



AN ESRI  
WHITE PAPER

JULY 2019

# Getting Started with Digital Transformation Using ArcGIS

*A Guide for  
Small and Rural Water Utilities*

380 New York Street  
Redlands, California 92373-8100 usa  
909 793 2853  
info@esri.com  
esri.com



Copyright © 2019 Esri  
All rights reserved.  
Printed in the United States of America.

The information contained in this document is the exclusive property of Esri. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by Esri. All requests should be sent to Attention: Contracts and Legal Services Manager, Esri, 380 New York Street, Redlands, CA 92373-8100 USA.

The information contained in this document is subject to change without notice.

Esri, the Esri globe logo, The Science of Where, ArcGIS, Insights, [esri.com](http://esri.com), and @esri.com are trademarks, service marks, or registered marks of Esri in the United States, the European Community, or certain other jurisdictions. Other companies and products or services mentioned herein may be trademarks, service marks, or registered marks of their respective mark owners.

**Table of Contents**

Executive Summary ..... 4

Guide to Digital Transformation ..... 4

Components ..... 4

ArcGIS Apps ..... 5

7 Steps to Get Started ..... 5

# Getting Started with Digital Transformation Using ArcGIS

## Executive Summary

Maps have always been essential to understanding and improving the delivery of safe, clean drinking water and reliable sewer and stormwater services. An early example you may be familiar with is the 1854 cholera outbreak in London. Then, Dr. John Snow used maps to trace the cholera source to the Broad Street pump, which enabled authorities to take the contaminated well out of service and stop the outbreak. Today, water utilities continue to use maps to meet a wide variety of challenges related to issues such as regulatory compliance, water quality, aging infrastructure and the loss of staff members' expertise upon retirement.

Today, with modern advances in technology such as improved Internet connectivity and powerful mobile devices, digital mapping can be readily deployed at a utility and improve the efficiency of workflows across the organization. Despite the availability of all this technology, some small and rural water utilities continue to rely on paper maps and/or on long out-of-date digital maps. This reliance makes it more difficult to overcome common industry challenges and costlier to operate thus the need for digital transformation. The benefits of digital transformation are well-known—such as reducing operations costs, achieving more with less, making smarter asset management decisions, attaining better regulatory compliance, and having more satisfied customers.

## Guide to Digital Transformation

For more information about how digital transformation benefits water utilities, please reference the white paper on [how Web GIS supports a water utility](#).

With technology advancements and well-documented best practices, there has never been a better time for water utilities to get started with digital transformation.

This guide will help you create the following: a system of record for storing and managing assets; a system of engagement for enabling access to asset information on any device at any time; and a system of insight for analyzing information and making smarter, more informed decisions about asset management.

## Components

With a subscription to [ArcGIS® Online](#), utilities can manage digital mapping content in the secure, cloud-based Esri® technology environment. Members of your organization can publish their data to ArcGIS Online and create [web maps](#) and apps that can be shared with whoever needs them. Existing ArcGIS Desktop customers who are current with their maintenance are entitled to ArcGIS Online.

[ArcGIS Solutions for Water](#) is a collection of ArcGIS solutions that provide map and app configurations that enable common water utility mapping workflows that leverage spatial information. The ArcGIS Solutions for Water maps and apps are designed to be configurable and extensible to meet the unique needs of individual water utilities.

They are freely available for water utilities to deploy on their licensed Esri software, and they are fully supported and maintained by Esri. New map and app configurations are continually being developed, and the source code is generally available for download. For more information, please see the white paper [Implementing ArcGIS for Water Utilities](#).

## ArcGIS Apps

ArcGIS includes several out-of-the-box applications that are designed to utilize web maps and provide additional functionality. Several apps are discussed throughout this guide. Below is a list of the apps with links to the product description and online help documentation:

- [ArcGIS Pro](#)
- [Collector for ArcGIS](#)
- [Survey123 for ArcGIS](#)
- [Web AppBuilder for ArcGIS](#)
- [Operations Dashboard for ArcGIS](#)
- [Insights for ArcGIS](#)

ArcGIS Pro is a desktop geographic information system (GIS) application that is typically used by water utilities to edit data, perform sophisticated analysis, and create maps. It can also be used to configure ArcGIS for Water Solutions maps and apps using the [ArcGIS Solutions Deployment tool](#). This ArcGIS Pro software-based tool automatically deploys the items, groups, feature layers, maps, and applications that make up a specific ArcGIS solution.

## 7 Steps to Get Started

To help make the entire process even easier, we have outlined seven steps to help you get started with digital transformation of water data, using ArcGIS.

### Step 1 Activate and Configure Your Mapping Portal

If you have already purchased a subscription to ArcGIS Online, then you or someone else in your organization should have received an email from Esri containing a subscription ID and a link to activate your subscription. Click the link in the email and follow the instructions.

During the process, you will be asked to provide a short name that will be used in the URL for your portal landing page. It is important to choose an appropriate, short name because it should not be changed later. A fitting short name may be as simple as your utility or organization name. You will also be asked to create the initial user login. This name cannot be changed. Be sure to check the box to enable Esri access during the user login creation. This will allow the user to access and download [ArcGIS Solutions for Water](#), which will be used throughout this guide.

Establishing your organization's mapping portal is an important step toward digital transformation through Web GIS. Your portal serves as the destination for users in your organization to access maps and applications. Some users in your organization may only need viewing capabilities, while others may need to edit data or access maps and collect information from the field. Before you assign users to the organization's portal, you will want to choose the correct user type for everyone. For more information, please review the [ArcGIS user types](#).

As you introduce maps and applications to your organization, it will become increasingly important to be sure that the right individuals have access to the appropriate information. This is achieved by assigning roles and privileges to user accounts. Also, adding members to groups and sharing items with them is another way to manage access and organize content. For more information, please refer to the online help sections listed below:

[Roles and Privileges](#)  
[Groups](#)

## Step 2 Deploy the Water Distribution System Foundation Configuration

A **system of record** for storing asset information is one of the most important components to effectively managing and maintaining a utility's assets. Esri offers a solution to easily publish services, maps, and applications that can be used to manage asset information in a GIS. The [Water Distribution System Foundation](#) template can be used as a fully hosted solution in ArcGIS Online, or it can be deployed in your organization's own infrastructure with ArcGIS Enterprise.

Now that you have successfully initialized and configured your mapping portal, it's time to create some content. The work involved in the next steps depends on how much data you have and how much needs to be collected and edited.

This step will guide you through the process of publishing the hosted feature layers that will serve as the containers for your GIS data. These layers are designed to be a starting point and can be changed or added to over time. They will be used as the foundation for the web maps and applications that serve the users in your organization.

1. Launch ArcGIS Pro and be sure the Solution Deployment add-in has been installed.
2. Follow the instructions found via the link above to deploy the Water Distribution System Foundation configuration.

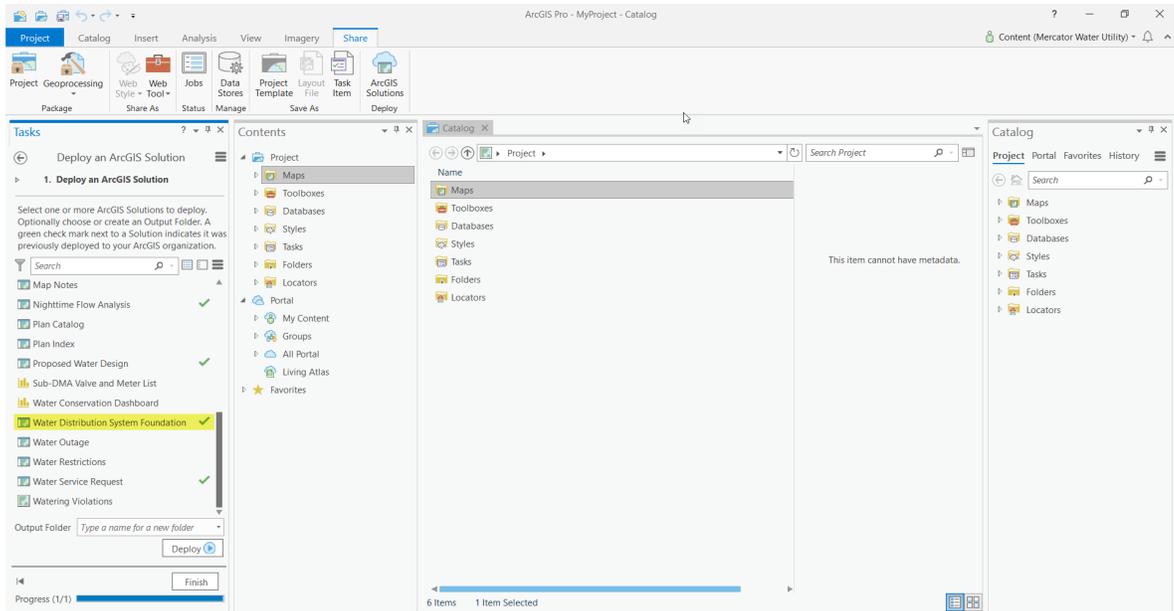


Figure 1. ArcGIS Pro with the Solution Deployment tool add-in is used to deploy the Water Distribution System Foundation configuration.

Once you have deployed the solution, you should take some time to examine and understand the data model to decide if you need additional configuration (additional fields, tables, and/or domains) to support your organization's needs. The data dictionary for Water Distribution System Foundation can be found in the [Get Started](#) section of the help documentation.

There are three main options for making changes. The first option is to use the Solution Deployment add-in to make the changes:

1. Navigate to the Task list for the Solution Deployment tool.
2. Choose Configure an ArcGIS solution.

## Getting Started with Digital Transformation Using ArcGIS

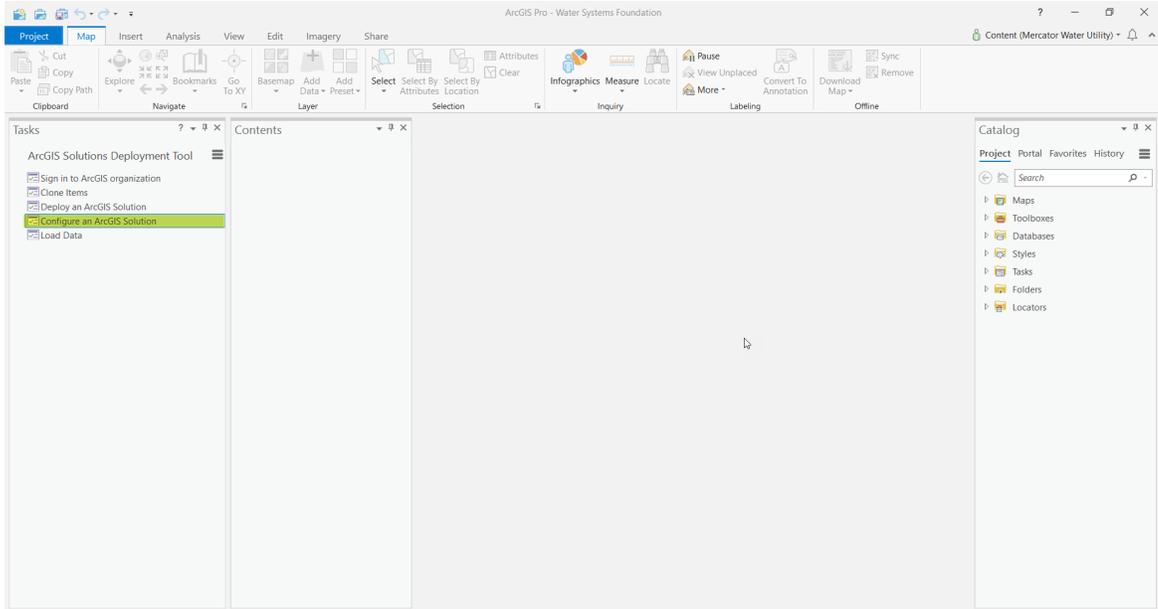


Figure 2. Use the Solution Deployment add-in to configure a solution.

Changes to hosted feature layers can also be made directly in ArcGIS Online.

1. Browse to the layer you wish to change.
2. Click the Data tab and choose the layer you wish to examine.
3. Toggle the fields to display field names.
4. Click a field name to view the settings and list of values (Domain). Here you can also edit the settings and list of values. Note—it is strongly recommended that you do not delete fields or domain values.

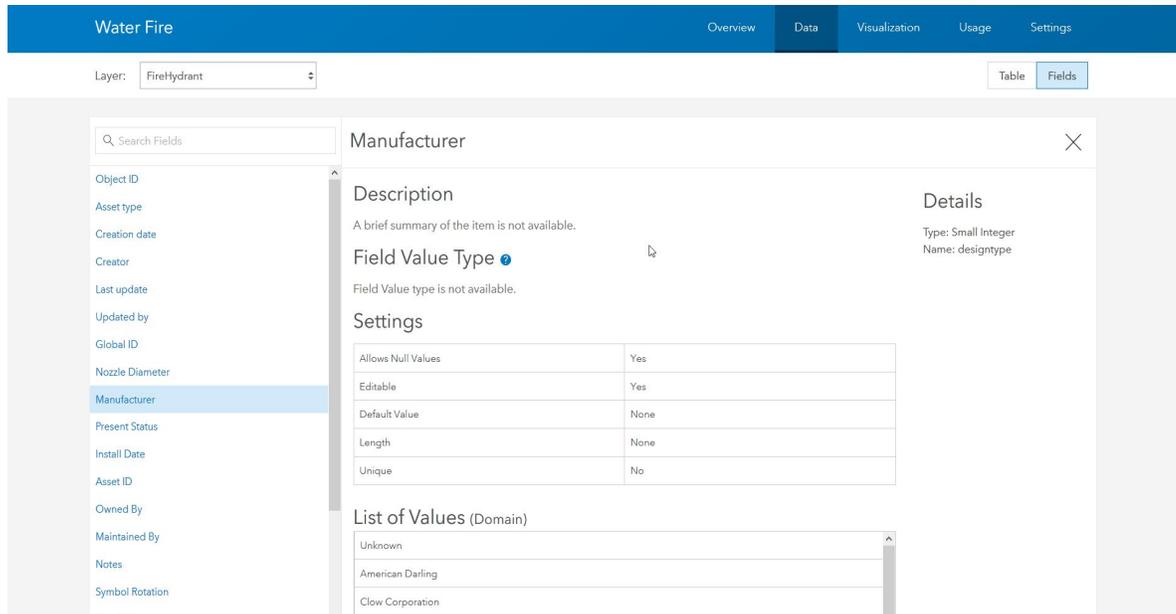


Figure 3. Use ArcGIS Online to configure attribute fields.

The last option (Advanced) is to download the Water Distribution System Foundation Components item from your organization. This includes the geodatabase schema and several map files containing the symbology. Changes can be made to the schema and layers can be republished. Please note that making changes to layer names and attribute fields or deleting fields should be avoided, as maps included in the foundation and other solutions may no longer work as a result. Adding fields and relationship classes to support additional workflows such as inspections is generally OK. Depending on your experience level and the extent you wish to alter the schema, it may be faster and easier for Esri Professional Services or a qualified Esri partner to assist with your specific configuration changes.

Once you are familiar with the data model structure and have made any changes or additions, you should load data into the corresponding layers. Your organization may have several types of data that contains information about the assets you can to load into ArcGIS. Here are some common data types:

- Geodatabases
- Shapefiles
- CAD files
- CSV files or spreadsheets

The choice of process may depend on the type of data you wish to load into ArcGIS. The preferred method for loading data from a geodatabase or shapefile is to use the Solution Deployment tool. If your data currently resides in spreadsheets, CSV or CAD files, or another format, other tools such as the [ArcGIS Data Interoperability extension](#) may be better suited. In that case, you should consult with Esri or a qualified Esri Partner for assistance loading data.

1. Navigate to the Load Data Task in the Solution Deployment tool.

# Getting Started with Digital Transformation Using ArcGIS

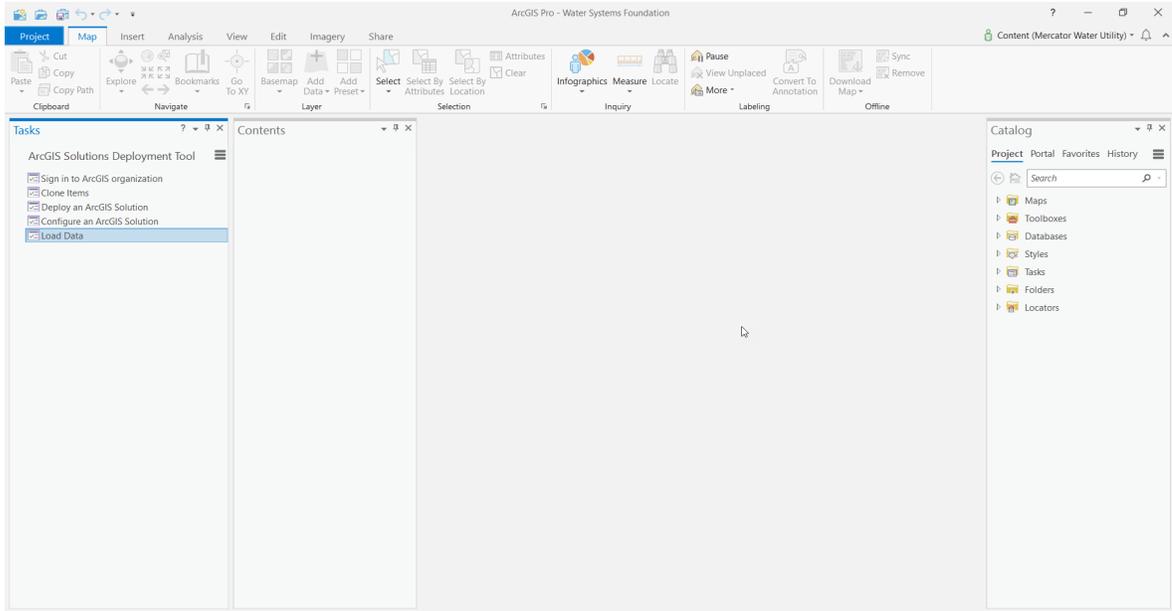


Figure 4. Use the Solution Deployment add-in to load data into hosted feature layers.

2. Choose the appropriate input datasets from which you want to load data. The Target Dataset field should be a layer in your Water Distribution System Foundation configuration. You can create an expression to query only the specific data that you wish to load.

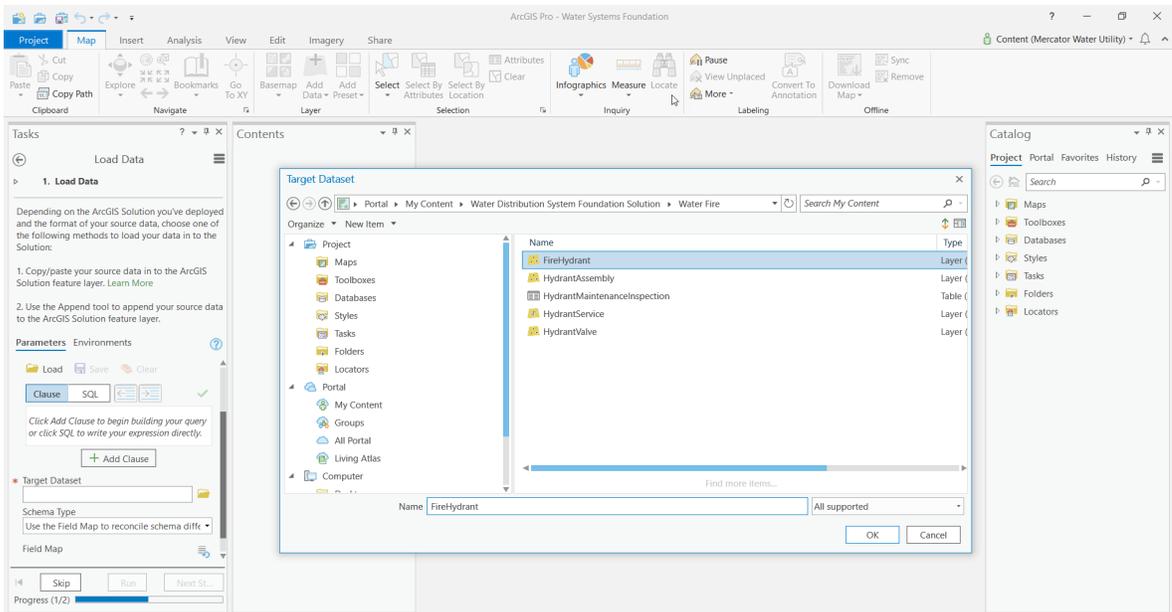


Figure 5. Load data from existing layers into new published hosted feature layers.

3. Use the field map to match the fields from your input dataset to your target dataset.

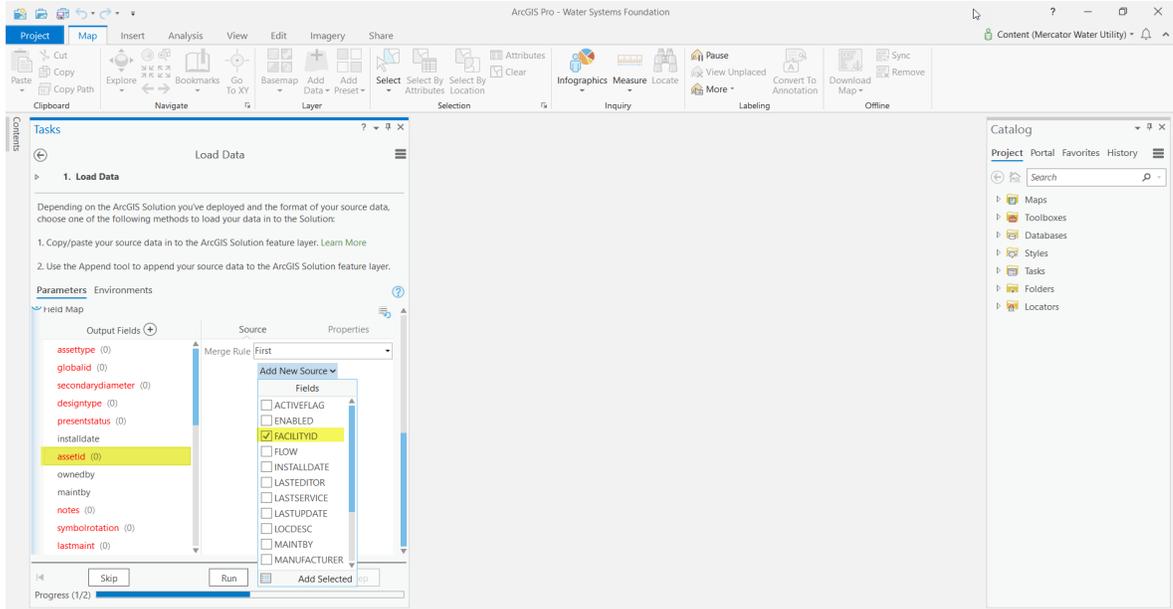


Figure 6. Field mapping from existing data to new hosted feature layers

Below are some additional methodologies and tools for loading data into ArcGIS:

1. Copy and paste
2. Append
3. Import
4. Publish from a spreadsheet using ArcGIS Maps for Office

It's likely that you will not have data for all layers and all fields that were published as part of the Water Distribution System Foundation configuration. In that case, it may be necessary to manually edit or collect features to populate the layers. You may not require all the layers depending on your organization's needs. Field data collection will be covered in the next step. As you begin editing and enabling others in your organization to edit data, it will be important to ensure that you have assigned the appropriate user type and permissions. For more information about editing and permissions, please visit the ArcGIS Online help sections listed below:

- [Manage hosted feature layers](#)
- [Disable editing](#)
- [Create hosted feature layer views](#)

It is also possible that the data you have loaded or that has been edited contains errors. Errors can include assets that are misidentified or missing, are placed in the incorrect location, or contain partial attribution information. The Water Distribution Systems Foundation template includes the Water Issues layer for capturing information errors. The Water Issues layer is included in the Digital Water Map and Mobile Viewer web maps. The Digital Water Viewer application also contains a Water Issues widget for adding and editing issues in addition to viewing and querying assets. The Water Issues layer can easily be added to other maps and apps so that anyone using a map or accessing the data can report issues.

### Step 3 Capture Data with High Accuracy Using Collector for ArcGIS

If your asset inventory is not complete, it may be necessary to collect additional assets and information by using a high-accuracy GPS device. Collector for ArcGIS is designed with this type of data capture in mind. It is recommended to add GPS metadata fields to layers created outside of the Water Distribution System Foundation to enable additional information pertaining to the accuracy of the data collected to be added. The Water Foundation layers have GPS metadata fields already enabled.

To capture information using Collector for ArcGIS, you will need to use a web map specifically for use in the field. The Water Foundation template includes the layers for data collection. Depending on your organization's needs, you may want either one map with all the layers for data collection or separate maps for each type of asset being collected.

Some considerations for field data collection include

- Configuring which layers and fields should be editable. This can be accomplished by setting properties within the web map or, alternatively, by creating a hosted layer view. The Water Foundation template contains noneditable views for all layers.
- Learning how to take web maps offline.
- Preparing maps for offline use.

The process for connecting a high-accuracy device to Collector may depend on your device's OS and the GNSS receiver. Resources for learning more about high-accuracy data collection can be found in the Collector for ArcGIS help sections listed below:

- [High-accuracy receivers](#)
- [Use high-accuracy GPS](#)
- [Manually update your data](#)

A **system of engagement** enables everyone in an organization to access the right information at the right time, from the right device. Web GIS is critical to the dissemination of information coming from the system of record. In the next steps, we will look at some ways to capture additional information and enable field crews to use maps and dashboards to support better decision-making.

## Step 4 Conduct Inspections on Assets

A critical component to managing assets is regular inspections. The Water Distribution System Foundation offers basic capabilities for asset inspection. The hydrant and valve layers that are published as part of the foundation contain related inspection tables. These layers can be utilized in web maps that are accessed using Collector for ArcGIS or Survey123 for ArcGIS to perform and record inspections directly related to the asset based on a unique Global ID field. Information from the related inspection records can be summarized and displayed to monitor progress. The next section discusses how to create an operations dashboard to help monitor progress for asset data collection and/or inspections.

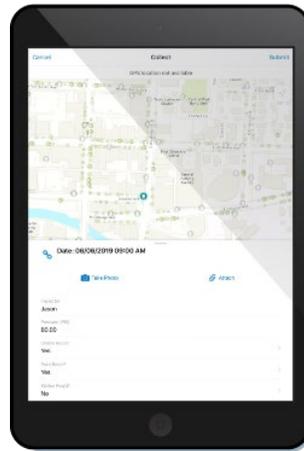


Figure 7. Perform hydrant inspections using Collector for ArcGIS on a mobile device.

## Step 5 Monitor Progress

A key step in maintaining a system of record and engaging with others is to monitor progress. The Operations Dashboard for ArcGIS application is useful for bringing together spatial information that measures key performance indicators (KPIs) to ensure the success of projects. Operations Dashboard is a web-based application that uses a web map and feature layers to report information via configurable widgets.

More information about creating dashboards can be found via the link below:

[Operations Dashboard Help Documentation](#)

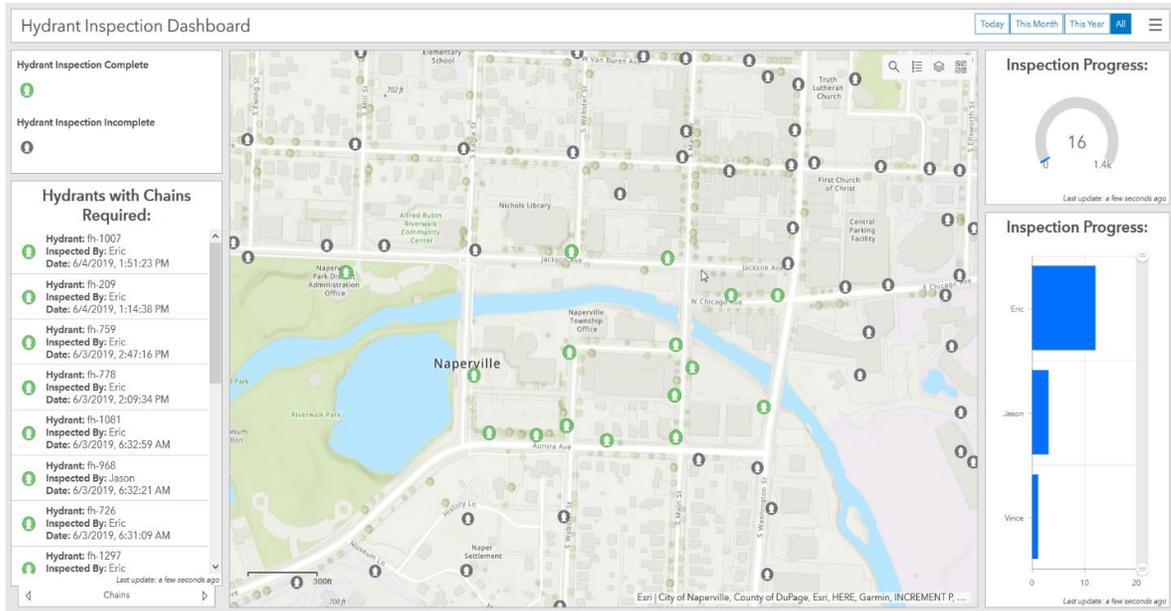


Figure 8. This example dashboard shows hydrant inspections and maintenance KPIs.

A **system of insight** is perhaps the most powerful aspect of digital transformation. By creating a system of insight, you will be able to augment decision-making with rich analytics based on location intelligence and powerful visualizations.

## Step 6 Analyze Results Using Insights for ArcGIS

Insights™ for ArcGIS is a powerful application that enables you to visualize, explore, and analyze data. With Insights, you can connect to spatial data layers from your portal, spreadsheets containing asset information such as condition assessment or previous work history, or the thousands of layers like demographics and soils from Esri's [ArcGIS Living Atlas of the World](#) collection. Insights enables you to assemble information through workbooks, pages, and cards and can be a powerful tool for identifying patterns and trends in your data. With Insights, you can begin to understand complex problems such as asset failure, water loss, billing inconsistencies, or conservation.

More information about using insights for water utilities can be found via the link below:

[Insights for ArcGIS Help Documentation](#)

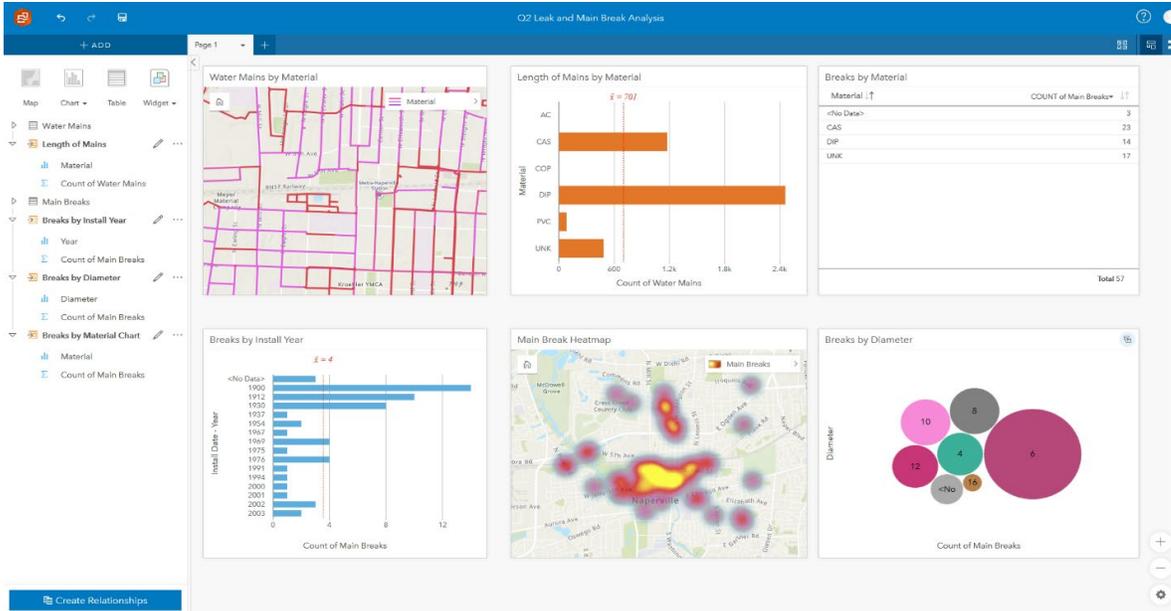


Figure 9. This sample Insights workbook displays water mains and breaks to highlight where leaks are occurring and the rate of occurrence by material, diameter, and age of pipe.

## Step 7 Learn about Other Workflows

The ArcGIS apps and ArcGIS Solutions for Water can be used in combination to satisfy a wide variety of workflows and business challenges. Some example workflows include using [Water Service Request](#) to capture operational issues such as water leaks and problems with pressure or quality. [Workforce for ArcGIS](#) can be used to manage tasks associated with asset inventory, maintenance, or response to requests. The [Water Outage solution](#) can be deployed for capturing leak information and creating and sharing water main break and service outage information within an organization as well as with the public. These are just a few examples of what is possible using the ArcGIS Solutions for Water and ArcGIS apps.

## Getting Started with Digital Transformation Using ArcGIS

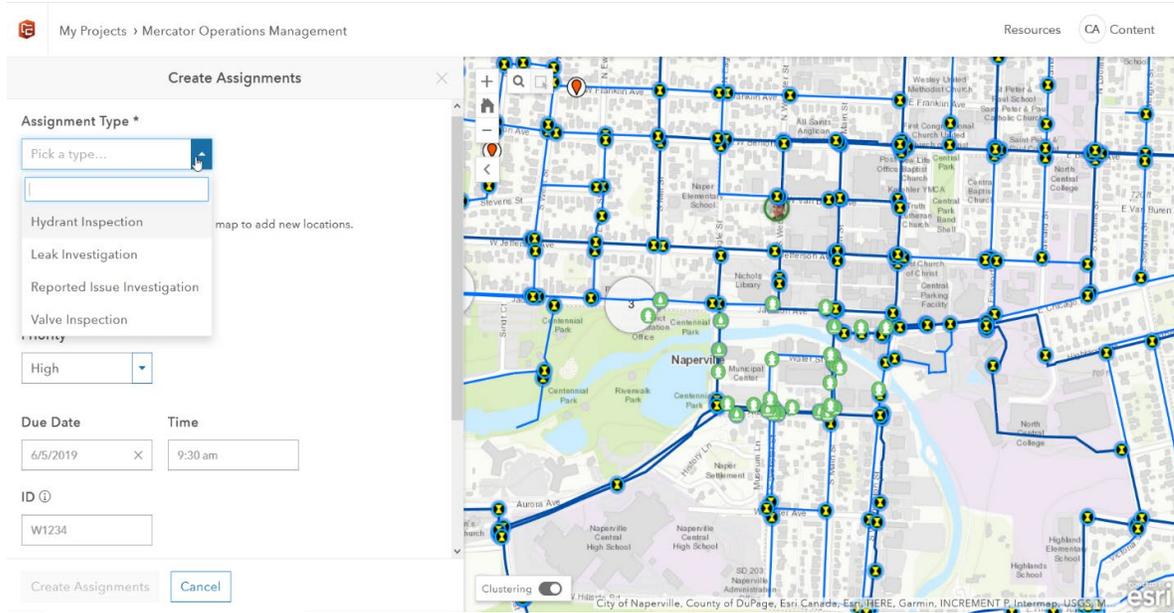


Figure 10. Use Workforce for ArcGIS to assign daily tasks.

### Additional Resources

[Esri Training](#)

[Esri Professional Services](#)

[Esri Technical Support](#)



Esri, the global market leader in geographic information system (GIS) software, offers the most powerful mapping and spatial analytics technology available.

Since 1969, Esri has helped customers unlock the full potential of data to improve operational and business results. Today, Esri software is deployed in more than 350,000 organizations including the world's largest cities, most national governments, 75 percent of Fortune 500 companies, and more than 7,000 colleges and universities. Esri engineers the most advanced solutions for digital transformation, the Internet of Things (IoT), and location analytics to inform the most authoritative maps in the world.

Visit us at [esri.com](http://esri.com).



### Contact Esri

380 New York Street  
Redlands, California 92373-8100 USA

1 800 447 9778  
T 909 793 2853  
F 909 793 5953  
[info@esri.com](mailto:info@esri.com)  
[esri.com](http://esri.com)

Offices worldwide  
[esri.com/locations](http://esri.com/locations)

For more information, visit  
[solutions.arcgis.com/water](http://solutions.arcgis.com/water)