameworks that support portlet development, including Liferay’s MVC Portlet framework. The STORM Dashboard portlets are deployed on a customised instance of the Liferay. The STORM proposed solution aims to focus on adapting reusable, versatile, customisable and open source social software rather than developing a new closed/proprietary solution.

The target users for these services will mainly be domain experts and site managers. In particular, specific Role Management rules have been defined. Each role has specific associated permissions to visualise or update contents. Specific actors and roles have been defined and are shown in Table 1:

**Table 1: STORM dashboard main actors and roles**

Main actors	
Actors	Profiles description
Site team	Types of profiles: Site manager, Manager, Area manager, Expert These profiles have the possibility to view and interact
First responders	N types of profiles to be involved These profiles have the possibility to view and interact
Rescue team	Types of profile: Team leader, Expert, Operator These profiles have the possibility to view and interact
Professionals	N types of profiles to be involved These profiles have the possibility to view and interact
Others	N types of profiles to be involved
Administrators	2 types of profile: Main administrators, Local administrators

For more technical detail, please refer to *Deliverable 7.1 – Collaboration and knowledge-sharing infrastructure definition, section 1.2 – Platform technical features*.

<sup>1</sup> <https://www.liferay.com/it/solutions>

## 2 STORM Collaborative Decision-Making Dashboard


The current knowledge sharing practices and how information is shared and coordinated during disasters in all STORM pilot sites have been described in order to improve the current understanding of knowledge sharing in Disaster Risk Management (DRM), since knowledge sharing is seen as one of the essential success factors for a DRM initiative. Knowledge sharing plays a crucial role during all the phases of disaster and represents a fundamental tool to share information, practices, ideas, etc., making certain that precise and dependable information will be readily available when needed.

There is however a need for a knowledge sharing platform that promotes an engagement between all the stakeholders of the cultural heritage domain, for a more extensive and regular communication. As a result, tools and services to support and stimulate the usage, sharing and creation of knowledge to promote collaboration, coordination and to improve and support collaborative decision making have been implemented.

The STORM dashboard aims to be the enabler (and at the same time supportive) tool for the development of a collaborative environment characterised by:

- The presence of many stakeholders who actively collaborate;
- The adoption of social collaboration models based on the development of collective intelligence, on transparency, on the concept of communities;
- Collaborative decision-making requirements.

The approach, based on collective intelligence, aims at integrating explicit knowledge (that is, directly represented by users in a structured way) with the implicit one (the one inserted by them in typically unstructured content (blogs, wikis, communities, etc.) and to the contextual extraction, derivation, determination of new knowledge. STORM proposes an integrated solution, namely the *STORM Collaborative Decision-Making Dashboard*, where collaborative and operational environments are strongly interconnected to each other. Existing knowledge (e.g. best practice, guidelines, lessons learnt, operative procedure and processes, etc.) related to natural disaster risk and impact can help in making the decisions and new knowledge (e.g. from the situational picture, risk assessment and data analytics) can be shared by the team of experts, in order to identify the best and most urgent recovery needs<sup>2</sup>. In the *STORM Collaborative Decision-Making Dashboard*, the *collaborative* and *operational environments* are strongly interconnected. The set of services and tools belonging to the respective environments supports the knowledge sharing, the coordination of involved stakeholders, and the decision-making process. The *STORM Collaborative Decision-Making Dashboard* provides a quick view of the main parameters coming from a systematic analysis, assessment of data and facts, according to the user's interests and needs. The opportunity to have a customisable and ready dashboard, mapping the current situation in a synthetic way and gathering the most relevant information, is an imperative for supporting efficient and effective decision making.

The first step to access to the *STORM Collaborative Decision-Making Dashboard* is to insert the log-in information, namely the “Screen name” and the “Password” and click on the  button, as shown in the following Figure 1:

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<sup>2</sup> D7.2 – Definition of knowledge-sharing tools



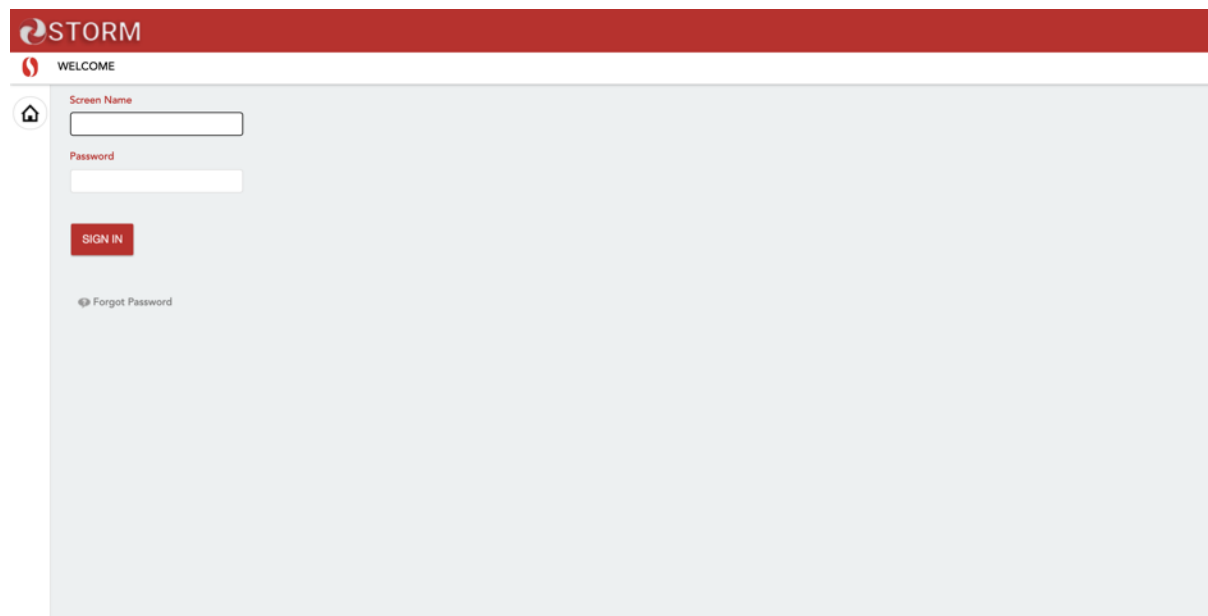


Figure 1: STORM Collaborative Decision-Making Dashboard - Log-in screen

Figure 2 shows the *STORM Collaborative Decision-Making Dashboard* main home page, underlining the specific collaborative and operative services coming from the two interconnected environments.

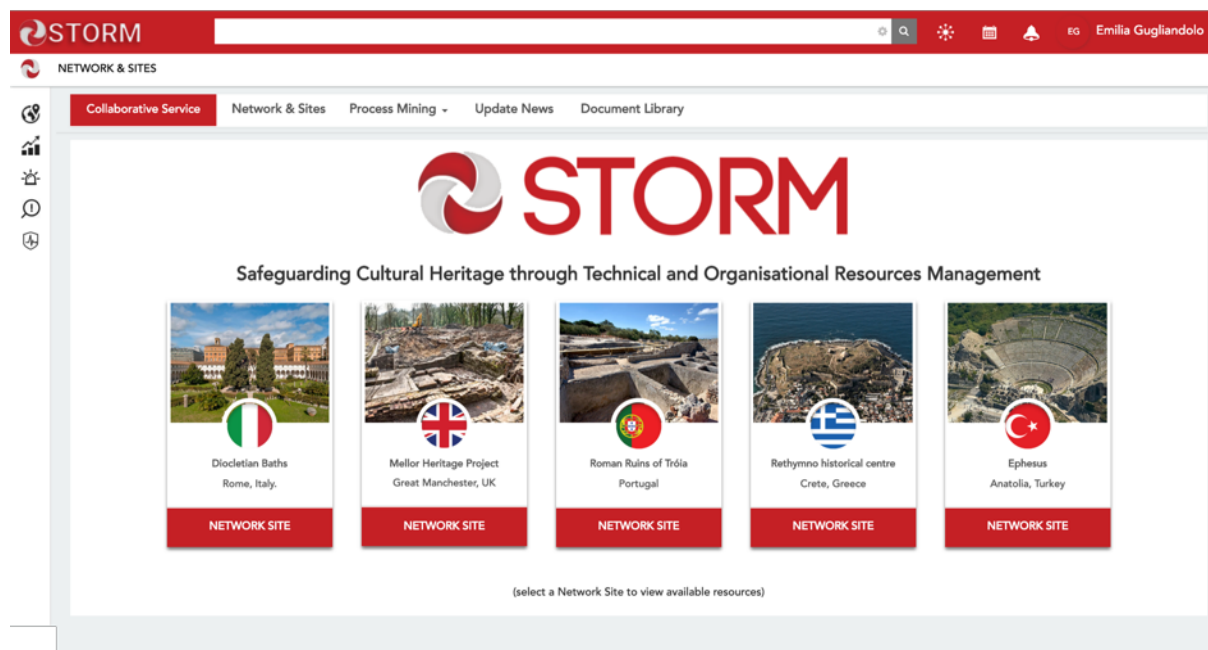


Figure 2: STORM Collaborative Decision-Making Dashboard - Home page

In particular, the collaborative services are on the top of the dashboard, namely *Network & Site*, *Process Mining*, *Update News* and *Document Library*, along with the *User Profile* and the *Semantic Search*. The operative services are on the left side, namely *Sensory Map*, *Visual Analytics*, *Event Manager*, *Risk Assessment* and *Situation Awareness*. In order to start to use all the dashboard services, it is fundamental to choose a reference site. For the time being, each user only has access to its own site.

In the following paragraphs, collaborative and operative services along with their respective environment are described in detail.

## **2.1 Collaborative services**

The basic principle of collaborative work is the concept of a working group, a set of individuals interacting with each other with some regularity, in the knowledge of being dependent on each other and sharing the same goals and tasks, in which each has a specific and recognised role, based on the circularity of communication. The *Collaborative Working Environment (CWE)* provides a set of services that encourage, capture, and organise free and open interaction among actors to create and exploit the collective knowledge. These services support several actions and operations related to information and knowledge management (e.g., creation, research and extraction, organisation and analysis, interaction), offering a set of customisable features. Specifically, a set of collaborative services is provided in order to enable the CH and emergency stakeholders to collect, contribute and share data and information as well as the knowledge on the potential threats, vulnerabilities, risks, along with the actions to be performed to manage, in a suitable way, the critical situation when it occurs, putting in the loop both their own experience and skills.

The purpose of collaborative services is to facilitate the management of information and content within the users through:

- Collaboration
- Communication
- Sharing
- Interaction

The available data and information related to the disaster (threats, vulnerabilities and risks) and how these have to be managed (operative procedures and processes, best practice, lessons learnt, etc.) are collected, managed and shared among different community stakeholders (emergency operators, first responders, citizens, public authorities, etc.). Knowledge sharing implies interaction and exchange of information and experiences, enabling the establishing of a virtuous mechanism of using, re-elaborating and releasing new knowledge that becomes a valuable asset for decision-making processes. One of the objectives of the STORM platform is to support users in carrying out part of their daily activities and their work.

The specific *Collaborative and Knowledge Sharing services* featured in the collaborative environment and, described in the following paragraphs, are:

- *User Profile;*
- *Semantic Search;*
- *Network & Site;*
- *Process Mining;*
- *Update News;*
- *Document Library.*

### 2.1.1 User Profile

Every user registered on the platform has its own profile and assigned roles. Moreover, the user can only access a specific site he/she belongs to. The *User profile* gives each user a complete visibility into how other users manage knowledge and their activities. Moreover, it shows the user's relevant roles and responsibilities, so that each user knows who is responsible for each relevant area, procedure and task. The type of users and the level of involvement and interaction in the platform depend on the users' respective roles and responsibilities in a certain process management area. Figure 3 shows the User Profile service, along with all the information provided for a specific user:

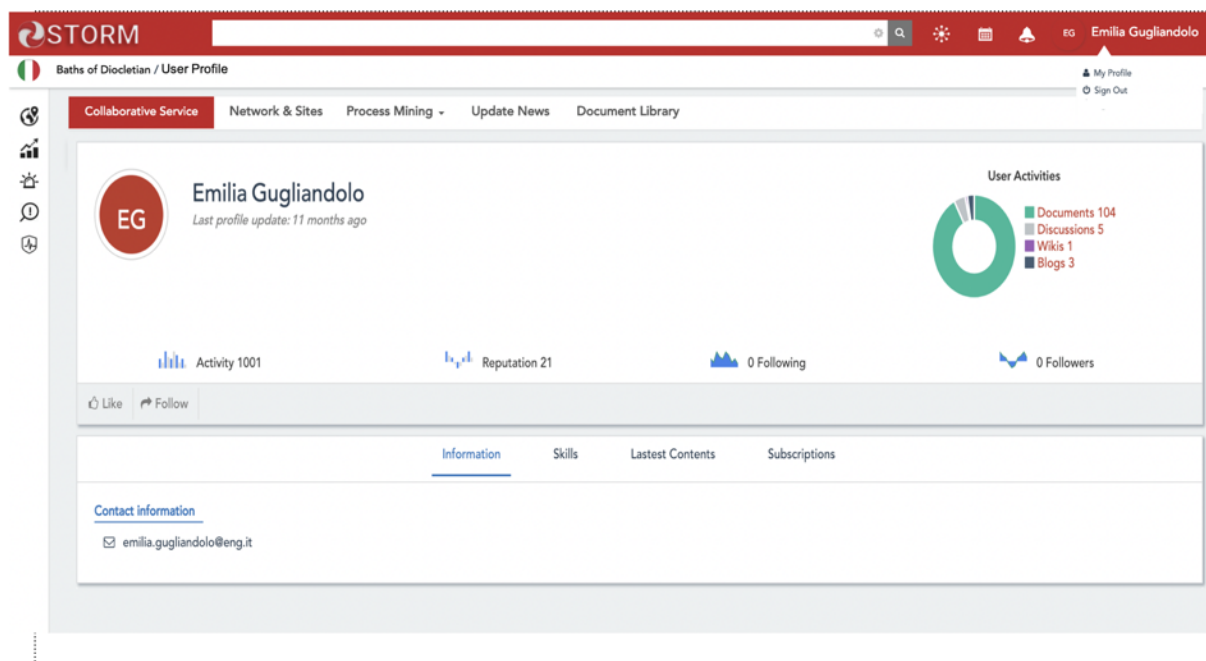


Figure 3: User Profile service

### 2.1.2 Semantic Search

The *Semantic Search* service is a functionality featured as an intelligent information retrieval. This approach tries to understand the intent and the context around a query, in order to retrieve the most pertinent resources, related to the particular information request<sup>3</sup>. It delivers the user a better match to queried content and information. Different knowledge and information are uploaded by users in the Document Library service and, using the Semantic Search, it will be easy to find the right knowledge. For this reason, a fast, efficient, simple, configurable and intuitive search and retrieval service is required in order to retrieve and find such information. Figure 4 shows the Semantic Search services found on top of the STORM Dashboard:



Figure 4: Semantic Search Service

<sup>3</sup> <https://ontotext.com/semantic-search-the-paradigm-shift-from-results-to-relationships/>

It is possible to visualise the recent searches using the option “My Search History”, as shown in Figure 5:

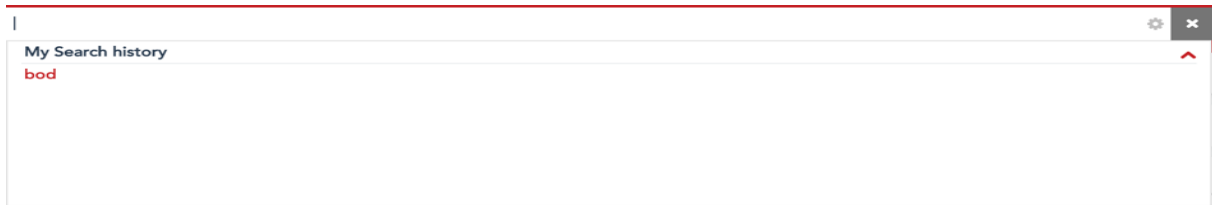


Figure 5: Semantic Search service - My Search history

Moreover, it is possible to type the content needed and the service shows all the connected results (Figure 6):

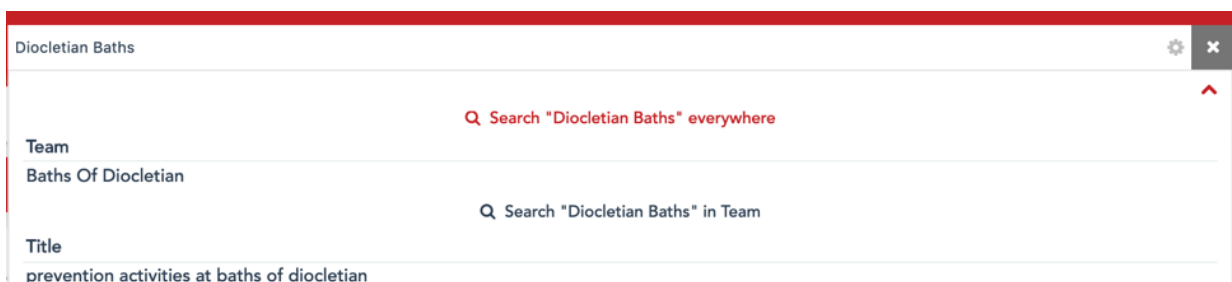


Figure 6: Semantic Search service - Search results 1/2

While, if it is needed a specific resource, typing the word in the search box and clicking on search, the results are visualised (Figure 7):

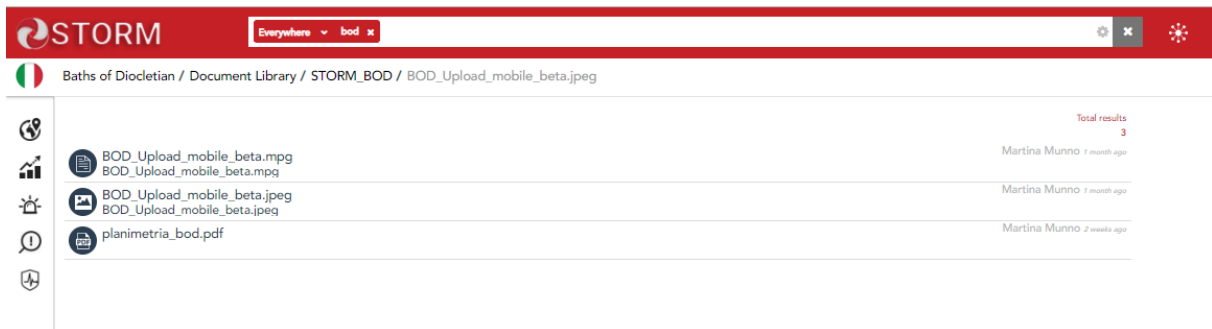


Figure 7: Semantic Search service - Search results 2/2

The service is able to identify, process and, if necessary, store existing relationships among all the available information in order to deliver aggregated results, expose and motivate the link between the user query and the proposed results, enrich the results suggesting, in addition to textual and multimedia resources, people, team, skill, etc., available in the platform. By definition, semantic search reaches out beyond keywords and seeks to understand the semantics of the search query. It improves search accuracy by looking at both data and their connections<sup>4</sup>.

<sup>4</sup> <http://treparel.com/built-on-kmx/technical-benefits-kmx>


Moreover, clicking on the  “Search Configuration” button, it is possible to choose some configuration parameters to set up for the search, using the Search Configuration panel (Figure 8):

Figure 8: Semantic Search service - Search Configuration panel

### 2.1.3 Network & Sites

The *Network & Site* (Figure 2) is a way to organise activities among all the members belonging to the same site. The Network & Sites service is the first appearing after the log-in in the dashboard. Each user has to choose a specific site in order to be able to use all the dashboard services.

Each *Network & Site* item represents a private area in which users are able to share documents, news, and activities related to a particular site. Moreover, all the dashboard services are related to that site. The following Figure 9 represents the main page of the Italian site (Diocletian Baths):

Figure 9: Network & Sites - Baths of Diocletian

When accessing a particular site, all the collaborative and operative services are available. The documents and all the activities performed in a specific site are not available to those users who are not part of it. In this way, it is possible to avoid sharing of data and/or activities with unwanted receivers.

#### **2.1.4 Process Mining**

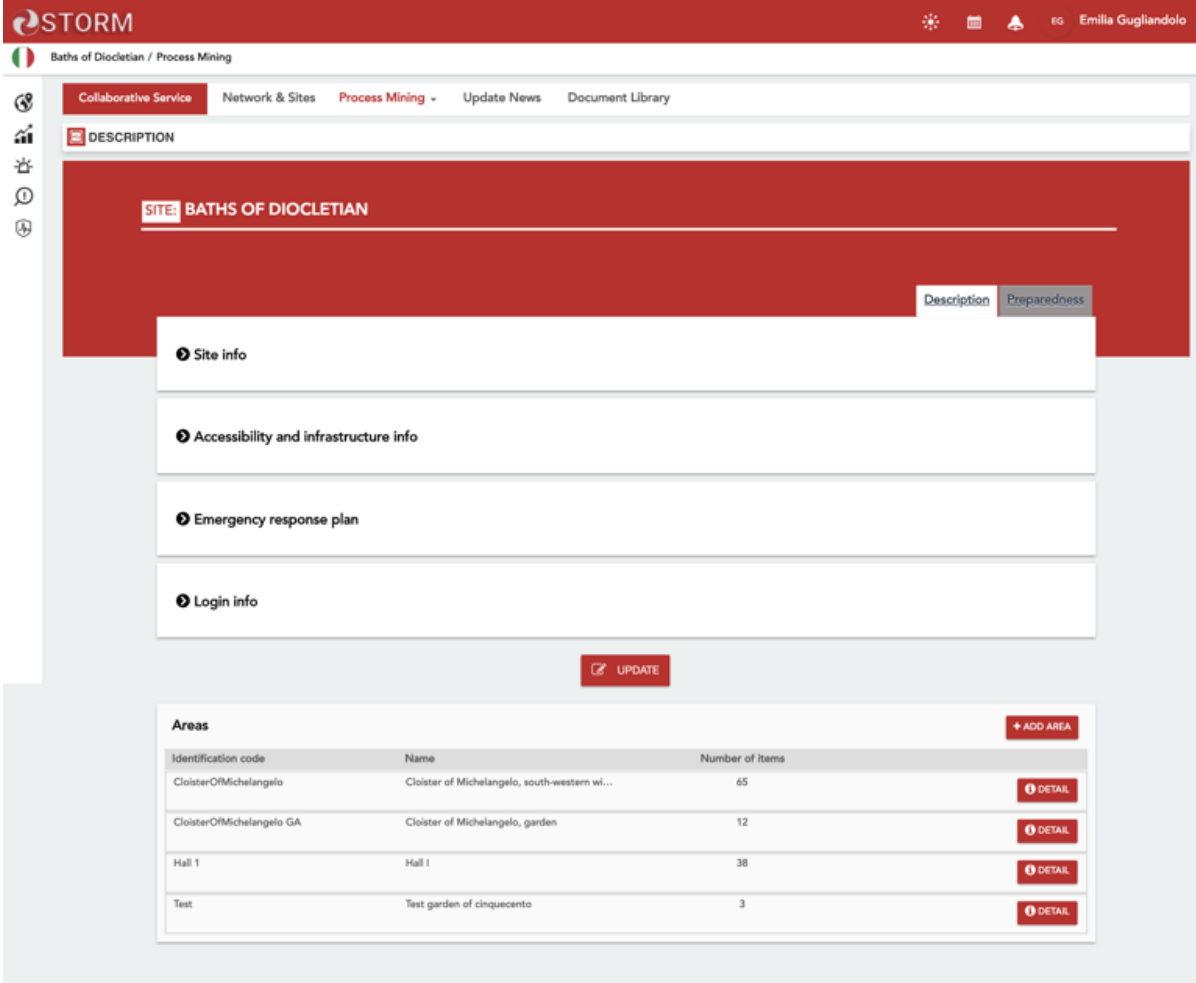
The STORM *Process Mining* collaborative service supports site managers and CH professionals during the STORM Quick Assessment process, covering both the phases of feeding and using the system, before and after a disaster. The STORM Quick Assessment process consists of some fundamental phases, as described in *D7.1 – Collaboration and knowledge-sharing infrastructure definition* and *D6.6 – STORM Damage Assessment and Decision Support Services*. The Process Mining service supports all STORM Quick Damage Assessment process phases through the use of specific forms, namely *Description* and *Preparedness* (including) forms. All forms are available at three different levels: Site, Area and Item. The following sections illustrate the forms used in the Process Mining service, here already filled, for the convenience of the reader.

##### **2.1.4.1 Description Forms**

The first STORM Quick Assessment process procedural phase, namely *Data Collection*, means the gathering of all the data to be entered in the system. The system is fed with all the relevant data and information useful to build a database containing detailed multimedia knowledge concerning the site of interest, such as historical and technical data, and material details at three different levels: site, area and item. In STORM, the *Description* forms give all the basic information required for future decisions. These data, in accordance with the required fields in the forms for each Site, Area and Item, are stored in the dashboard knowledge base.

## Site Description

A standard set of forms are filled in order to collect key data related to each site. The *Site Description* form allows adding general information regarding the site, as showed in Figure 10:



The screenshot shows the STORM web interface for the 'Baths of Diocletian / Process Mining' site. The main content area is titled 'DESCRIPTION' and contains a red header with 'SITE: BATHS OF DIOCLETIAN'. Below this, there are four expandable sections: 'Site info', 'Accessibility and infrastructure info', 'Emergency response plan', and 'Login info'. At the bottom of these sections is an 'UPDATE' button. Below the sections is an 'Areas' table with the following data:

Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western w...	65	DETAIL
CloisterOfMichelangelo GA	Cloister of Michelangelo, garden	12	DETAIL
Hall 1	Hall I	38	DETAIL
Test	Test garden of cinquecento	3	DETAIL

Figure 10: Site Description Form

The form is organised in the following sections:

- *Site information*: this section allows to add (i) photographs of the setting, aerial situation, as well as relevant documents; (ii) brief information about the type, features, complexity of the site, and geographical information (country, region and so on).
- *Accessibility and infrastructural info*: information useful to provide a description of the accessibility of the site, describing the means to reach the place in case of emergency, the number of entrances, a geographical location and so on. Moreover, specific information related to the technical features and service points such as the water, gas, mobile data and wi-fi coverage availability are provided.
- *Emergency response plan*: information related to the existence of monitoring, risk assessment and/or response plans in place.
- *Login info*: information about the author of the form.

At the end, a list of the identified Areas for the Site is available. The following Figure 11 and Figure 12 show the *Site Description* form details for a specific site (the Baths of Diocletian):

STORM

Baths of Diocletian / User Profile

Collaborative Service | Network & Sites | Process Mining | Update News | Document Library

PROCESS MINING

SITE: BATHS OF DIOCLETIAN

Select Site

Description | Preparedness | First Aid

Site Info

UPLOAD IMAGES AND DOCUMENTS

SELECT A REPRESENTATIVE IMAGE

DELETE

ID BOD	Name Baths of Diocletian	Type Complex
Number of areas 3	Protection grade .	Property Central government
Country Italya	Region Lazio	City Rome
Province/District RM	Postal code 00185	Address Viale Enrico De Nicola
Number of buildings/structures 3	Institution Museo Nazionale Romano	Description Museo Nazionale Romano
Site manager Anna De Santis	Main contact Francesca Boldrighini	Phone .
Current use Monument	Use Partially used	Context Urban Centre

Figure 11: Site Description Form – Details #1



Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western wing	65	<a href="#">DETAIL</a>
CloisterOfMichelangelo.GA	Cloister of Michelangelo, garden	12	<a href="#">DETAIL</a>
Hall 1	Hall I	38	<a href="#">DETAIL</a>

Figure 12: Site Description Form – Details #2

The form allows to load a representative photo, to insert and visualise data relating to the location of the site, and data relating to site contacts. Furthermore, the form allows to insert data regarding the accessibility of the site and the available infrastructures. Then, there is a section of the form showing information about the sensors installed in the site. There is also the possibility to load some important documents and maps. Each form ends with compilation info, i.e. data and author.

Compilation notes have been developed to guide the experts through the compilation of the implemented forms. In the following Table 2, for each field in the left column, a description of its meaning is reported on the right. If the value of the field has to be chosen among the values of a list, these possible values are reported.

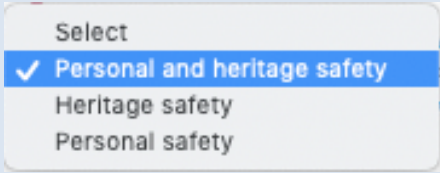
Table 2: Compilation notes for the Site Description Form


FIELD	COMPILATION NOTES FOR THE SITE
<b>Site Info</b>	
<b>Upload images and documents</b>	From this section it is possible to upload images and documents related to the specific site. The uploaded material will be saved in the Document Library.
<b>Select a representative image</b>	It is possible to choose <u>one</u> representative photo of the site

<b>ID</b>	Short unique identification code assigned by the owner/ responsible of the site, or given by the CH authority; can refer to an institutional code, and if it does not exist a new code can be proposed.
<b>Name</b>	Common full name of the site
<b>Type</b>	Information on the ensemble of the site: Complex: e.g. a church, the nearby bell tower and the convent make up the complex Single: e.g. just the church
<b>Number of Areas</b>	Number of areas in which the site will be divided for risk analysis management.
<b>Protection grade</b>	Highest designation/heritage listing grade of the site in national, regional or local inventories.  Open field to record the highest designation/heritage listing grade of the site in national, regional, municipal/local and/or other inventories, e.g. UNESCO World Heritage list, as restrictions are different for each case
<b>Property</b>	Public, Private, Public-Private Partnership
<b>Country</b>	
<b>Region</b>	
<b>City</b>	
<b>Province/District</b>	
<b>Postal Code</b>	
<b>Address</b>	
<b>Number of buildings/structures</b>	Number of structurally independent buildings that make up the site
<b>Institution</b>	This is where the management institution should be filled (in some cases, specially when it is public, it might be the same as Property)
<b>Description</b>	Open field intended for description about the architectural features; short synthetic historical information of the entire site, etc.
<b>Site Manager</b>	Name of the person
<b>Main Contact</b>	Name of the person to be contacted in case of emergency
<b>Phone</b>	Phone number of the Main Contact

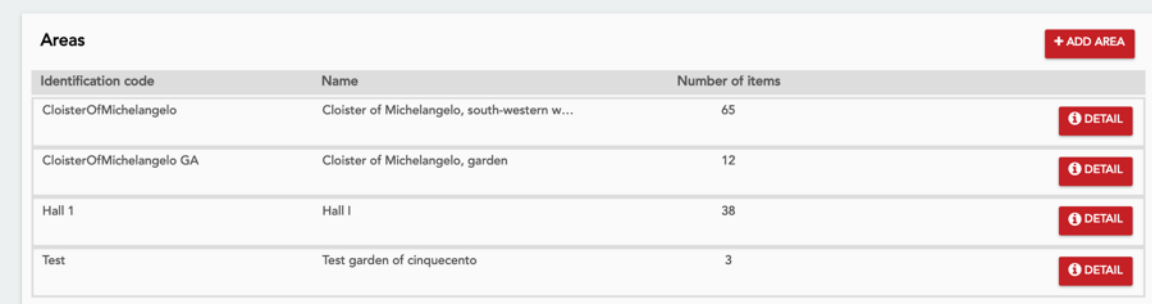
<p><b>Current use</b></p>	<div data-bbox="485 219 896 855" style="border: 1px solid #ccc; padding: 5px;"> <p>Select</p> <ul style="list-style-type: none"> <li>Antiquarium</li> <li>Archaeological site</li> <li>Archive</li> <li>Art gallery</li> <li>Cultural park</li> <li>House</li> <li>Library</li> <li>Lodging place</li> <li>Military place</li> <li><input checked="" type="checkbox"/> Monument</li> <li>Museum</li> <li>Office</li> <li>Religious building</li> <li>Service place</li> <li>Shopping centre</li> <li>University</li> <li>Warehouse</li> </ul> </div>
<p><b>Use</b></p>	<div data-bbox="485 882 932 1061" style="border: 1px solid #ccc; padding: 5px;"> <p>Select</p> <ul style="list-style-type: none"> <li>Not used</li> <li><input checked="" type="checkbox"/> Partially used</li> <li>Used</li> </ul> </div> <p>Refer to the use of the place at the time of compilation; these data are useful to recognise the place after a disaster.</p>
<p><b>Context</b></p>	<div data-bbox="485 1173 896 1738" style="border: 1px solid #ccc; padding: 5px;"> <p>Select</p> <ul style="list-style-type: none"> <li>Agricultural area</li> <li>Coastal area</li> <li>Fluvial/Lake bed</li> <li>Hill/Slope</li> <li>Industrial area</li> <li>Lagoon</li> <li>Marine area</li> <li>Mountain</li> <li>Other</li> <li>Out of town isolated area</li> <li>Suburban area</li> <li>Swamp</li> <li>Underwater</li> <li><input checked="" type="checkbox"/> Urban Centre</li> <li>Valley</li> </ul> </div> <p>This information is useful to provide a description of the geographical quality of the site</p>
<p><b>Accessibility and Infrastructure info</b></p>	
<p><b>Pedestrian entrance</b></p>	<p>Short description of the site pedestrian accesses: number of entrances and a geographical location. The field is open, but it is necessary to be succinct.</p>

<b>Emergency vehicle entrance</b>	Open answer field. Describe the entrance for all kinds of vehicles, give the number of entrance and the location. Provide all useful information that could facilitate and/or restrict the arrival of the emergency services.
<b>Car park</b>	Describe it, give the number and location of specific areas
<b>Special emergency vehicles</b>	The space is free, but it is necessary to be succinct. It is useful to provide information of the site; in particular related to the access of special vehicles describing the means to reach the place of emergency, the number of entrances a geographical location.
<b>Fluvial dock</b>	Open answer field. Provide useful information if the access route is navigable (of a waterway or sea) by ships or boat and if near the area or site there is a dock
<b>Maritime dock</b>	Open answer field. Provide useful information if the access route is navigable (of a waterway or sea) by ships or boat and if near the area or site there is a dock
<b>Heliport</b>	Open answer field. Provide useful information regarding position and/or relevant features on existing or potential helicopter landing areas.
<b>Heavy vehicles entrance</b>	Open answer field for the description, number and location of entrances, as well as useful information regarding to characteristics of vehicles
<b>Possible obstacles</b>	Describe briefly what can hinder the access (for example, an electric gate or a narrow passageway or even locked areas)
<b>Water</b>	For specific information related to technical characteristics, service points and/or maps of the piping system. Retrievable from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>Gas</b>	For specific information related to the technical characteristics, service points or maps of the pipes, cables, etc. Retrievable from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>Mobile data coverage</b>	For information on 3G or 4G signal strength in the different areas of the site. This field comes from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>Wi-Fi coverage</b>	For information on technical features and signal-covered areas. This field comes from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>AC Power</b>	This field comes from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>Ethernet connection</b>	This field comes from Area Description Form and is automatically filled in. The areas you have selected “yes” appear listed in this section.
<b>Risk Plans</b>	
<b>Monitoring plan</b>	Yes or no. Related to the existence or not of a monitoring plan

<b>Site risk assessment report</b>	Yes or no
<b>Site included in a risk map</b>	Yes or no
<b>Emergency Response Plan</b>	Yes or no
<b>Risks addressed</b>	If any of the previous fields is marked 'Yes', then this field may be used to list the risks addressed by these plans, reports or maps.
<b>Focus of the Emergency plan</b>	 <p>Allows selecting the focus of the established emergency procedures.</p>
<b>Sensor nodes</b>	The available sensors for each area of the sites are showed. This information comes from Area Description Form where it is possible to attribute sensors to an area.

When the details have been filled in, you have to save the information by clicking on the  button on the bottom of the page.

For each site, different areas are identified. Specific forms are filled in for each identified area. It is possible to add a new area in the reference site, clicking on the specific button “Add Area”; to visualise a specific Area form clicking on the “Detail” button for the chosen area, as shown in Figure 13:






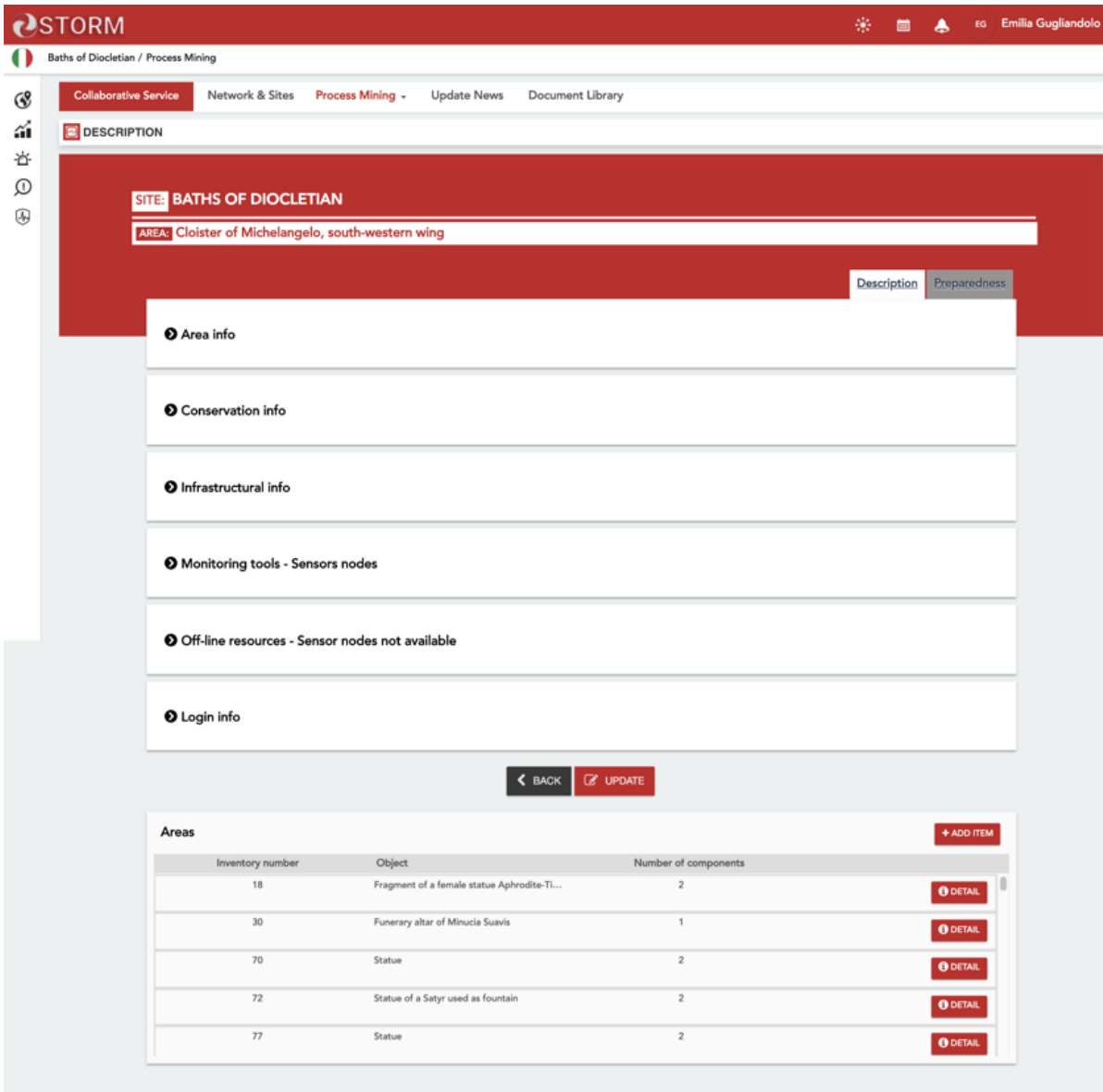
Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western w...	65	
CloisterOfMichelangelo GA	Cloister of Michelangelo, garden	12	
Hall 1	Hall 1	38	
Test	Test garden of cinquecento	3	

Figure 13: Site Description Form - Area details

### Area Description

*Area Description* form allows adding general information regarding the specific area as shown in the following Figure 14:



**SITE:** BATHS OF DIOCLETIAN

**AREA:** Cloister of Michelangelo, south-western wing

Description Preparedness

- Area info
- Conservation info
- Infrastructural info
- Monitoring tools - Sensors nodes
- Off-line resources - Sensor nodes not available
- Login info

BACK UPDATE

Inventory number	Object	Number of components	
18	Fragment of a female statue Aphrodite-Ti...	2	DETAIL
30	Funerary altar of Minucia Suavis	1	DETAIL
70	Statue	2	DETAIL
72	Statue of a Satyr used as fountain	2	DETAIL
77	Statue	2	DETAIL

Figure 14: Area Description Form

*Area Description* forms contain all the information related to each specific area, organised in the following sections:

- *Area info*: general information related to the specific area are provided in this section, such as a representative image that must refer exclusively to the area. This section gives a general picture along with area description, location and usage information.
- *Conservation info*: section about the conservation condition, including dates of restructuring or restorations done in past. This represents important information in order to know if previous interventions are too old. Moreover, an evaluation in terms of number of past hazardous events, considering the most relevant, identification of the main risks highlighted at the area level are provided.
- *Infrastructural info*: specific information related to the technical characteristics and service points in terms of water, gas, mobile data and wifi coverage availability etc. are provided.
- *Monitoring tools – Sensor nodes*: information related to the available sensors in the area.

- *Off-line resources*: information related to the available off-line sensors in the area.
- *Login info*: information related to author of the form.

At the end, a list of the available items identified within that area is shown. The following Figure 15 and Figure 16 show the *Area Description* form for the Baths of Diocletian site:

**Area info**

**Name**  
Cloister of Michelangelo, south-western wing

**Description**  
Portico of the south-western wing of the Michelangelo's cloister of the Certosa di Santa Maria degli Angeli

**Identification code**  
CloisterOfMichelangelo

**Items number**  
65

**Property**  
Central government

**Area reference contact**  
Francesca Boldrighini

**Main contact**  
Francesca Boldrighini

**When made**  
1565

**Typology**  
Monument

**Total area (mq)**  
350

**Setting isolation**  
Semiconfined

**Setting position**  
Partially covered/sheltered

**Location within the site**  
Center

**Current use**  
Museum

**Usage**  
Permanent

**Visitors**  
Medium

**Conservation info**

**Conservation conditions**  
Good

**Conservation description**  
TO BE FILLED BY CONSERVATOR

**Significant intervention date**  
06/11/2018

**Significant intervention description**  
TO BE FILLED BY CONSERVATOR

**Past events frequency**  
TO BE FILLED ----

**Past events source**  
TO BE FILLED ----

**Past events description**  
TO BE FILLED ----

**Past events frequency**  
www

**Past events source**  
www

**Past events description**  
www

Figure 15: Area Description form details #1

**Infrastructural info**

Water:  Description: on the portico is located the public toilet

Gas:  Description:

AC Power:  Description: on the ground there are the channeling of the video, network and electrical system accessible through several manhole covers placed in the floor

Mobile Data Coverage:  Description:

WiFi Coverage:  Description:

Internet Access:  Description:

**Monitoring tools - Sensors nodes**

...delNode047 Panagiotis pluto

**Off-line resources**

Upload surveys

- STORM services are used by the end users and one of the main aims is to support the Quick Damage Assessment processes execution.docx

Delete

Creation date:  Sensors nodes:

Description	Latitude	Longitude	Model name
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Login info**

Author:  Creation date:

User of the last update:  Date of the last modification:

**Areas**

Inventory number	Object	Number of components
18	Fragment of a female statue Aphrodite-Ti...	2
30	Funerary altar of Minucia Suavis	1
70	Statue	2
72	Statue of a Satyr used as fountain	2
77	Statue	2

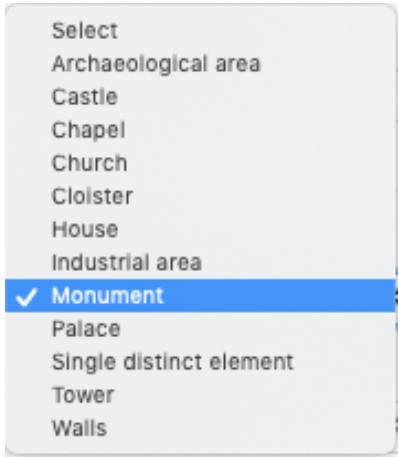
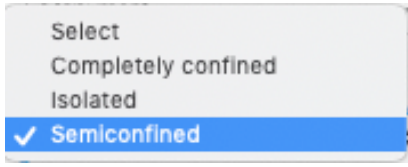
Figure 16: Area Description form details #2

The form allows loading a representative photo and contains data about the main features of the area, such as typology, measurements, and current uses. Then it is possible to insert data relating to the state of conservation and data about past events occurred in the area. Then a section contains data about the available infrastructures and a section contains data about the installed sensors.


As for the site, compilation notes to guide the compilation of the *Area Description* form have been specified and are shown in the following Table 3:

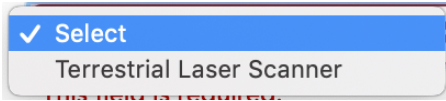



**Table 3: Compilation notes for the Area Description form**

FIELD	COMPILATION NOTES FOR THE AREA
<b>Area Info</b>	
<b>Upload images and documents</b>	The photo image must refer exclusively to the area in question, give a general picture, if possible, and other useful/relevant details.
<b>Select a representative image/ Delete</b>	For the selection (or deletion) of a representative picture of the area.
<b>Name</b>	Name of the area, institutional or otherwise. In some cases, it is the extensive version of the identification code, e.g. “Oficina de salga 21”
<b>Description</b>	Open answer field for a short description of the main historical, artistic and/or other relevant features of the area.
<b>Identification code</b>	Institutional code. In some cases, it is the abbreviation of the name of the area.
<b>Items number</b>	The number is assigned automatically by the application (from the Site Description Form)
<b>Property</b>	Public; Private; Not for Profit; Public-Private Partnership (see DES SITE)
<b>Area reference contact</b>	The name of the person who has the responsibility. It might be left blank in case the site has the same person in charge of the whole site.
<b>Main contact</b>	Main telephone contact of the reference person
<b>When made</b>	Chronology of the area
<b>Typology</b>	 <p>A dropdown menu for the 'Typology' field. The menu is open, showing a list of options: Select, Archaeological area, Castle, Chapel, Church, Cloister, House, Industrial area, <b>Monument</b> (highlighted with a blue bar and a checkmark), Palace, Single distinct element, Tower, and Walls.</p>
<b>Total area (sqm)</b>	
<b>Position</b>	 <p>A dropdown menu for the 'Position' field. The menu is open, showing a list of options: Select, Completely confined, Isolated, and <b>Semiconfined</b> (highlighted with a blue bar and a checkmark).</p>

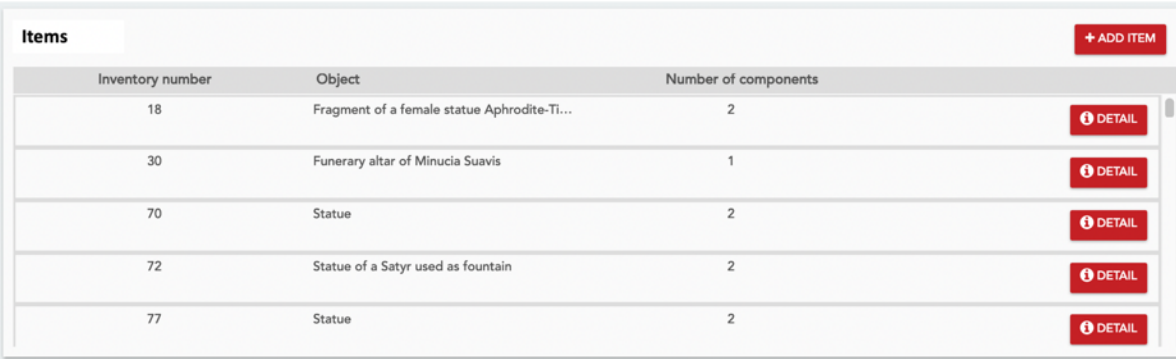
	Information on the position of the area relatively to other areas, to understand its structural stability and eventual risks
<b>Setting</b>	<div data-bbox="523 302 949 481"> <p>Select</p> <ul style="list-style-type: none"> <li>Indoor</li> <li>Outdoor</li> <li><input checked="" type="checkbox"/> Partially covered/sheltered</li> </ul> </div> <p>Information on the degree of exposure to the outdoor environment.</p>
<b>Location within the site (GPS)</b>	GPS coordinates
<b>Current use</b>	<div data-bbox="523 660 917 1265"> <p>Select</p> <ul style="list-style-type: none"> <li>Antiquarium</li> <li>Archaeological site</li> <li>Archive</li> <li>Art gallery</li> <li>Cultural park</li> <li>House</li> <li>Library</li> <li>Lodging place</li> <li>Military place</li> <li>Monument</li> <li><input checked="" type="checkbox"/> Museum</li> <li>Office</li> <li>Religious building</li> <li>Service place</li> <li>Shopping centre</li> <li>University</li> <li>Warehouse</li> </ul> </div>
<b>Usage</b>	<div data-bbox="523 1310 928 1534"> <p>Select</p> <ul style="list-style-type: none"> <li>Discontinuous</li> <li>Never</li> <li><input checked="" type="checkbox"/> Permanent</li> <li>Sporadic</li> <li>Temporary</li> </ul> </div>
<b>Visitors</b>	<div data-bbox="523 1568 949 1736"> <p>Select</p> <ul style="list-style-type: none"> <li>Low</li> <li><input checked="" type="checkbox"/> Medium</li> <li>High</li> </ul> </div> <p>Relevant information to ascertain the pressure on the site and the need for personal safety plans and special measures.</p>
<b>Conservation Info</b>	

<b>Conservation condition</b>	
<b>Conservation description</b>	Open field about the conservation condition
<b>Significant intervention date</b>	Date of past conservation-restoration or other relevant works
<b>Significant intervention description</b>	Open field for the description of the undertaken interventions that could have had an impact on the conservation condition.
<b>Past events frequency</b>	Give an estimate in terms of number of past hazardous events, considering the most relevant
<b>Past events source</b>	Give the source and, if possible, a link to documents
<b>Past events description</b>	refer to the main risks highlighted at the area level
<b>Infrastructural Info</b>	
<b>Water</b>	Yes or no field related to water sources. Consider that this information will appear on the SITE level.
<b>Description</b>	Open field for information on location, technical features, etc. of water sources.
<b>Gas</b>	Yes or no field related to gas sources. Consider that this information will appear on the SITE level.
<b>Description</b>	Open field for information on location, technical features, etc. of gas sources
<b>AC Power</b>	Yes or no field related to environmental control possibilities. Consider that this information will appear on the SITE level.
<b>Description</b>	Open field for information on location, technical features, etc. of environmental control possibilities (HVAC)
<b>Mobile data coverage</b>	Yes or no. Consider that this information will appear on the SITE level.
<b>Description</b>	Describe location and technical features
<b>Wi-Fi coverage</b>	Yes or no. Consider that this information will appear on the SITE level.
<b>Description</b>	Describe location and technical features
<b>Internet access</b>	Yes or no. Consider that this information will appear on the SITE level.

<b>Description</b>	describe location and technical features
<b>Monitoring tools – Sensor Nodes</b>	
<b>Installed Sensors</b>	It is possible to choose the specific sensors from the list of the available ones
<b>Off-line Resources</b>	
<b>Upload survey</b>	It is possible to add new survey clicking on the “Upload Survey” button and, after choosing the file to be uploaded, filling in the following fields
<b>Creation date</b>	It is an automatic date generated when the survey is uploaded
<b>Sensor nodes</b>	Choose the specific registered off-line sources from the list 
<b>Description</b>	A description of the uploaded survey
<b>Latitude</b>	
<b>Longitude</b>	
<b>Model Name</b>	The name of the uploaded specific model, if exists

When all the details have been filled in, it is possible to save the information clicking on the  button.

For each area, different items are identified. Specific forms are filled in for each identified item. It is possible to add a new item, clicking on the specific button “Add Item”; or to visualise a specific Item form, clicking on the “Detail” button for the chosen item, as shown in Figure 17:








Inventory number	Object	Number of components	
18	Fragment of a female statue Aphrodite-Ti...	2	
30	Funerary altar of Minucia Suavis	1	
70	Statue	2	
72	Statue of a Satyr used as fountain	2	
77	Statue	2	

Figure 17: Area Description Form - Item details

### Item Description

For each area, all the available Items should be identified. Items can be artefacts and structures present in the area such as a wall, frescoes, sculptures, decorative structures, movable paintings, mosaic floors it can be related to a little part of it or a large part. Specific forms are filled in for

each item. The *Item Description* form allows to add general information regarding the specific item as shown in the following Figure 18:

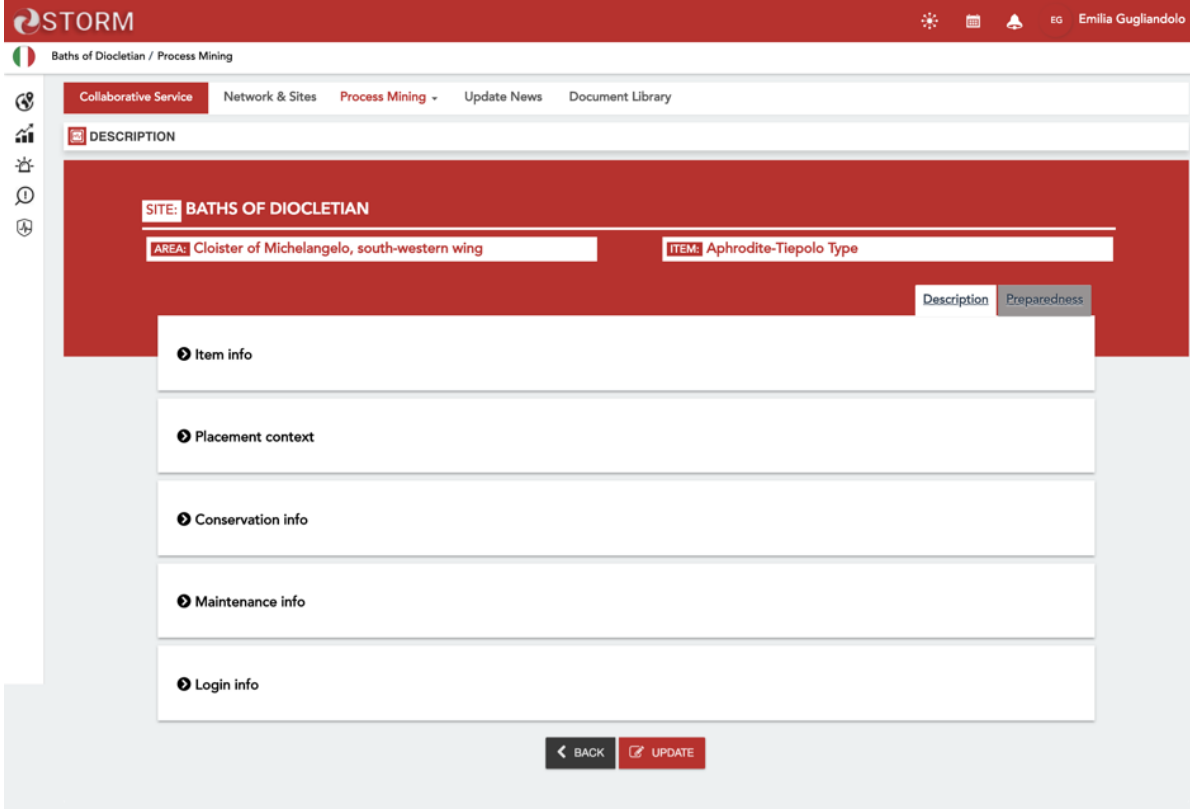


Figure 18: Item Description Form

*Item Description* forms contain all the information related to the specific item and are organised in the following sections:

- *Item info*: general information related to the specific item are provided in this section such as images and documents of the setting and general situation along with a representative image or photographs of multiple sides for three-dimensional artefacts. This section gives a general picture, showing the short unique identification code of the item and a free description of the object.
- *Placement context*: single objects/structures are logically or physically separable. For objects consisting of a set or aggregation of objects, it is important to consider information related to the overall object, namely a “complex object”. The components must be described together with the main object, providing as much as possible the list of component objects. and interconnection systems This section gives all the details associated with the components of complex objects.
- *Conservation info*: information about conservation condition is registered in this section.
- *Maintenance info*: information about maintenance programmes are filled in (e.g. periodic maintenance; scheduled maintenance; preventive maintenance) along with a description related to the organisation system, number of people involved, typology of interventions, existing reports or photographic documentation.
- *Login info*: information related to author of the form.

The following Figure 19 and Figure 20 shows all the details of the *Item Description* form for a specific site (Baths of Diocletian):

STORM

EG Emilia Gugliandolo

Baths of Diocletian / Process Mining

Collaborative Service
Network & Sites
Process Mining
Update News
Document Library

DESCRIPTION


**SITE:** BATHS OF DIOCLETIAN

**AREA:** Cloister of Michelangelo, south-western wing
**ITEM:** Aphrodite-Tiepolo Type

Description
Preparedness

**Item info**

UPLOAD IMAGES AND DOCUMENTS



SELECT A REPRESENTATIVE IMAGE

DELETE

**Name**

**Inventory number**

**Object**

**Property**

**Placement context**

**Number of components**

**In contact with**

**Location in the area**

**Movable**

**Anchored**

**Description**

**Component connection system**

**When made**

**Size**

**Weight**

**Material class**

**Specific material**

**Technique**

**Cultural significance**

**Documents**

**Documents source**

**Documents description**

+ -

Figure 19: Item Description form details #1

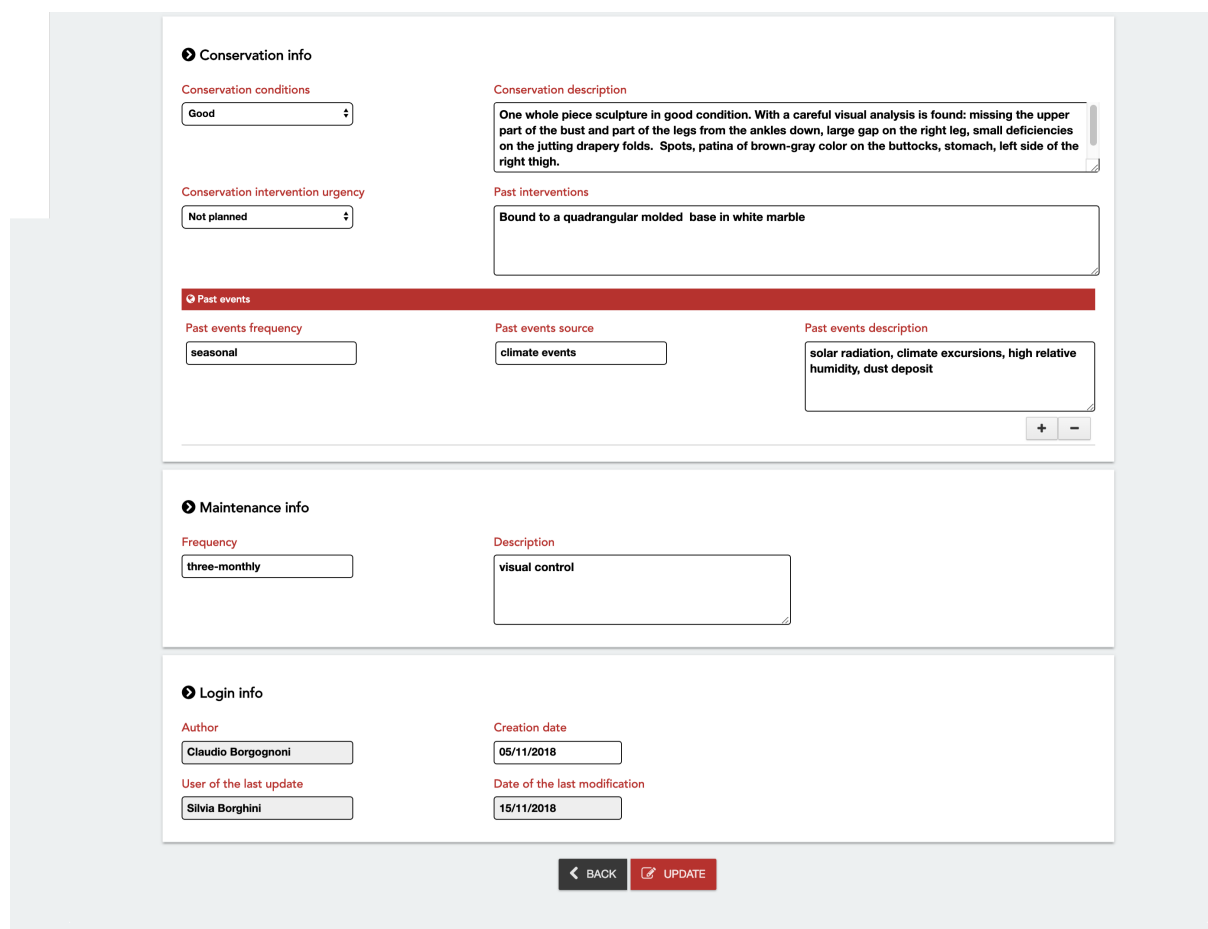


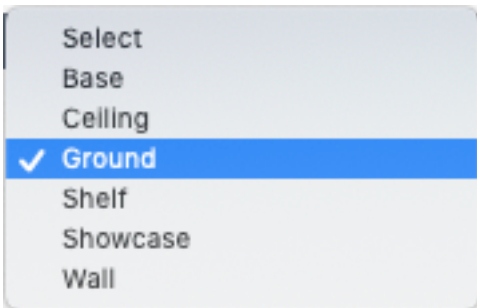
Figure 20: Item Description form details #2

The form allows loading a representative photo of the item and contains data about the main features of the item, such as the type of object, its description, its size, its weight and its material. It is possible to insert data relating to the state of conservation and related past interventions on the item. Then a section contains data about the installed sensors. There is also the possibility to load relevant documentation.

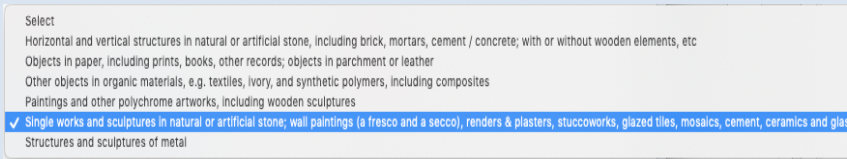
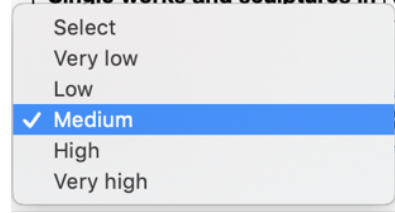

As for the *Area* and *Site Description*, compilation notes to guide the compilation of the *Item Description* form have been specified and are shown in the following Table 4:

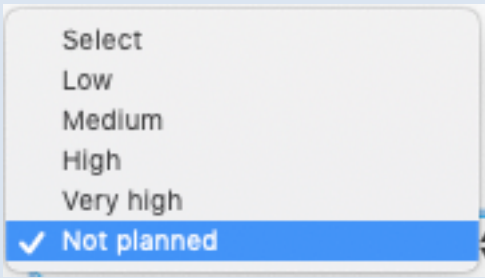
Table 4: Compilation notes for the Item Description form

FIELD	COMPILATION NOTES FOR ITEMS
<b>Item Info</b>	
<b>Upload images and documents</b>	Photographs of the object and its setting. For three-dimensional artefacts, it is possible to upload images taken from multiple sides.
<b>Select a representative image / Delete</b>	Single image that should allow a swift identification of the object.
<b>Name</b>	Current name and/or institutional denomination from inventory catalogue

<b>Inventory number</b>	Short unique identification code of the items, as given by the CH authority; can refer to an institutional code or be created new if it doesn't exist (e.g. if the item is a wall). This field is mandatory and cannot be repeated.
<b>Object</b>	Free description of the object., including a description of all its components (that may or may not be included in its name).
<b>Property</b>	Public; Private; Not for Profit; Public-Private Partnership
<b>Placement Context</b>	
<b>Number of components</b>	In the case of items that are composed of multiple objects, e.g. a crucifix including a cross and a statuette of Christ; a polyptych; a porcelain coffee service, all components that may be logically singled out should be accounted for.
<b>In contact with</b>	 <p>This menu allows recording the item's immediate setting. The nearby 'Location' (open) field allows clarifying this setting, if necessary, for instance if the item is in contact with more than one other element.</p>
<b>Location in the area</b>	Short description of the placement of the item within the area that can additionally be used to clarify the elements with which the item is in contact and/or to provide data on reachability, etc.
<b>Movable</b>	Yes or no, depending if the item can be transported or not.
<b>Anchored</b>	Short indication on the item's fixation/securing system, particularly if it is not easily removable/circumvented in an emergency.
<b>Description</b>	Open field to provide a more detailed description of the items. It should mention important features, integrated components, materials, manufacture techniques, importance within the collection/site, etc.
<b>Component connection system</b>	Short description on how the material connection between the different item components (if existing) is fashioned, e.g. metal pins or rods, glue, etc.
<b>When made</b>	Date or historical period of manufacture
<b>Size</b>	Maximum height, width and depth.
<b>Weight</b>	If the item is unmovable, this information it is not required: this data is aimed at evaluating the possibility of moving (evacuating) the object



<p><b>Material class</b></p>	 <p>This menu is intended for recording the item’s material-form typology. The different pre-defined classes will share some emergency procedures, and therefore it may be useful for the site manager to have an idea on how many items exist in each typology.</p>
<p><b>Specific material</b></p>	<p>Information related to the materials of the element(s) composing an item</p>
<p><b>Technique</b></p>	<p>Information related to specific manufacture technique</p>
<p><b>Cultural significance</b></p>	 <p>This field records the cultural value of the object within the site. It is a crucial field in the definition of priorities for intervention.</p> <p>Take note, this field is also reported in the <i>Risk Assessment</i> and from the significance attributed item priorities will be given for each area.</p>
<p><b>Documents</b></p>	<p>In this section it is possible to upload any kind of relevant document to support knowledge on the item, e.g. archival references, historical sources, research studies, conservation reports, etc.</p>
<p><b>Document source</b></p>	<p>For indications on the source of the collected documents</p>
<p><b>Document description</b></p>	<p>Which kind of documents are available, and eventual short content description.</p>
<p><b>Conservation Info</b></p>	
<p><b>Conservation condition</b></p>	 <p>General appreciation of the conservation condition, ideally assessed by a conservator-restorer. The whole ‘Conservation Info’ section should be updated regularly, and definitely whenever there are events that may impact the conservation condition of the item.</p>
<p><b>Conservation description</b></p>	<p>Open field for at-length description on the conservation condition at the moment of data collection; to be written by a conservator-restorer or conservation expert.</p>

<p><b>Conservation intervention urgency</b></p>	 <p>This field is also the responsibility of a conservator-restorer, and classifies the need for a conservation intervention.</p>
<p><b>Past interventions</b></p>	<p>Description related to former interventions impacting the item, negatively or positively, either documented or recognisable via item analysis, e.g. cement fillings, painting revarnishings; structural reinforcement; etc., generally aimed at the conservation of the item.</p>
<p><b>Past events</b></p>	<p>Description related to past events that negatively impacted the conservation condition of the item, either natural or anthropogenic in origin.</p>
<p><b>Past events frequency</b></p>	<p>Related to the rate of occurrence of events that negatively impacted the item, natural or anthropogenic in origin, and particularly those generating emergencies.</p>
<p><b>Past events source</b></p>	<p>In principle this field should refer to the hazard classification list.</p>
<p><b>Past events description</b></p>	<p>At-length description on the events, with details on the dynamic of the damage, if known, e.g. ‘the wall painting was leached by the pouring rain, because in the 2012 the roof covering was rundown’</p>
<p><b>Maintenance Info</b></p>	
<p><b>Maintenance info</b></p>	<p>To record information about the maintenance system in place for that specific item and its respective scheduled actions.</p>
<p><b>Frequency</b></p>	<p>Periodicity of the maintenance actions.</p>
<p><b>Description</b></p>	<p>At-length description of the organisation system, including number of people involved, typology of intervention, existing reports, mappings or photographs; products used; etc.</p>

### 2.1.4.2 Preparedness Forms

The second STORM Quick Damage Assessment procedural phase, named *Preparedness*, allows to define and/or estimate what resources and preventative measures are needed. The assessment of the intervention plan and the arrangement of the minimum necessary resources may be recorded. Filling the *Preparedness* forms entails events simulation and emergency interventions identification, which will support the site’s Preparedness and Response planning. In STORM, the *Preparedness* forms collect all the information that may be gathered in advance in order to be ready to face future real disasters. In particular, the main information given through the *Preparedness* forms are about people training, contingency plans to guarantee accessibility to the site, securing and first aid products and materials ready to be used, identification of key people to be involved during the emergency, number of people needed,

availability of information and so on. *Preparedness* forms are available at the three levels: Site, Area and Item.

### Site Preparedness

At site level, the Preparedness includes all the resources that should be available at the site in order to be prepared to face the emergency phase. The first step is to start with a hypothetical specific hazard related to the site (determined using the risk assessment tool). Some relevant information such as planned actions and complementary measures are collected through the STORM Process Mining service, using the *Description* forms previously filled in.

A standard set of forms are filled in order to collect key data related to each site. The *Site Preparedness* form allows adding general information regarding the Site as shown in the following Figure 21:

The screenshot shows the STORM web interface for the 'Baths of Diocletian' site. The main content area is titled 'PREPAREDNESS' and features a list of expandable sections: Hazard selection, Contacts, Monitoring info - Sensors nodes, Resources, Accessibility, Responses, and Login info. Below this list is an 'UPDATE' button. At the bottom, there is an 'Areas' table with the following data:

Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western ...	65	<a href="#">DETAIL</a>
CloisterOfMichelangelo GA	Cloister of Michelangelo, garden	12	<a href="#">DETAIL</a>
Hall 1	Hall I	38	<a href="#">DETAIL</a>
Test	Test garden of cinquecento	3	<a href="#">DETAIL</a>

Figure 21: Site Preparedness form

The form is organised in the following sections:

- *Hazard selection*: a dropdown list of hazards and a dropdown list of areas allow the immediate display of the risk assessment values for each selected hazard-area combination. The displayed results are loaded from another STORM operative service, named *Risk Assessment*, which should be completed beforehand (see D5.2 - STORM Risk Management Tool). These only appear once the *Risk Assessment* has been completed.
- *Contacts*: information related to the site's main contacts list including organisation, job and role. This information allows identifying key people to be involved during the emergency.
- *Monitoring info – sensors nodes*: information related to the sensors available at the site, coming from *Site Description* Forms.
- *Resources*: records the securing and first aid materials and hardware available, along with details about the type, description, specifications and location on the site, so as to know the available resources and to quickly find them during an emergency.
- *Accessibility*: accessibility details of the site coming from *Site Description* forms along with contingency plans to guarantee accessibility to the site.
- *Responses*: allows the recording of protocols to be followed in an emergency, where the different steps should be filled according to the seriousness of the impact (of the preselected hazard).
- *Login info*: information about the author of the form.

At the end, a list of the identified areas for the site is available. The following Figure 22 and Figure 23 show all the details of the *Site Preparedness* form for a specific site (the Baths of Diocletian):

The screenshot shows the STORM web application interface. At the top, there is a navigation bar with the STORM logo and user information (Emilia Gugliandolo). Below this, a breadcrumb trail indicates the current location: 'Baths of Diocletian / Preparedness'. The main content area is titled 'PREPAREDNESS' and features a header for the 'SITE: BATHS OF DIOCLETIAN' with an aerial image of the site. Two tabs, 'Description' and 'Preparedness', are visible, with 'Preparedness' being the active tab.

The 'Preparedness' section is divided into three main panels:

- Hazard selection:** This panel includes a 'Hazards' dropdown menu (currently set to 'Select'), an 'Areas' dropdown menu (also set to 'Select'), and a table for defining hazards. The table has columns for 'Name' and 'Description'. Below the table, there are several input fields for risk analysis: 'Relevance for site manager', 'Likelihood', 'Magnitude severity', and 'Expected intensity of impacts'. Further down, there are fields for 'Area risk analysis' including 'Severity', 'Impacts from primary hazards', 'Impacts from hazards and threats', and 'Overall risk statement'. At the bottom of this section are fields for 'Risk score', 'Vulnerability score', 'Susceptibility', 'Exposure', 'Copying and adaptive capacity', and 'Priority'.
- Contacts:** This panel contains a table for listing contacts. It has columns for 'Associated' (with a checkbox), 'Name', 'Job', 'Organizations', and 'Phone'. One contact is listed with the name 'Storm User'.
- Monitoring info - Sensors nodes:** This panel shows a list of sensor nodes. It includes a table with columns for location and sensor type. The locations listed are 'Hall I', 'Cloister of Michelangelo, south-western wing', 'Cloister of Michelangelo, garden', and 'Test garden of cinquecento'. The sensor types listed are 'Gases Sensor Node', 'Weather Station', 'Environmental Node', 'Smart Cities Pro', and 'Acoustic Noise Node'.

Figure 22: Site Preparedness form – Details #1

### Accessibility

<p><b>PedestrianEntrance</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">Viale Enrico De Nicola</div>	<p><b>EmergencyVehicleEntrance</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">Viale Enrico De Nicola</div>	<p><b>CarPark</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">-</div>
<p><b>SpecialEmergencyVehiclesEntrance</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">Viale Enrico De Nicola</div>	<p><b>FluvialDock</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">-</div>	<p><b>MaritimeDock</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">-</div>
<p><b>Heliport</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">-</div>	<p><b>HeavyVehiclesEntrance</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">-</div>	<p><b>PossibleObstacles</b></p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;">Numerosi cancelli</div>

<p>Category</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Situation</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>	<p>Contingency plan</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>
<p>Category</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Situation</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>	<p>Contingency plan</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>

Select map

### Responses

<p>Emergency step</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Seriousness of impact</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Protocol</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>	<p>Recommendations</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>
<p>Emergency step</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Seriousness of impact</p> <div style="border: 1px solid #ccc; padding: 2px;">Select</div>	<p>Protocol</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>	<p>Recommendations</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>

### Login info

<p>Author</p> <div style="border: 1px solid #ccc; padding: 2px;">Emilia Gugliandolo</div>	<p>Creation date</p> <div style="border: 1px solid #ccc; padding: 2px;">19/02/2019</div>
<p>User of the last update</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>	<p>Date of the last modification</p> <div style="border: 1px solid #ccc; padding: 2px; min-height: 20px;"></div>

UPDATE

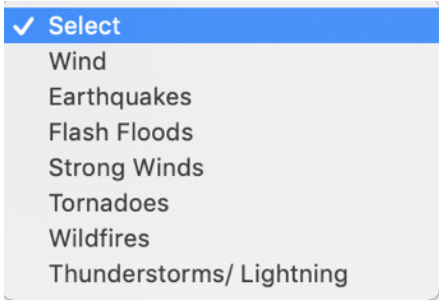

### Areas

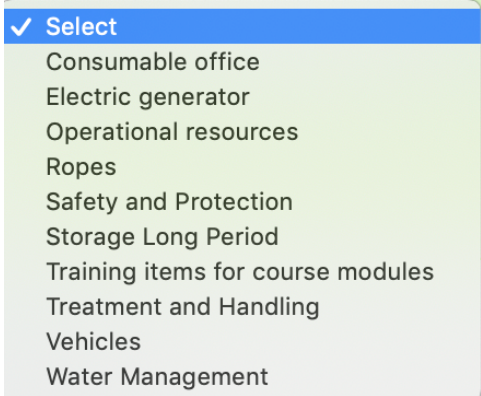
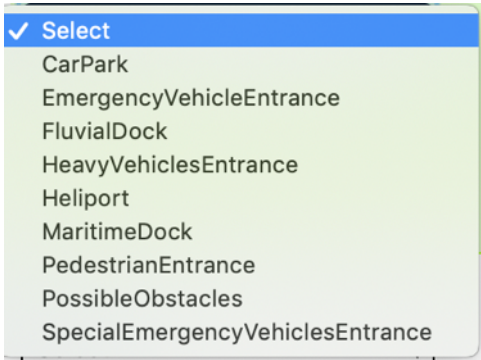
Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western ...	65	DETAIL
CloisterOfMichelangelo GA	Cloister of Michelangelo, garden	12	DETAIL
Hall 1	Hall 1	38	DETAIL
Test	Test garden of cinquecento	3	DETAIL

Figure 23: Site Preparedness form – Details #2

Compilation notes have been developed to guide the experts during the compilation of form information. In the following Table 5, for each field in the left column, a description of its meaning is reported on the right column. If the field data has to be chosen among entries in a list, the possible entries are reported.


**Table 5: Compilation notes for the Site Preparedness Form**

FIELD	COMPILATION NOTES FOR THE SITE
<b>Hazard Selection</b>	
<b>Hazards</b>	<p>From this section it is possible to choose a specific hazard from a list, in order to retrieve all site-specific information linked to that hazard, coming from the Risk Assessment Tool.</p> 
<b>Area</b>	<p>From this section it is possible to choose a specific Area from the list in order to retrieve all the risk assessment information pertaining to that specific Area-hazard combination.</p> 
<b>Name</b>	When the area is selected, its name is reported in this field (coming from the Area Description Form)
<b>Description</b>	The description of the area is reported in this field (coming from Area Description Form)
<b>Area Risk Analysis</b>	Upon area selection, all the Area Risk Analysis fields (Severity, Impacts from primary hazards, Impacts from (secondary) hazards and threats, Overall risk statement, Risk score, Vulnerability score, Susceptibility, Exposure, Coping and Adaptive capacity, Priority) are retrieved from the Risk Assessment Tool and displayed
<b>Contacts</b>	
<b>Associated</b>	It is possible to view a list of contacts in order to choose the contacts (with all the information about the name, job, organisations and phone) to be associated for each area-hazard combination
<b>Monitoring info – sensor nodes</b>	
<b>Installed Sensors</b>	It is possible to visualise the sensors available in each area; this information is preloaded from the Area description forms.

<b>Resources</b>	
<b>Type</b>	<p>Available resources may be described by adding successive fields in the ‘Resource’ section. The first field allows choosing the specific resource type.</p> 
<b>Name</b>	Allows recording/displays the specific name of the chosen resource
<b>Description</b>	Allows recording/displays the description of the chosen resource
<b>Location</b>	Allows recording/displays the position of the chosen resource
<b>Accessibility</b>	
All the ‘Accessibility’ information is retrieved from the <i>Site Description</i> Form (apart from Category, Situation and Contingency plan)	
<b>Category</b>	<p>Select from the list a specific accessibility category</p> 
<b>Situation</b>	Describe the current condition
<b>Contingency Plan</b>	Insert a possible contingency plan to overcome the situation
<b>Select Map</b>	It is possible to upload a specific map showing emergency or accessibility paths
<b>Responses</b>	
<b>Emergency Step</b>	In this section, protocols may be defined (or consulted) for actions that may become necessary in emergency contexts at site level. To add info, it is firstly necessary to select an emergency step from the list:



	<div style="border: 1px solid black; padding: 5px;"> <input checked="" type="checkbox"/> Select                  Authorisation to enter the site                  Communication among actors                  Control point established                  Hazard identified                  Salvage area defined             </div>
<b>Seriousness of impact</b>	Each of the different steps may have different protocols according to the seriousness of the impact: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <input checked="" type="checkbox"/> Select                  Crisis                  Disaster                  Incident             </div>
<b>Protocol</b>	Description of the protocol for the actions that have to be carried out
<b>Recommendations</b>	Other specific recommendations useful to face the emergency

When all the details have been filled in, it is possible to save the information by clicking on the  button.

For each site, different areas are identified. It is possible to visualise a specific *Area Preparedness* form clicking on the “Detail” button for the chosen area, as shown in Figure 24:





Areas			
Identification code	Name	Number of items	
CloisterOfMichelangelo	Cloister of Michelangelo, south-western...	65	
CloisterOfMichelangelo GA	Cloister of Michelangelo, garden	12	
Hall 1	Hall I	38	
Test	Test garden of cinquecento	3	

Figure 24: Site Preparedness Form - Area details

## Area Preparedness

For each site, different areas are identified. Specific forms are filled in for each identified area. *Area Preparedness* forms contain all the information related to the specific area, as shown in the following Figure 25:

The screenshot shows the STORM web application interface. At the top, there is a navigation bar with the STORM logo and user information (Emilia Gugliandolo). Below this, there is a breadcrumb trail: Baths of Diocletian / Preparedness. The main content area is titled 'PREPAREDNESS' and features a header for 'SITE: BATHS OF DIOCLETIAN' and 'AREA: Cloister of Michelangelo, garden'. There are tabs for 'Description' and 'Preparedness', with 'Preparedness' being the active tab. The form contains several sections, each with a dropdown arrow: Hazard selection, Infrastructural info, Resources, Responses, Past events, and Login info. At the bottom of the form, there are 'BACK' and 'UPDATE' buttons. Below the form is a table titled 'Items' with the following data:

Inventory number	Object	Number of components	
135750a	Architectural element	1	<a href="#">DETAIL</a>
135750b	Architectural element	1	<a href="#">DETAIL</a>
715	Pedestal	1	<a href="#">DETAIL</a>
717	Architectural element	1	<a href="#">DETAIL</a>
909	Head of bull	2	<a href="#">DETAIL</a>

Figure 25: Area Preparedness form

*Area Preparedness* forms contain all the information related to the specific area, organised in the following sections:

- *Hazard Selection*: after selecting the hazard, information about the Area (coming from the *Description* forms) and the results (coming from the *Risk Assessment*) of the Area risk analysis are displayed.
- *Infrastructural info*: contingency plans to guarantee accessibility to the site are detailed in this section.

- *Resources*: description of securing and first aid materials and hardware available for emergencies, along with details about the type, specific resources and their location within the area, so as to quickly find them during emergency.
- *Responses*: an area Assessment is conducted starting from the emergency step selection along with the seriousness of its impact. The action planned from protocol is provided and the proposed recommended action.
- *Past events*: past experiences in terms of past risks, their frequency and description are provided.
- *Login info*: Information related to author of the form.

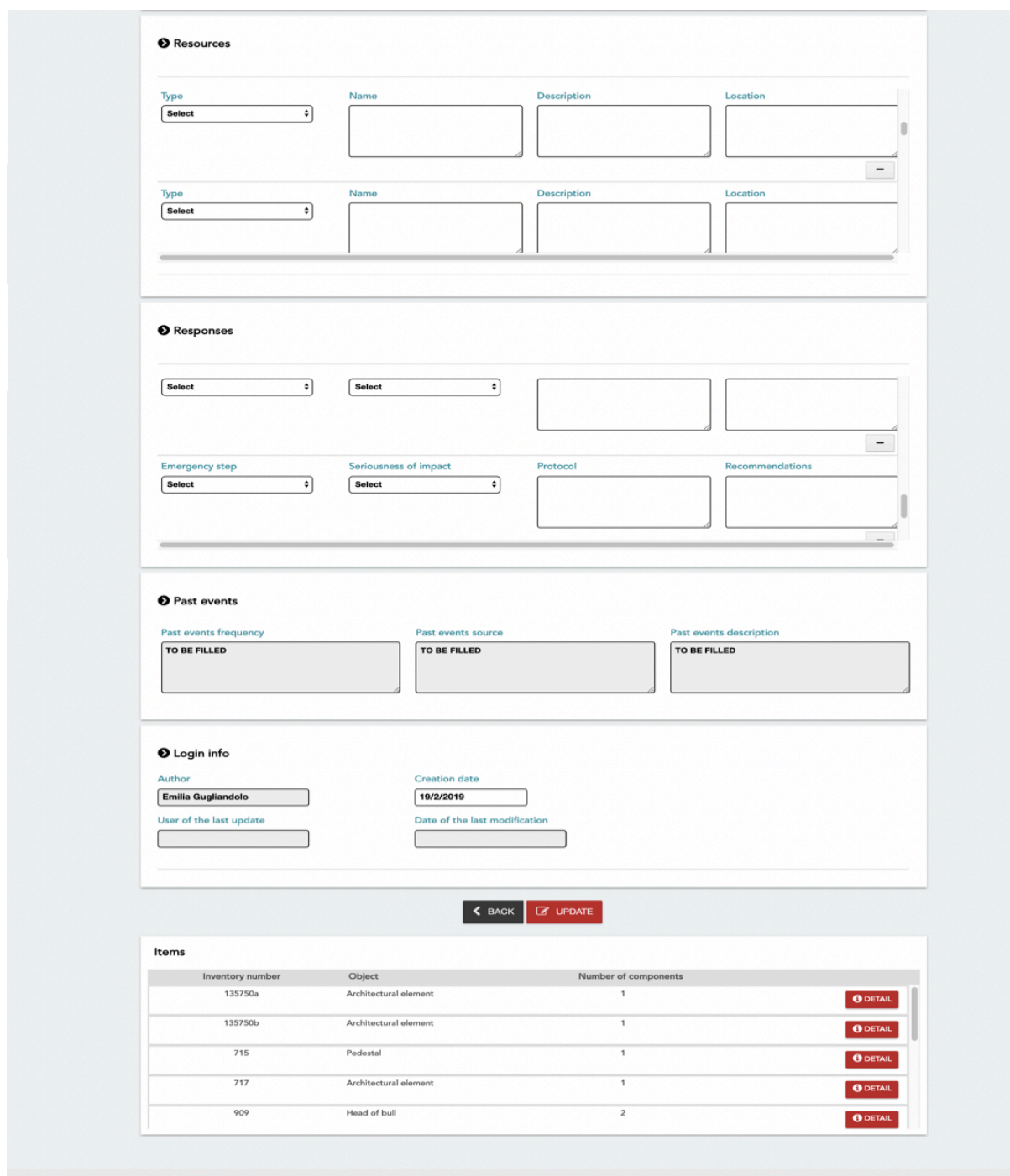
At the end, a list of the available items identified within that area is shown. The following Figure 26 and Figure 27 show the details of the *Area Preparedness* form for a specific site (the Baths of Diocletian):

The screenshot shows the STORM web application interface. At the top, there is a navigation bar with the STORM logo and user information (Emilia Gugliandolo). Below this is a breadcrumb trail: 'Baths of Diocletian / Preparedness'. The main content area is titled 'PREPAREDNESS' and features a header with a site image, 'SITE: BATHS OF DIOCLETIAN', and 'AREA: Cloister of Michelangelo, garden'. There are tabs for 'Description' and 'Preparedness', with the latter being active. The form is divided into two main sections:

- Hazard selection:** This section includes a 'Hazards' dropdown menu, 'Area info' fields, and a grid of input boxes for various infrastructure types: Water, Gas, MobileDataCoverage, WiFiCoverage, ACPower, and InternetAccess. Below this is an 'Area risk analysis' section with multiple input fields for Severity, Impacts from primary hazards, Impacts from hazards and threats, Overall risk statement, Risk score, Vulnerability score, Susceptibility, Exposure, Copying and adaptive capacity, and Priority.
- Infrastructural info:** This section contains two rows of input fields. Each row starts with a 'Category' dropdown menu, followed by 'Situation' and 'Contingency plan' text input fields.

At the bottom of the form, there is a placeholder icon for a photo or document.

Figure 26: Area Preparedness form – Details #1



**Resources**

Type:  Name:  Description:  Location:

Type:  Name:  Description:  Location:

**Responses**

Emergency step:  Seriousness of impact:  Protocol:  Recommendations:

**Past events**

Past events frequency:  Past events source:  Past events description:

**Login info**

Author:  Creation date:

User of the last update:  Date of the last modification:

**Items**

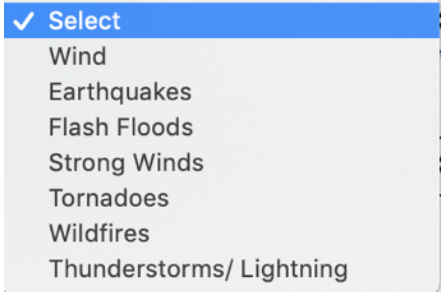
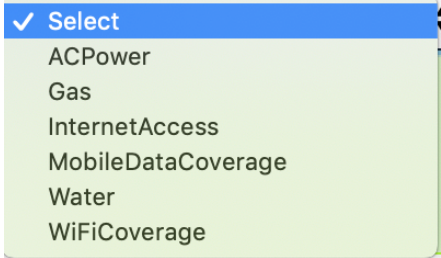
Inventory number	Object	Number of components	
135750a	Architectural element	1	<input type="button" value="DETAIL"/>
135750b	Architectural element	1	<input type="button" value="DETAIL"/>
715	Pedestal	1	<input type="button" value="DETAIL"/>
717	Architectural element	1	<input type="button" value="DETAIL"/>
909	Head of bull	2	<input type="button" value="DETAIL"/>

Figure 27: Area Preparedness form – Details #2

*Area Preparedness* forms contain data about an area and a specific hazard. The form contains data about priority and risk level coming from the risk assessment process. Then there is a list of contacts, sensors and data about accessibility and infrastructures, as in the form of the site. Finally, there is a section about the resources that can be used during the emergency and a section where the experts insert planned actions to be performed during the emergency.

As for the site, compilation notes to guide the compilation of the *Area Preparedness* forms have been specified and are shown in the following Table 6:

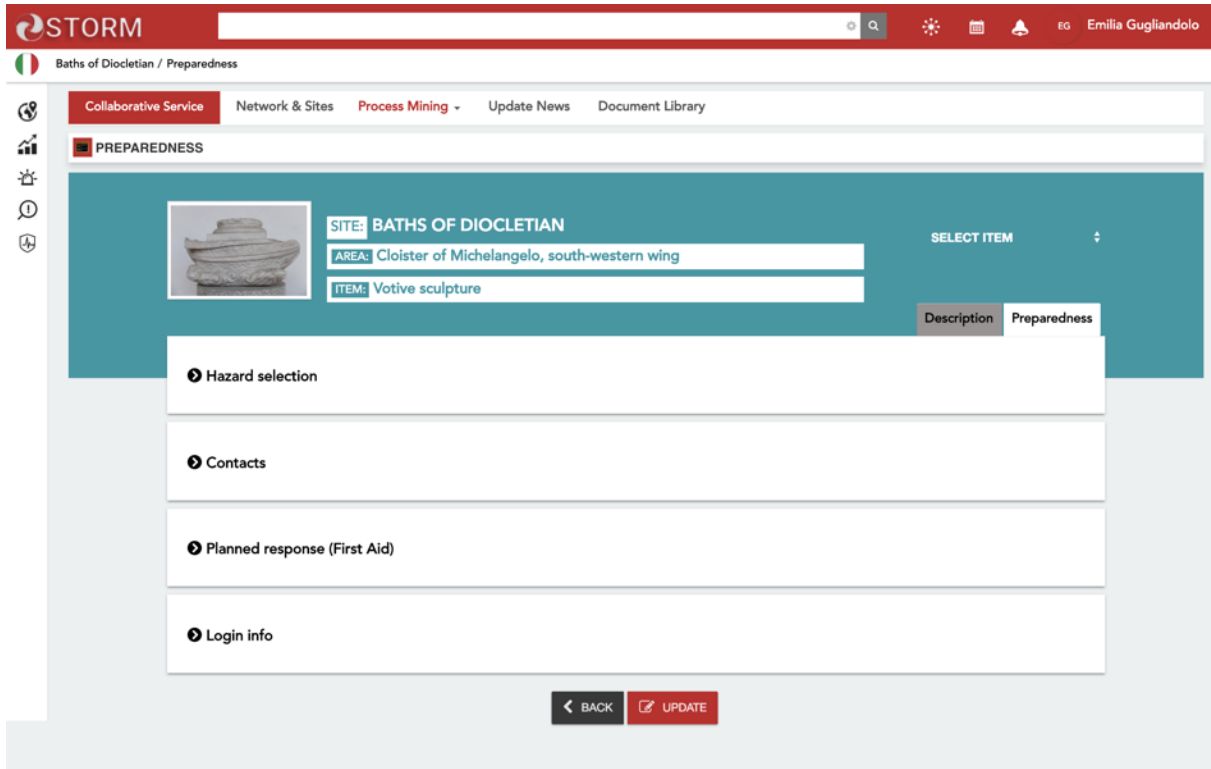
**Table 6: Compilation notes for the Area Preparedness form**

FIELD		COMPILATION NOTES FOR THE SITE
<b>Hazard Selection</b>		
<b>Hazards</b>	<p>From this section it is possible to choose a specific hazard from a list in order to retrieve all the linked information (coming from the Risk Assessment Tool).</p> 	
<b>Area Info</b>	<p>All the information in these fields comes from the Area Description Form (Water, Gas, Mobile Data Coverage, Wi-fi Coverage, AC Power, Internet Access)</p>	
<b>Area Risk Analysis</b>	<p>All the information in these fields comes from the Risk Assessment Tool (Severity, Impacts from primary hazards, Impacts from (secondary) hazards and threats, Overall risk statement, Risk score, Vulnerability score, Susceptibility, Exposure, Coping and Adaptive capacity, Priority)</p>	
<b>Infrastructural info</b>		
<b>Category</b>	<p>Select from the list a specific infrastructural category</p> 	
<b>Situation</b>	<p>Describe the current condition</p>	
<b>Contingency Plan</b>	<p>Insert a possible contingency plan to overcome eventual critical situations</p>	
<b>Show Map</b>	<p>It is possible to visualise a specific map showing further infrastructural information</p>	
<b>Resources</b>		
<b>Type</b>	<p>It is possible to choose from a list the specific resource type</p>	

	<ul style="list-style-type: none"> <li>✓ Select</li> <li>Consumable office</li> <li>Electric generator</li> <li>Operational resources</li> <li>Ropes</li> <li>Safety and Protection</li> <li>Storage Long Period</li> <li>Training items for course modules</li> <li>Treatment and Handling</li> <li>Vehicles</li> <li>Water Management</li> </ul>
<b>Name</b>	Allows recording/displays the specific name of the chosen resource
<b>Description</b>	Allows recording/displays the description of the chosen resource
<b>Location (GPS)</b>	Allows recording/displays the position of the chosen resource
<b>Responses</b>	
<b>Emergency Step</b>	<p>In this section, protocols may be defined (or consulted) for actions that may become necessary in emergency contexts at area level. To add info, it is firstly necessary to select an emergency step from the list:</p> <ul style="list-style-type: none"> <li>✓ Select</li> <li>Authorisation to enter the site</li> <li>Communication among actors</li> <li>Control point established</li> <li>Hazard identified</li> <li>Salvage area defined</li> </ul>
<b>Seriousness of impact</b>	<p>Each of the different steps may have different protocols according to the seriousness of the impact</p> <ul style="list-style-type: none"> <li>✓ Select</li> <li>Crisis</li> <li>Disaster</li> <li>Incident</li> </ul>
<b>Protocol</b>	Description of the protocol, i.e. the actions that have to be carried out
<b>Recommendations</b>	Other specific recommendations useful to face the emergency
<b>Past events</b>	
<b>Past events frequency</b>	Rate of occurrence of past hazardous events, considering the most relevant. Information coming from the Area Description Form
<b>Past events source</b>	In principle, this field should refer to the hazard classification list. Information coming from the Area Description Form
<b>Past events description</b>	Description of the most relevant events, that occurred in the area. Information coming from the Area Description Form

## Item Preparedness

For each area, all the available items are identified. Specific *Preparedness* forms are filled in for each item. *Item Preparedness* forms contain all the information related to the specific item and planned actions to be done in order to face an emergency. *Item Preparedness* forms allow adding general information regarding the specific item, as shown in the following Figure 28:



The screenshot shows the STORM web interface for the 'Baths of Diocletian / Preparedness' section. The page features a navigation menu with 'Collaborative Service', 'Network & Sites', 'Process Mining', 'Update News', and 'Document Library'. The main content area is titled 'PREPAREDNESS' and includes a header with a site image, 'SITE: BATHS OF DIOCLETIAN', 'AREA: Cloister of Michelangelo, south-western wing', and 'ITEM: Votive sculpture'. A 'SELECT ITEM' dropdown menu is visible. Below the header, there are four sections: 'Hazard selection', 'Contacts', 'Planned response (First Aid)', and 'Login info'. At the bottom, there are 'BACK' and 'UPDATE' buttons.

Figure 28: Item Preparedness Form

The forms are organised in the following sections:

- *Hazard selection*: after selecting the hazard, information about available resources and the Item proper (e.g. object features, conservation condition, etc.) are provided.
- *Contacts*: information related to the site's main contact list such as organisation, job and role, in order to identify key people to be involved during an emergency befalling this Item.
- *Planned response (First Aid)*: this section includes information related to the planned actions in response to a damaging event/emergency, including recommended steps and mitigation tools, precautions, and other specifications. Details regarding people needed and protection available on site are provided, along with the planned activities.
- *Login info*: information related to author of the form.

The following Figure 29 and Figure 30 show the *Item Preparedness* form for a specific site (e.g. Baths of Diocletian site):

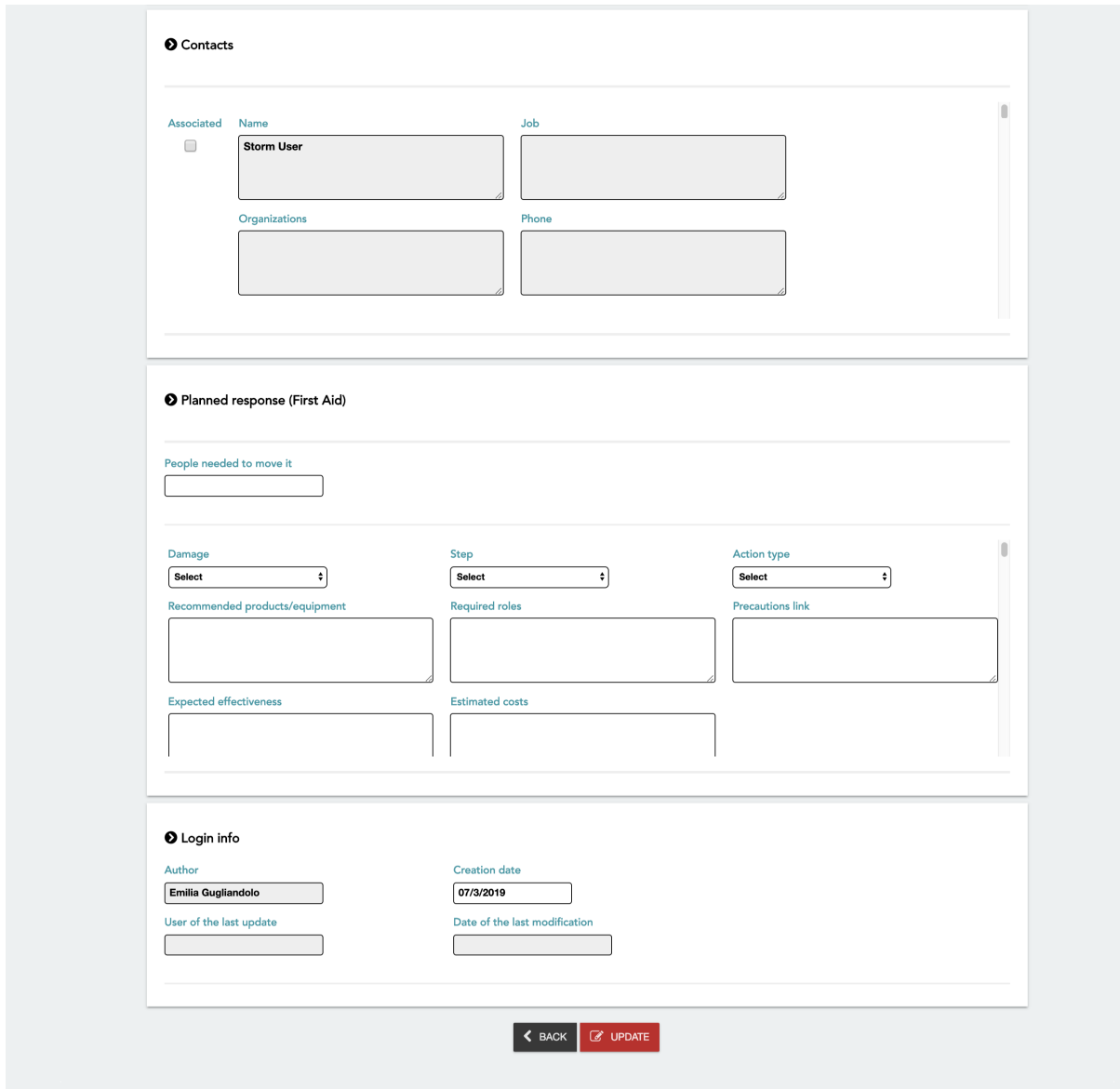


The screenshot shows the 'Item Preparedness' form for the 'Baths of Diocletian' site. The form is divided into several sections:

- Header:** SITE: BATHS OF DIOCLETIAN, AREA: Cloister of Michelangelo, south-western wing, ITEM: Votive altar. Includes a 'SELECT ITEM' dropdown and tabs for 'Description' and 'Preparedness'.
- Hazard selection:** A section with a 'Hazards' dropdown menu (currently showing 'Select') and a 'Resources' section with two empty text input fields.
- Item description:** A grid of fields:
  - Inventory number: 189
  - Priority: (empty)
  - Sensitivity value: (empty)
  - Object: Votive altar
  - Material class: Single works and sculptures in natural or artificial stone; wall paintings (a fresco and a secco), renders & plasters, stuccoworks, glazed tiles, mosaics, cement, ceramics and glass
  - Specific material: Marble
  - Conservation description: One whole piece sculpture in good condition. With a careful visual analysis is found: the upper right frame is missing, part of the left volute. Small lacks along the edges of the frame.
  - Technique: Sculpture
  - Location in the area: Between 22nd and 23rd columns of SW portico
  - Size: 55 x 43 x 40
  - Weight: 250

Figure 29: Item Preparedness form – Details #1

A specific section of the *Item Preparedness* form is dedicated to the First Aid, namely section *Planned Response (First Aid)*. During the real emergency, this pre-inserted information is of great importance and therefore it should be regularly revised, and updated when necessary. Regarding the intervention on the field, when a hazard strikes, a dedicated mobile application has been designed to give users recommendations and guidelines, in real time, on the site. The actual implementation of the response phase of course takes place after the hazard hits and, at that stage, the process involves the real operative use of the system, with info on securing and first aid activities. The First Aid corresponds to practical actions made by trained personnel, with specific skills, based on intervention schemes identified in the simulation phase. In STORM, the First Aid is used during real emergencies via mobile application and is currently available at Item level. In particular, First Aid details are inserted in the *Item Preparedness* forms.

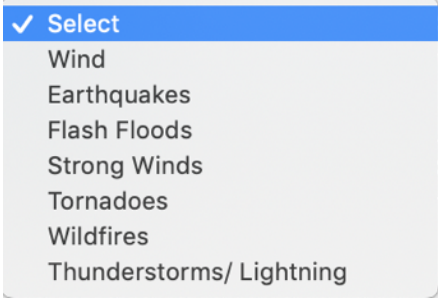
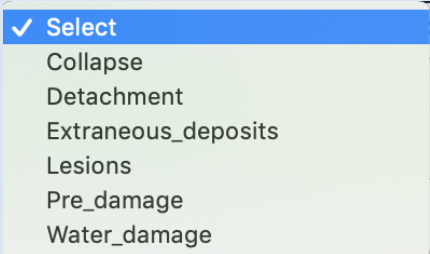
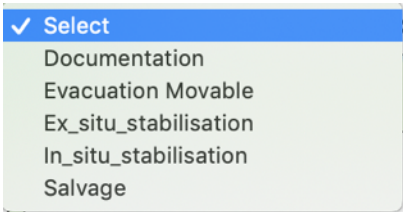
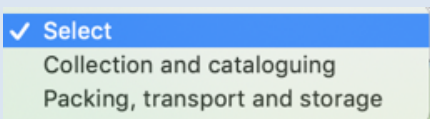


**Figure 30: Item Preparedness form – Details #2**

As for the *Area and Site Description*, compilation notes to guide the compilation of the *Item Description* form have been specified and are shown in the following Table 7:

**Table 7: Compilation notes for the Item Preparedness form**

FIELD		COMPILATION NOTES FOR THE SITE
<b>Hazard Selection</b>		
<b>Hazards</b>		From this section it is possible to choose a specific hazard from a list in order to retrieve all the linked information (coming from the Risk Assessment Tool).

	
<b>Resources</b>	Information in these fields comes from Site Preparedness Form
<b>Item Description</b>	All the information in the these fields comes from the Item Description Forms (Inventory Number, Name, Material class, Specific material, Conservation description, Technique, Location in the area, Size, Weight) and Risk Assessment Tool (Priority, Sensitivity value).
<b>Contacts</b>	
<b>Associated</b>	It is possible to view a list of contacts in order to choose the contacts (with all the information about the name, job, organisations and phone) to be associated to an emergency striking this specific Item.
<b>Planned Response (First Aid)</b>	
<b>People needed to move it</b>	Insert the number of people needed to move the item
<b>Damage</b>	<p>The planned actions will depend on the type of damage withstood by the item. Therefore, it is firstly necessary to select a damage type from the list:</p> 
<b>Step</b>	<p>According to the selected type, a new dropdown list becomes available, where it is possible to select the step to be carried out</p> 
<b>Action Type</b>	<p>According to the selected step, it is possible to choose the action type from yet another a list; for example, the dropdown below is available upon choosing 'Evacuation' in the 'Step' menu:</p> 

<b>Recommended products/equipment</b>	The useful and recommended resources in terms of products and equipment have to be filled in in this field
<b>Required roles</b>	The required role to perform the selected actions have to be specified
<b>Precautions</b>	Specifications on personal protective equipment and/or special care requirements e.g. for the handling of the Item should be recorded here.
<b>Expected effectiveness</b>	The expected effectiveness in order to understand the value for money can be specified here
<b>Estimated costs</b>	An estimate of costs can be given in this field.

When all the details have been filled in, it is possible to save the information by clicking on the



button.

### 2.1.5 Update News

This collaborative service allows members of a site to share particular news. In this way, knowledge on strategic issues arises. *Update News* represents a service useful for communications, events, relevant news (Figure 31).

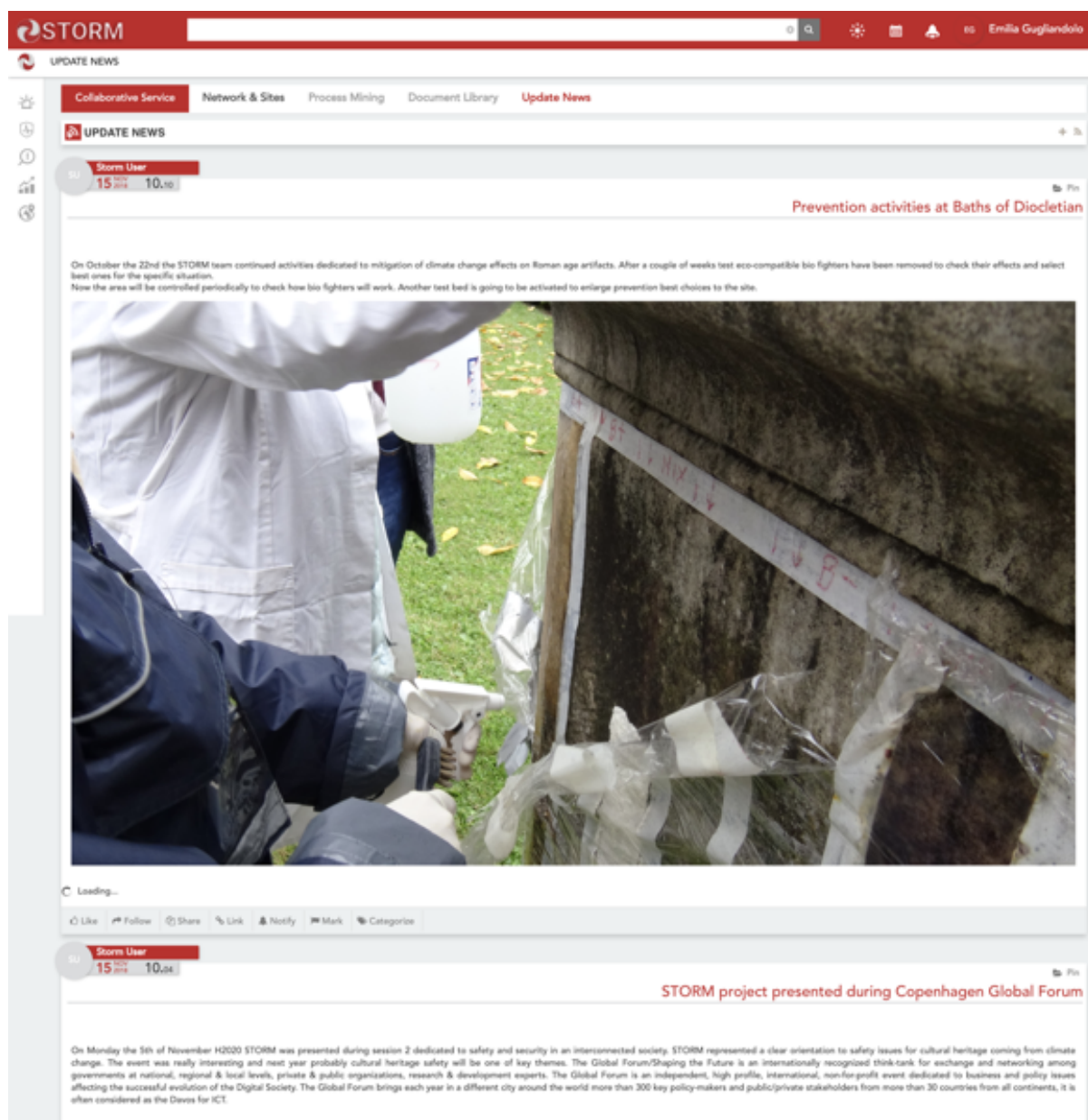
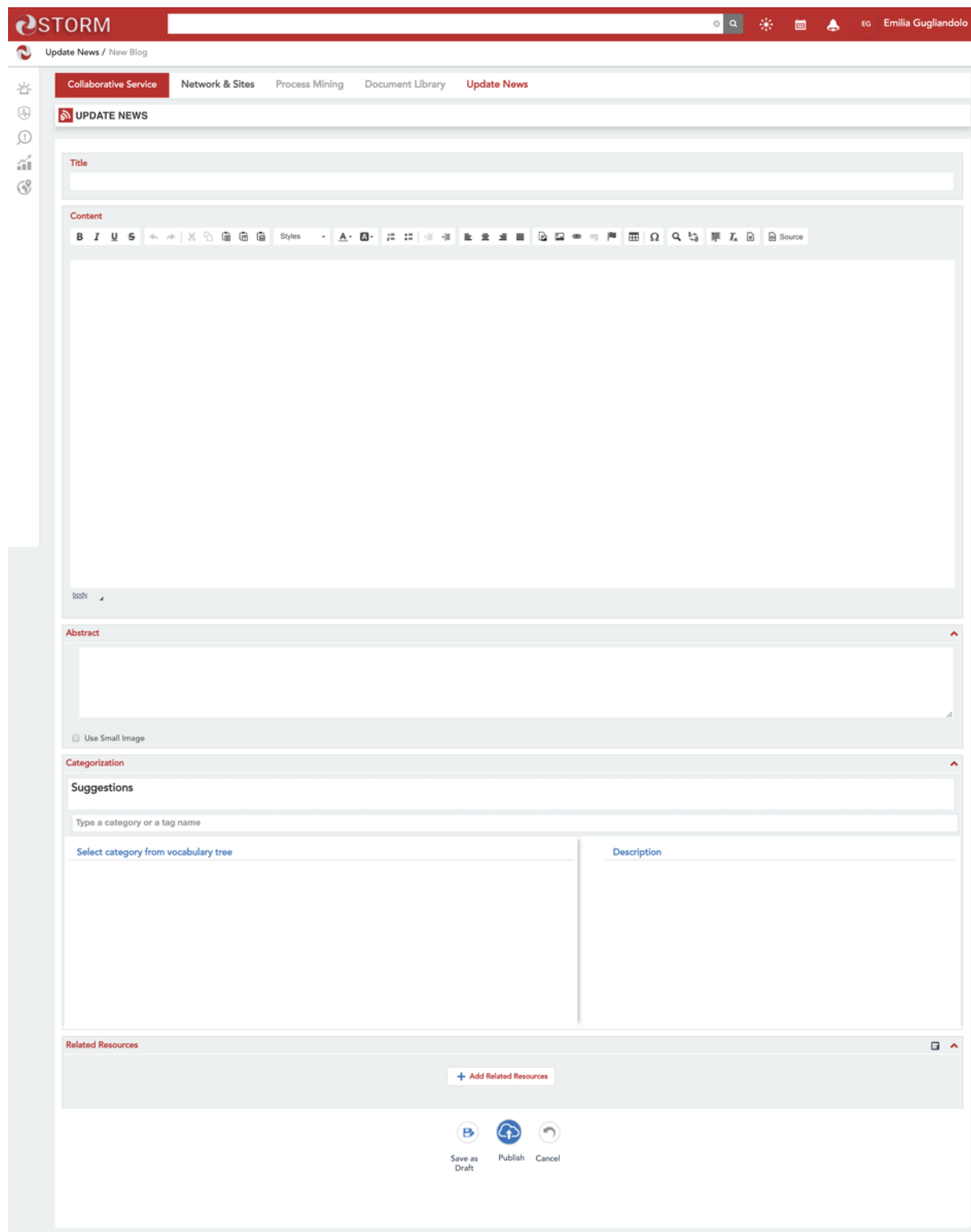


Figure 31: Update News service

The service allows community users to add blogs, categorise and associate them to other contents on the dashboard. Clicking on the + button on the right, each user can add a news piece (Figure 32) filling in the “title” and the “content”, explaining all the details of the specific news or event to be shared with all the other users. The “abstract” section summarises the news content in order to have a brief view of the topic. It is possible to associate a specific category or tag with the news and to associate another linked resource available on the platform.



**Figure 32: Update News - Add new blog**

When news are published, notifications may be sent to specific users. Moreover, all contributions are tagged with the contributor's name and contact information to know exactly who to contact for more information.

News can be visualised in more detail by clicking on the specific blog (Figure 33). Moreover, each user can comment the news and, in this way, instant feedback loops are created.

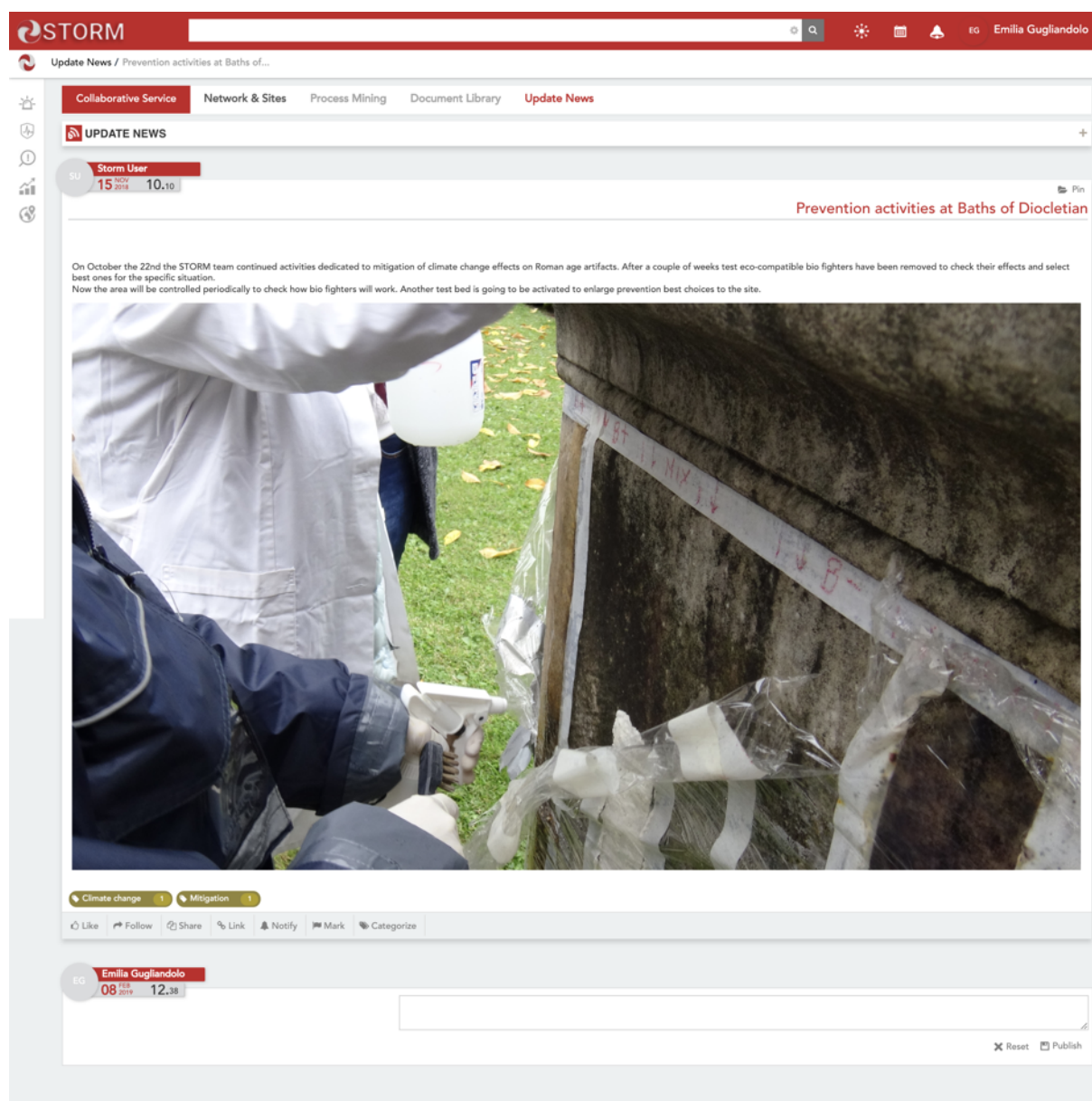


Figure 33: Update News service - View a news

Different actions can be performed when visualising news such as: *Like*, *Follow*, *Share*, *Notify* and so on. This service allows people to share knowledge and communicate in an easier way.

### 2.1.6 Document Library

The *Document Library* (Figure 34) is a service that supports document management (upload, view and download documents) among users. The quality and quantity of information received can have negative impacts if it is not managed correctly. In order to assure the usability of all the data about the cultural assets, all the relevant information is grouped into folders in order to more simply find the right data, in the right place, at the right time. The identification and listing of information and knowledge linked to site, area and items is an important requisite. For this reason, specific folders at site, area and item level are essential to store CH information. All the available information helps to reconstruct the evolution in time and consequently to design a

correct approach. Each user can organise the documents by grouping them into specific folders so that everyone can easily consult them.

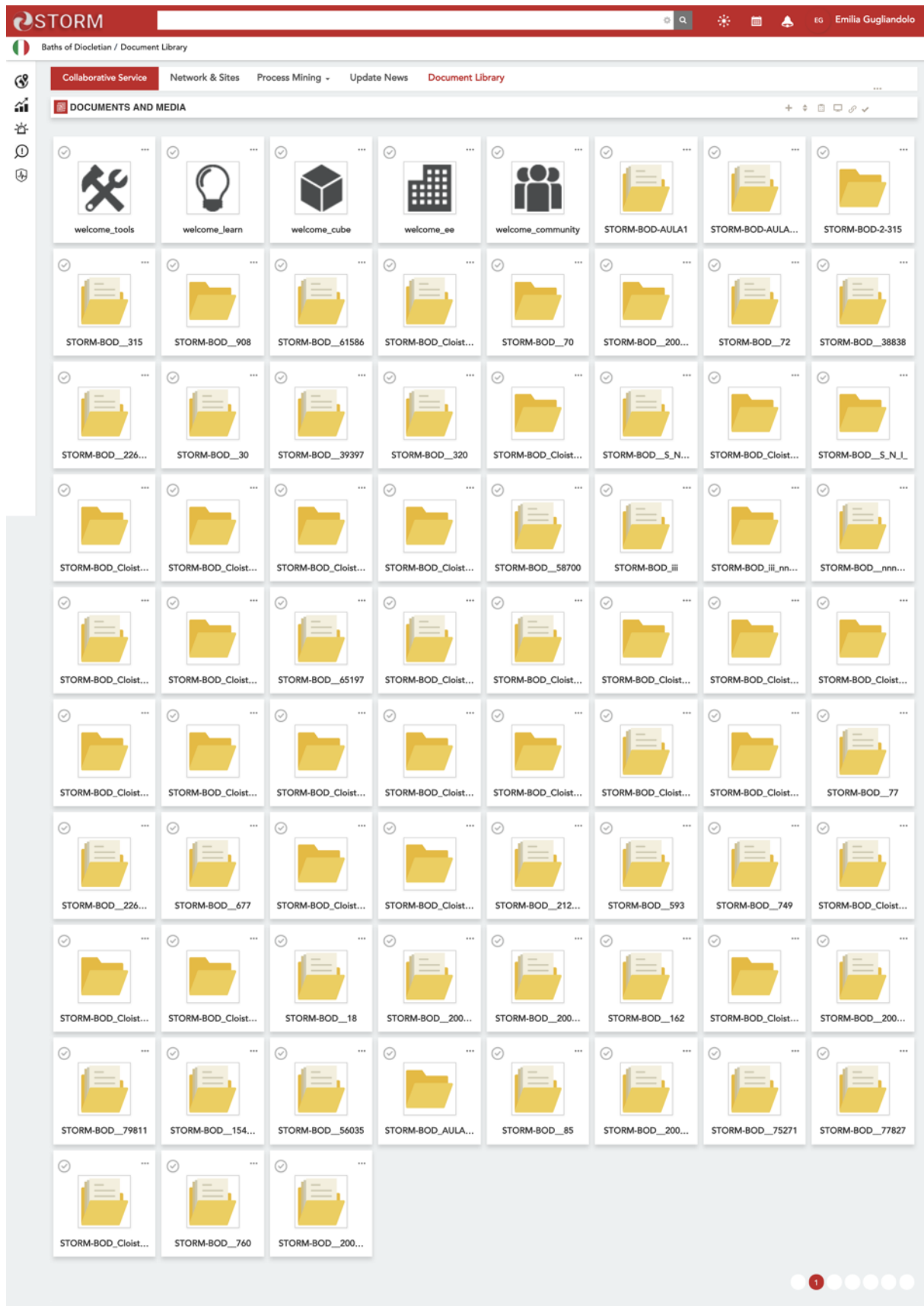


Figure 34: Document Library service



This service represents a valuable support for document sharing that allows knowledge sharing among users that work and collaborate for a common purpose. STORM users collect and gather all the available data and information related to threats, vulnerabilities, risks, operative documents, best practice, lessons learnt, etc. A knowledge archive further helps to distribute relevant information more effectively, simplifying the search for adequate information and providing the decision makers with the needed information to set the right strategies at the right time. It is possible to easily visualise the content of each folder, clicking on the folder itself. All the documents contained are visualised as shown in the following Figure 35:

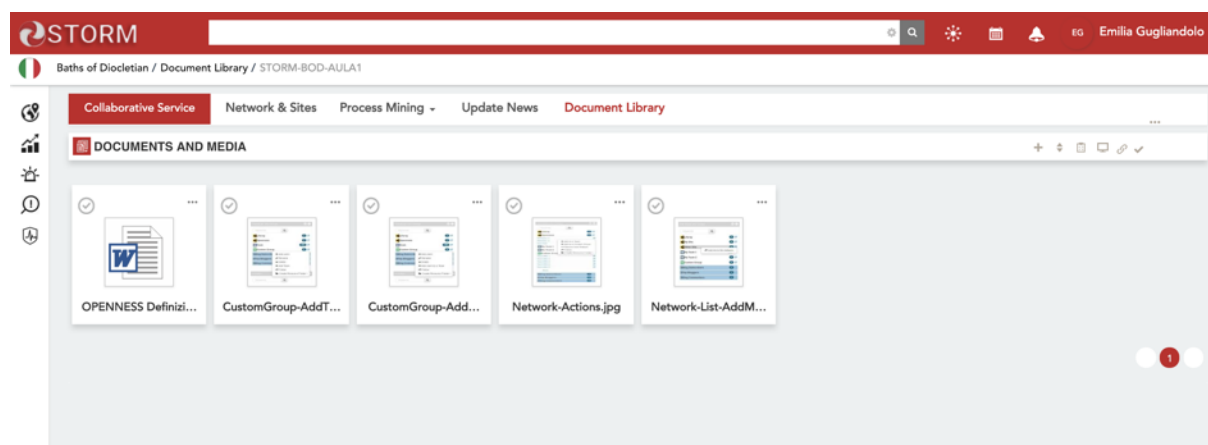


Figure 35: Document Library service - View a folder

The service allows users to add a new folder, clicking on the + button on the right, in order to upload one or more documents at one time. It is necessary to fill in the folder Name and a brief description as shown in the following Figure 36:

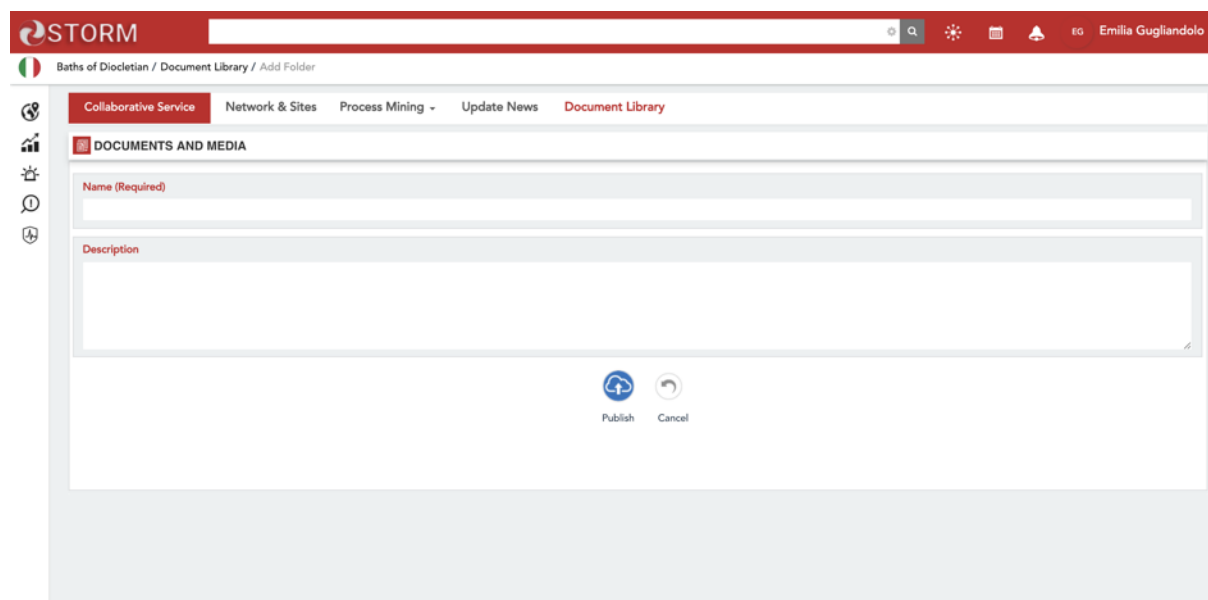


Figure 36: Document Library service - Add a new folder

*Document Library* service gathers all the CH databases. In this way, when a disaster occurs, all the information gathered could help users.

## 2.2 Operative Services

The *Operational Working Environment* (OWE) provides operative tools, services and applications supporting collaborative decision making. The development of the Operational Working Environment is not intended to replace any existing participation methods but rather to act with innovative practices and techniques for the community. Hence, it is not aimed at substituting the decision makers' responsibilities, but rather at assisting in making decisions by providing additional supportive information and tools. The opportunity to have customisable prompt solutions mapping the current situation in a systematic way and gathering the most relevant information is an imperative for supporting decision making. The operative tools assist decision makers to enhance understanding and management of a critical situation in a collaborative and shared manner. General information (e.g. guidelines, reports, etc.) related to dramatic events (e.g. flood, earthquake) are made available, shared and dynamically adapted in near real-time by an ad-hoc team of experts to identify the most urgent actions called for by the emergency. The operational environment provides a quick view of the main parameters coming out from a systematic analysis and assessment of data and facts according to the user's interests and needs. Stakeholders need to make informed and consensual decisions working together and sharing information and the best available data. A set of operative tools, services and applications help, during all the Disaster Risk Management phases, to:


- Generate the current situation to be analysed giving all the necessary information to identify decisions that need to be made;
- Recognise the right processes/tasks to be selected and people (and their specific role) to be involved for each of them;
- Evaluate the measurements and options to make better decisions;
- Collaborate with other involved stakeholders;
- Gathering the most relevant information in order to detect anomalous events;
- Evaluate the decision taken.

Moreover, to enable an effective decision-making process, users need a complete overview of the critical situation, which means, in terms of data and information, an integration of current (real time) and past knowledge of critical evolution to help decision making leading actors to better understand the situation in progress. The Operational Working Environment integrates operative tools, services and applications, to support decision making in extreme or high-pressure environments, establishing necessary and useful functionalities for representing the critical situation and providing information for decision making support.

The specific *operative services* featured in the operational environment are the following:

- *Sensory Map*;
- *Visual Analytics*;
- *Event Manager*;
- *Risk Assessment*;
- *Situation Awareness*.

## 2.2.1 Sensory Map

The *Sensory Map* service shows the monitoring areas and the position of the installed sensors. The icons  are the locations which need to be monitored because they have been affected by main hazards. Figure 37 illustrates the first page of the Sensory Map. In particular, it visualises on the map all the available sensors for the Italian site, through the WEG-GIS layer (for further detail, please refers to the D7.8 - *Functional easy- to-use Web-GIS interface*):

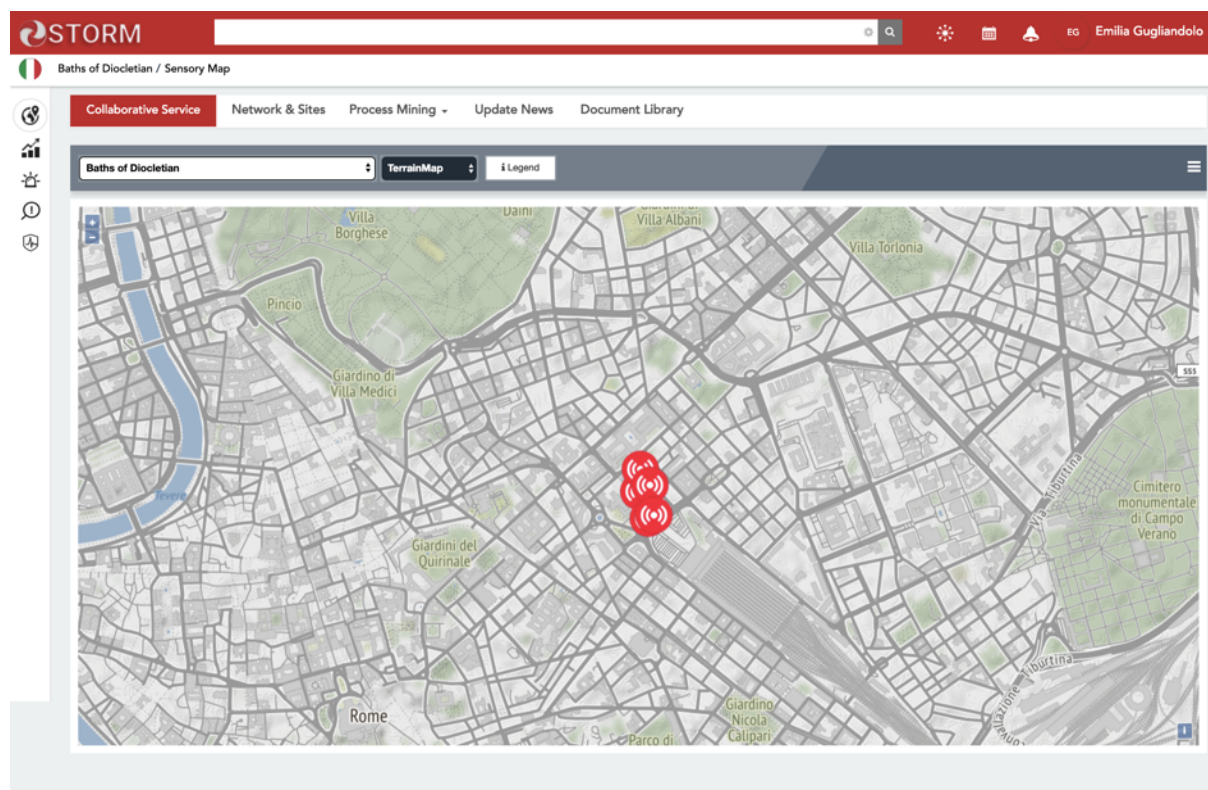

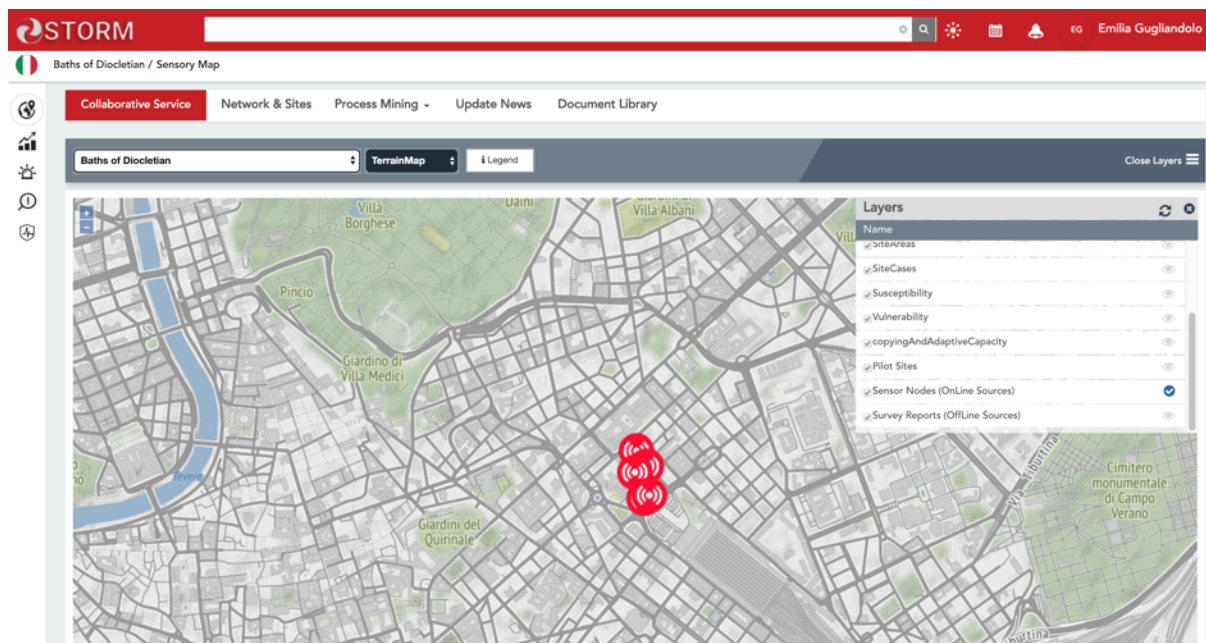


Figure 37: Sensory Map service

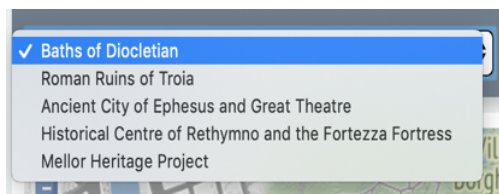
Specifically, the service shows the position of the installed sensors, named *On-line Data Sources*, and the results coming from the damage assessment technologies, termed *Off-line Data Sources*. The *On-line Data Sources* generally consist of one or more nodes capable of hosting one or more sensors, and an aggregator or base station capable of collecting data received by several nodes and send them to a data gathering module for their collection, storage and management. The *Off-line Data Sources* are used for scientific surveying activities that can be implemented periodically or after a natural hazard event, to monitor and assess damage (for more technical detail, please refers to the D3.3 – *System Architecture*).

For each pilot site, it is possible to visualise all the available on-line and off-line sensors. With this aim, the first step to be followed is to select the *Sensor Nodes (online Sources)* layer clicking on the  icon in the list of the layers and zooming in the concerned area. Then, the on-line sensor nodes available will be visualised (Figure 38).

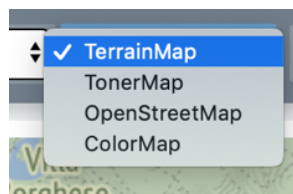


**Figure 38: Sensor Nodes in Baths of Diocletian**

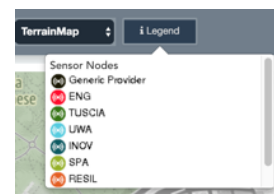
Additional features can be provided by clicking on: the *site selection* menu (Figure 39) where it is possible to change the selected site; the *style map* menu (Figure 40) where it is possible to select and change the style of visualisation; the *legend* menu (Figure 41) to obtain further information regarding the sensor providers.



**Figure 39: Site selection menu**



**Figure 40: Style Map menu**



**Figure 41: Legend menu**

In the next step, it is possible to visualise the information node pop-up (Figure 42) and the last measures (Figure 43) by clicking on the respective icon on the map.

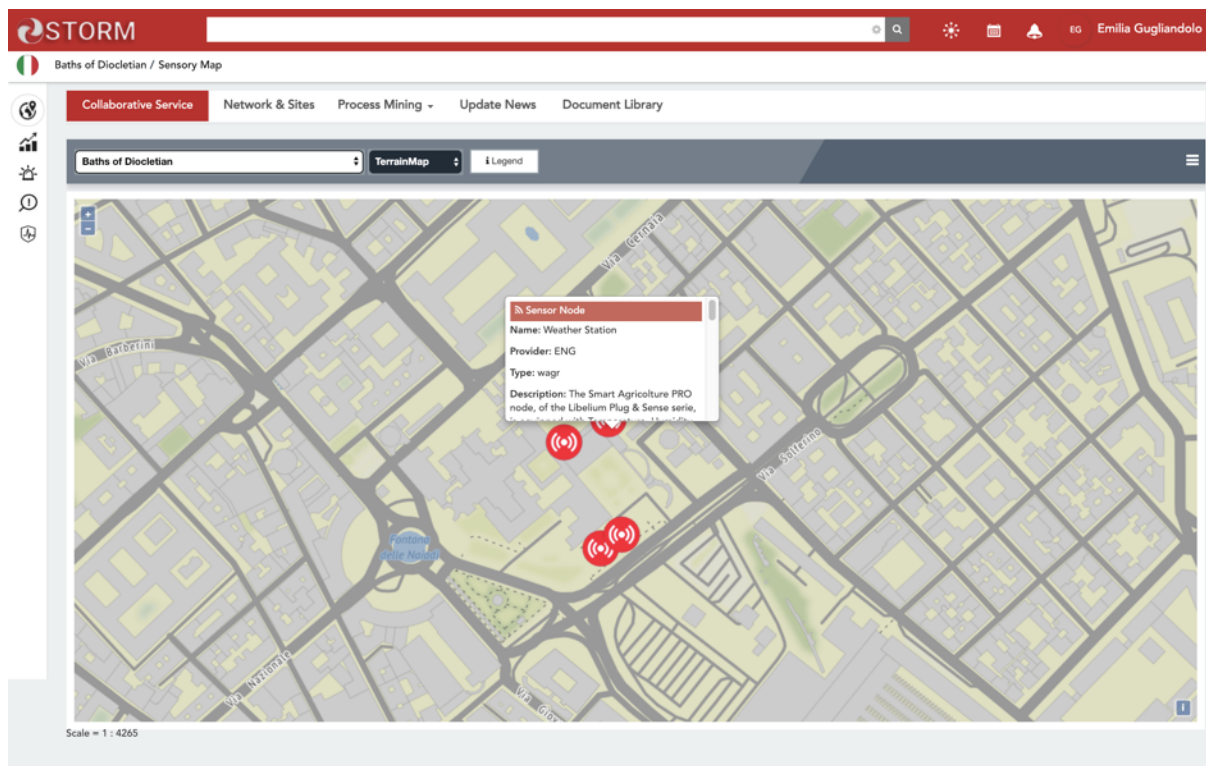


Figure 42: Info Sensor Node in Baths of Diocletian pilot

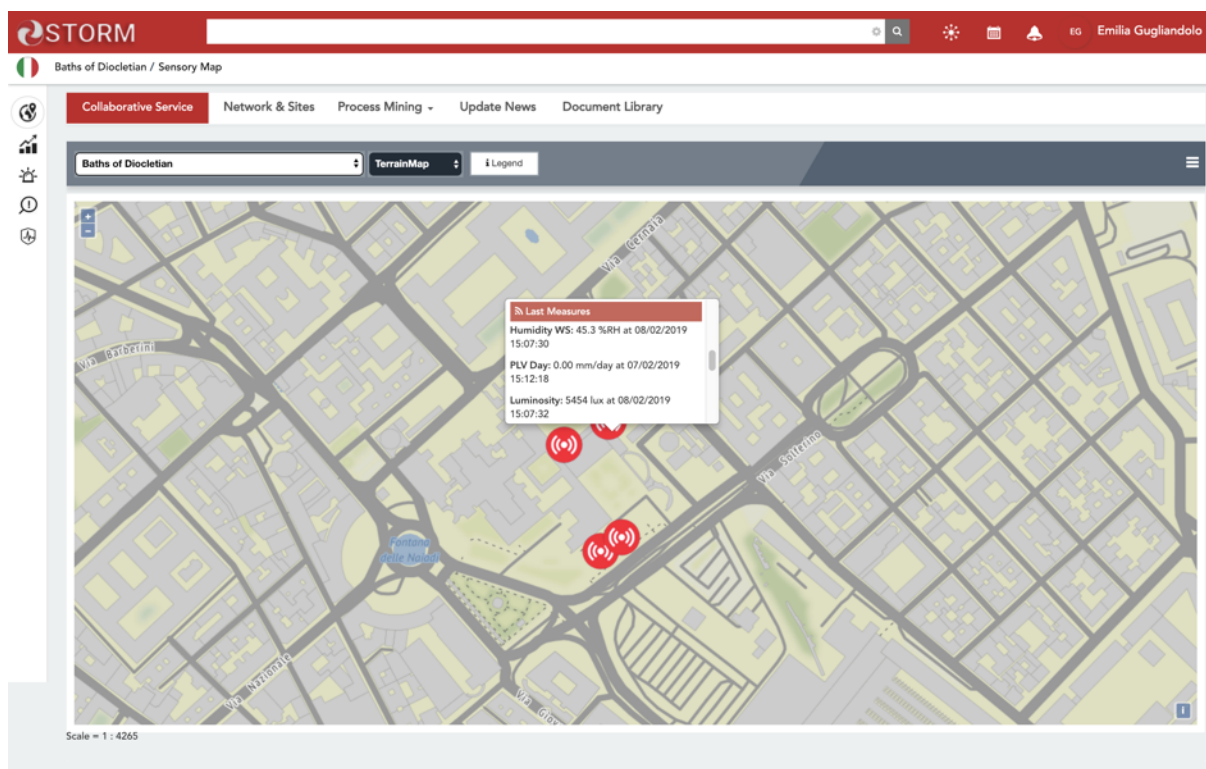


Figure 43: Info Last Measures in Baths of Diocletian pilot

In order to visualise the detailed information regarding the sensor node, the user has to click on the pop-up in the icon. Figure 44 shows the detail of the selected sensor node. In this example, the details of a sensor node in the Baths of Diocletian site are visualised.

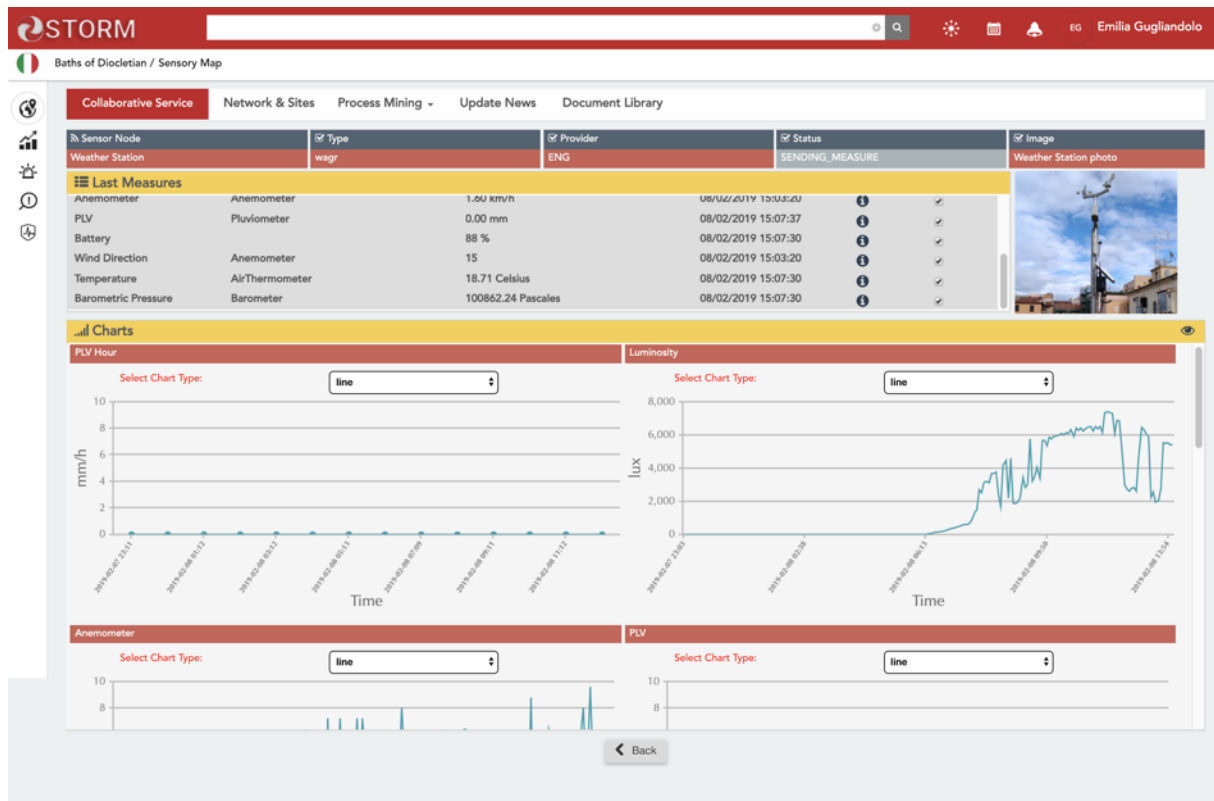


Figure 44: Detailed information on sensor node in Baths of Diocletian site

In this case, the last measures for each sensor (Figure 45), and data provided by sensors through charts (Figure 46) are presented.

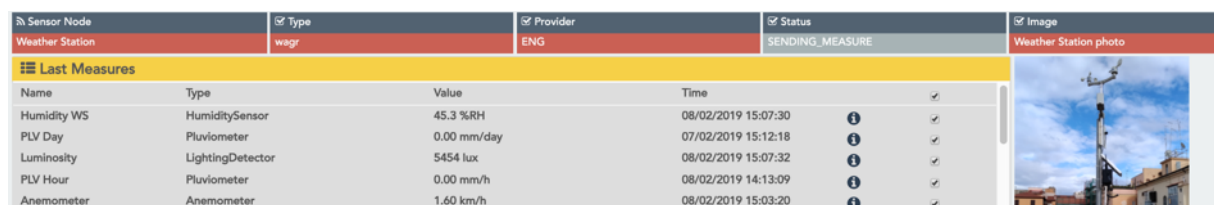


Figure 45: Last measures in Baths of Diocletian site



Figure 46: Charts for each sensor in Baths of Diocletian site

It is possible to select a specific graph related to a chosen sensor, checking  or de-checking  sensor names in the *Last Measures* list; then, by clicking on the icon it is possible to visualise the requested graph, as shown in Figure 47.

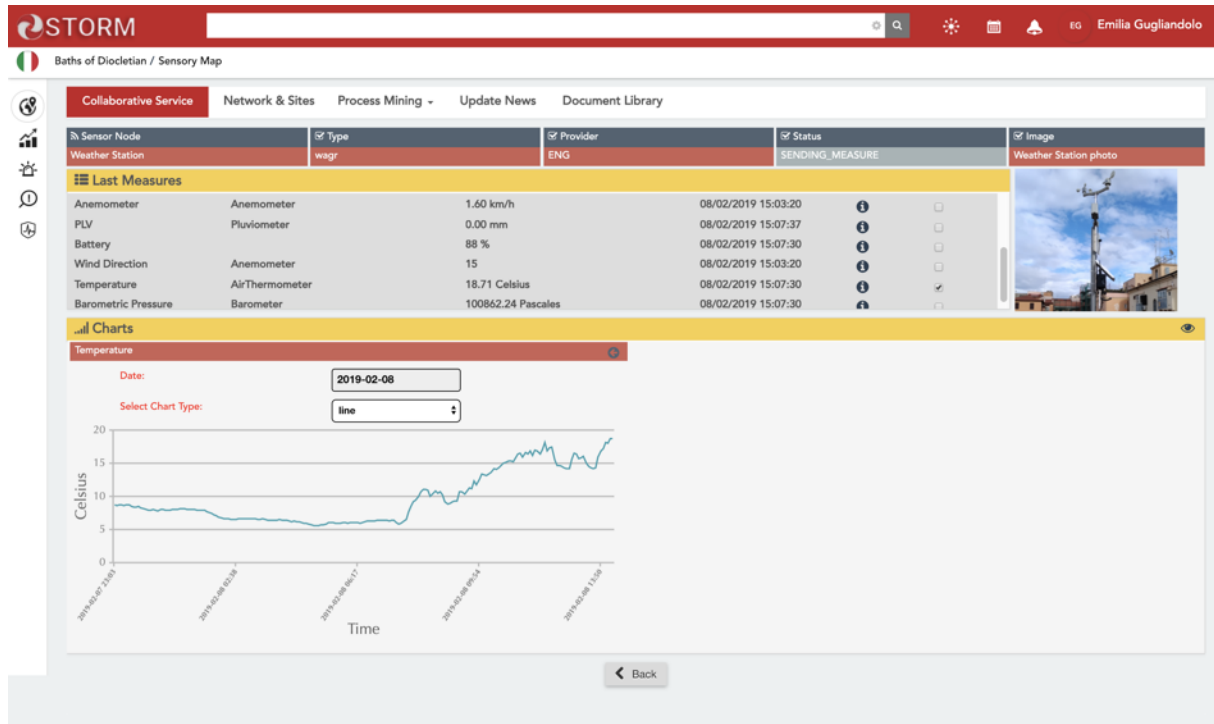


Figure 47: Visualise only Chart selected in Baths of Diocletian site

When only one graph has been selected, it is possible to change the data for temporal interval, clicking on the backward and forward icons. In Figure 48, data regarding the last temporal interval is visualised; instead, in Figure 49, data regarding the previous temporal interval is visualised.

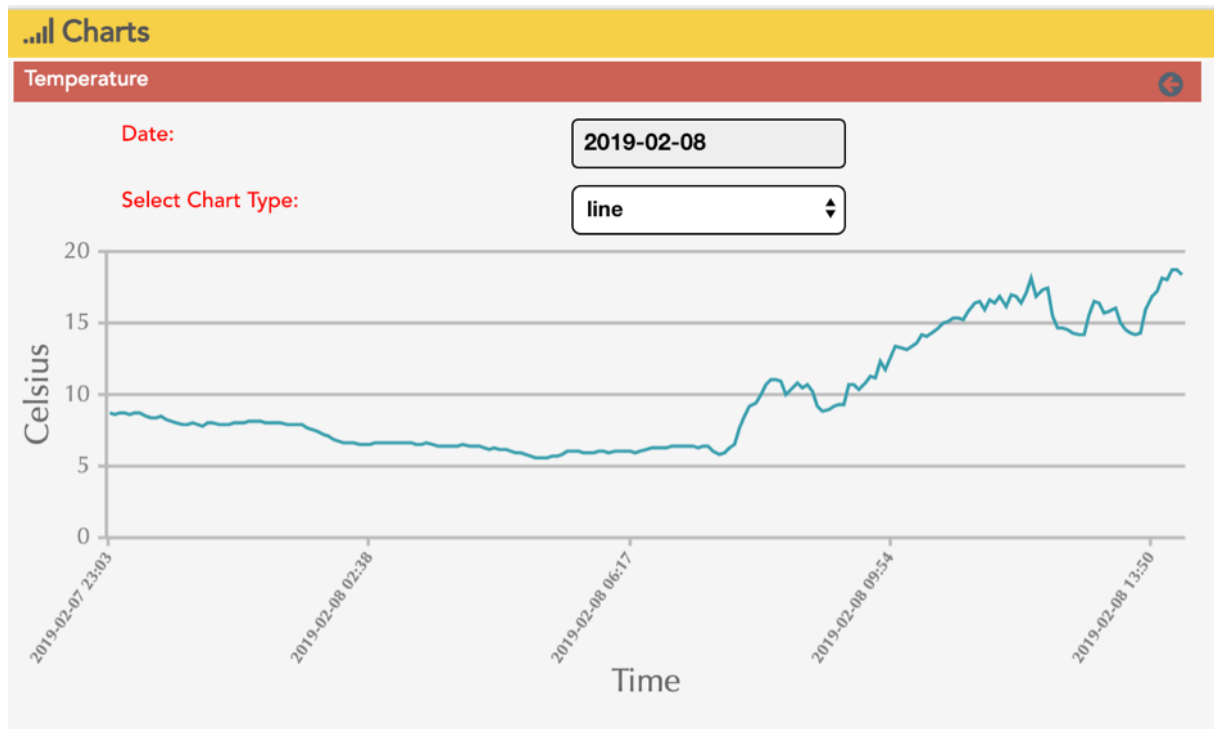


Figure 48: Example of Data chart regarding the last temporal interval



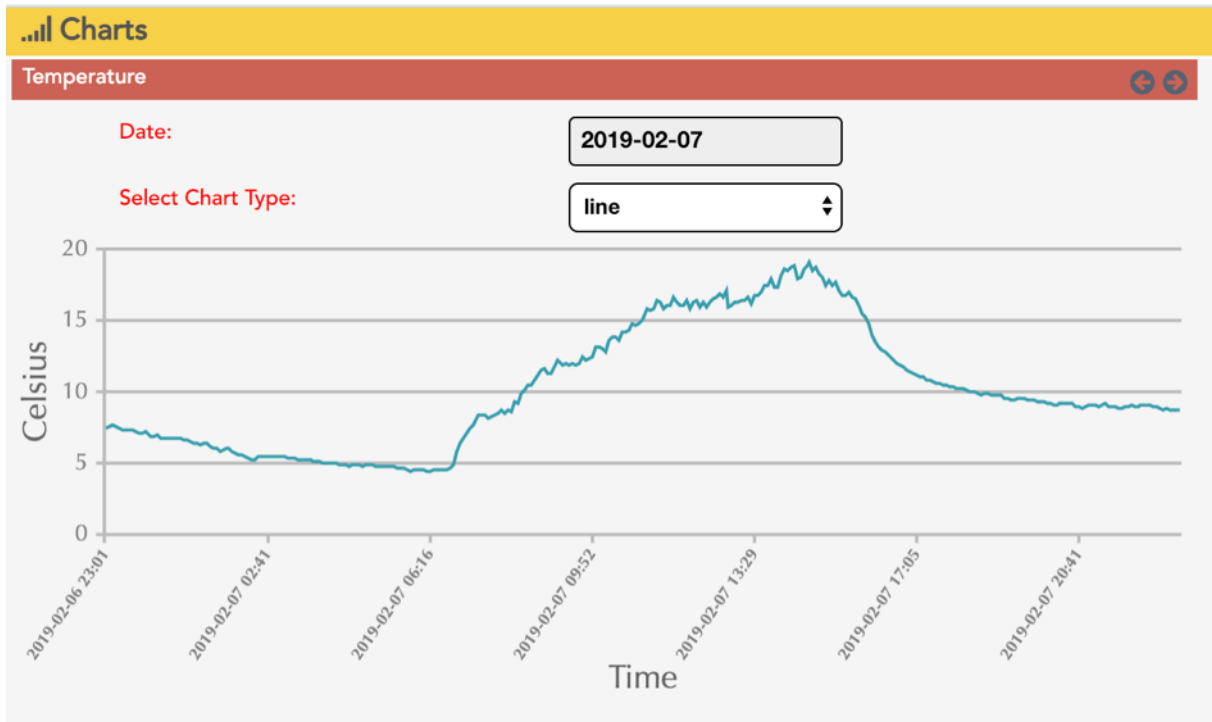


Figure 49: Example of Data chart regarding the previous temporal interval

For each graph, it is possible to change the type of chart and the interval range data. This is shown in Figure 50 and in Figure 51.

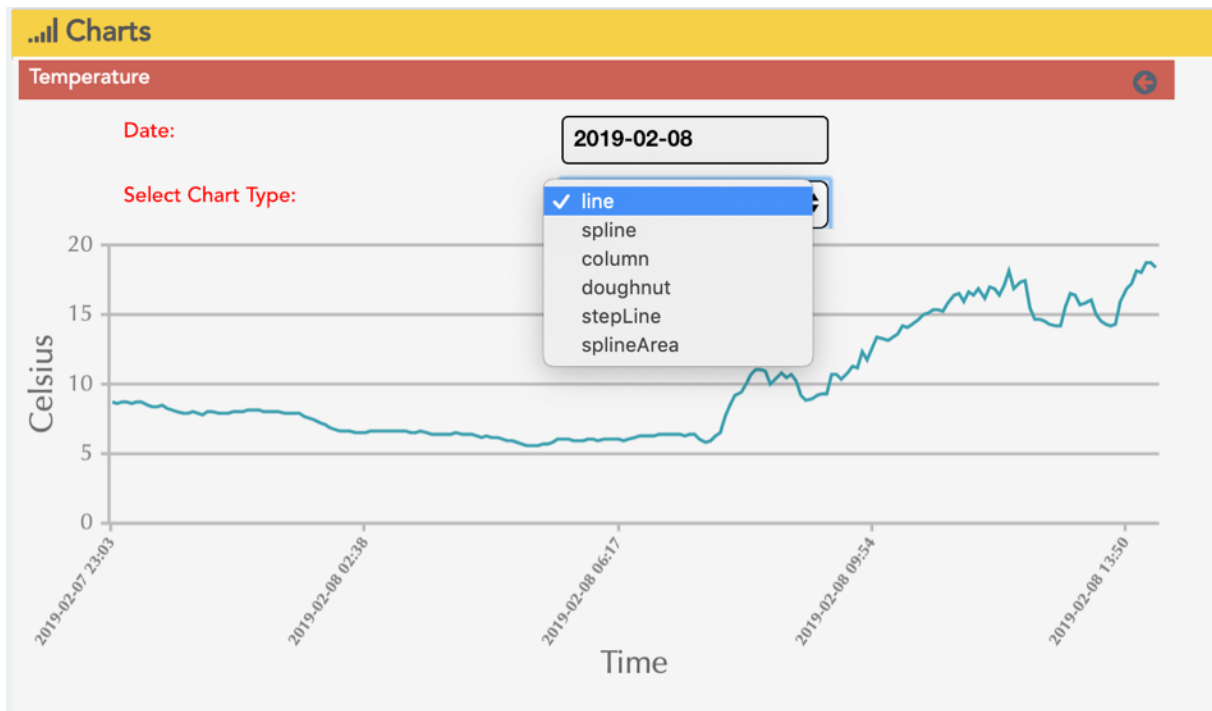
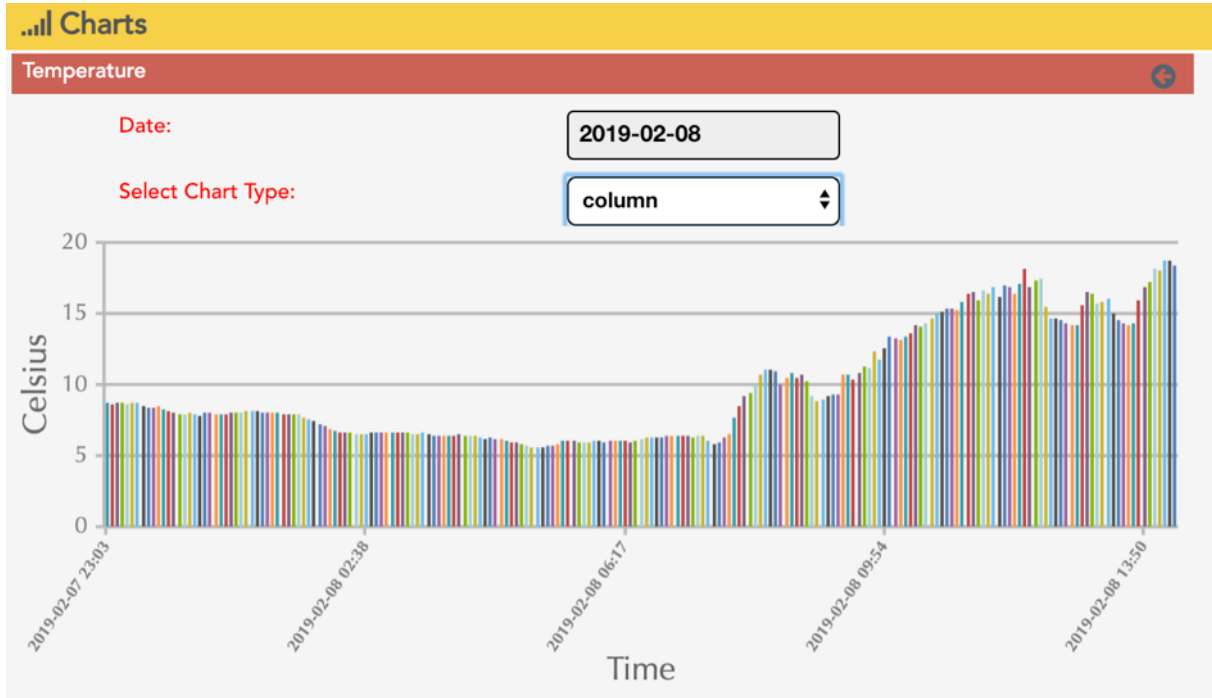



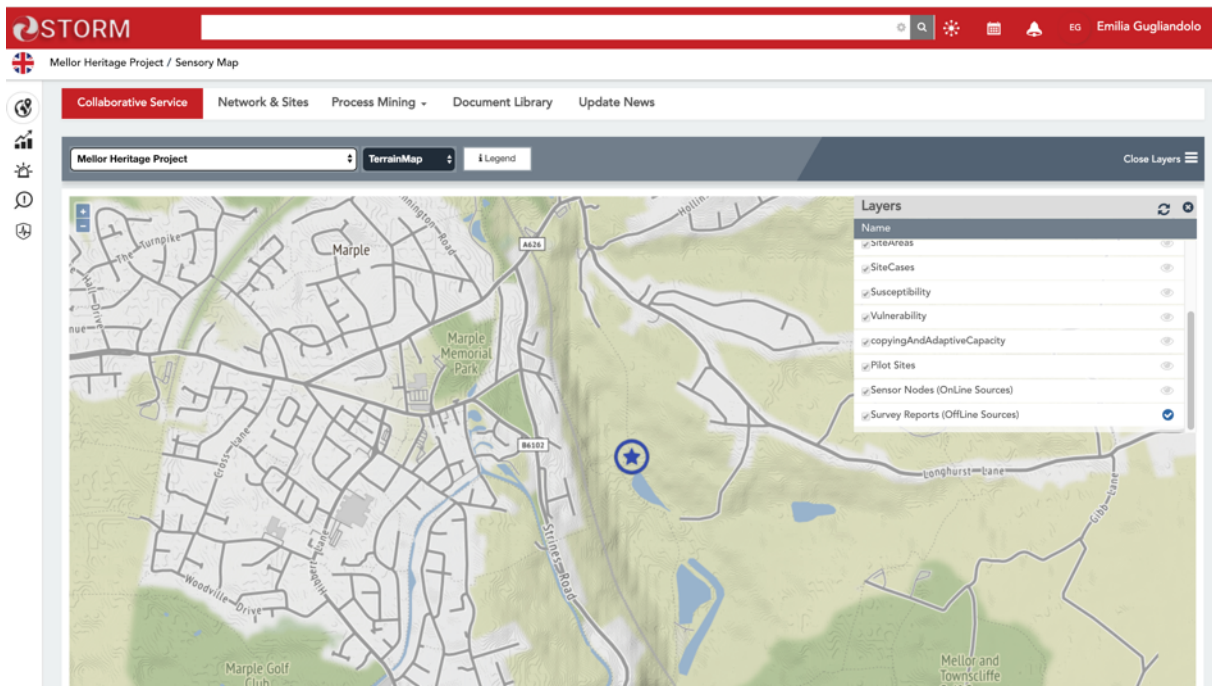
Figure 50: Change type Chart and/or Interval information data




**Figure 51: Result Graph after the change of type Chart and Interval range**

The Off-line Data Sources are used for scientific surveying activities that can be implemented periodically or after a natural hazard event, to monitor and assess damage.

The Off-line Data Sources results come from Induced Fluorescence, Terrestrial and aerial Photogrammetry, Laser Scanning, Electrical Resistivity Tomography, Ground Penetrating Radar, Infrared Thermal Imaging, x-Ray Diffraction and Fluorescence, Spectral Camera. After activating the specific Survey Reports (Off-line Sources) layer, the available off-line sources are visualised using specific icons , as shown in the following Figure 52:



**Figure 52: Off-line sensor sources**

Clicking on the related icon  on the map, a form with brief information (Figure 53) along with a detailed section with the specific measurement information details as an image, 3D model, etc., can be shown (Figure 54).

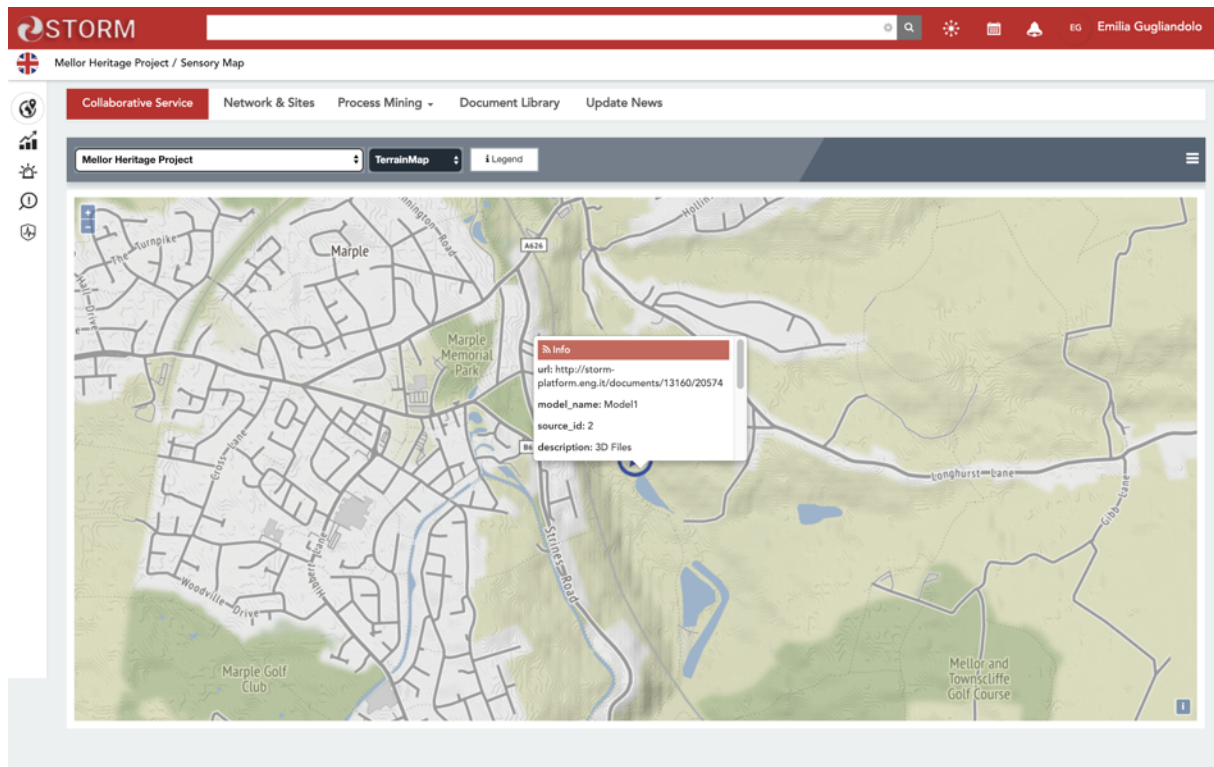


Figure 53: Brief off-line sensor information

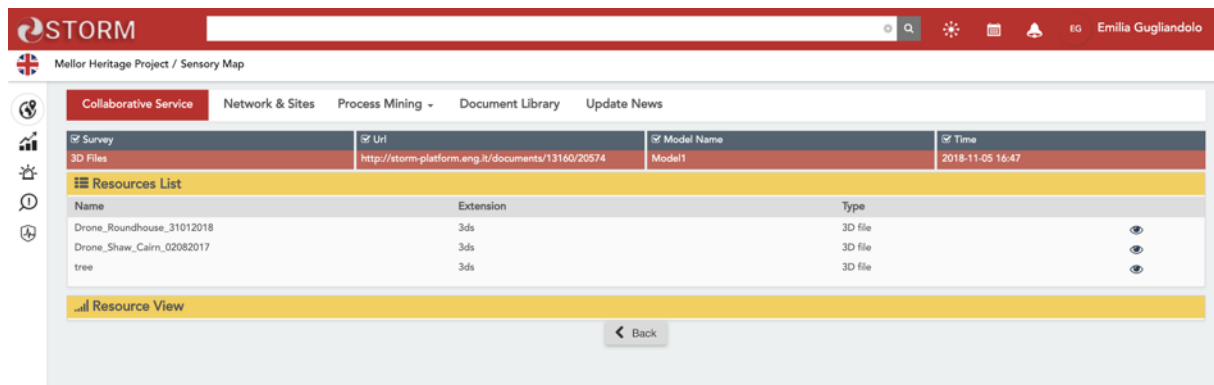

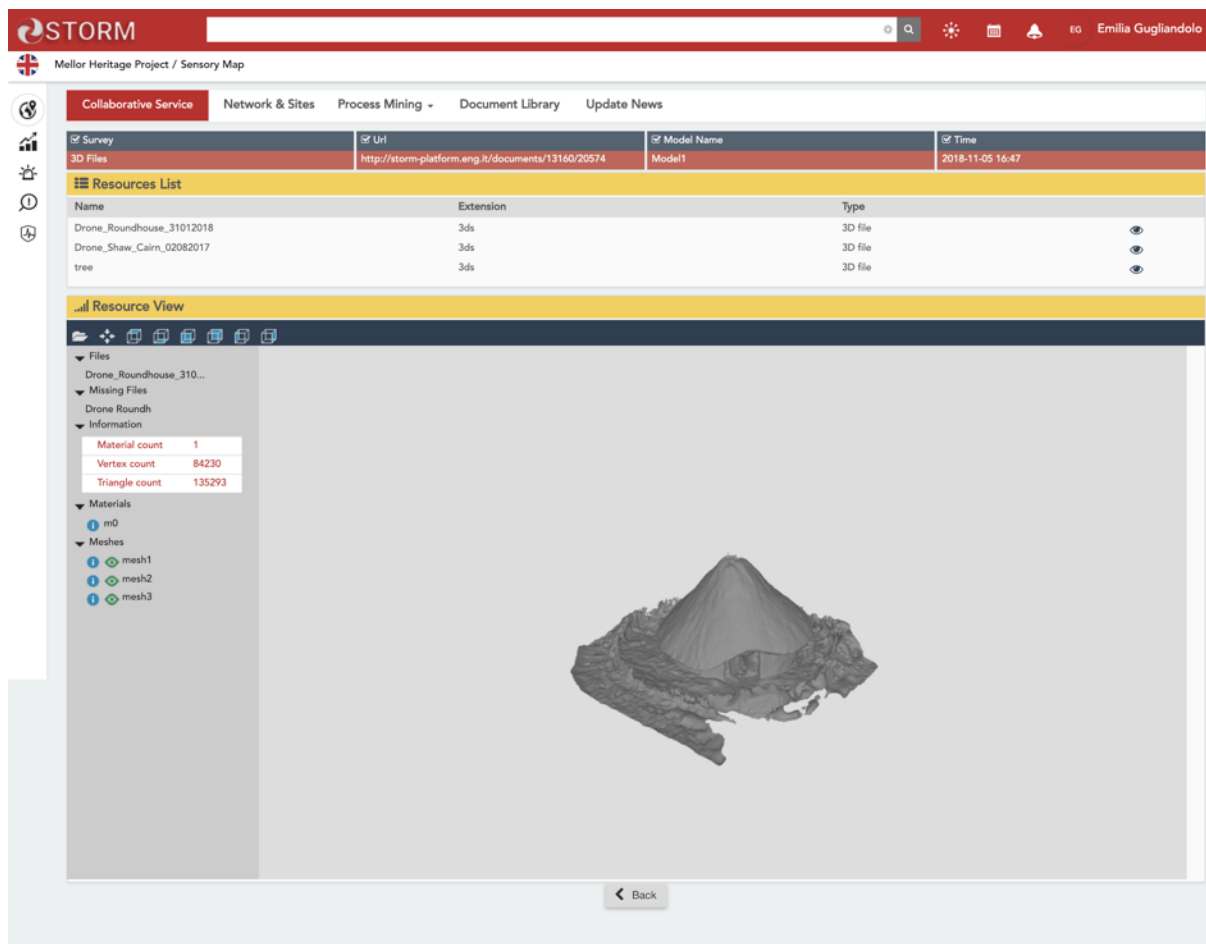


Figure 54: Detailed off-line sensor information

By clicking on the  icon, it is possible to visualise the details of a specific survey with the specific measurement information details as an image, 3D model, etc., as shown in Figure 55:



The screenshot displays the STORM web interface for the Mellor Heritage Project / Sensory Map. The top navigation bar includes 'Collaborative Service', 'Network & Sites', 'Process Mining', 'Document Library', and 'Update News'. The user 'Emilia Gugliandolo' is logged in. The main content area shows a 'Resources List' table with the following data:

Name	Extension	Type
Drone_Roundhouse_31012018	3ds	3D file
Drone_Shaw_Cairn_Q2082017	3ds	3D file
tree	3ds	3D file

Below the table is a 'Resource View' section showing a 3D model of a structure. The left sidebar provides detailed statistics for the selected model:


Material count	1
Vertex count	84230
Triangle count	135293

The sidebar also lists 'Materials' (m0) and 'Meshes' (mesh1, mesh2, mesh3). A 'Back' button is visible at the bottom of the resource view.

Figure 55: Detailed survey information

## 2.2.2 Visual Analytics

The *Visual Analytics* service gathers sensor network data and other relevant information from disaster-affected areas and presents them to the user of the system. Data are processed to provide easy-to-understand representations considering both past events and the current situation at STORM sites. This feature is essential to identify risks and to monitor their evolution, starting from the analysis of the current and historical data. This information could be visualised on appropriate charts and maps. Data analytics is used to improve the understanding of situations and to support the end user in effective decision making via various data visualisations. Specifically, information provided should include: i) type of the threats and their characteristics (e.g. wind or rain, intensity, direction, occurrences, time-frame, etc.); ii) maps of hazardous events occurred on the site; iii) monitoring of specific measures relative to assets (e.g. humidity, temperature, volume); iv) historical data monitoring of natural events; v) historical data monitoring of specific measures relative to the assets and evolutionary trends.

In the Visual Analytics service, the home page is presented as a map in a WEB GIS layer where it is possible to select the preferred site/area/sensor node in order to visualise the associated analytics. For example, the pop-up of the weather station sensor node in Baths of Diocletian site is shown in Figure 56. The analytics is visualised by clicking on the  icon in the pop-up.

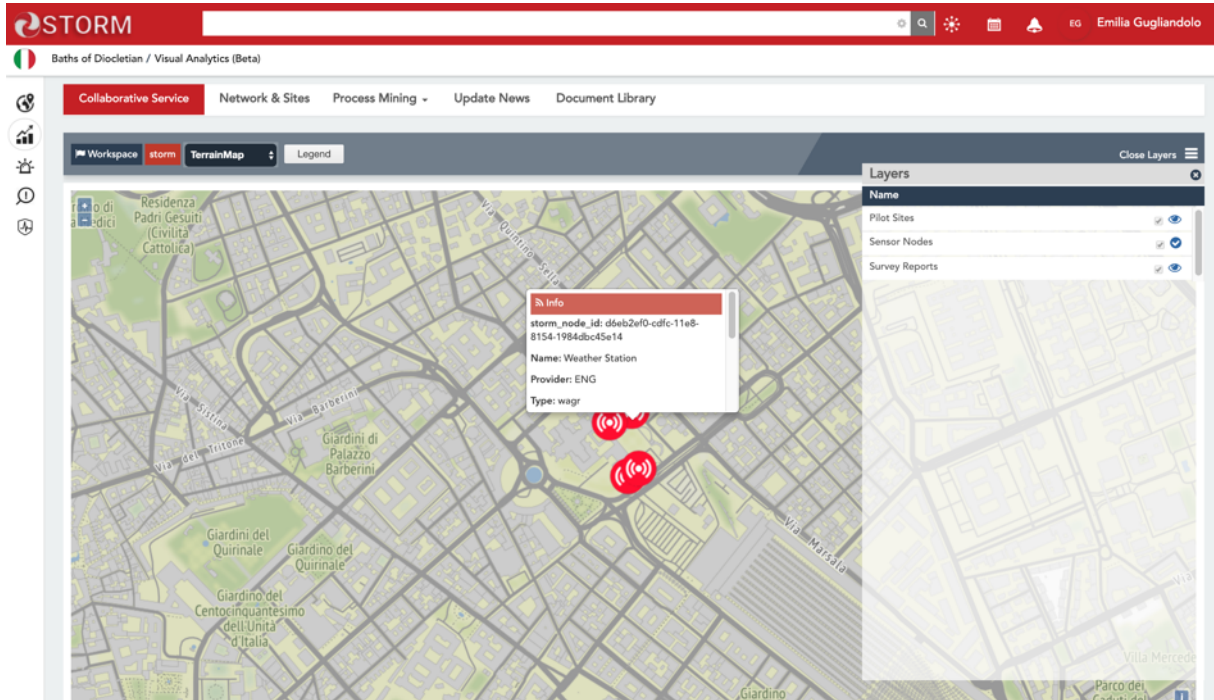


Figure 56: Weather Station in Baths of Diocletian Site Popup

The list of analytics regarding the weather station in the Baths of Diocletian Site is shown in Figure 57.

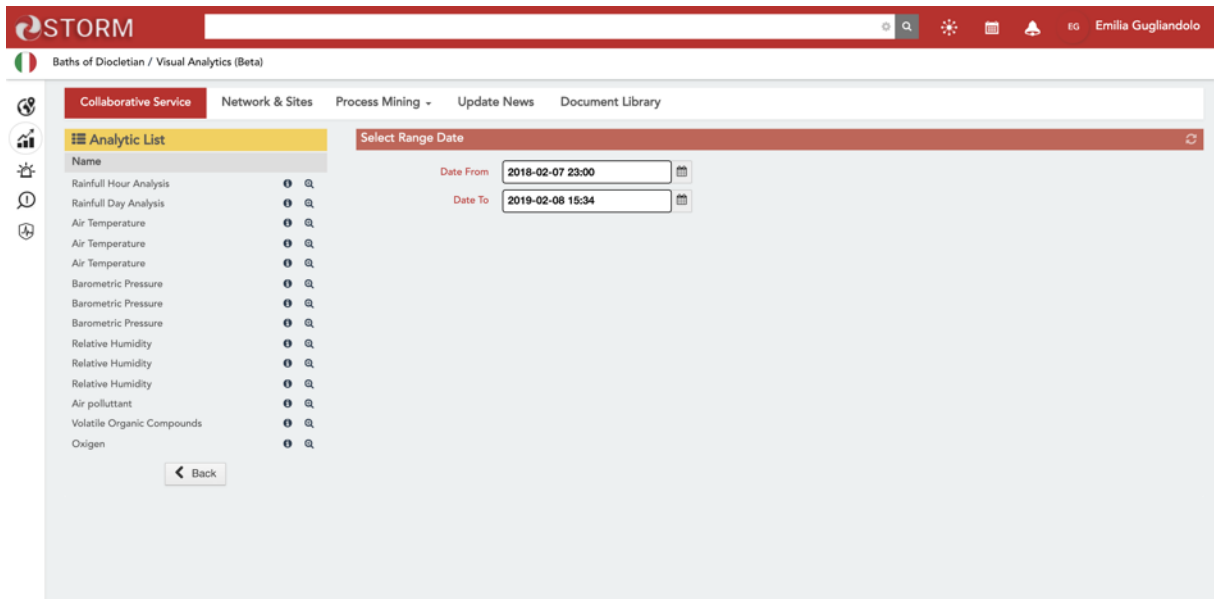


Figure 57: Analytic List regarding the Weather Station in Baths of Diocletian Site

For each day analytics, it is possible to filter for interval data, changing the dates through a calendar (Figure 58).

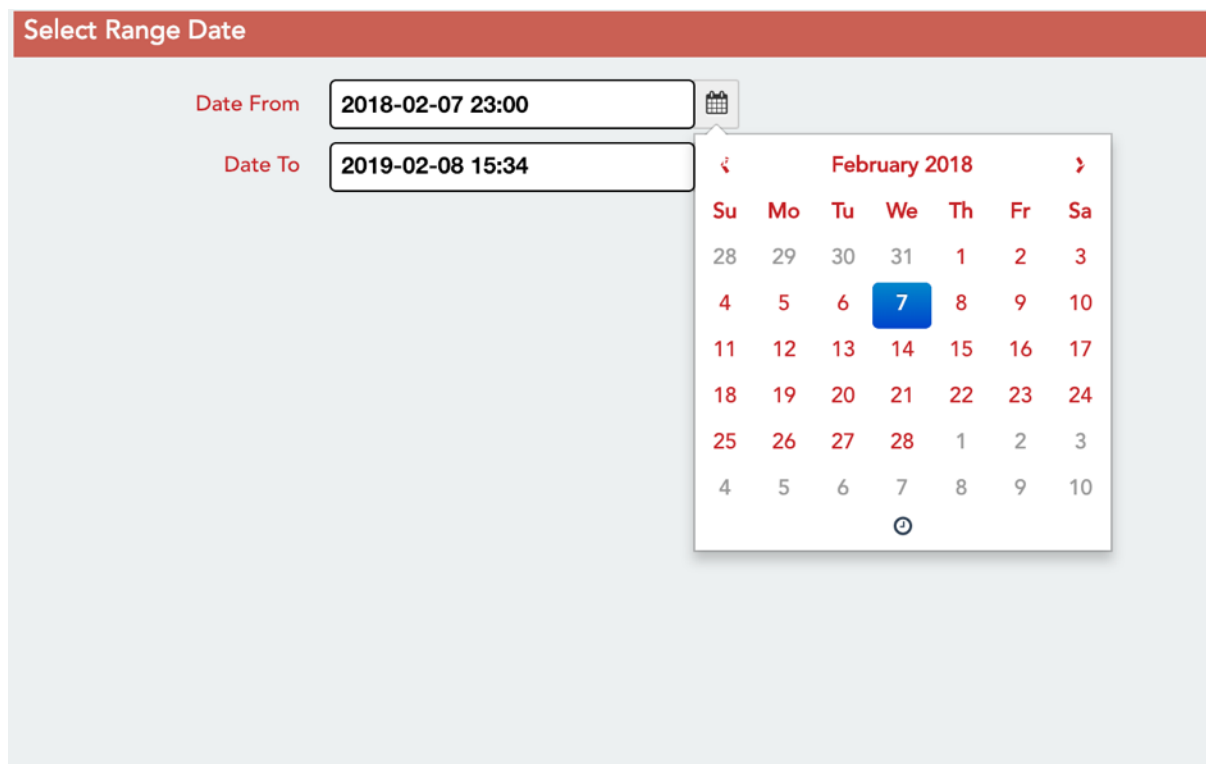


Figure 58: Change range of interval information


After choosing the range, by clicking on the  icon in the Analytic List it is possible to visualise the detailed information. For example, the *Air Temperature Analytic* details are shown in Figure 59.



Figure 59: Selected Air Temperature Analytic Details

More specifically, the *Statistics Index* values are presented in Figure 60, instead the analytics charts are shown in figures below (Figure 62, Figure 63, Figure 64).

View Analytic Detail		
Name	Type	Entity
Air Temperature	descriptive	Sensor Node
Statistics Index		
Name	Description	Value
Aritmetic average	Aritmetic average	13.52463
Samples	Samples	339
Standard deviation	Standard deviation	16.85232
Varicance	Varicance	284.00058
Coefficient of variance	Coefficient of variance	1.24605
Maximum	Maximum	30.51765
Minimum	Minimum	-0.759
Less than 0.0	Less than	2
Less than or equals 4.0	Less than or equals	85

Figure 60: Statistics Index in Air Temperature Analytic

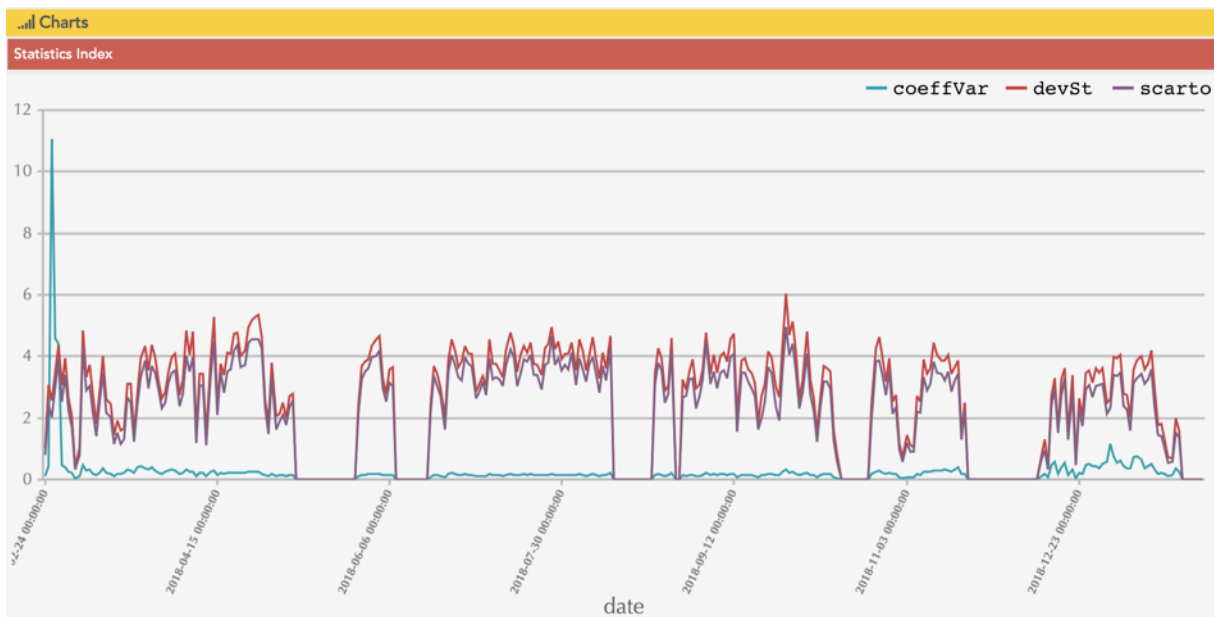


Figure 61: Statistic Index Chart in Air Temperature Analytic



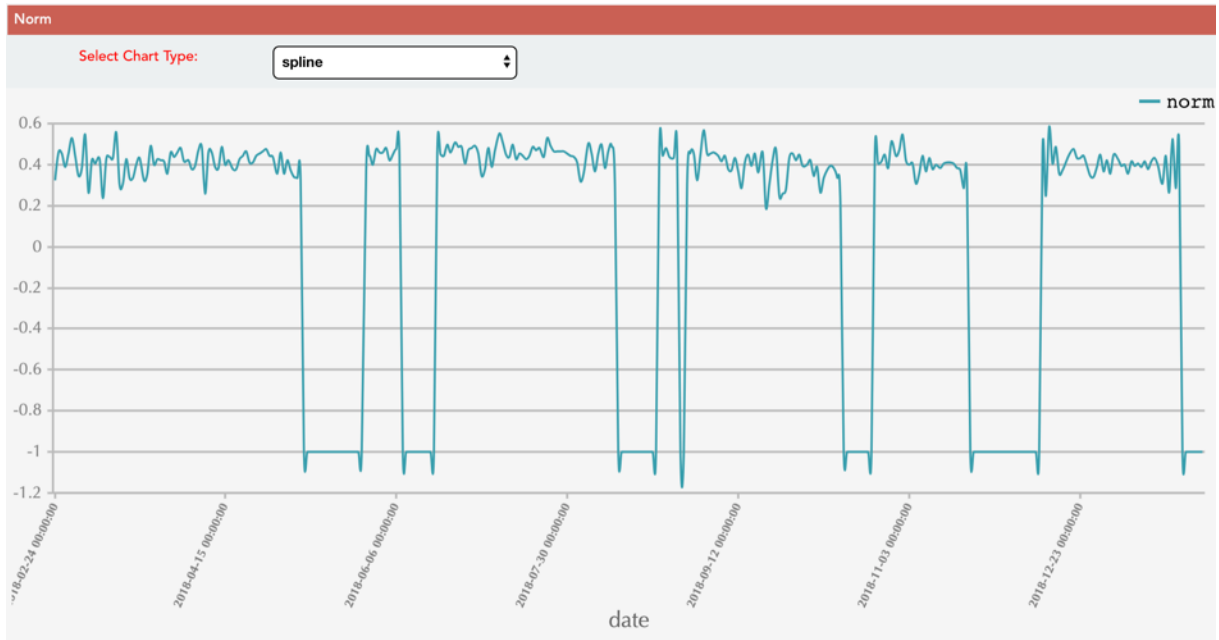


Figure 62: Norm Chart in Air Temperature Analytic

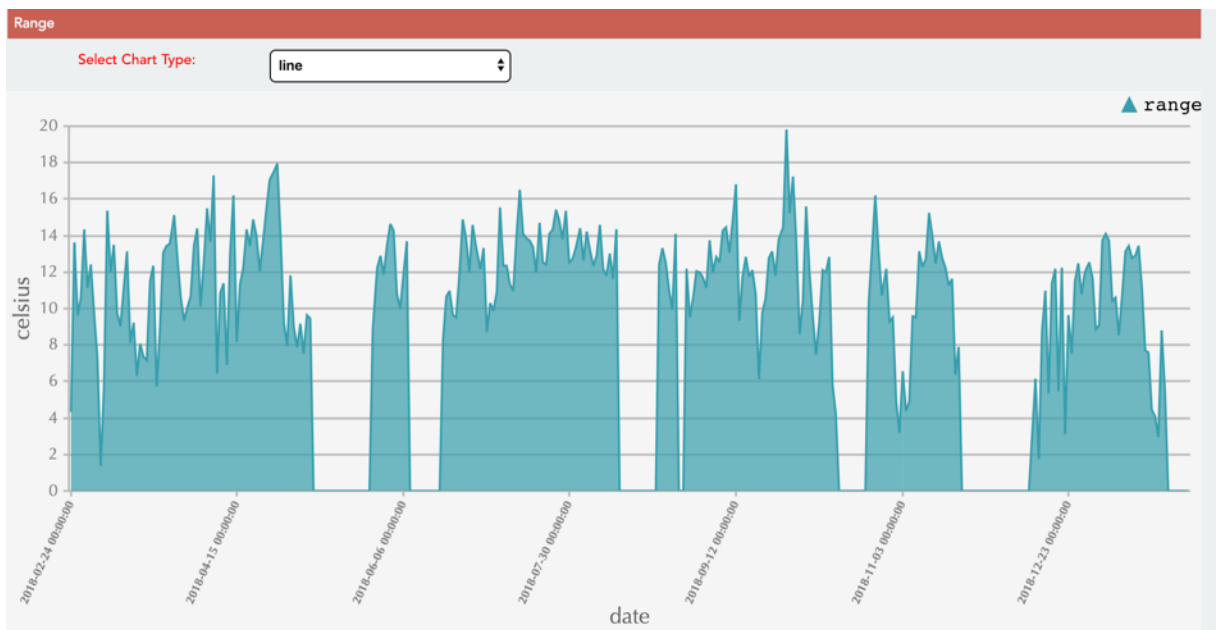


Figure 63: Range Chart in Air Temperature Analytic



Figure 64: Minimum, Maximum and Average Chart in Air Temperature Analytic

For the simple chart is possible to change the type of chart (Figure 65, Figure 66).

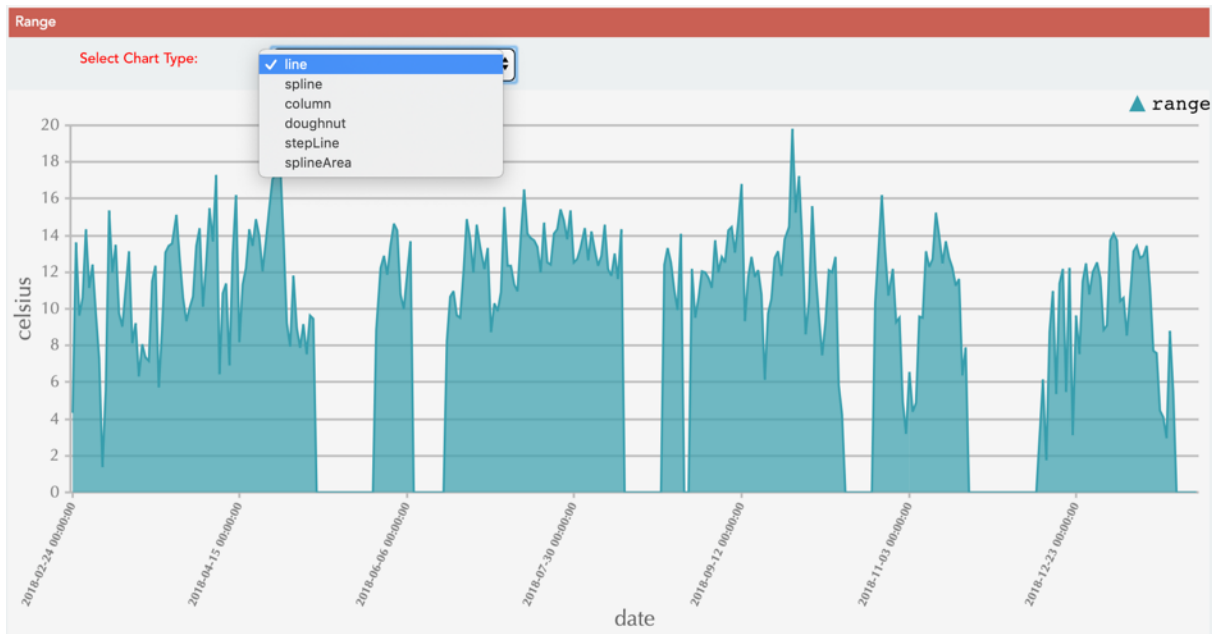
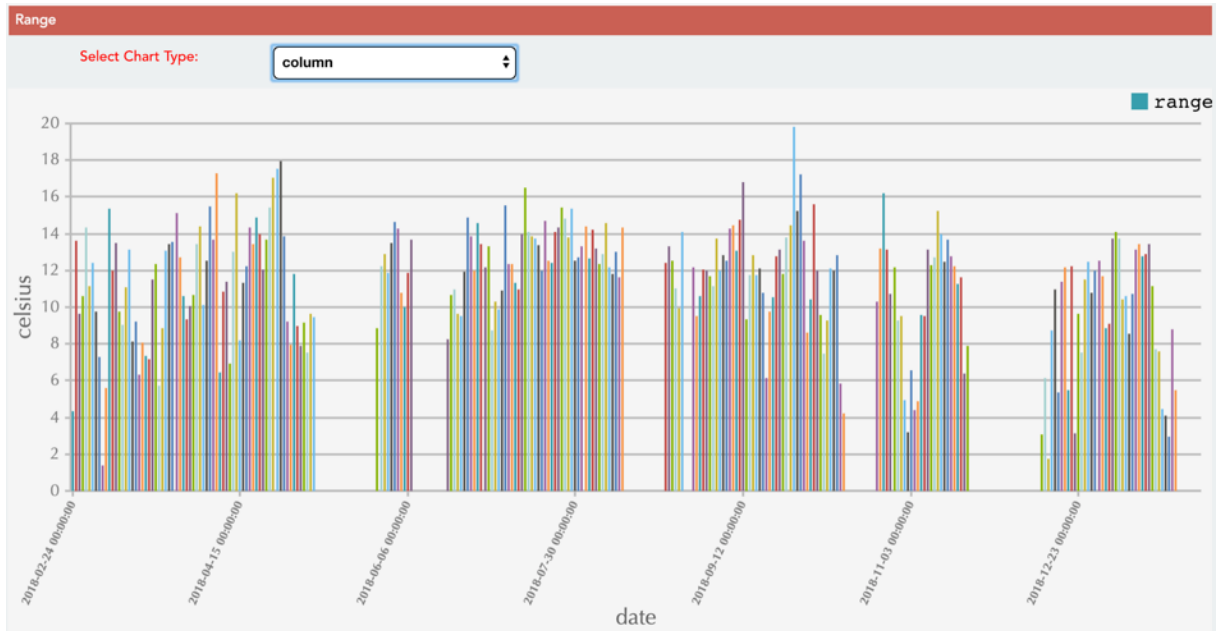



Figure 65: Change type chart



**Figure 66: View chart with type selected**

It is possible to change interval range of date in the selected Analytic, clicking the  icon to refresh data.

### 2.2.3 Event Manager

The *STORM Collaborative Decision-Making Dashboard* detects hazardous events or identifies relevant threats starting from the useful information extracted by processing and analysing data from STORM On-line and Off-line Data Sources. The detection of a damage caused by a hazardous event previously occurred or the identification of some threats that could increase the exposition or vulnerability of an asset against specific hazards can be also manually notified to the platform. Potential damages, events and threats detected by an expert user, analysing the results produced by an off-line Data Source, could be added into the platform directly using the *Event Manager* service. The Event Manager service provides a set of functionalities for managing (add, delete, update and show) all the STORM events both produced in an automatic and continuous way by the system and manually by an expert user. Events manually inserted in the platform will be added along with those produced by the continuous monitoring through the On-line Data Sources.

The first step is to select specific Site, Area and Item related to the event that needs to be added, as shown in the following Figure 67:

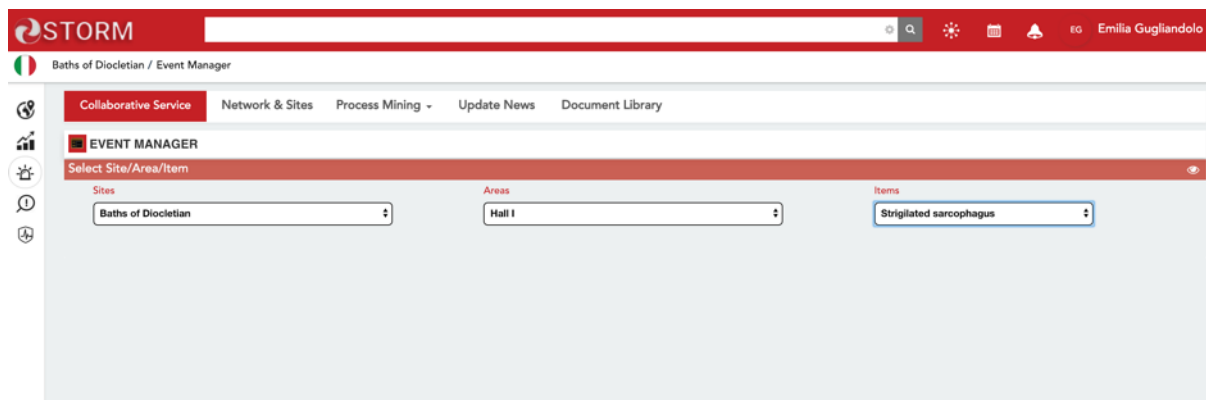



Figure 67: Event manager service

Clicking on  icon is possible to visualise all the active events manually inserted, if available, as in the following Figure 68:

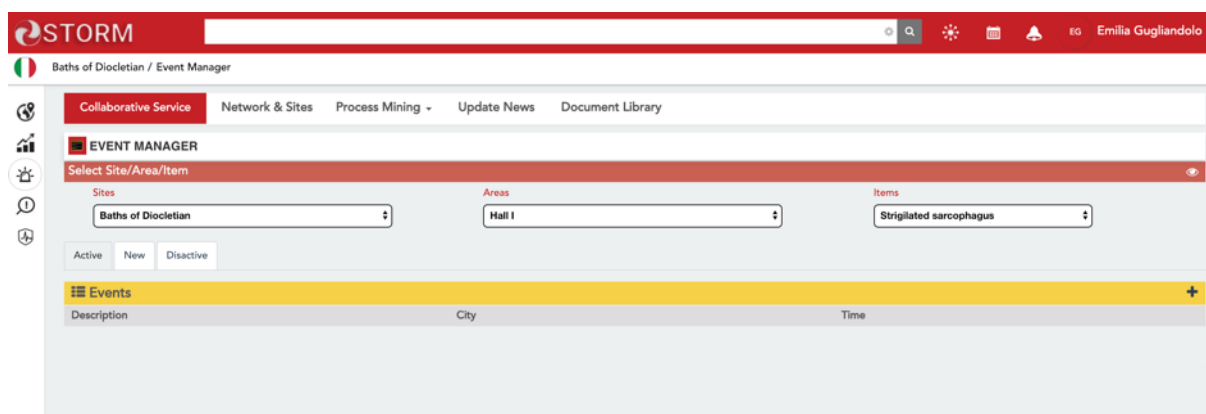



Figure 68: Event Manager services - Available events

Clicking on  is possible to add a new event (Figure 69):

**STORM** Baths of Diocletian / Event Manager

Collaborative Service Network & Sites Process Mining - Update News Document Library

**EVENT MANAGER**

Add New Event

**General Information**

Site: Baths of Diocletian Area: Hall I Item: Strigilated sarcophagus Status: New

Description: [Text Area]

Time: [Field] Range: [Field] Category: Accidental Fires And Explosion, Altered Water Table, Animal Stampede, Anthropogenic Hazards And Threats

**Geocode Information**

Search Address: [Field]

Q Search

[Map of Rome]

Address Name: [Field]  
 Street: [Field]  
 City: [Field]  
 Country: [Field]  
 Latitude: [Field]  
 Longitude: [Field]  
 Radius: [Field]

**Resource Information**

Resource List

Name	Extension	Type

< Back Save

Figure 69: Event Manager service - Add a new event

In particular, to add a new event, a “Description” of the event itself has to be inserted, as well as the “Time Range” and the specific event “Category”, choosing from a list (Figure 70):

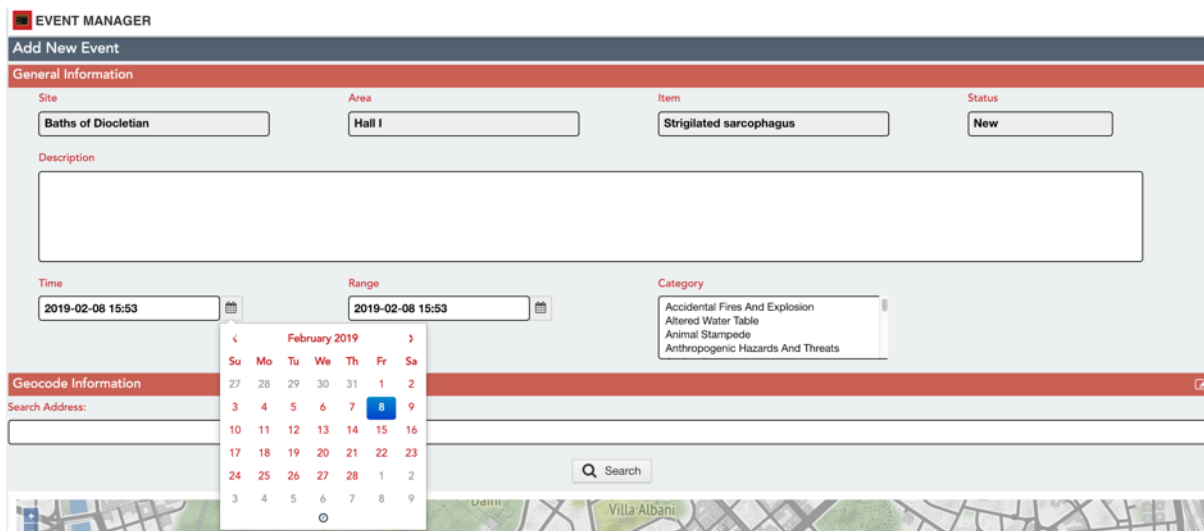



Figure 70: Event Manager service - Further details 1/2

Moreover, clicking on the Edit/Change Geocode information  icon, is possible to draw on the map, the area linked to the event in order to localize the event itself (Figure 71):

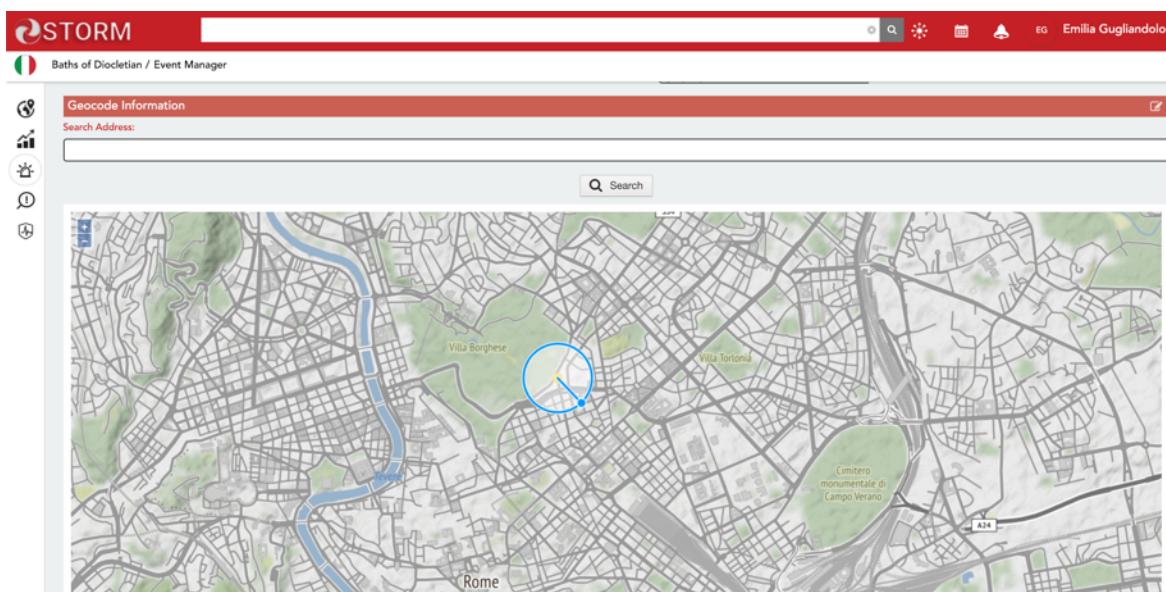


Figure 71: Event Manager service - Further details 2/2

The location of the registered event is visualised, and all the information is shown. Moreover, in the section “Resource information”, it is possible to select the event related off-line survey uploaded in the platform (Figure 72):

STORM
Emilia Gugliandolo

---

Baths of Diocletian / Event Manager

Collaborative Service
Network & Sites
Process Mining -
Update News
Document Library

EVENT MANAGER

Add New Event

General Information

Site <input type="text" value="Baths of Diocletian"/>	Area <input type="text" value="Hall I"/>	Item <input type="text" value="Strigilated sarcophagus"/>	Status <input type="text" value="New"/>
--	---	--	--

Description

Time <input type="text" value="2019-02-08 15:53"/>	Range <input type="text" value="2019-02-08 15:53"/>	Category <input type="text" value="Accidental Fires And Explosion&lt;br/&gt;Altered Water Table&lt;br/&gt;Animal Stampede&lt;br/&gt;Anthropogenic Hazards And Threats"/>
---	--	---

Geocode Information

Search Address:

Address Name	<input type="text" value="Puccini, Via Giacomo Puccini, Municipio Roma II, Roma, RM, Lazio, 00198, Italia"/>
Street	<input type="text" value="Via Giacomo Puccini"/>
City	<input type="text" value="Roma"/>
Country	<input type="text" value="Italia"/>
Latitude	<input type="text" value="41.9115341"/>
Longitude	<input type="text" value="12.4926749"/>
Radius	<input type="text" value="1696.3360365442932"/>

Resource Information

Resource List

Name	Extension	Type

Figure 72: Event Manager service - Add a new event finalisation

## 2.2.4 Risk Assessment

The *Risk Assessment* (Figure 73) supports the derivation of appropriate risk management strategies developed in the context of STORM. The Tool aims to help the site managers and experts to assess the level of risk in different areas of the site and determine site-specific strategies to mitigate the risk associated with natural hazards and climate change.

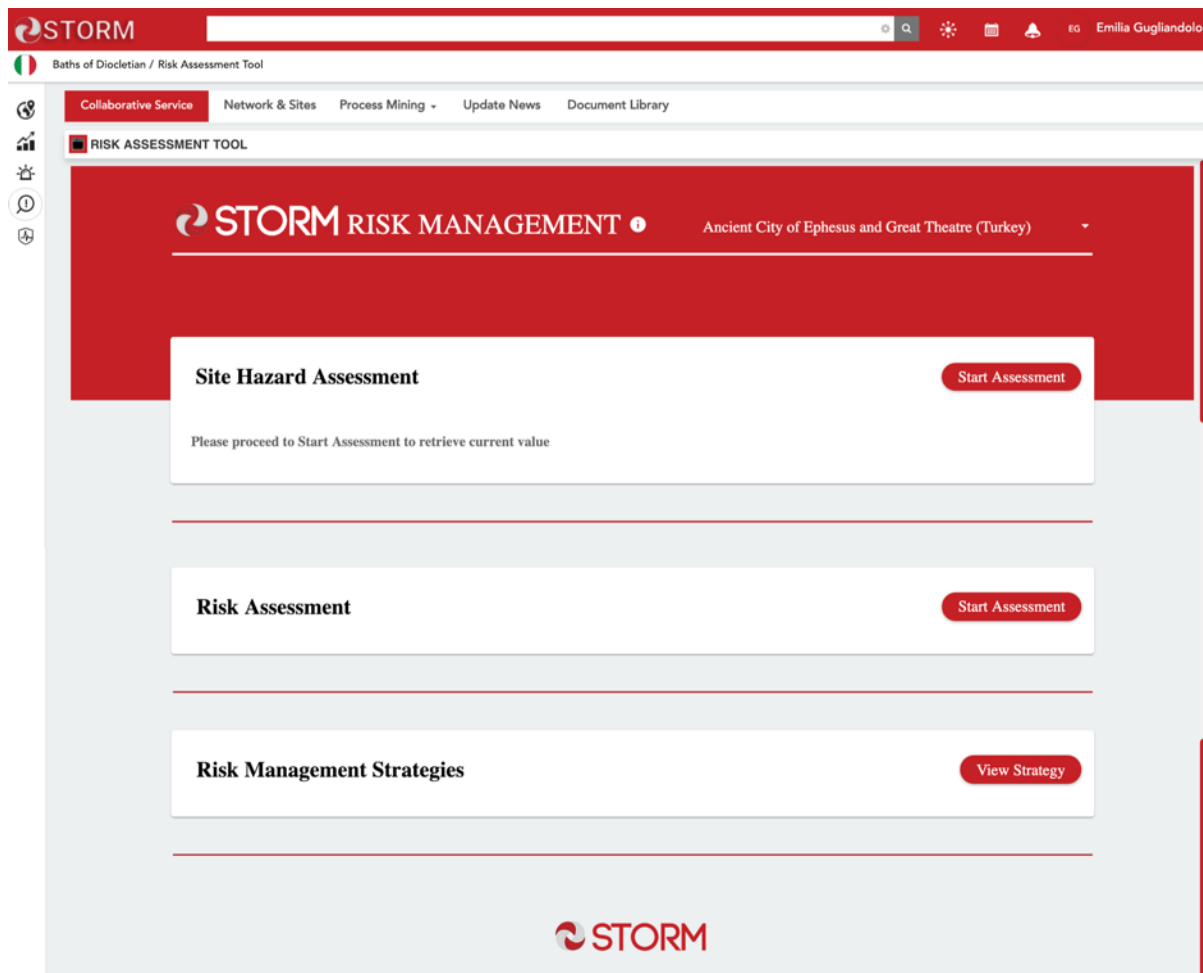


Figure 73: Risk Assessment Tool

Further details about this tool will be explained in the D5.2 - *STORM Risk Management Tool*.

## 2.2.5 Situation Awareness

*Situation Awareness* services (Figure 74) provides a detailed view of maps with all the indicators and parameters essential to control the situation and assist decision makers. A clear picture of the situation with all the details about vulnerability and risk areas, hazardous events, and other relevant information are visualised in a thematic map in order to identify the impact on CH site, areas and assets. In this way, users can understand the current situation status, having a real-time monitoring on how the situation evolves and enabling a kind of common operational picture.



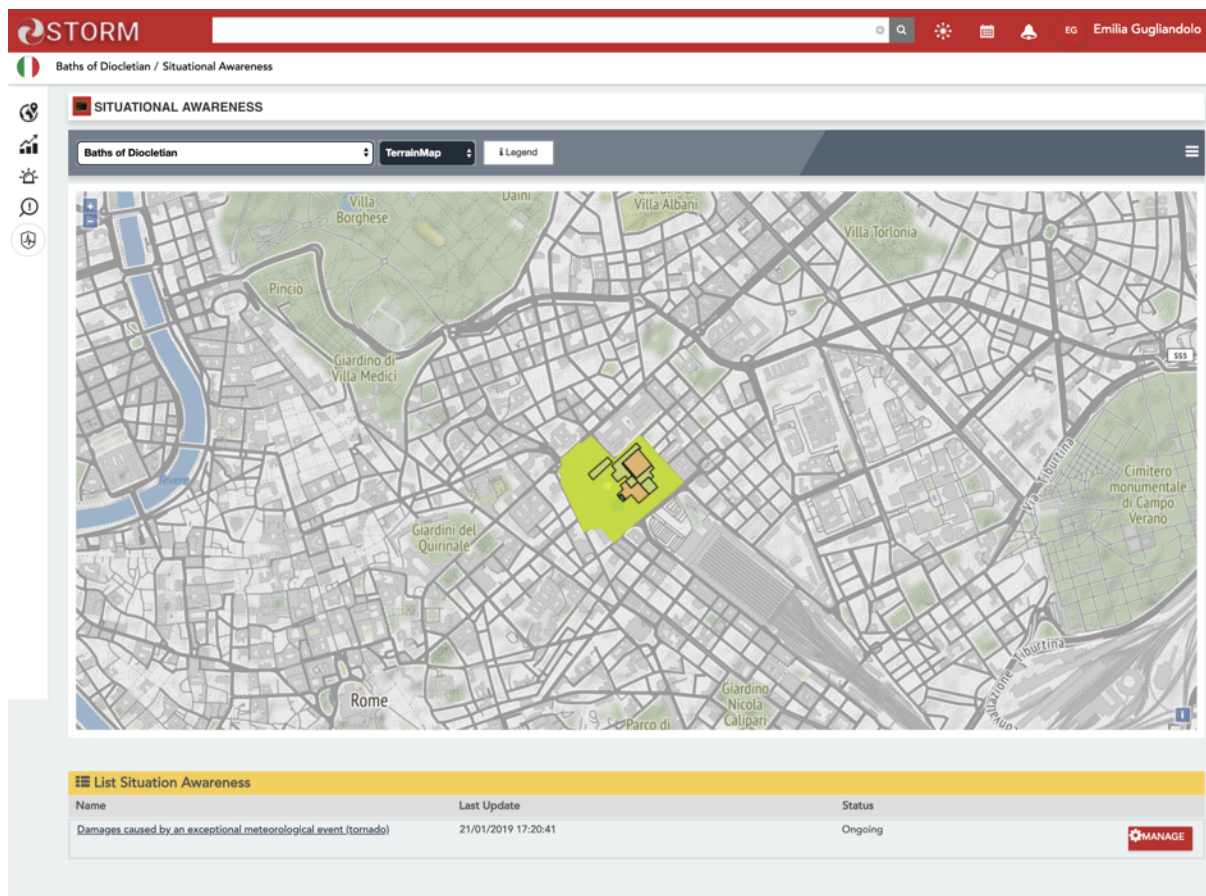


Figure 74: Situational Awareness service

The *Situation Awareness* service is organised in different views, describing dangerous situations that arise when determined STORM events, detected by the system, happen. All the dangerous situations are listed along with their date and status. In particular, clicking on the situation listed in the section “List Situation Awareness”, the specific localisation on the map is shown with the icon, as in Figure 75.

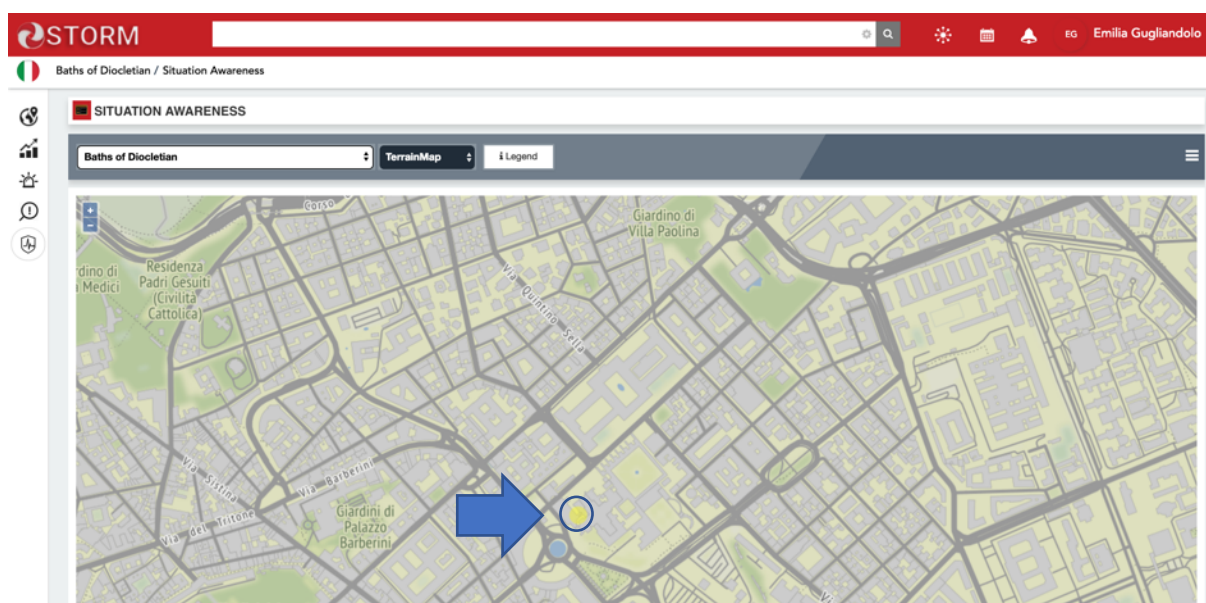



Figure 75: Situation Awareness service - Situation on the map

Moreover, in order to have further details on the specific situation, is possible to click on the  and a brief form with the main information is visualised on the map (Figure 76):

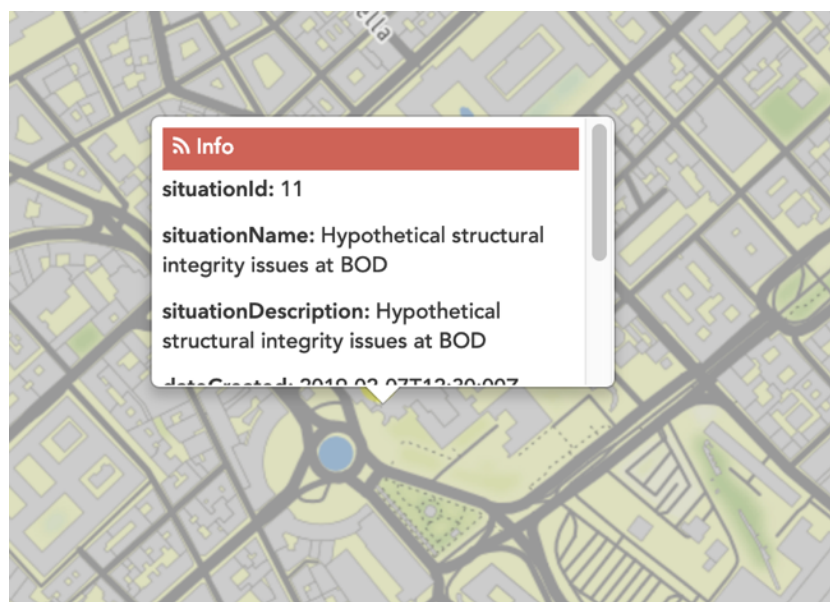


Figure 76: Situation Awareness service - Situation description

It is also possible to select a specific layer choosing from a list available on the right (Figure 77):

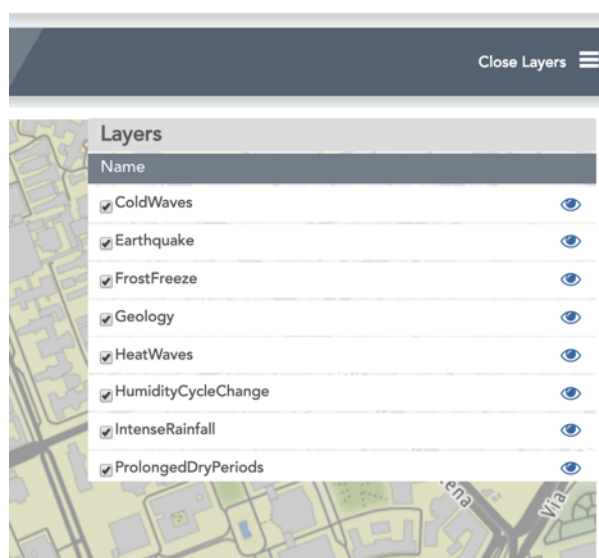


Figure 77: Situation Awareness service - Choose layer

In this way, for each dangerous event, is possible to take under control the situation on the map. Choosing the “Earthquake” layer, it is possible to visualise the current situation and the risk level as shown in Figure 78:

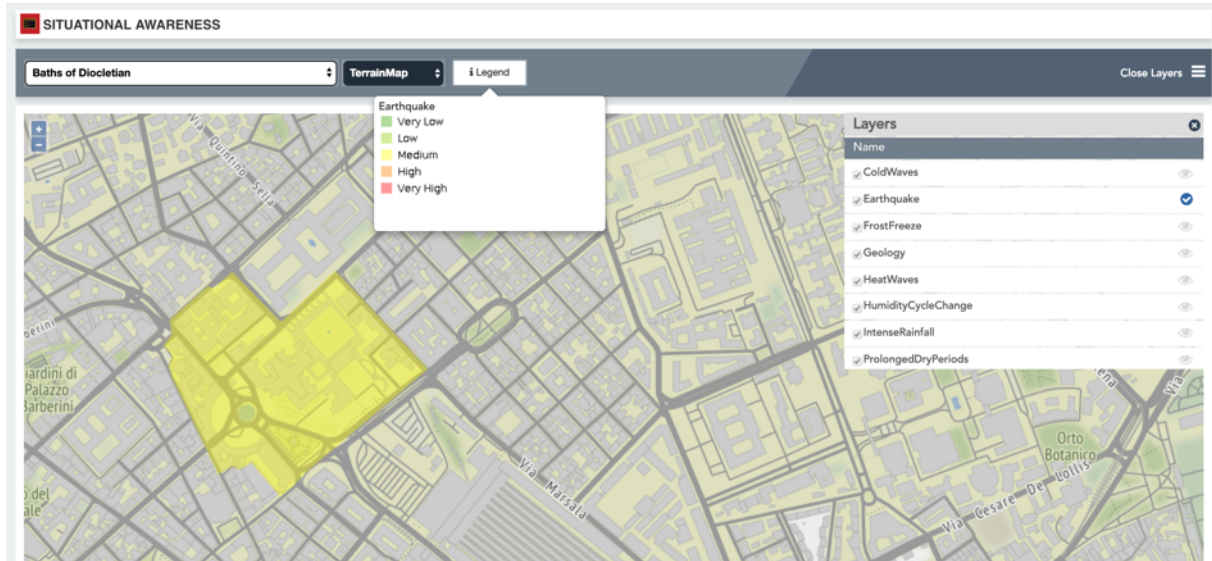


Figure 78: Situation Awareness service - Earthquake example

Moreover, the current situation is available both on-Map and on-Time, respectively focused on the geographical or temporal dimension. In the following Figure 79, all the dangerous situations are listed:

Name	Last Update	Status
Damages caused by an exceptional meteorological event (tornado)	21/01/2019 17:20:41	Ongoing

Figure 79: Situation Awareness service - List Situation Awareness

In order to manage a specific situation, clicking on button, a detailed view of the current dangerous situation is visualised in Figure 80:

Hazard	Asset	Description	Status	User
strong winds	168-item	Required intervention at Baths of Diocletian for the Micro-asian sarcopha...	pending	Maria Concetta Capua
strong winds	27-area	Required intervention at Test garden of cinquecento	pending	Maria Concetta Capua
strong winds	167-item	Required intervention at Baths of Diocletian for the Front Cover of sarco...	pending	Giovanni Bianco
flashfloods	168-item	Required intervention at Baths of Diocletian for the Micro-asian sarcopha...	unassigned	Choose User
flashfloods	167-item	Required intervention at Baths of Diocletian for the Front Cover of sarco...	unassigned	Choose User
flashfloods	27-area	Required intervention at Test garden of cinquecento	unassigned	Choose User

Figure 80: Situation Awareness service - Manage Situation

All the fundamental information is provided to the user, namely a description of the specific damage, the status, the affected site, the temporal range. Moreover, a process list is visualised illustrating the specific hazards, the involved assets, a brief description and the user that manages the situation, if already established. Otherwise, the site manager can choose to assign a specific process to a user, using “Choose User” in order to start the process. The user has a detailed view of the current situation according to the affected area and the detected hazard category.

### 3 Conclusion

This deliverable focuses on the description of the set of collaborative and operative services provided in the *STORM Collaborative Decision-Making Dashboard*. It promotes the creation of a collaborative environment for a more extensive and regular communication and collaboration of the cultural heritage actors, providing, at the same time, a set of operational services for the decision-making process. With this objective, the *STORM Collaborative Decision-Making Dashboard* services have been described. In particular, all the functionalities for STORM collaborative and operative services have been addressed along with the list of screenshots representing the user interaction with the service. The functionalities and graphical layout for STORM services have been addressed. An interactive environment not only provides opportunities for an exchange of information among system users, but can also facilitate the establishment of closer links. This may lead to a more effective collaboration among the different actors by interactively involving them in the decision-making process. It could enhance the general coordination between actors involved and assist in the selection of the most efficient strategies and measures depending on available information and resources. The main purpose of the proposed collaborative dashboard is to inform and assist the stakeholders involved in the formulation and selection of risk reduction measures based on available risk information and stakeholders' needs. The dashboard supports the collaborative interactions among stakeholders in a better-informed and transparent decision-making environment, rather than provide the collaborative decisions itself.

The main features and consequent benefits of the dashboard include:

- The creation of an interactive environment that not only provides opportunities for an exchange of information among users of the system but can also facilitate the establishment of closer links;
- A more effective collaboration between the different actors by interactively involving them in the decision-making process;
- The enhancement of the general coordination between actors involved;
- Assistance in the selection of the most efficient strategies and measures depending on available information and resources;
- The supporting of the collaborative interactions among stakeholders in a better-informed and transparent decision-making environment, rather than providing the collaborative decisions itself;
- The speeding up of response times where the right people with the relevant skills are identified more quickly and disaster events dealt with in a timelier manner.

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STORM deliverable D3.3 – System Architecture

STORM deliverable D5.2 – STORM Risk Management Tool

STORM deliverable D7.1 – Collaboration and knowledge-sharing infrastructure definition

STORM deliverable D7.2 – Definition of knowledge-sharing tools

STORM deliverable D6.6 – STORM Damage Assessment and Decision Support Services

STORM deliverable D8.5 – Platform integration, testing and deployment v1

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