This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776816

project Ô

D7.4: User Collaborative Platform

V.3 – 03.2022

Status of deliverable: PUBLIC

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Deliverable Review and Approval

The individuals listed below are not directly involved in the preparation of this deliverable and will review the present document.

Name	**Organization**
Giulia Molinari	IRIS

Deliverable Development and Review Process

	Key Event	Deadline	Done by
1	Submission of Draft Deliverable to reviewers	18/03/2022	18/03/2022
2	Section 1,2 and 3 compiled by Fondazione Politecnico	21/03/2022	21/03/2022
3	Initial Review and Comments obtained	23/03/2022	21/03/2022
4	Section 4 and Appendix I compiled by Institute for Methods Innovation	30/03/2022	30/03/2022
5	Uploading and submission of Final Deliverable on Participant Portal	31/03/2022	31/03/2022

Executive summary

This report is the accompanying document for deliverable D7.4, which consists in the demonstrative software named User Collaborative Platform (UCP). The main objective of Project Ô is to demonstrate innovative approaches and technologies to support the circular economy, addressing the technical, economic, environmental, and social aspects to redefine water value chains. UCP is a business-facing web platform targeted to promote circularity and to create new local water loops connecting water users, wastewater provider and treatment technologies.

UCP has been developed starting from specifications defined on deliverable D7.2 and functionalities described in deliverable D7.3 and it is now hosted on Politecnico di Milano server infrastructure and available at the following url: https://xake.deib.polimi.it:8080.

The platform relies on a stack of open-source software: links to code repositories are provided, to ensure re-usability and future development of this product.

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1 Introduction

The main objective of Project Ô is to demonstrate innovative approaches and technologies to support an integrated and symbiotic use and re-use of water by contributing to the transition to a circular economy, addressing the technical, economic, environmental, and social aspects so as to redefine some water value chains. New water treatment technologies (developed by WP2) are different in scope, but all are characterized by their relatively high energy efficiency and low cost. On the one hand, this requires a modular approach and a novel control unit based on new smart sensors; on the other, information and decision-making support is needed for all stakeholders involved in the planning and management of water resources.

Project Ô provides this support through different software tools:

- a Decision Analytics Platform (DAP), developed by WP4, targeting mainly water regulators, relying on a multi-objective decision-making approach to allow the analysis of traditionally incommensurable and conflicting objectives and to explore their trade-offs;
- a demonstrative Technology Selection Toolbox (WP7, deliverable D7.1) allowing to select the best technology to match water requirements (in terms of quantity and quality) with local, "alternative" water availability;
- a User Collaborative Platform (UCP), mainly business-facing, to promote a symbiotic exchange of water volumes over a defined territory to improve the circularity of resources between different partners involved in the water treatment value chains.

UCP requirements, technical specifications and user interface functionalities were described in previous D7.2 and D7.3 deliverables and have been used to support the development process.

Deliverable D7.4 consists of the demonstrator UCP, while the present report is the accompanying document, where:

- Section 2 reports a visual overview of platform pages and functionalities[1];
- Section 3 contains links to the online platform, to the custom software repositories developed for the UCP, and to the online documentation;
- Section 0 reports the outcomes of the user survey, compiled by Project Ô partners that will be taken as input for future, potential, exploitation of the UCP.

UCP is part of the Work Package 7 - *Circularity of water and circular economy: interfacing systemic issues with innovative business models* and it is specifically related to Task 7.2 *Users collaborative platform*.

Figure 1 shows the link between all Project Ô WPs: WP7 acts as a collector for performance data of the technologies developed in other WPs and Stakeholders' needs in terms of demand and offers of treated water. The UCP presented in this deliverable is the main result of WP7 and it is oriented to future exploitation of its technology and approach.

[1] Detailed description of functionalities is available on Deliverable D7.3

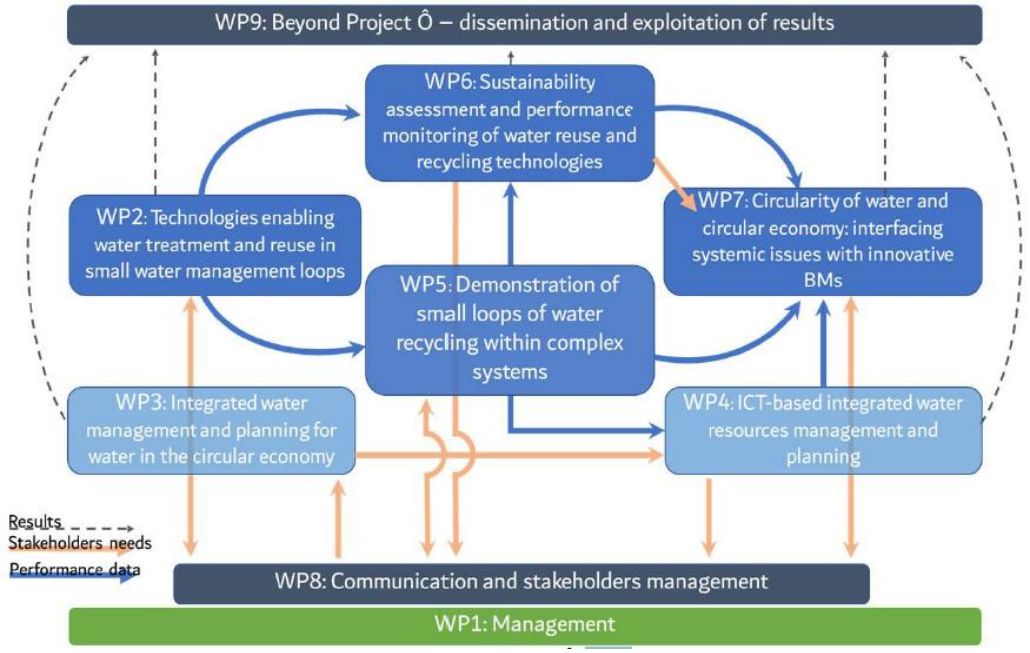

Figure 1: ProjectÔ Work packages interdependencies

2 Platform overview

The User Collaborative Platform is a multi-user web application, based on an intuitive interface, targeted to provide a marketplace for water circular economy, to become a meeting point for different roles, to enforce the relationship between water supply and demand.

Advanced water treatment technologies, like those developed within Project Ô, are the connecting points between water demand and water offer, enabling and facilitating water re-use practices. The platform makes easier the exchange of information between users belonging to different roles and it fosters the creation of new opportunities and water loops.

In this section, a collection of UCP pages screenshots is presented to provide a synthetic overview of its visual appearance and functionalities. A more detailed description of all functionalities has been already provided in the Deliverable D7.3, while the platform itself is available for testing at the URL specified in Section 3.

In order to provide a clear visual identity to the platform, a new logo was also designed, inspired by Project Ô logo and by the concept of water circular economy (Figure 2).

USER COLLABORATIVE PLATFORM

Figure 2: UCP large format logo.

2.1 User interface

A clean and attractive landing page presents the concept and main features of the platform, also providing a reference to Project Ô website and social channels (Figure 3).

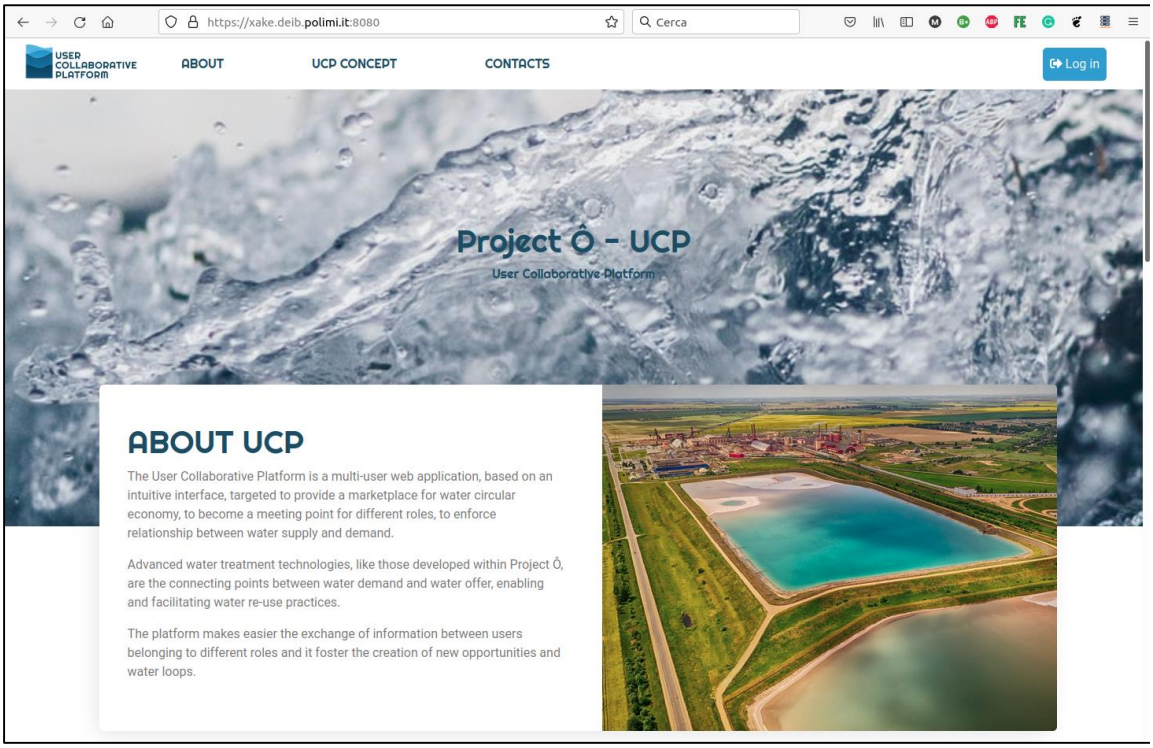

Figure 3: UCP landing page.

Once logged in, the user can inspect an interactive dashboard (Figure 4) where all platform contents are presented with their location on the map. Summary of user own contents are also provided for quick and direct access.

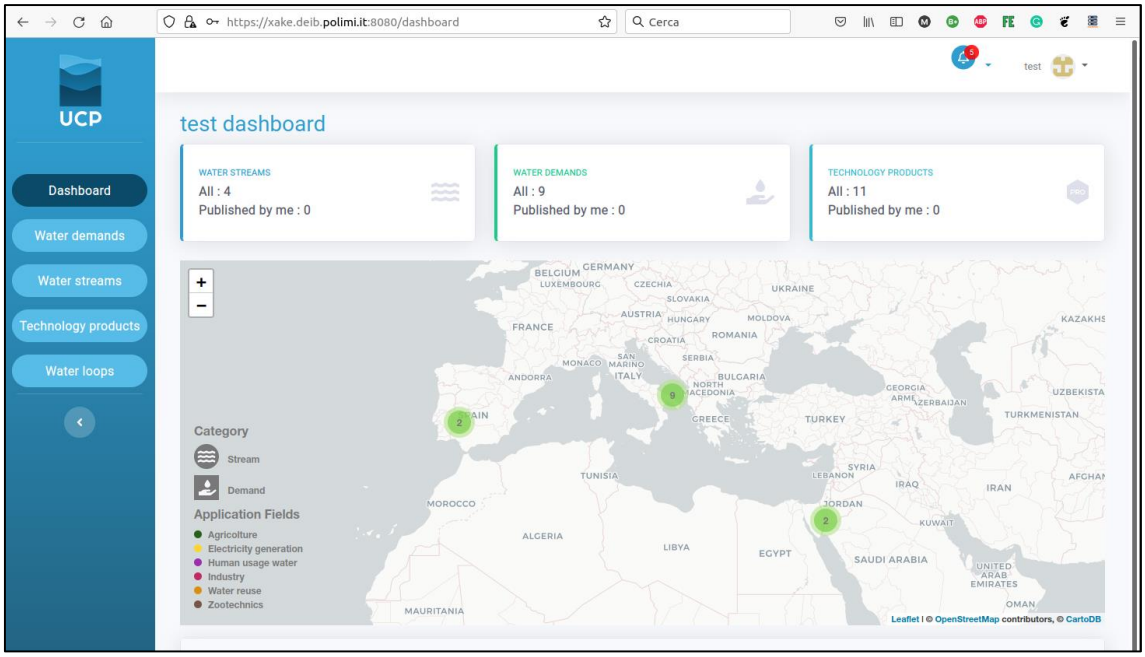

Figure 4: UCP user dashboard

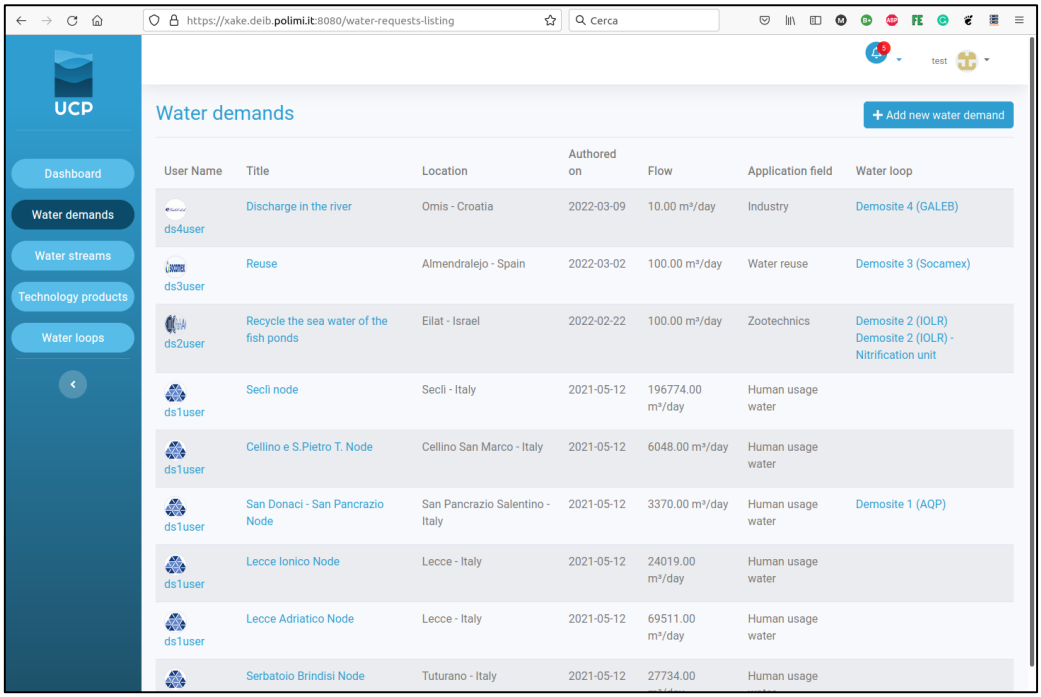

Figure 5: List of water demands inserted into UCP

The left menu provides access to the three components of the water loop: water use demand, water stream offer, treatment technology solutions. For each component, a list of existing items is reported: Figure 5 presents, as an example, the list of water demands entered in the UCP. Clicking on the "Add new water demand" button (top right of Figure 5) allows to access the creation form for a new item (Figure 6).

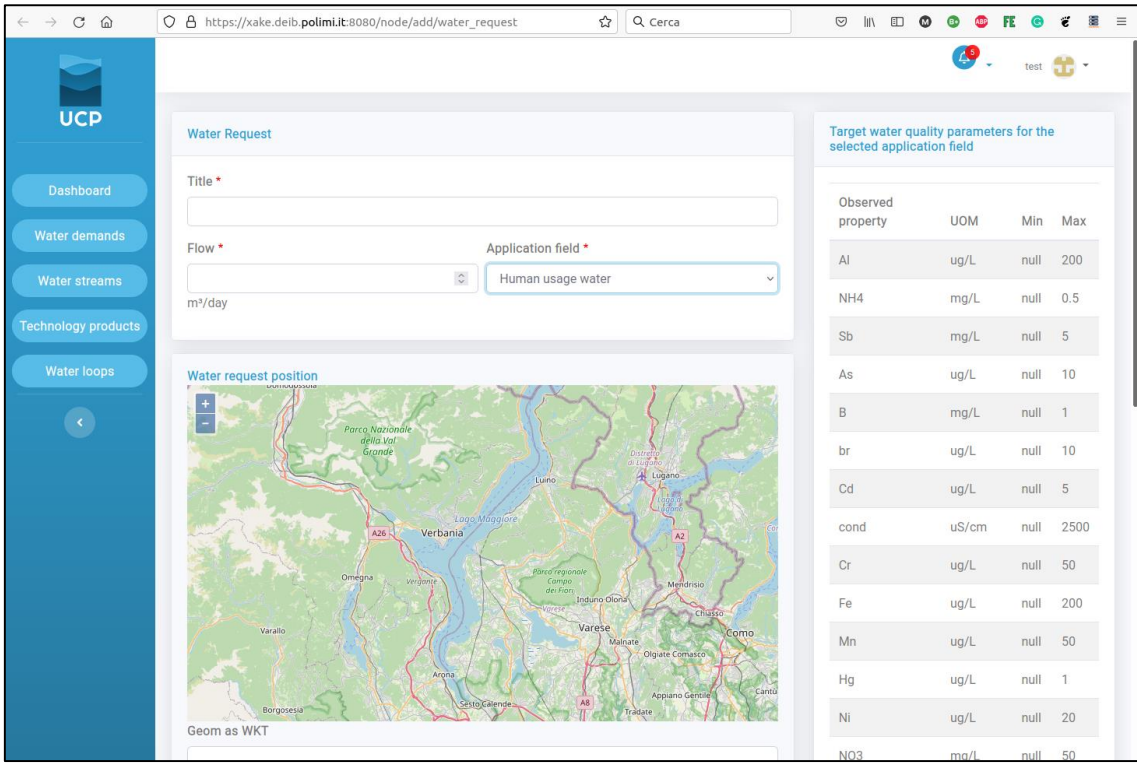

Figure 6: New water demand creation form.

The water loop creation page connects water demands, technologies, and Water Streams: figure 7 shows an example of a water loop. The interactive map allows first to choose a Water Stream and then a Water Demand among those closer to it. The matching algorithm of the platform also provides suggestions on the best choice of technology, based on information related to both application field and water quality parameters. Visual indicators provide insights into the increase/decrease of available parameters as well as the fulfillment of law constraints.

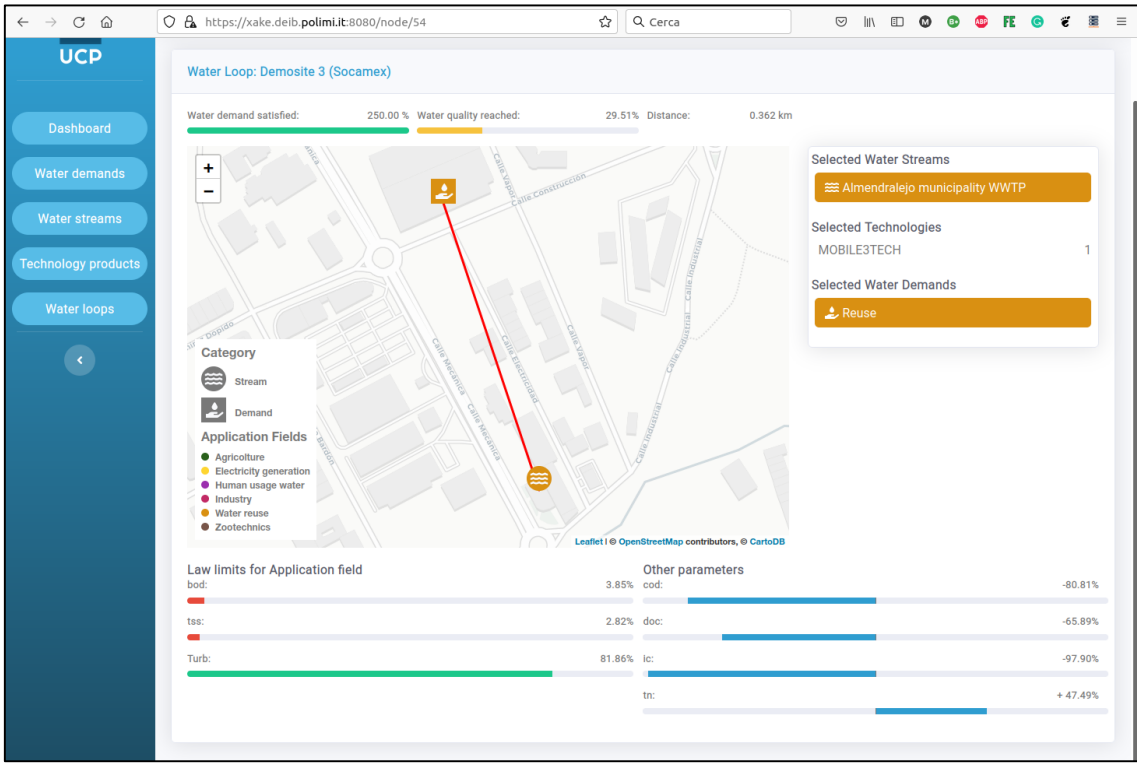

Figure 7: Example of water loop entered by another user: the logged-in user has only read access to this content, without possibility to edit it.

2.2 Administrator interface

UCP takes advantage of the powerful and extensible management tools included in Drupal[2], the Content Management System (CMS) used to develop the Platform.

2.2.1 Users management

Figure 8 shows a sample of the list of users registered on the platform: the list shows several useful information (user status, roles, last active date, ...) and allows, by clicking on the Edit button to change or manage user information and permissions.

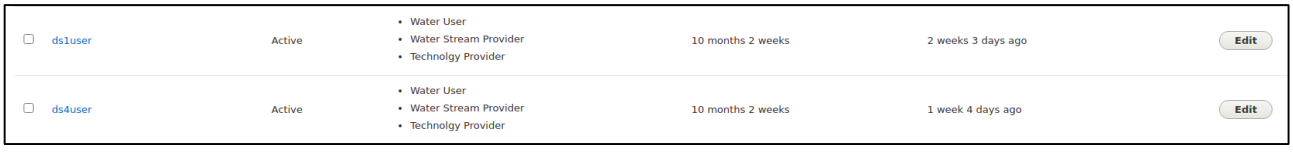

Figure 8: Platform user list

Figure 9 provides an example of user information managed by the platform. Besides user credentials or personal information, the platform administrator has the possibility to assign one or more specific Roles to

[2] See https://www.drupal.org/ for reference.

the user: this granular permission system allows to determine who can have read or write access to the different platform items.

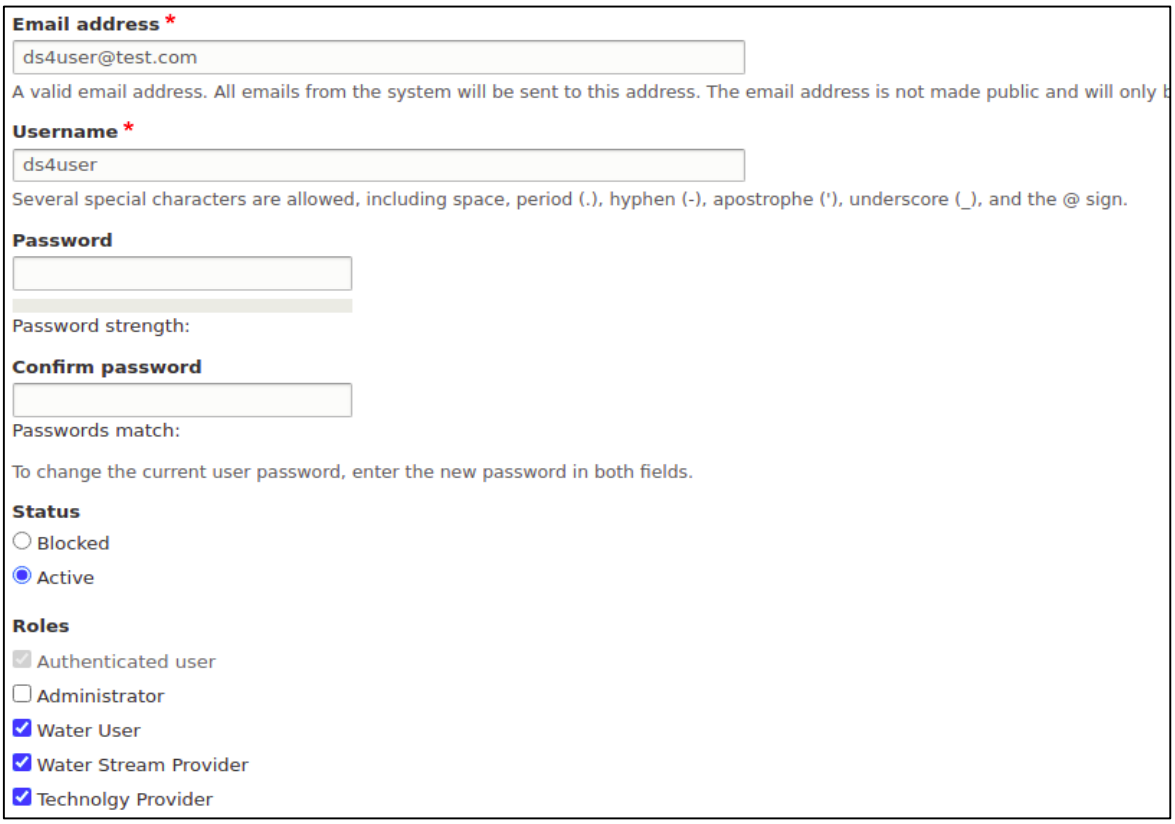

Figure 9: Edit user information page.

2.2.2 Water quality parameters

Water stream provider users can specify water analysis parameters to characterize their offer. Platform administrators can easily manage parameters of analysis specification, adding new parameters or editing their properties (unit of measure, description in different languages).

Figure 10 presents the form used to insert new parameters and define their properties. Positional order in the parameters list can be configured from this form as well. The name of the property is in the first column, in the second one the machine name, then we give a description that can be extended to other languages.

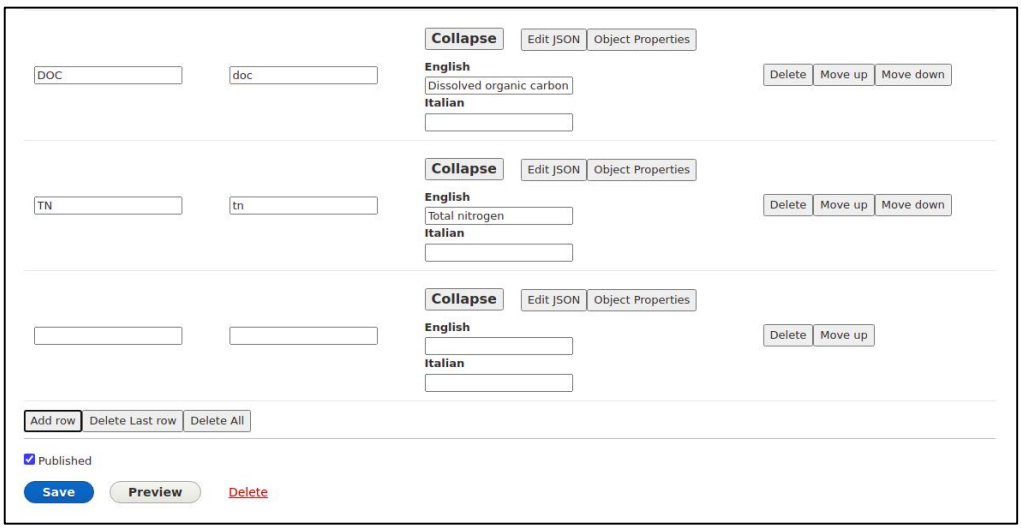

Figure 10: Water quality parameters creation form

2.2.3 Application fields

The platform administrator is also able to add or change the application field that can be used in the platform to characterize water demands, water streams, or treatment technologies. Figure 11 shows the list of Application Fields already inserted into the platform.

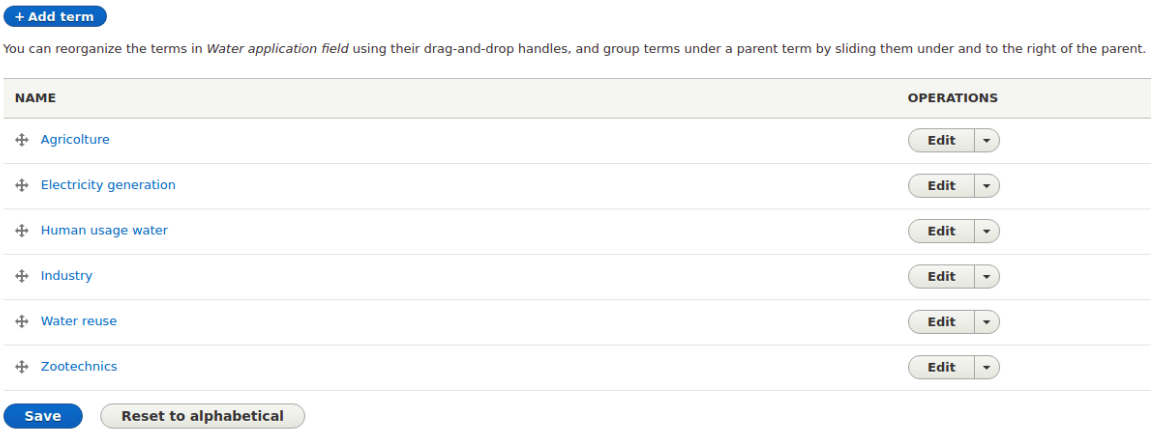

Figure 11: Application fields list

The button **Add term** allows adding a new Application Field, by specifying in the creation form (example in Figure 12) its Name, Description, and Marker color. Name property will then be used to populate the application field list in the platform and, together with marker color, in the Map Legend of UCP interactive maps (Figures 4 and 7).

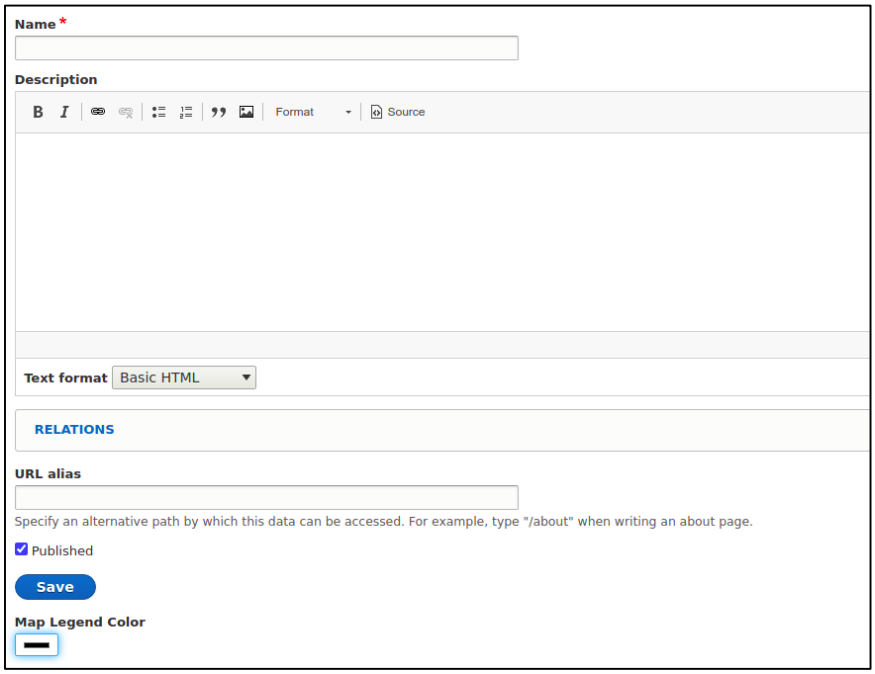

Figure 12: Form for creation of a new application field

Application fields can be linked to water quality targets, either related to legal (e.g. drinkable water regulations) or technical (e.g. specific industrial processes) constraints. These targets can be expressed as several requirements and described with a number of attributes: Title, Country and, if applicable, related legal

reference. The selection of the Country can also be used to improve the suggestion of the matching algorithm, when creating a new Water Loop.

Figure 13: Water quality target creation form

Figures 13 and 14 show the creation form for water quality targets: for each parameter defined in the platform (see Section 2.2.2) is possible to insert a range of admissible values. Once all the relevant parameters have been inserted, specifying the *Application field* allows for creating the connection between application fields and water quality targets.

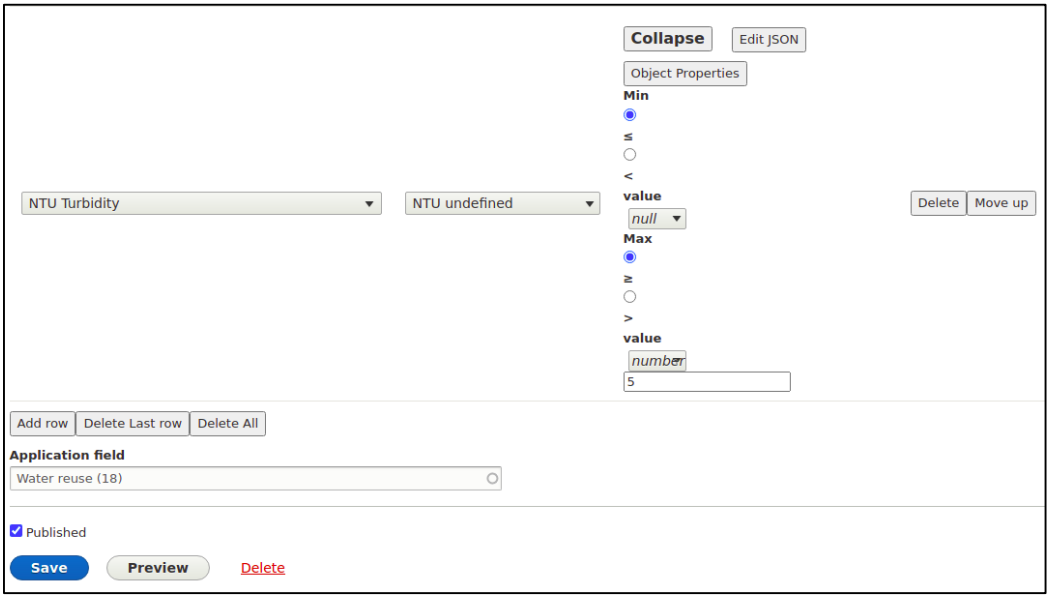

Figure 14: Water quality target parameters definition

3 UCP Demonstrator

UCP Demonstrator was hosted at Politecnico di Milano IT infrastructure and available at the following URL: https://xake.deib.polimi.it:8080/ .

Platform content is currently related to data and information coming from WP2 activities and deliverables (namely D2.1 and D2.4) that are classified as "Confidential, only for members of the consortium (including the Commission Services)". Consequently, also the access to the online platform is currently reserved for Project Ô partners.

A final test session was held on 10 March 2022, where all Partners have been invited and UCP functionalities have been showcased. Users attending the meeting received personal credentials to enter the platform, while all the other partners have been invited to apply for an account (at the following URL: https://xake.deib.polimi.it:8080/user/register) and to watch a video tutorial[3] presenting UCP functionalities. An independent review of the final test session has been provided by Institute for Methods Innovation and described in the following Section 4.

At the delivery date of the present report, UCP has 20 registered users. The platform will be maintained and online up to the end of the Project and it will be possible to involve other partners as new users and, for existing ones, to add or update platform contents. The development team will also remain active in bug-fixing and software updates activities.

The User Collaborative Platform has been developed using a stack of open-source software, mixing mature and well-known solutions with customized software components in order to provide a scalable and stable web environment. Development strategy has also been oriented to:

- ensure synergies with the Decision Analytic Platform, currently under development within the WP4 activities, as anticipated in Section 1;
- provide portable and modular software solutions, oriented to commercial exploitation, coherently with the goals of the Exploitation Plan (see WP9).

Deliverable D7.3 has already provided extended details, references and technical information on the software used and platform architecture (see Section 3.1 of D7.3).

Software specially developed within WP7 activities for the implementation of UCP has also been released as open source software, under the GNU General Public License v3[4]. It can be freely downloaded, used, and modified from the following repositories:

- UCP Drupal module: https://github.com/EILab-Polimi/prjo_ucp
- UCP Drupal theme: https://github.com/eilab-polimi/prjo_ucp_theme

[3] Available online at http://xake.deib.polimi.it/project_o/ucp_screencast/
[4] See https://www.gnu.org/licenses/gpl-3.0.en.html for more details.

4 UCP User Feedback Report

4.1 Introduction

The Institute for Methods Innovation was tasked with designing a user feedback questionnaire specifically tailored to the UCP. The user testing questionnaire was designed to collect unmoderated feedback with remote testers. The survey focused on alignment between user expectations of the UCP and experiences with the interface, navigation, and explanations. For example, questions focused on ease of use and how intuitive the platform was for users.

4.2 Methods

Partners within the ProjectÔ consortium were invited by Fondazione Politecnico to attend a live demonstration on 10 March 2022. A total of 9 people attended, including representatives for Institute for Methods Innovation and Fondazione Politecnico. To broaden the pool of testers after the demonstration, Fondazione Politecnico circulated the materials and user testing survey within the ProjectÔ consortium. One reminder was sent after 8 days from the invitation and the survey was closed after 14 days.

In total, 25 individuals were invited to test the platform's features and complete the feedback survey. The user feedback survey was started by 11 respondents from which 5 fully completed and 6 partially completed. As a result, the number of responses per question depends on how far into the survey respondents progressed and whether the question was hidden through survey logic (e.g. because further follow up is unnecessary after an initial screening question). Further details about the survey can be found in Appendix I.

4.3 Results: Overall

The first section screened respondents based on whether they had access the UCP. Most respondents indicated they had accessed the platform prior to completing the survey (Figure 15). This preliminary question was required before respondents could proceed with more detailed assessments of their experiences with the UCP.

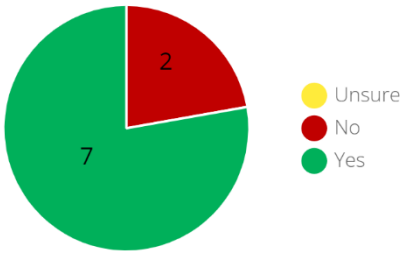

Figure 15: Accessed the platform

Respondents were asked about the type of device and internet browsers used to access the platform. The most common device used were laptops (n=4) and the platform was accessed mainly in Google Chrome (n=3), followed by Firefox (n=1) and Microsoft Edge (n=1) browsers.

A question was posed to respondents about which UCP functionalities they used (Figure 16). There was an even distribution between the functionalities tested – adding a new *Water Loop*, *Technology Product* and *Water Stream* were tested by two users and *Water Demand* was tested by one user.

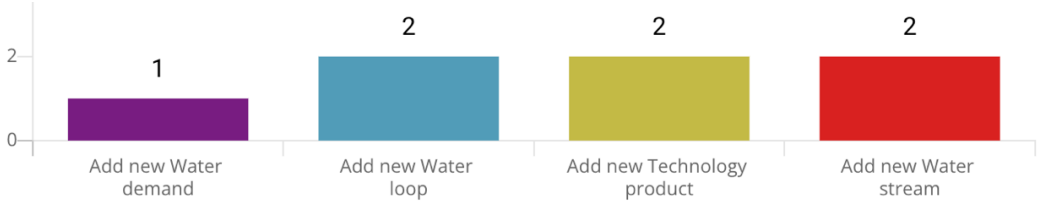

Figure 16: Which of the following platform functions did you use?

Users were asked about what they expected to gain from using the platform (Table 1). Most responses focused on the application and future use of the technology.

Table 1: Open-ended questions on expected gains

What do you hope to gain from using the platform?
Insights on water re-use process
Connections between offer and demand
New applications of our technology
Potential uses for future
Access to basic information about the technology and demosites

Users were asked about their reasons for using the platform (Table 2). The main responses included interest in specific uses of the platform, testing, and keeping up to date with progress in ProjectÔ.

Table 2: Open-ended questions on reasons using the platform

What are your reasons for using the platform?
Finding offers or demands of regenerated water in a pilot way to push the utilisation habits of water towards a circular economy
Understand the opportunities of application of our water treatment technology in different water loops
To follow the progress of the Project O
Testing purpose
Testing

4.4 Results: Demonstration feedback

The second section focused on the live demonstration on 10 March 2022 hosted by Fondazione Politecnico. These questions focused on whether they attended the live demonstration, when they used the platform in relation to the demonstration, and if they still had questions that needed to be answered (Table 3).

Table 3: Open-ended questions on expected gains

Questions	Yes	No	Total
Did you attend the live demonstration?	3	3	**6**
Did you use the platform ***during*** the live demonstration?	2	2	**4**
Did you use the platform ***after*** the live demonstration?	4	0	**4**
Do you have questions that still need to be answered?	0	3	**3**

Overall, responses were evenly split between those who attended (n=3) and did not attend (n=3) the live demonstration. Respondents also indicated if they had used the platform during (n=2) and after (n=4) the demonstration. None of the respondents indicated still having questions that needed to be answered.

Additionally, users were also asked for how much time they used the platform following the demonstration (Figure 17). The amount of time reported for platform use ranged between 1-2 hours (n=2) and 2-4 hours (n=1).

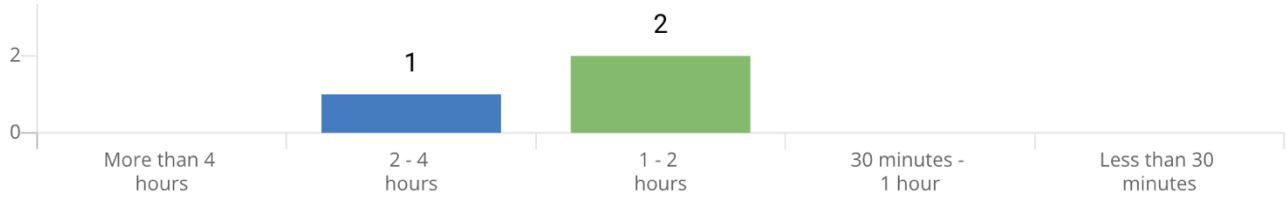

Figure 17: After the demonstration, approximately how much time did you spend using the platform?

4.5 Results: User Perceptions & Experiences

The third and last section focused on user perceptions and experiences with the UCP and platform features. Indeed, all users (n=4) indicated that the platform and its features are useful to them now, as it stands. Additionally, none of the users (n=4) reported use of a similar platform in the past.

Furthermore, users were asked to rate their overall experience with using the UCP and all users reported their experience as “Easy” (n=4). One user specifically stated that they “found the tutorial useful”.

Users were asked in more detail about specific aspects of the user experience with the UCP (Figure 18). Overall, all users agreed that “the platform was easy to use” (n=4), that they “could easily find what they were looking for on the platform” (n=4) and that “information on the platform was clear” (n=4). Most users (n=3) agreed that “the platform was comfortable to use” while one user indicated a neutral response. Alternatively, one user agreed that they are “interested in using the platform for their own work” while the remainder indicated a neutral response (n=2).

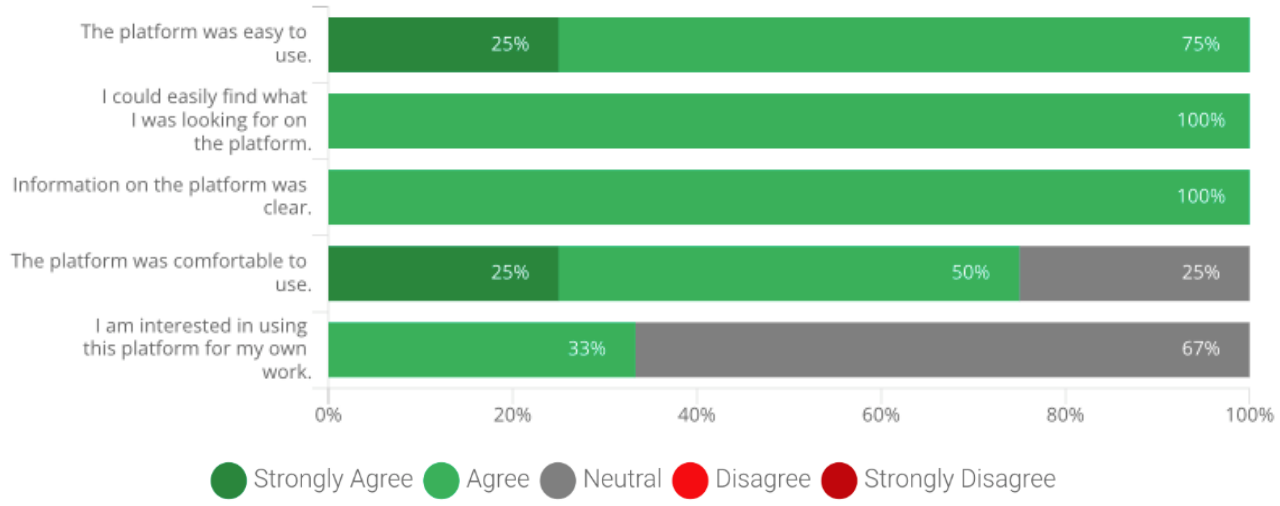

Figure 18: Level of agreement to statements about using the platform

Finally, users were asked what they like most and least about using the UCP (Tables 4 and 5). For most liked aspects, the simple, intuitive and user-friendly interface was mentioned (n=4). There was also mention of the "analysis specification management", although further clarification would have been helpful.

*Table 4: Open ended responses to **most** liked aspects of using the platform*

What did you like most about using this platform?
Simplicity
Intuitive to use
Simple and user friendly.
Clean interface, analysis specification management

For the least liked aspects, one user noted the absence of "economic aspects" within the platform, which may reference a place in the platform to calculate financial costs. Another user raised concerns about the functionality for "creating a water loop" and suggested that the "connection between [water] stream and technology" could be optimised further.

*Table 5: Open ended responses to **least** liked aspects of using the platform*

What did you like least about using this platform?
[…] not sure If I understood well the usage of the technology while creating a water loop. […] Water stream is already linked to a specific technology since it allows you to end up with a specific water quality of the stream. Maybe it could be optimized […] the connection between stream and technology. In case of the demand it´s very clear.
Economic aspects are not really included in the platform

4.6 Conclusion

Overall, user testing feedback about the UCP functionality, usefulness and ease of use is positive and appears to show a successful proof of concept. Despite none of the users reporting use of a similar platform before, no substantial confusions, concerns, or technical difficulties were presented. Users appreciated the UCP interface and features. These conclusions are supported by the high level of agreement from users on the platform being useful as it currently stands. Although there was comparatively less agreement by testers about interest in using the platform in their own work, it is unclear whether they were simply not the primary target group for the UCP.

While these results are very positive overall, feedback about the economic aspect not being included in the platform and an optimised connection between water streams and technology should be taken into consideration to further improve the UCP. Additionally, it should be noted as a limitation that this user feedback is also based on a relatively small sample of ProjectÔ consortium partners who have been working with the ideas and concepts of the project for a long time. As such, we recommend widening the demonstration of the UCP to stakeholders outside of the ProjectÔ consortium prior to publicly launching the platform, to ensure the UCP can achieve its objectives beyond this proof of concept.

Appendix I – User Testing Feedback Questionnaire

Welcome!

Thank you for being willing to contribute your feedback about this platform. We are keen to understand your experiences and perspectives as a current and future platform user.

Here, you will find a number of questions about the user experience and your views about how useful the platform is for your work. Please be as honest and direct in your feedback as possible to help us improve the platform for users like you.

Participation in this research is voluntary. By default, your responses will be anonymised prior to reporting and publishing of data and results. No personally identifiable information will be shared with third parties for any reason without your explicit consent.

[PAGE BREAK]

Agreement to Participate

Please read the following statements below:

- I confirm I am 16 years of age or older.
- I understand that my responses to the following survey will be stored and used for research and evaluation purposes only.
- I understand the information I provide about myself is confidential.
- My identity will not be disclosed for commercial use by a third party or made public without my explicit consent.
- I understand that my participation is voluntary, and I can withdraw at any time.
- I agree I have received adequate information about my participation in this survey and understand what will happen to the information I provide.

1.1. Please indicate whether you understand the information provided above, that you agree with the statements above, and that you are willing to participate in this survey: [Checkbox (Inline)]

Yes, I understand, agree, and am willing to participate in this survey.

Shown if Yes, I understand, agree, and am willing to participate in this survey. is NOT selected in 1.1. [Applies to text below]

If you would like clarification about any of the information above before starting, or if you have difficulties completing this form, please email support@methodsinnovation.org.

[PAGE BREAK]

2.1. Have you accessed the platform? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 2.1. [Applies to 2.2 to 2.6.]

2.2. What do you hope to gain from using the platform? [Text line]

2.3. What are your reasons for using the platform? [Text line]

2.4. Which type of device did you use? [Dropdown]

Desktop	Tablet	Other (please specify)
Laptop	Smartphone	

2.5. Which browser did you use? [Dropdown]

Firefox	Opera	Unsure
Google Chrome	Brave	Other (please specify)
Microsoft Edge	Internet Explorer	

2.6. Which of the following platform functions did you use? [Checkbox (Button)]

Add new Water demand	Add new Technology product
Add new Water stream	Add new Water loop

[PAGE BREAK]

3.1. Did you attend the live demonstration? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.1. [Applies to 3.2.]

3.2. Did you use the platform *during* the live demonstration? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.2. [Applies to 3.4.]

3.4. Were you able to ask questions? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.4. [Applies to 3.5.]

3.5. Were the answers you received helpful? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.2. [Applies to 3.6.]

3.6. Do you have questions that still need to be answered? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.1. [Applies to 3.3.]

3.3. Did you use the platform *after* the live demonstration? [Likert Scale (3-point: Yes - No - Unsure)]

Shown if Yes selected in 3.3. [Applies to 3.7.]

3.7. After the demonstration, approximately how much time did you spend using the platform? [Likert Scale (5-point: Less than 30 minutes - More than 4 hours)]

[PAGE BREAK]

4.1. Is this platform useful to you now, as it currently stands? (i.e., if there are no changes) [Likert Scale (3-point: Yes - No - Unsure)]

4.2. Are the platform features useful? [Likert Scale (3-point: Yes - No - Unsure)]

4.3. Have you ever used a platform similar to this in the past? [Likert Scale (3-point: Yes - No - Unsure)]

[PAGE BREAK]

5.1. How would you rate your overall experience with using the platform? [Likert Scale (5-point: Difficult - Easy)]

5.2. Please describe your experience with the platform: [Text line]

Using the response options below, please indicate your level of agreement: [Likert Scale (5-point: Agree - Disagree)] *[5.3 to 5.7 in random order]*

5.3. The platform was easy to use.
5.4. I could easily find what I was looking for on the platform.
5.5. Information on the platform was clear.
5.6. The platform was comfortable to use.
5.7. I am interested in using this platform for my own work.

5.8. What did you like the most about using this platform? [Text line]

5.9. What did you like least about using this platform? [Text line]