Texas Stream Team Datamap and Site Automation

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Client: The Meadows Center for Water and the Environment
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1. Introduction

1.1 Summary

Prepared by Web Geo Consulting Company (WGCC) for the Meadows Center, this progress report outlines the tasks we have completed, currently working on, and plan to complete for the Texas Team Stream datamap update process. So far, we have completed the core data infrastructure, configured and formatted two Survey123 forms, and created an ArcGIS dashboard. Current and future work focuses on autopopulation, data validation, and design elements.

1.2 Purpose

The purpose of this project is to reduce site request processing time and improve the accuracy of site information and water quality monitoring data. To do this, we are focusing on creating a foundational data structure and implementing automation and data validation. This includes creating a one-to-many relationship between site records and monitoring data where records submitted through the Survey123 forms are automatically linked. In the New Monitoring Site Request Form (NMSRF), we will automate site attribute population using authoritative ArcGIS Online layers. The Water Quality Monitoring Form (WQMDF) will include a dynamic list of approved, active, and inactive sites that community scientists can select from when submitting monitoring data. The form will also include a data validation system where entered core measurement values will be compared to global and site-specific water quality standards.

1.3 Scope

The scope remains unchanged as outlined in the original proposal. Below is a restatement of the scope for reference. This project will focus on sites within the state of Texas and is expected to be completed by April 23, 2025. Refer to Figure 1 for the Area of Interest (AOI) and water monitoring site locations.

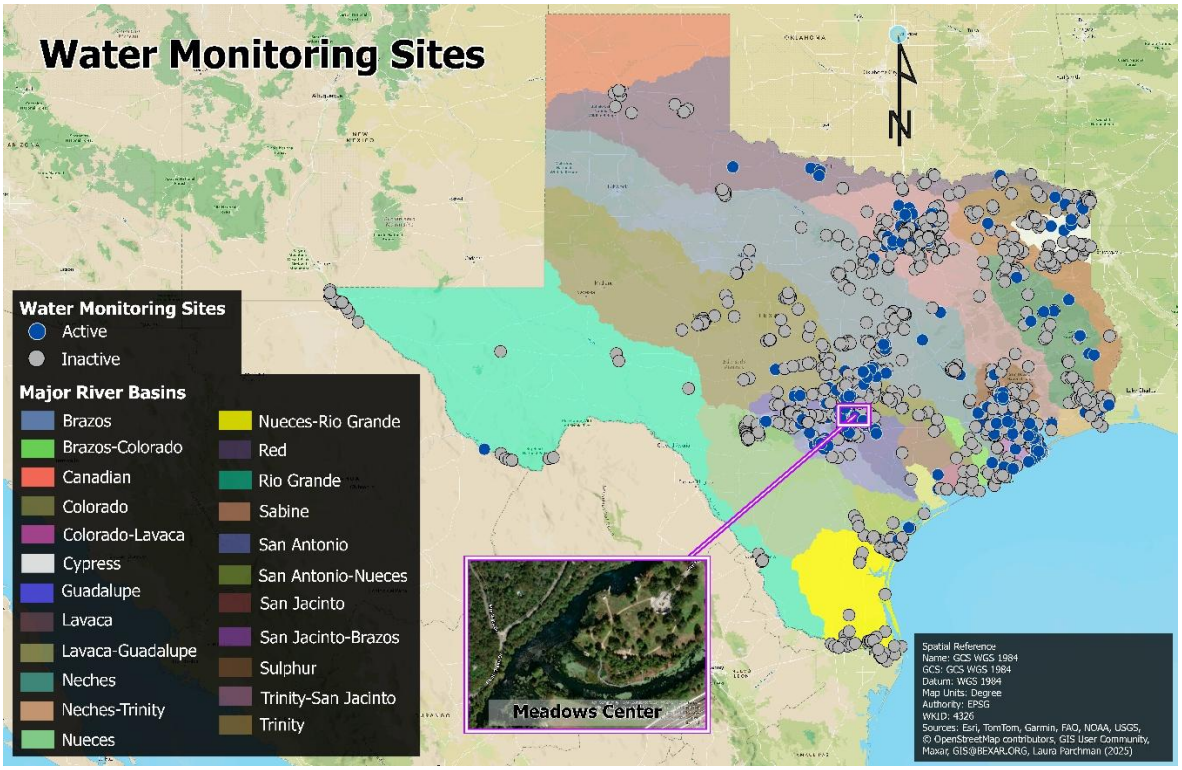

Figure 1. Area of interest

2. Tasks

2.1 Related Tables: siteAttributes and monitoringData

2.1.1 Work Completed

Before developing any Survey123 forms or the ArcGIS dashboard, we created the foundational feature layer and standalone table required for the updated datamap workflow. As outlined in our proposal, we implemented a one-to-many relationship between a point feature class and a standalone table: one storing sites and their attributes (siteAttributes) and another storing monitoring records (monitoringData).

Using ArcGIS Pro, we created the feature class and table and added their respective fields. The siteAttributes point feature class includes 31 fields that store information such as site information and hydrologic attributes, community scientist information and request details, status and internal tracking fields, metadata fields, and image attachments. The monitoringData standalone table has 23 fields that store general information regarding the sampling event, core water quality measurements, and metadata.

To maintain data consistency, we set up domains for fields such as “siteStatus,” “privateProperty,” and “testingType.” These domains restrict the values that are allowed for these fields. For example, “testingType” has values “probe,” “standard,” and “other” in its domain list; no other values will be allowed to be stored in this field.

For the creation of the one-to-many relationship class, we used the GlobalID field in siteAttributes as the primary key and added a corresponding GUID (Global Unique Identifier) field called “siteGlobalID” in monitoringData as the foreign key. Using a GlobalID-GUID configuration allows each site to be associated with multiple monitoring records.

After establishing the one-to-many relationship, we added a test record to the siteAttributes feature class and two related records to the monitoringData table, ensuring that the siteGlobalID matched the Global ID of the site record. This confirmed that the relationship class was functioning correctly. We then published both feature class and table as a single hosted feature layer to ArcGIS Online and verified that the relationship was maintained. Using the “related” field in the hosted feature layer, we confirmed that feature layer and table maintained their relationship after being uploaded online (Figure 2).

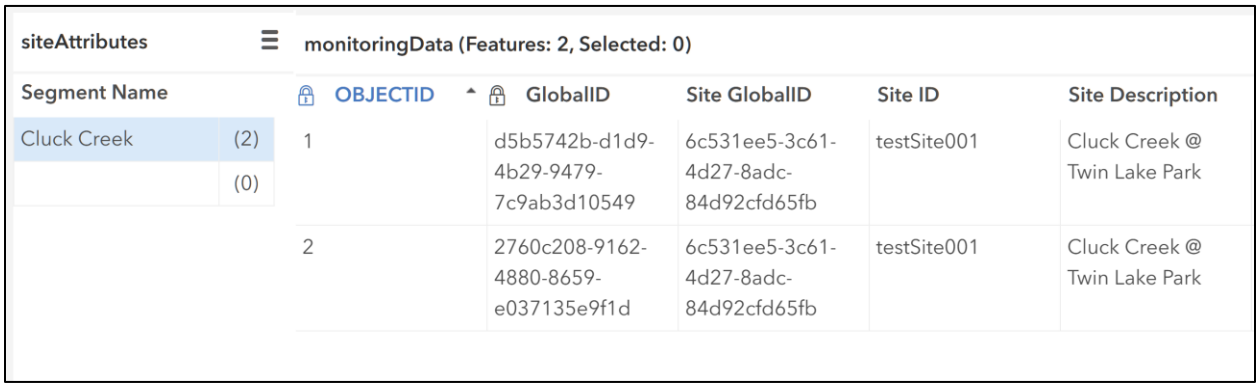

Figure 2. Related tables in ArcGIS Online

2.1.2 Present Work

As we shift our focus towards the Survey123 Forms and the ArcGIS Dashboard, we currently aren’t working on any changes or additions to the feature layers.

2.1.3 Work Scheduled

Between April 10th and April 16th, we plan to test the full data flow between the forms and hosted feature layer. This involves populating the siteAttributes feature layer and monitoringData table with data submitted from both forms to confirm the forms and their respective layers are connected.

We will start by submitting a New Monitoring Site Request. Using the internal dashboard, we will confirm that the newly submitted site request appears in both the map element and the editable version of the form. From there, we will change the site status from "new" to "approved." Next, we will open the Water Quality Monitoring Data Form (WQMDF) to verify that the newly approved site appears in the dynamic site list.

After filling out the form and submitting the monitoring data, we will check to see if the siteGlobalID field matches the GlobalID of the corresponding site in the siteAttributes layer. This walkthrough of the datamap process will show that the relationship class is maintained and both site and monitoring records are automatically linked as data is submitted.

2.2 New Monitoring Site Request Form

2.2.1 Work Completed

Once the feature layer and table were finalized and uploaded, we created the New Monitoring Site Request Form (NMSRF) using the siteAttributes feature layer in Survey123 Connect. Since the form was generated directly from the feature layer, all question types, names, and labels were pre-populated in the XLS Form. We manually adjusted question constraints and visibility, added descriptive text to the top of the form, and added subtext beneath individual questions. We customized the form's design by modifying background and text colors, font sizes, and adding hyperlinks. To improve efficiency and data accuracy, we autopopulated fields such as County, River Basin, and Hydrologic Unit Codes HUCs (Hydrologic Unit Codes) using the pulldata() function in the calculation column (Figure 2). These fields are autopopulated using ArcGIS Online feature layers from authoritative sources, including TxDOT, the Houston Advanced Research Center, and ESRI. To verify the connection between the New Monitoring Site Request Form and the siteAttributes feature layer, we submitted one test form and confirmed that the data was successfully recorded in ArcGIS Online.

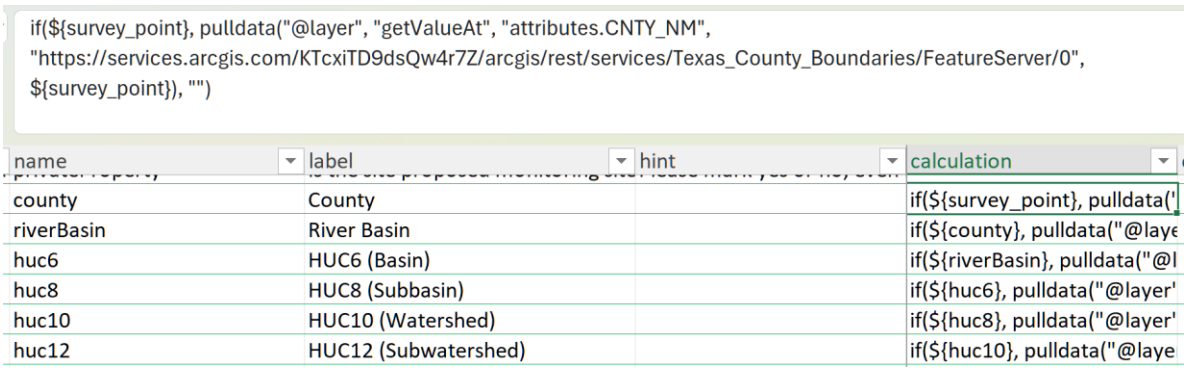

Figure 2. Pulldata() function for County Field

2.2.2 Present Work

After the completion of the form's configuration, formatting, and design, we aren't currently working on any changes or additions.

2.2.3 Work Scheduled

Between March 26th and April 2nd, we plan to explore how to manage question visibility based on the form's mode. Currently, setting the field appearance to "hidden" removes the survey question from both public and editable views, even though these fields are still recorded in the feature layer. Fields such as siteStatus and staffComments need to be hidden from public view but accessible in the editable view so that staff can make changes to the form as they review site requests.

2.3 Water Quality Monitoring Data Form

2.3.1 Work Completed

With the related tables completed, we began creating the Water Quality Monitoring Data Form using the monitoringData table. As with the New Monitoring Site Request Form, integrating the feature layer automatically populated the question types and names in the XLS form. From here, text descriptions, background colors, font design were manually added. To confirm that the form connects to the monitoringData table, we submitted one test form and verified that the data was correctly recorded in ArcGIS Online.

Some parameters, such as total dissolved solids (TDS) and dissolved oxygen (DO) average, require calculations. TDS is calculated by multiplying conductivity by 0.65. The DO average is calculated as the mean of the two DO titration values, but only if the absolute

difference between them is less than 5. Both calculations were implemented in the calculation column to autopopulate the correct values. For the DO average, we used a conditional expression so that the average is only calculated when the titration values are within an acceptable range. If invalid values are entered, a warning message pops up prompting the user to check their entries (Figure 4).

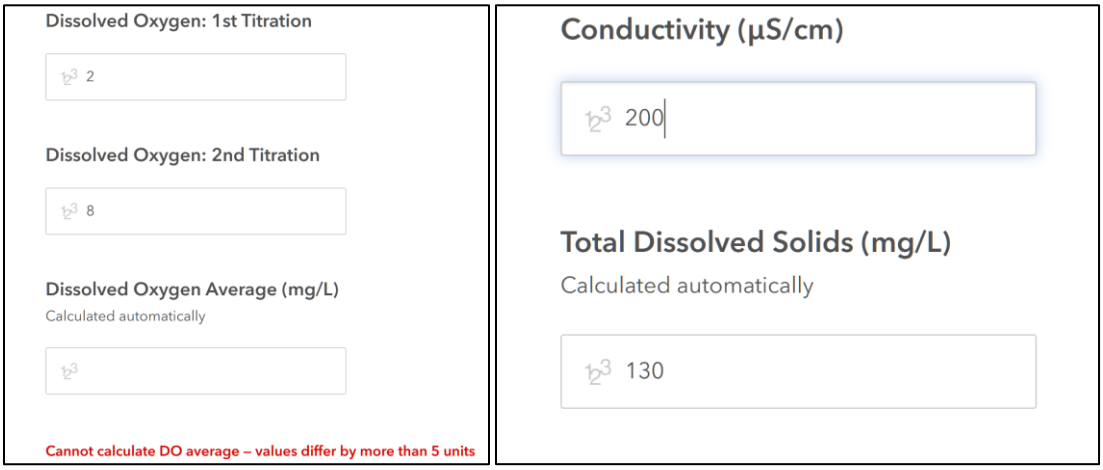

Figure 4. Automatic calculations in Water Quality Monitoring Data Form

2.3.2 Present Work

Currently, we are working on connecting the New Monitoring Site Request Form and the Water Quality Monitoring Data Form by using the one-to-many relationship between the siteAttributes feature layer and the monitoringData table. Our goal is to make sure that each new monitoring record submitted through the form is automatically linked to its corresponding site record. To do this, we are developing a dynamic list of approved, active, and inactive sites that community scientists can select from when submitting monitoring data. Using the pulldata() function, the form will retrieve site IDs and descriptions from the siteAttributes feature layer. Once a site is selected, the form will also retrieve the site's GlobalID and store it in the siteGlobalID field of the monitoring record, which establishes the link between monitoring data record and site record.

2.2.3 Work Scheduled

Between April 3rd and April 9th, we plan to work on a data validation system to improve data quality. This system will reference a CSV containing stream-specific and global parameters.

The form will retrieve the appropriate minimum and maximum values based on the site's associated segment ID. If the site has no associated segment ID, the form will retrieve global parameter values. If the user enters a value outside the parameter range, a warning note will appear, alerting the user of what the value is expected to be. While users are alerted of abnormal values, they are still allowed to submit the form, allowing for these abnormal values to be recorded.

2.4 Site Request Review Dashboard

2.4.1 Work Completed

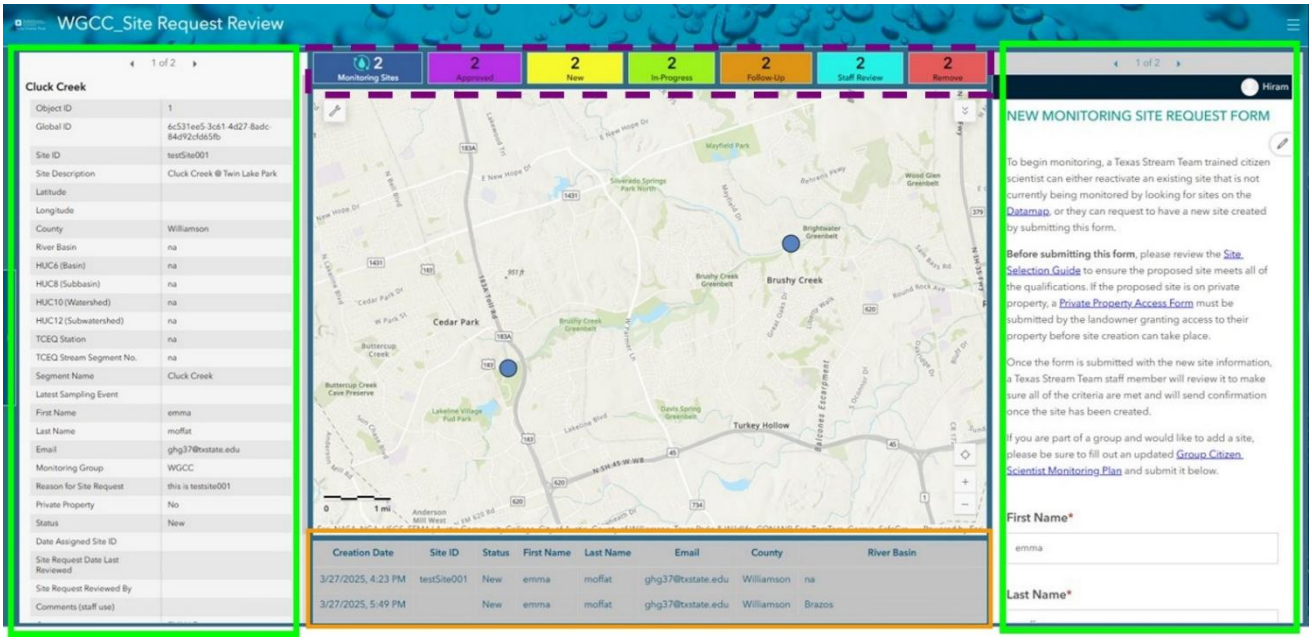

Figure 5. Current draft of the Site Request Review Dashboard

As outlined in the original Meadows Center Request for Proposal (tds) objectives, we updated and customized an ArcGIS Dashboard to replace the existing version. After the newly developed NMSRF was completed, we added status indicators for water monitoring sites. As shown in Figure 5, these indicators appear at the top of the page, marked by purple hash marks. They represent seven status types: current, approved, new, in progress, follow-up, staff review, and remove. This connection will ensure that the data is consistently updated in real time.

The left panel, highlighted in green, shows data submitted from the New Monitoring Site Request Form (WQMDF), with its source being a view layer of the siteAttributes layer. This view layer is a subset of the original siteAttributes feature layer, not connected to the

monitoringData table while including all the original fields. This is done to support embedding functionalities within ArcGIS Dashboard. On the right panel is editable version of the "New Monitoring Site Request Form," which allows Meadows Center personnel to verify that the information submitted by community scientists aligns with the Center's specific criteria.

Within the orange outline, the table was also redesigned by removing the site description, which had become overly detailed and difficult to read. Upon review, it was determined that this information was already accessible in the left-hand information panel. In its place, county and river basin details were added to provide a clearer, quick-reference overview, enabling users to make more informed decisions.

2.3.2 Present Work

Following the suceessful completion of updates completing the updated changes with the Dashboard, no further modifications to the proposed Dashboard are planned at this time.

2.2.3 Work Scheduled

Between April 16th and April 23rd, our final task will be to complete the design of the dashboard. With the siteAttributes feature layer populated with sample data, we will symbolize the point features based on the status of the site, matching the colors of the status counters at the top of the dashboard. During this final task, we will also make minor design adjustments.

2.5 Problems and Concerns

Our main challenge throughout this project is working with workflows and tools that we don't have prior experience with. Over the past several weeks, we were often learning processes as we were developing the related tables, Survey123 forms, and ArcGIS Dashboard.

While creating the related tables, we discovered that relationship classes needed to be built in ArcGIS Pro since ArcGIS Online doesn't support this functionality. We also had to learn the importance of using a GlobalID-GUID configuration to ensure that the point feature class and table were properly linked.

For the Survey123 Forms, we had to learn XLS Form-specific syntax for calculations, constraints, and formatting. Additionally, we learned that ArcGIS dashboards has issues with

supporting related tables. To remedy this, we created a view layer of the siteAttributes layer, allowing us to integrate site data with the dashboard without compromising functionality.

As a result of this ongoing learning, our tasks have taken longer to complete than expected. However, each challenge we encountered has expanded our understanding of the datamap process, which will improve the overall quality of our final deliverables.

2.6 Updated Timetable

Figure 6 shows are updated timetable for our project. This timetable summarizes what is described in "work scheduled" sections for the related tables, forms, and dashboards.

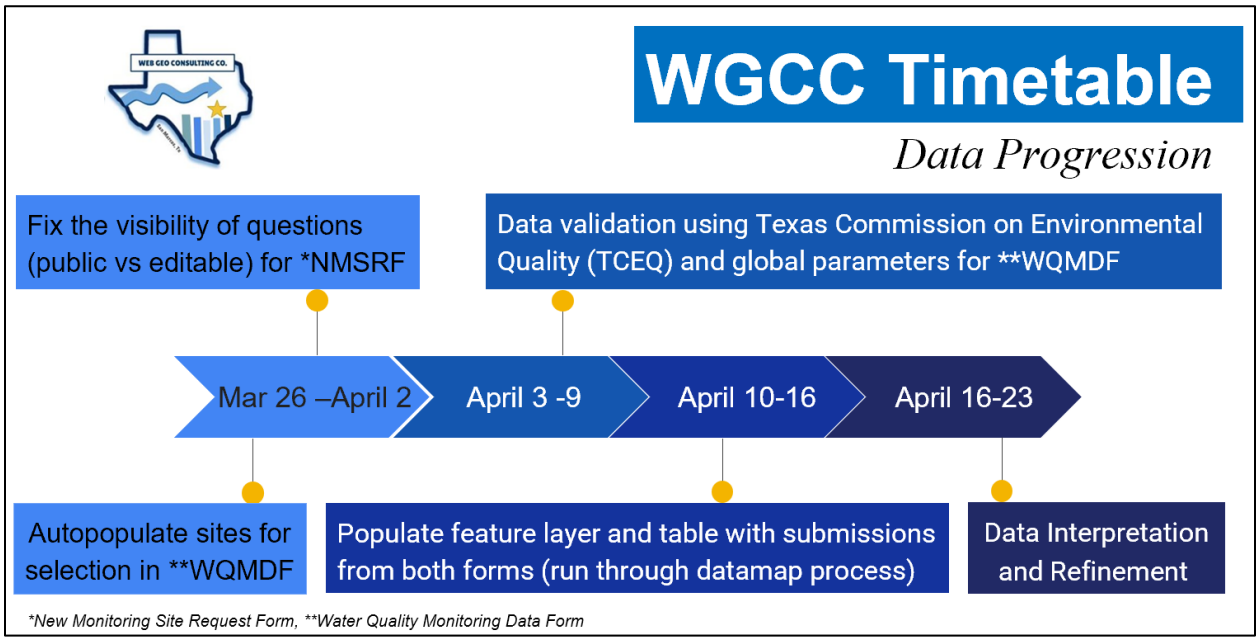

Figure 6. Updated Timetable

3. Conclusion

Through enhanced data automation, validation, and visualization, this proposes a faster and more accurate datamap process for the Texas Stream Team. Achieving our objectives will provide a more accessible and reliable public datamap while also reducing administrative workload. By making these improvements, this project will support the broader impacts of

empowering community scientists and contributing to environmental sustainability and water conservation efforts.