



# Using GIS for Flood Impact Assessment and Recovery

OFMA 2024 Spring Workshop

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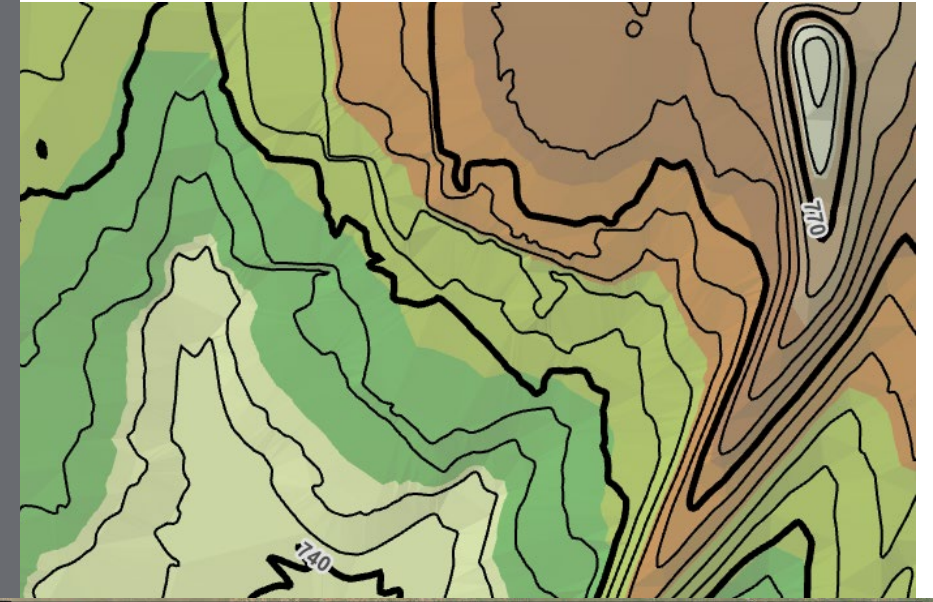
# Presenters

## Michael Couch, GISP, CFM

- GIS Principal and Department Manager for Meshek
- GIS/Floodplain Experience- 20 years
- Program Management and Leadership

## Jason Kleps, GISP, CFM

- GIS Project Manager for Meshek
- GIS Experience - 14 years
- Survey Management and Programming



ArcGIS System Ready  
Specialty



esri Partner Network  
Silver

# GIS Software

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# ArcMap Life Cycle Update

## Time to move to Pro

- ArcMap (ArcGIS Desktop) final release: 10.8.2 (released 12/9/21)
- Support ends March 2026
- **NEW SALES of ArcMap (ArcGIS Desktop and Extensions) will end JULY 1, 2024**
- Contact customer rep or OK rep for questions
- ArcMap license has conferred a matching ArcGIS Pro license; will be Pro only for new customers (existing renewals good to 2026 date)

### ArcGIS Desktop 10.8.2

Release date: December 9, 2021

#### Technical Support

Support status: Extended

	General Availability Dec 2021-Feb 2022	Extended Mar 2022-Feb 2024	Mature Mar 2024-Feb 2026	Retired March 2026
Create a case	✓	✓	✓	
Phone and chat	✓	✓	✓	
Online support resources	✓	✓	✓	✓
Software updates and patches	✓	✓		
New environment certifications	✓			

# Modern GIS Applications

## Different Options for Different Purposes

No longer desktop-executable install only:

- Viewers
- Dashboards
- Hub Sites
- Field Apps
- All fully supporting web and mobile access

The image displays two web-based GIS applications. The top application is the 'Community Rating System (CRS) Viewer' for the City of Tulsa, showing a map of Tulsa with various floodplain data layers. The bottom application is the 'Bixby Hydrant & Valve Dashboard', which provides a comprehensive overview of hydrant and valve assets. It includes a central map with asset locations, several data visualizations, and a summary table.

**Bixby Hydrant & Valve Dashboard Summary:**

Category	Value
Total Hydrants	1,327
Inspected	1,313
No Access	82
Remaining	14
Total Valves	3,580
Inspected	3,487
No Access	719
Remaining	93

**MS4 Statistics Table:**

City of Catoosa		City of McAlester		Rogers County	
Locations Monitored	Inspections Performed	Locations Monitored	Inspections Performed	Locations Monitored	Inspections Performed
155	183	301	126	224	274

# GIS Survey and Field Data Collection

## Interacting with and Collecting Data

### ArcGIS Field

- "Map-centric"
- Collect new data and edit existing data
- Ideal for asset inventory – lots of features
- Access data via mobile device
- Offline editing available

### Survey 123

- "Form-centric"
- Build forms specific to your data collection needs
- Ideal for replacing paper-based forms
- Access data via mobile device
- Offline editing available

### QuickCapture

- Click and go – click for a type, snap a pic, go on to the next

ArcGIS Survey123  
MS4 - City of McAlester  
**Outfall Inspection Form**

**Inspection Details**

Inspector: chill\_meshek  
Inspection Date: Sunday, September 17, 2023 5:27 PM  
Facility Name: \_\_\_\_\_  
Comments: \_\_\_\_\_

Outfall Photo: [Camera Icon] [Gallery Icon]

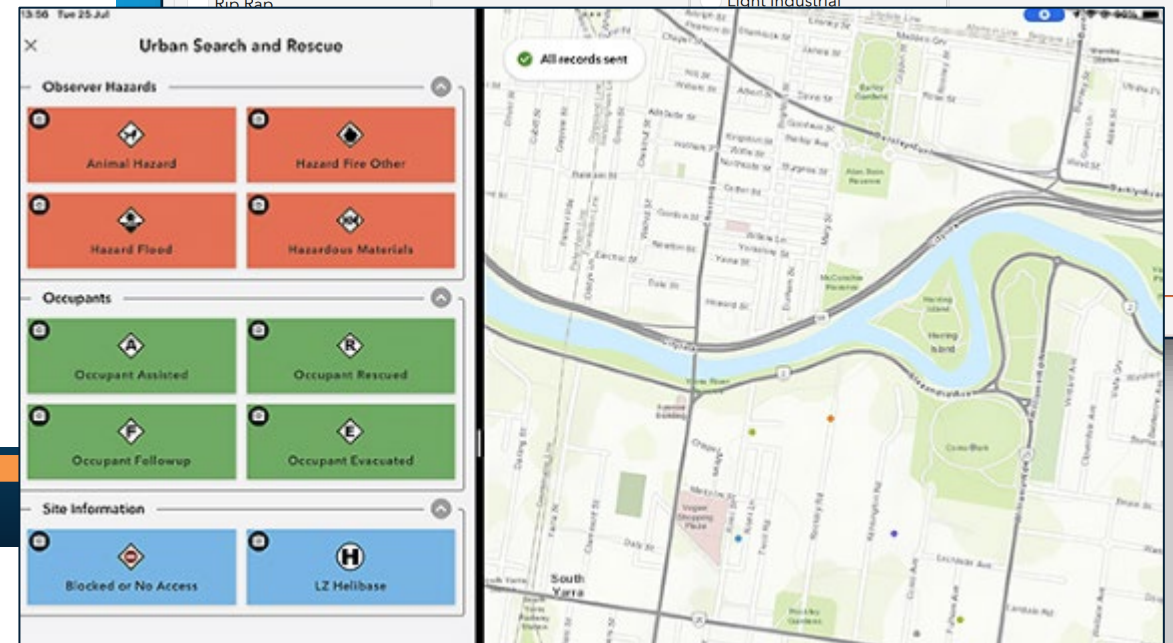
**Outfall Inspection**

Outfall Type \*  
 Pipe  Open Channel

**Additional Details**

Depth: \_\_\_\_\_  
Flow \*  
Heavy Moderate Trickling Dry  
Monitoring? \*  
 Yes  No  
Submerged? \*  
 Yes  No  
Odor Present? \*  
 Yes  No  
Scouring? \*  
 Yes  No

Materials Present:  Rip Rap  
Drainage Class:  Light Industrial



# Training

Take advantage of the training through the Esri Academy – most free or covered by maintenance.

Many specialty consultants.

State conference workshops (SCAUG, OFMA, OML)

Esri User Conference

User Community / Google



# ArcGIS Solutions for Damage Assessment

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# Focused Apps

- ArcGIS Solutions - <https://www.arcgis.com/apps/solutions>
- Solutions for every need:
  - Damage Assessment
  - Permitting
  - Construction Inspections
  - Flood Impact Assessment
  - And Many More ...

The screenshot displays the ArcGIS Solutions website interface. At the top, there are navigation links for 'ArcGIS Solutions', 'Home', and 'My Solutions', along with a user profile for 'Jason Kleps' and a search bar. The main content area is titled 'Solutions: 141' and features a grid of application cards. Each card includes a representative image, a title, and a brief description of the application's capabilities. The cards shown are:

- Crime Analysis:** Crime Analysis can be used to enhance public safety, identify emerging trends, organize law enforcement operations, and plan crime-prevention strategies.
- Water Distribution Data Management:** Water Distribution Data Management can be used to map water distribution assets, edit data, view system maps in the field and office, view asset reports, and collaborate with map notes.
- Citizen Problem Reporter:** Citizen Problem Reporter can be used to solicit non-emergency requests (for example, blight, graffiti, trash, potholes, clogged drains, and flooding) from the general public.
- Address Data Management:** Address Data Management can be used to maintain an authoritative address repository and continuously improve the quality of address data.
- Capital Project Tracking:** Capital Project Tracking can be used to manage an active project portfolio, communicate project status, and share project updates with internal and external stakeholders.
- Emergency Management Operations:** Emergency Management Operations can be used to maintain situational awareness and share essential emergency information during an emergency.
- Lead Service Line Inventory:** Lead Service Line Inventory can be used to develop a lead service line inventory and monitor the replacement of service lines required to comply with the Environmental Protection Agency's (EPA) Lead and Copper Rule Revisions.
- Flood Impact Analysis:** Flood Impact Analysis can be used to analyze the impact of flooding on critical infrastructure and share flood impact maps with internal and external stakeholders.

# Esri Damage Assessment Solution



## Damage Assessment

ArcGIS Solutions



# Esri Damage Assessment Solution

## Damage Assessment

Focused Maps and Apps

### First Responders



Windshield  
Damage Report

### Damage Assessment Coordinator



Damage Assessment  
Operations

### Emergency Management Mobile Worker



Individual Assistance  
Survey



Public Assistance  
Damage Inventory



Public Assistance  
Survey

### Residents



Damage Assessment  
Site



Damage Assessment  
Photo Viewer



Public Damage Report



### State / Federal Agencies

Damage Photos

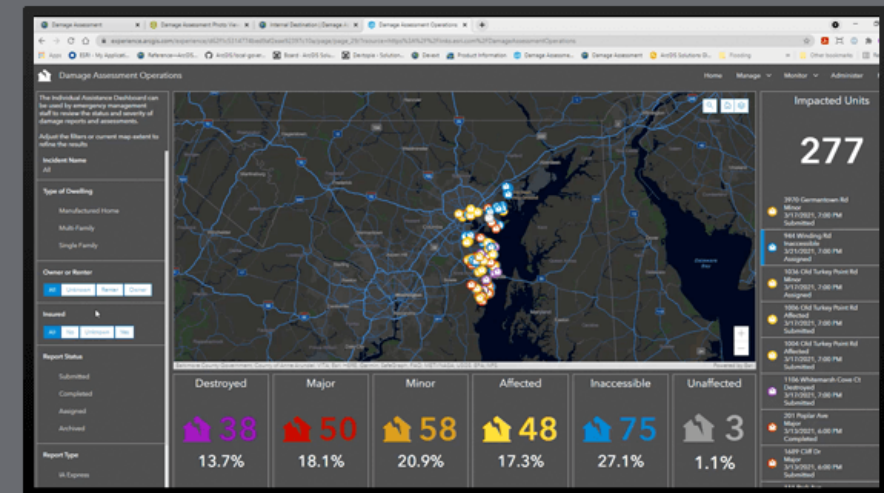
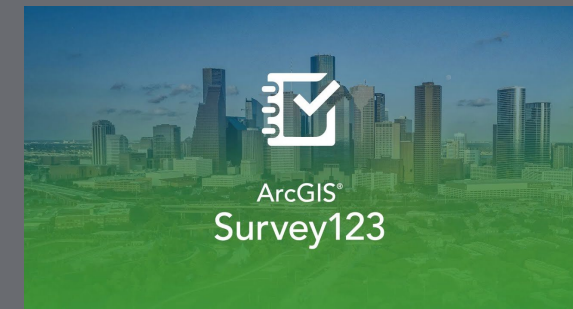


Damage Reports and Data



# Damage Assessment Solution

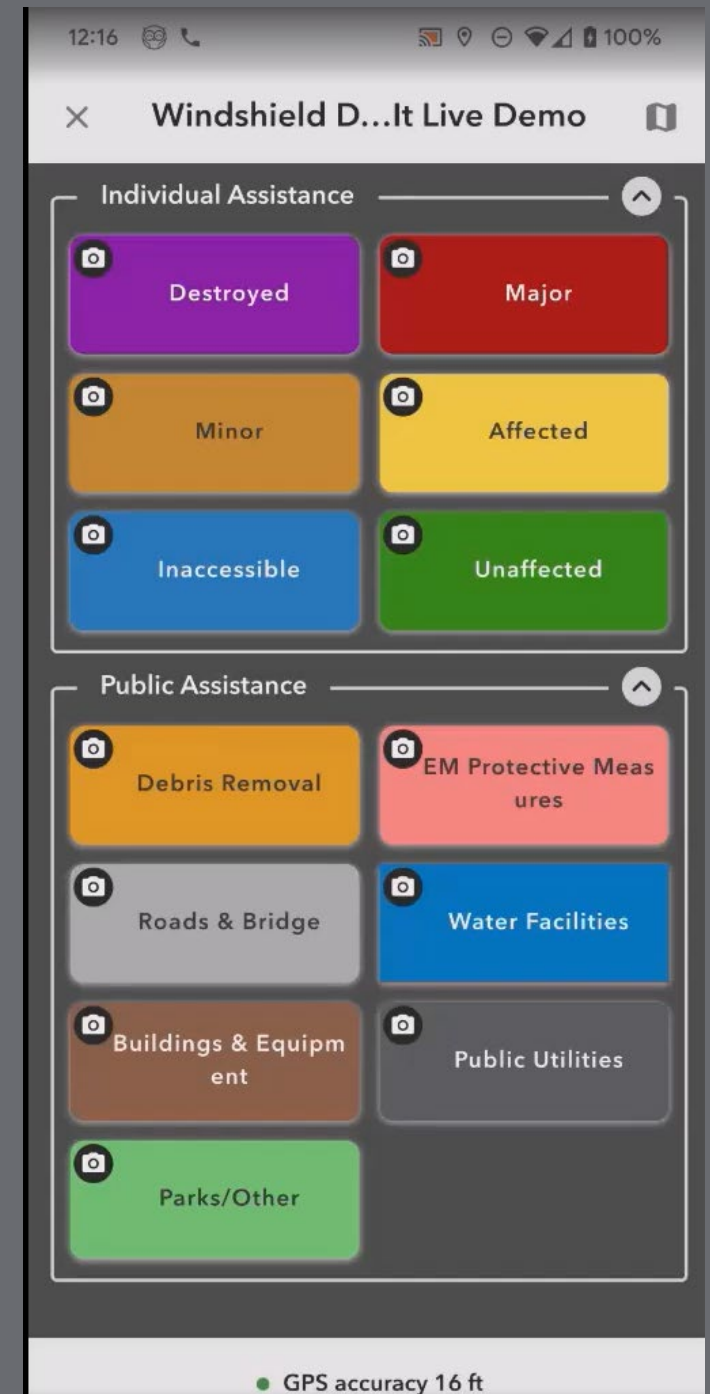
- Solution comes with maps, apps, and layers with FEMA-approved survey templates for conducting Joint Preliminary Damage Assessments (PDA)
- Customizable
- Rapid assessment using Quick Capture
- More detailed follow up surveys using Survey123
- Data collected feeds into layer and into dashboard
- PDF reports can be generated from the data



# Damage Assessment Solution

## Quick Capture

- For rapid assessments in the days after a disaster
- Just set up the categories you want to collect – these become brightly colored buttons
- Create points with a click
- Can also add photos



# Damage Assessment Solution

## Survey123

- For more detailed surveys in the days/weeks after a disaster
- “Form”-centric (but also includes a map)
- Intelligent forms
  - conditional drop-downs
  - auto-calculation of fields
- Can also add photos

12:24 100%

Individual Assistance Survey

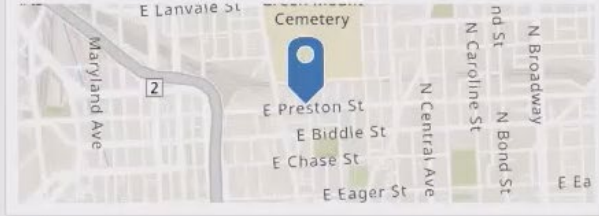
For questions on conducting damage assessments, refer to the:  
[FEMA's Preliminary Damage Assessment Pocket Guide](#)

### Individual Assistance Field Collection Survey

Incident ID or Name \*  
Choose the incident Name or ID:  
Baltimore Flooding

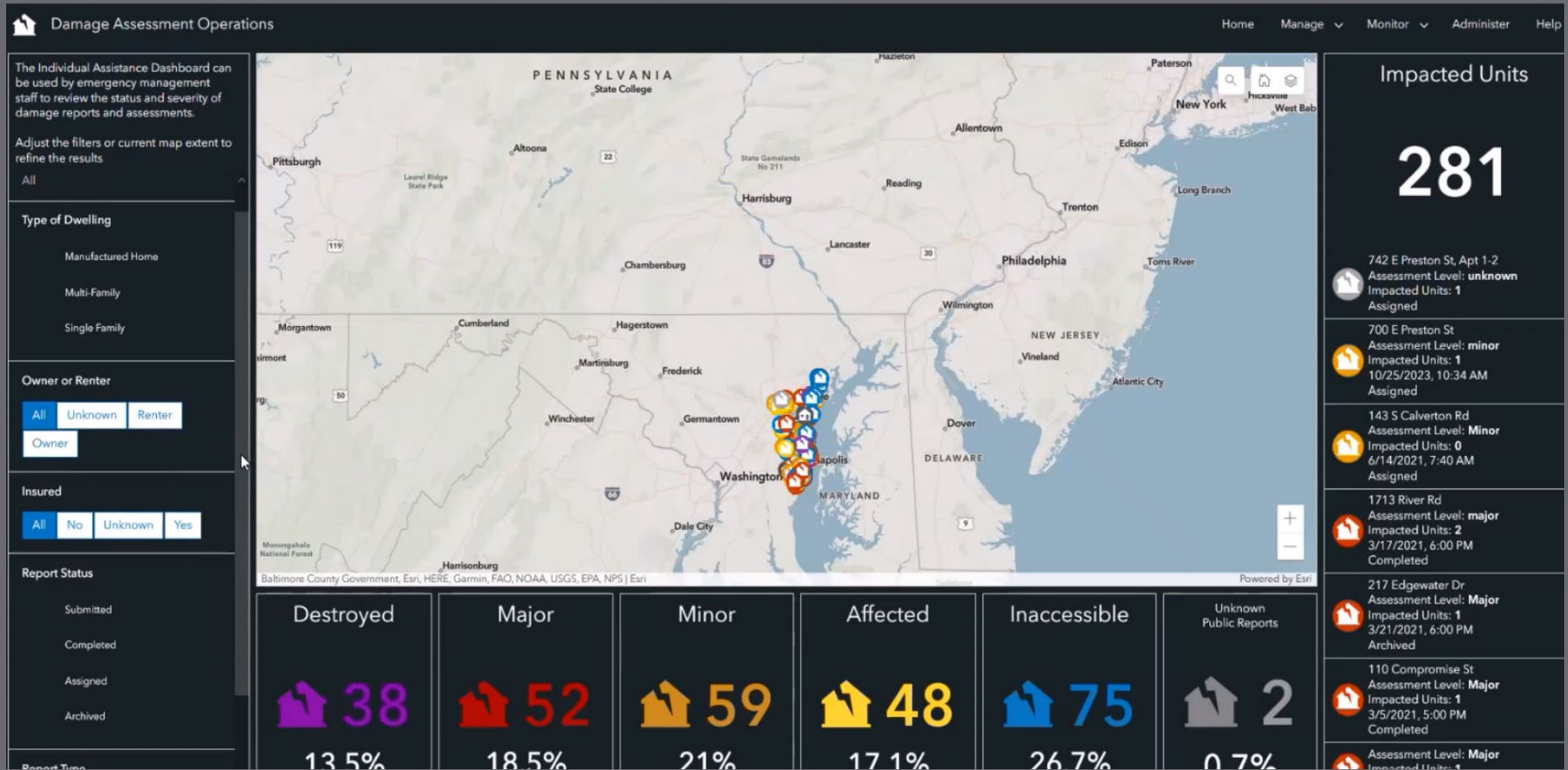
PDA Operations Start Date: \*  
Friday, October 27, 2023

Coordinates of the damage: \*  
Open map below to *place pin on the structure, not in the street.*  
39°18'N 76°36'W



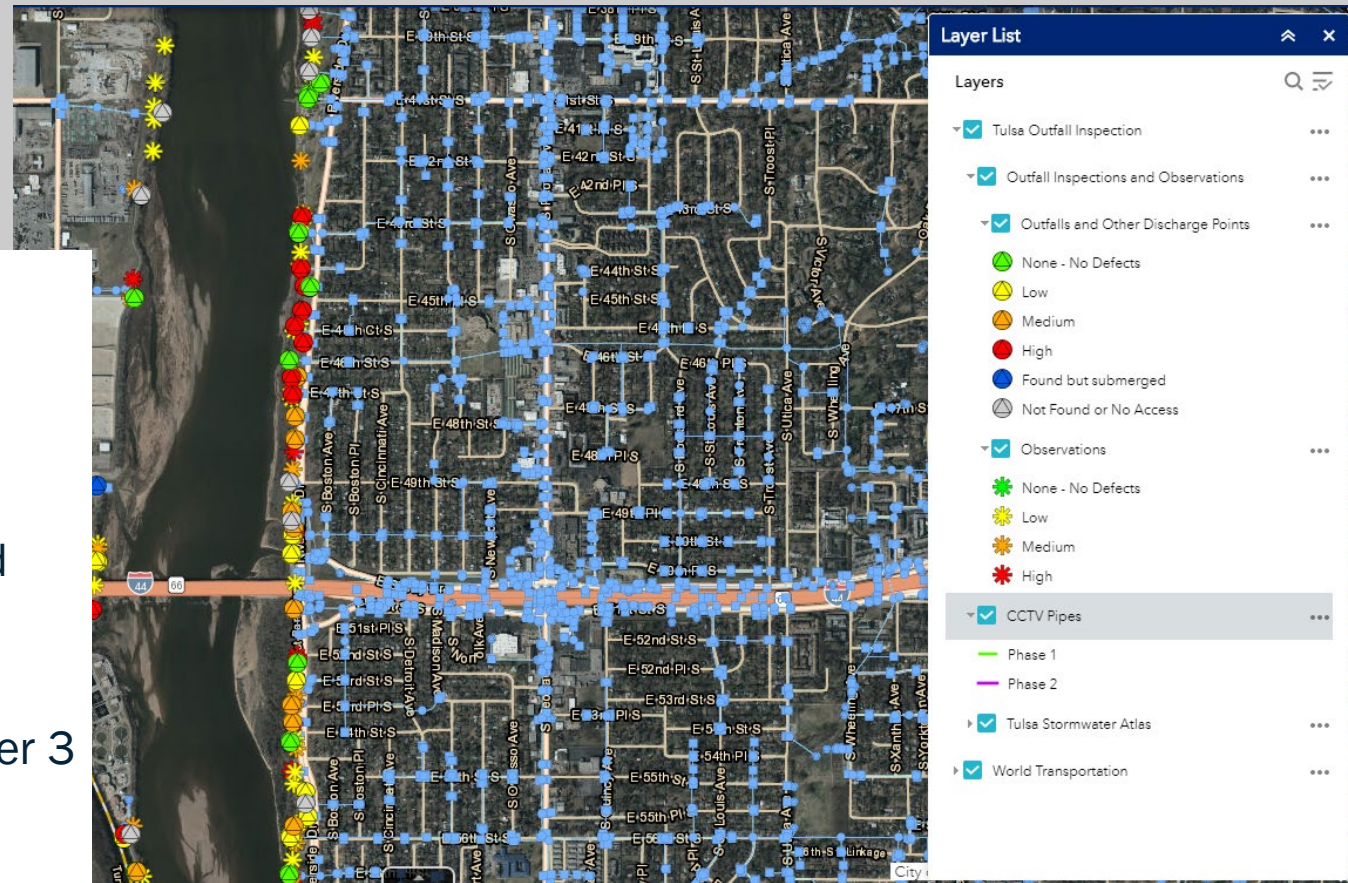
Location Information:  
Street Address:  
742 E Preston St, Apt 1-2

# Esri Damage Assessment Solution



## Case Study *Tulsa - 2019 Floods*

- Damages to the storm sewer system, outfalls, and levees assessed using field apps
- “Eyes-on” inspections completed in under 3 days, results available near-live
- CCTV inspections and repair estimates followed
- Data was used to submit for reimbursement from FEMA





# Esri Emergency Debris Management Solution



## Emergency Debris Management

ArcGIS Solutions



# Esri Emergency Debris Management Solution

## Emergency Debris Management

Focused Maps and Apps

Operations Lead / Manager



Emergency Debris Management Center

Clearance Crews



Debris Clearance Assignments

Assessors



Debris Assessment Form  
Truck Certification Form

Monitors



Load Ticket  
Unload Ticket

First Responders



Road Debris Reporter

Auditors / Contractors



Debris Records Reviewer

Residents



Debris Removal Services

Emergency Debris Management Center

Debris Areas / Routes



Critical Facilities



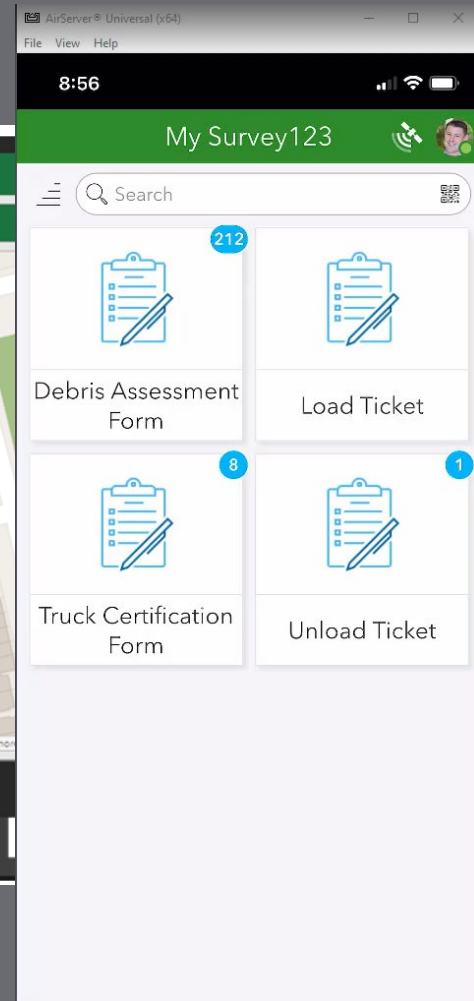
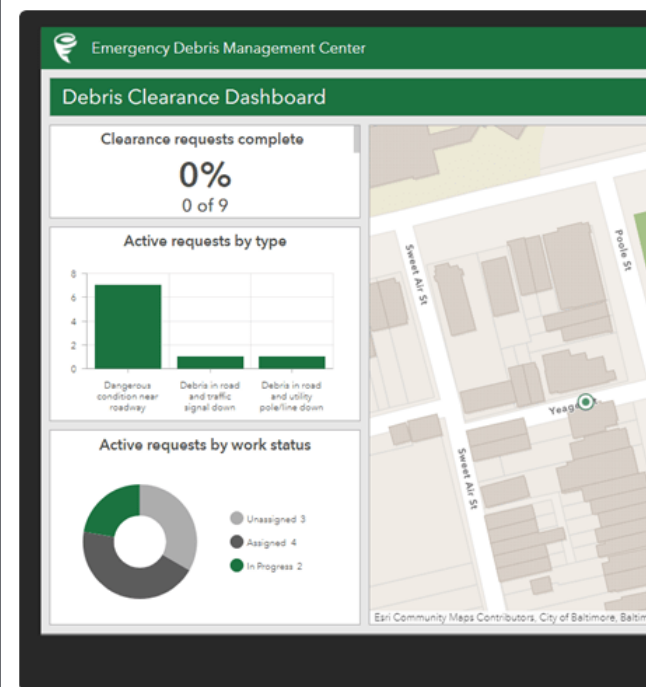
Crews / Contractors



Debris Sites

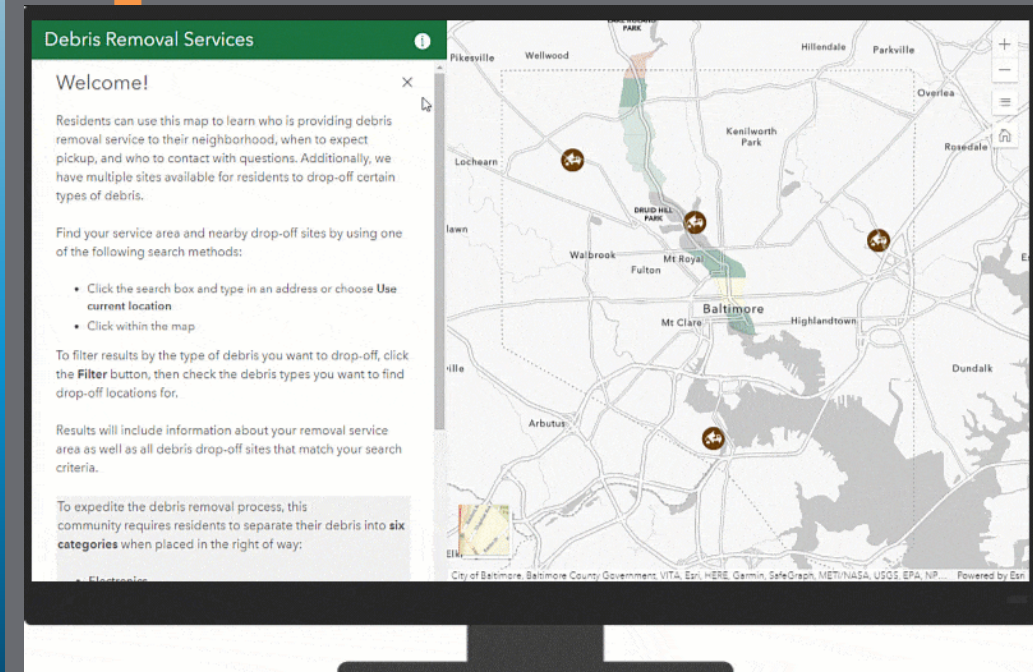


ArcGIS Online



# Emergency Debris Management Solution

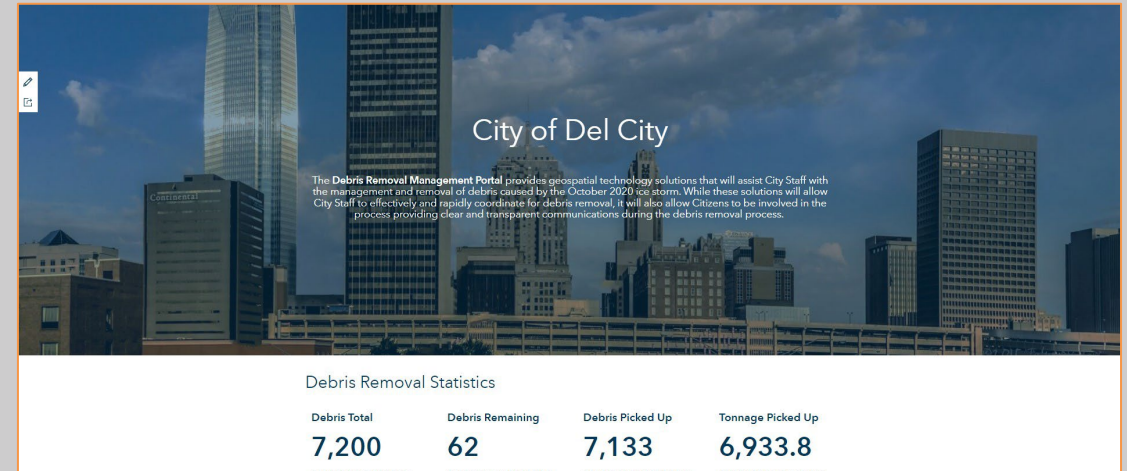
- Assess debris removal needs
- Monitor debris removal activities
- Collect data on debris amounts
  - Load tickets
  - Unload tickets
- Reporting in dashboards and PDFs
- Let citizens know where debris collection points are located



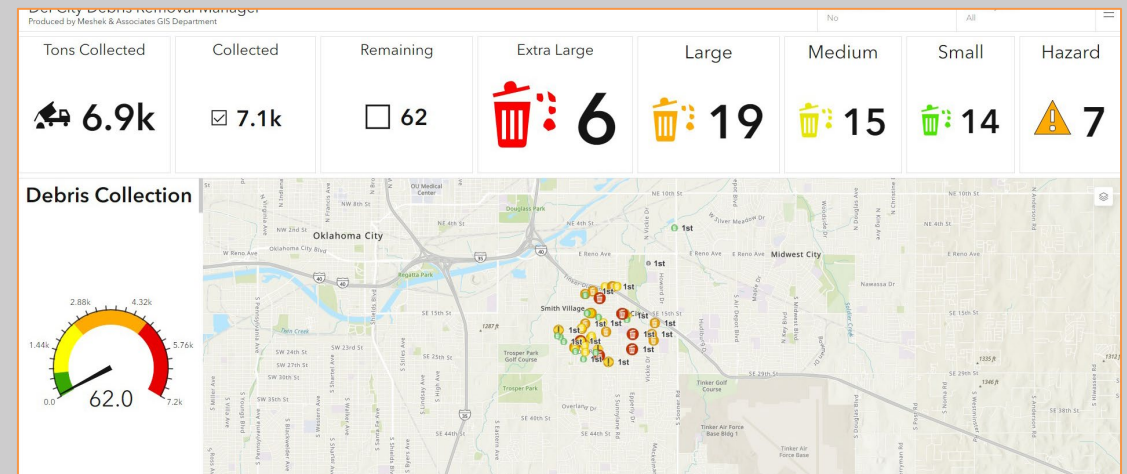
# Case Study

## Del City - 2020 Ice Storm

- Assess, inventory, and manage the collection of debris from winter storm
- Initial assessment and inventory using mobile GIS apps
- Data viewed and managed in real time using dashboards
- Data was used to submit for reimbursement from FEMA



Del City Hub Site



Del City Debris Removal Dashboard

# Esri Flood Impact Analysis Solution



## Flood Impact Analysis

ArcGIS Solutions



# Esri Flood Impact Analysis Solution

## Flood Impact Analysis

Focused Maps and Apps

GIS Analyst

Depth Raster 

Elevation Raster (DTM) 

Water Surface Elevation 

Public Infrastructure 



Flood Impact Analysis



ArcGIS Online  
ArcGIS Enterprise

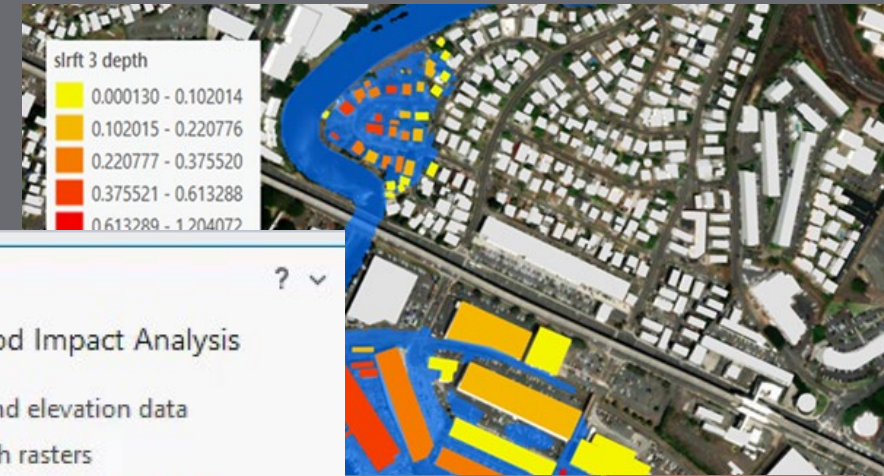
Operations Staff



Flood Impact Maps

# Flood Impact Analysis Solution

- Visualize impact of flooding on public infrastructure and critical facilities
- Requires certain data:
  - Flood depth raster
  - Water surface elevation
  - Elevation raster
  - Public infrastructure data
- Guided, task-based workflow
- Share maps internally and with public

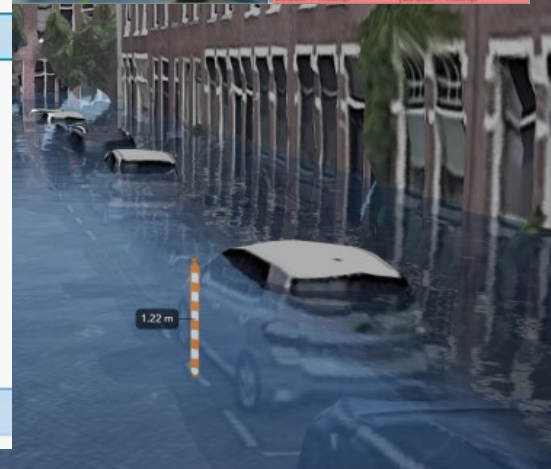


Tasks

How to use Flood Impact Analysis

- Prepare flood depth and elevation data
  - Prepare flood depth rasters
  - Prepare water surface elevation rasters
- Define flood impact
  - Create flood impact areas
  - Analyze roads
  - Analyze low-level water crossings
  - Analyze bridges
  - Analyze buildings
- Share flood impact information (optional)
  - Share flood impact information
- Visualize flood scenarios in 3D (optional)
  - Show flood impact map in 3D
  - Create 3D flood levels from raster
  - Source 3D content
  - Create depth elevation raster
- Share 3D flood impact scene (optional)
  - Project ground elevation surface
  - Publish 3D flood impact scene
  - Share depth elevation raster

Affected buildings	Loss potential
1,282	\$33.037M
Bridges to watch	Flooded bridges
84	36
Roads < 1m	Roads 1-2m
24	33
Roads 2-3m	Roads > 3m
23	26



# Esri Flood Impact Analysis Solution





# Flood Data Resources

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# Accessing FEMA Data

## FEMA Data Links

### FEMA Map Service Center

- <https://msc.fema.gov/portal/home>

### FEMA National Flood Hazard Layer

- <https://www.fema.gov/flood-maps/national-flood-hazard-layer>

### FEMA Mapping REST Services (Direct Data Link)

- <https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer>

# Publicly Available NFIP Data

There is a redacted dataset available in CSV format!

Data is reported by community, Census block group, Census tract, ZIP, and lat/long (truncated to a single decimal point – a difference of several miles if relying on the coordinates).

*As with all data sources, it's critical to keep the methodology, the weaknesses, and the strengths in mind.*

[https://www.fema.gov/  
openfema-data-  
page/fima-nfip-  
redacted-claims-v2](https://www.fema.gov/openfema-data-page/fima-nfip-redacted-claims-v2)


# Estimated BFE Viewer

<https://webapps.usgs.gov/infrm/estBFE/>


Welcome to the

## Estimated Base Flood Elevation Viewer

Base Level Engineering assessments are produced using high resolution ground data to create technically creditable flood hazard information that may be used to expand and modernize FEMA's current flood hazard inventory.



**High Flood Risk**


 This location is in a 1% (100 year) flood zone.

[View Report](#)

[Zoom](#) [Close](#)

**Property Look Up**

Where data are available, produce a property-specific report with estimated base flood information.

 What's My Flood Risk?



**View Base Level Engineering Data**

Access all available Base Level Engineering data without GIS software.

 I Want to Explore

File Name	Size	
12030106_Models.zip	383.9 MB	<a href="#">Download</a>
12030106_Depth01.zip	82.8 MB	<a href="#">Download</a>
12030106_Depth002.zip	91.3 MB	<a href="#">Download</a>
12030106_Elev01.zip	19.5 MB	<a href="#">Download</a>
12030106_Elev002.zip	20.1 MB	<a href="#">Download</a>
12030106_VectorData.zip	263.7 MB	<a href="#">Download</a>

<https://apps.nationalmap.gov/downloader/>

# Topography - The National Map Viewer

The single best place to go for the latest 3DEP LiDAR based topography data is the National Map Viewer Data Downloader.

The NRCS Data Gateway website is still useful for older post-quad data (lower resolution 2m/+ and older than 3DEP; soon all will be replaced by new 3DEP)

All pre-3DEP areas are in the process of re-acquisition, but will not be available soon (est. 2026)



# Thank you!

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*GIS Coordinator's Manual credited activities*