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**Technical Report**

**To:** Professor David Reckhow  
Professor of Civil & Environmental Engineering

**From:** Robert Acer, Brendan Pickett, Claudia Baptista, & Holly Lancey

**Date:** May 1<sup>st</sup>, 2017

**Re:** CUPSS Asset Management Case Study and Feedback

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**Introduction:**

The Water Innovation Network for Sustainable Small System (WINSSS) aims to develop technological solutions in support of small systems. *The Internet of Things (IoT) – Water Treatment Technologies, Management, and Integration in an Online World* was an independent study created and led by Dr. David Reckhow and Patrick Wittbold. The independent study course used EPA's Check Up Program for Small Systems (CUPSS) as an asset management tool for the UMass Water Technology Field Site, a research facility for piloting drinking and wastewater technologies. The first portion of the class focused on the use of the PC based CUPSS software, through demonstration and webinar sessions held by expert Art Astarita. The second portion of the class focused on the design and use of The Mobile CUPSS App developed by program engineers Matthew Mattingly and Maxime Israel of UMass Amherst. Once the team of students had a thorough understanding of both the PC and mobile app versions of CUPSS, they were assigned a project to perform a case study using both versions of the software. The UMass Water Technology Field Site provided a perfect opportunity to record assets in both versions of the software and provide feedback to the developers of the mobile application. The feedback would then be used to update the app and prepare it for public release.

The case study site included the UMass Civil Engineering Department's Water Technology Field Site Building along with a portion of the Town of Amherst (TOA) Wastewater Treatment Plant to collect asset information. The team broke the location into four sub-locations including the Pilot Building, TOA, Sewer Station, and Pump House. Within each location, our team recorded all assets on site pertinent to the Water Pilot Unit. All assets were first recorded using traditional pen and paper and then manually inputting the information into the PC version of CUPSS. Next the CUPSS Mobile App was used to perform the identical asset management procedure. The collected information was used to provide user feedback, development ideas, troubleshooting, and debugging requirements to the program engineers for the CUPSS Mobile App interface.

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Figure 1 – Diagram of Site With Sub-Locations Shown

## CUPSS Comparison:

The current CUPSS computer software and mobile app being developed both have advantages and disadvantages to their use. The current CUPSS computer software serves as an interactive asset management program for small systems. Within the CUPSS software, users can create work orders in which assets are entered into. These assets are then organized by the software based on either priority, category, asset type, and other categories. Within the software, users can track operation & maintenance schedules, manage the financial aspect of the assets, and develop an asset management plan to maintain the work order's assets. The home screen of the computer software, seen in *Figure 3*, includes both a calendar and message box to remind the user of the day's tasks in asset management. Overall, the software is built to allow the user to oversee all aspects of their asset management plan and keep them on track in improving each of their assets. The downside to the computer software is its functionality on certain devices. In our study, only those with Microsoft Windows computers were able to effectively download and use the software. Those with Apple Macintosh computers were unable to use the software on their laptops. The software could definitely use some updates, as much of the technology of the program is outdated and in much need of improvement. For instance, the software provides no description of the required fields when a user is inventorying an asset, and a new user of the program could easily become confused or unsure of what each category is supposed to represent. The software could be improved by becoming more personalized and allowing the user to fill out the categories they feel they most understand and would be able to use.

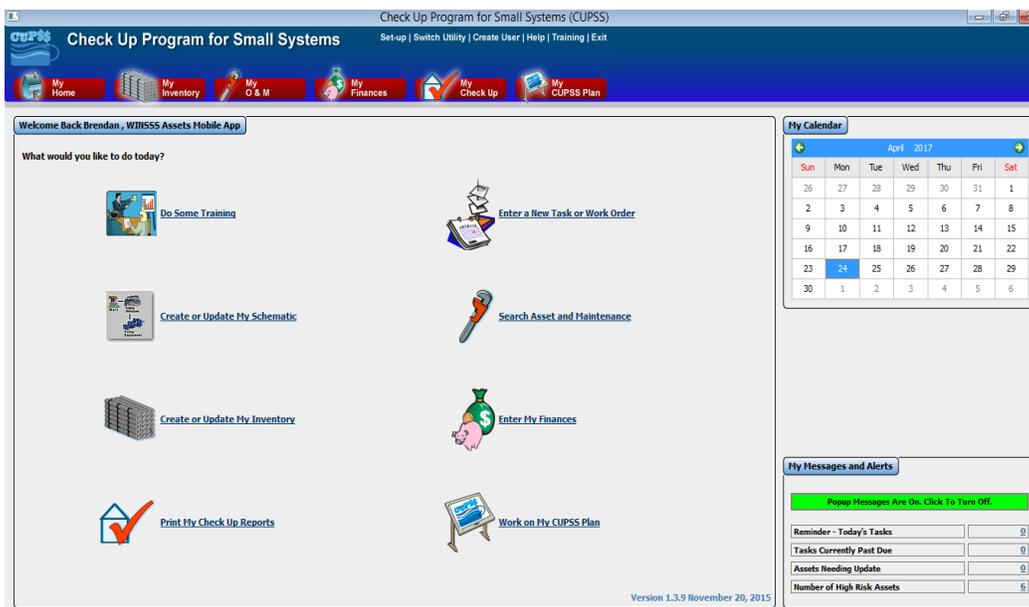


Figure 2 - CUPSS Software Home Screen

On the other hand, the CUPSS mobile app is more practical for field use. The current CUPSS computer software is limited in the fact that when inventorying assets in the field, the user must first record the asset data by hand and then log into the CUPSS software to organize it.

The mobile app aims to eliminate this inconvenience of inventorying the assets twice. Unlike the computer software, the mobile app does not include the interactive portion of the asset management plan (i.e., tracking operation & maintenance schedules, managing finances, creating asset management plans). The app simply allows you to go out into the field, inventory assets with their location (you can use your location on your phone to create a coordinate for the asset), and export the newly inventoried assets to an Excel spreadsheet that can be inputted into the CUPSS software. Now that the assets from the mobile app can be placed directly into CUPSS from the spreadsheet, the user no longer has to input the recorded assets into the software themselves. The user can then track O&M practices, manage finances, and interactively develop a plan in the computer software. *Figure 4* shows the home screen of the CUPSS mobile app, where users inventory assets from the field. The app is very straightforward and easy to use, which means that new users will not be confused on how to collect important data. A major downside to the app is that since it is mostly for inventorying assets in the field, the user is unable to categorize assets into separate jobs. Instead, all assets inventoried are grouped together and it is up to the user to export only certain assets into the CUPSS software when looking at specific jobs. Additionally, the current version of the software has its bugs that interfere with its functionality. These problems are minor and can be fixed by the developer of the app. Another significant difference between the software and the app is that it is more difficult to “clone” assets on the app than the software. Many inventoried assets are similar to each other, and it is easier for the user to clone an asset and make one or two changes to it to create a new one. With the app, the cloning process involves clicking on the asset, cloning it, going back to the inventory, and clicking on each one again to edit its properties. This longer process allows for more mistakes to be made and confusion to occur, since the app renames the assets as “Asset Name - Clone 1, 2, etc” each time you clone an asset. Overall, the CUPSS Mobile App is a tremendous help in inventorying assets for its ability to be easily used in the field.

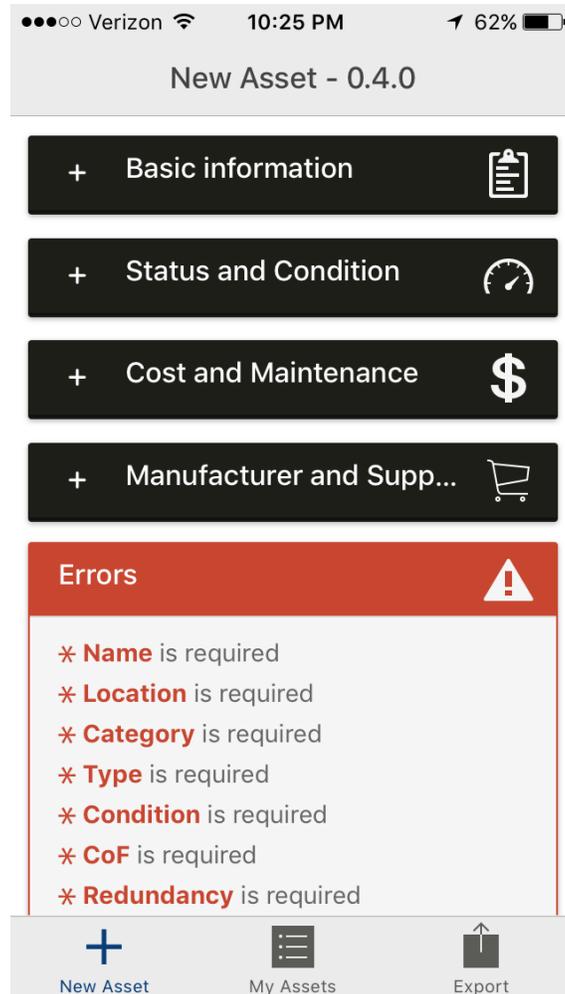


Figure 3 - CUPSS Mobile App Home Screen

### Suggestions and Recommendations:

Through multiple field tests of the CUPPS Mobile App our team was able to test and work with the developer from version 2.0 through the latest version 4.0. From the first version through the last, we went through a total of three updates in 3.0, 3.1, and 4.0. Each version improved on the last and took our suggestions into account.

The preliminary version of the app had an issue with exporting the XLSX file where users struggled to open the app on a PC. The first update replaced the XLSX manipulation plugin for smoother updates and fixed the “Corrupted file” issue by reviewing data formatting prior to exportation of the excel file. Another initial fix was the user's desire to clone an asset quickly to avoid redundancy; 3.0 added a “Clone” button to clone a specific asset. Finally, users recommended an asterisk be utilized to indicate required fields rather than the original bold font. This update was made in version 3.0 where the asterisk changes from red to green when a required field is filled.

From version 3.0 testers sent additional feedback concerning assets not being able to be

submitted without a “Frequency” input, but this wasn’t a required field. Version 3.1 fixed this bug allowing users to submit assets this left blank. Additionally, testers suggested an alias field for assets where they could have custom user defined names. Additionally, version 3.1 had minor performance boosts in formatting of the screen.

The team stayed with version 3.1 for a while as the developer requested to give significant feedback in order to make a significant update for the final update the team would experience for the semester. After multiple uses, the team came up with a long list of feedback for final improvements to CUPPS Mobile. Under General Comments our team suggested that the new “Alias” section should change concurrently with “Name” imputation. The team also suggested added a “Save Asset” option towards top of each screen and perhaps an attachment option for pictures corresponding to each asset. Within the Basic Information section testers reported the app would jump to the top of page when clicking on “notes”, misalignment of text, and absence of a “location services must be turned on” message under the “locate” option. Within Status and Condition testers reported “Redundancy” be eliminated as a required field for submission of an asset and the absence of visibility of the final “s” in the section “Asset Status”. Within Cost & Maintenance testers noticed misalignment of section headers “Expected Useful Life”, “Replacement Cost”, & “Routine Maintenance Cost” as text is inputted. Finally, under Manufacturer & Supplies users disliked that the section doesn’t allow input of text under “Supplier Information” without text inputted in “Manufacturer” as well as noticed misalignment with “Supplier Address” & “Supplier Phone” as text is inputted. Version 4.0 took into account this feedback and overall users were satisfied with the results. Other changes were released with 4.0 such as introduction of custom colors, and the implementation of exporting by category directly on the Asset list page.

For future versions the team recommends granting a trial period of CUPPS Mobile to municipalities who have been managing water and wastewater utilities for several years. This way the project engineers can receive even more detailed feedback from users who have been in the field for several years and curtail the app’s features to meet their needs.

<b>Location</b>	<b>Asset Name</b>
<b>TOA</b>	Gate Valve 1
	Gate Valve 2
	Wastewater Supply Line 1
	Wastewater Supply Line 2
	Wastewater Supply Line 3
<b>Pump House</b>	Pump Manifold 1
	Pump Manifold 2
	Pump Manifold 3
	Drain
	Supply Pump 1
	Supply Pump 2
	Supply Pump 3
	Supply Pump 4
	Distribution Hose 1
	Distribution Hose 2
	Distribution Hose 3
	Distribution Hose 4
	True Union Check Valve
	Distribution Pipes
<b>Pilot Building</b>	Heated Hose
	Pipe Manifold
	True Union Check Valve 2
	Sump Pump
	Waste Holding Tank
	Cast Iron Drain Line
<b>Sewer Station</b>	True Union Check Valve 3
	Final Discharge Line
	Sewer Station Manifold

*Table 1- List of Assets*

### **Summary/Conclusion:**

The implementation of asset management ensures water and wastewater utilities are provided the important information needed to make decisions to help maximize the value of their capital. Such information includes asset conditions, performance, and cost to maintain, repair, or replace such assets. Through this case study, we were able to explore and improve the CUPSS mobile app by working alongside the WINSSS team and the app developer in order to ease the use of asset management. By utilizing the UMass Water Technology Field Site and by performing a case study using the PC and mobile version of CUPSS, we were able to monitor and improve many aspects of the application that should meet the needs an asset manager is looking for.

As detailed in this report, there are many features of the CUPSS Mobile App that make asset management more efficient and user friendly. We've concluded that through the implementation of the mobile app users will be able to put into practice asset management in a

more practical way. The mobile app eliminates unnecessary steps and makes the possibility of asset management in the field more practical. The convenience of the CUPSS Mobile App makes it possible for multiple employees in a utility to keep assets up to date. By having this management of inventory, utilities are able to put in place a long-term plan to maintain and upgrade their systems. Through use of the CUPSS Mobile App, utilities will become more efficient and save money while providing optimal services from their systems. Ideally, the app would make it possible for more municipal workers to be able to update their asset management frequently. Every field worker could be trained in the use of the mobile app and be able to remotely send asset management information to the asset manager of the municipality. Implementation of the CUPSS Mobile App would be beneficial to any utility looking to provide quality service by developing a new system to maintain assets and operations.