GIS Mapping at Utilities

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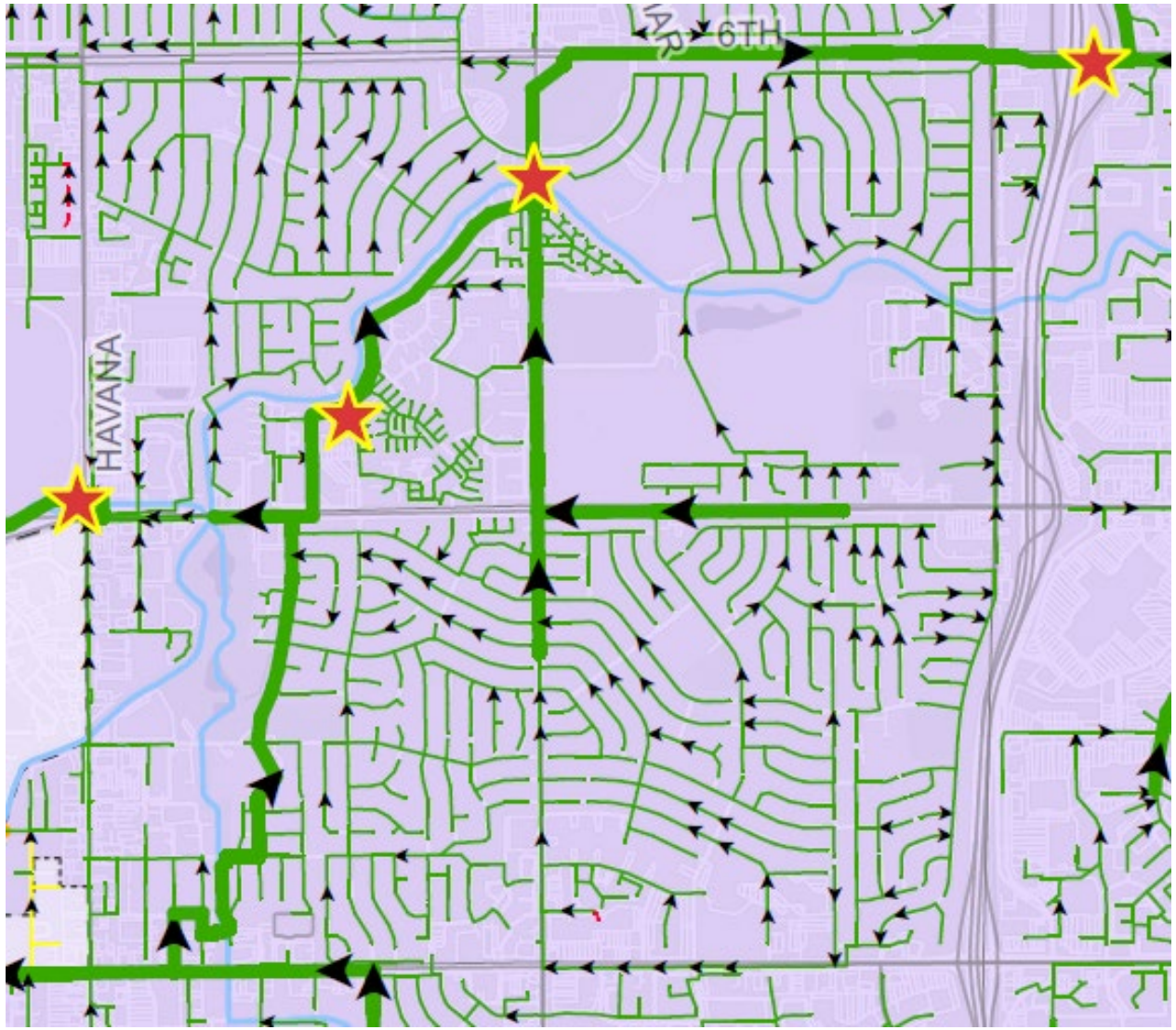
CECTI School - November 4th, 2022

Image Source: ESRI

Overview

- What is GIS?
- Software landscape
- Digital Asset Record
  - Horizontal
  - Vertical
- Networks and Models
- Mobile and Web Solutions
- What's next in GIS?



All icon's sourced via Noun Project

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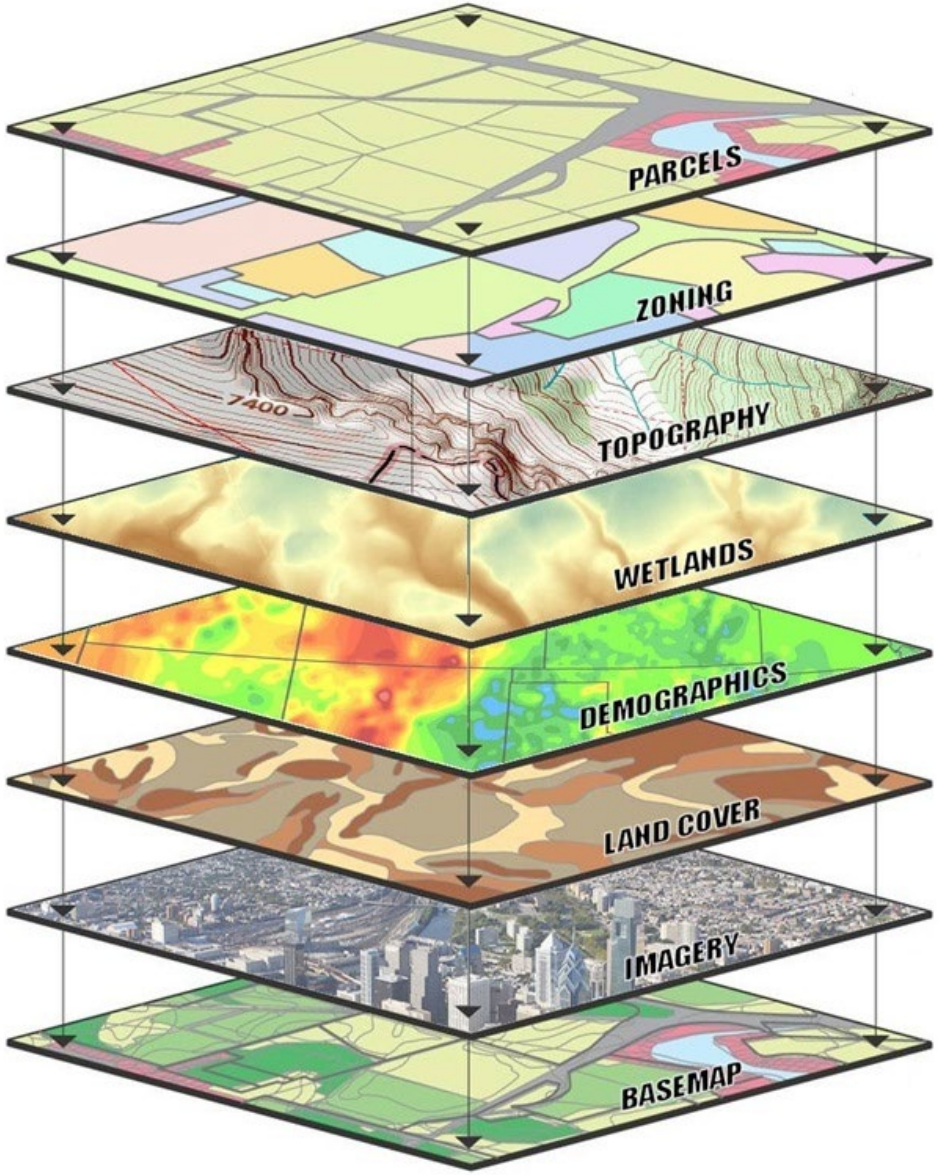
What is GIS?

GIS = Geographic Information Systems

- Adopted by utilities starting in the 90s
- Spatial database
- "Integrating location data (where things are) with all types of descriptive information (what things are like there)" - ESRI



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Source: ESRI and https://www.usgs.gov/media/images/gis-data-layers-visualization

Why GIS?

- System of Record
  - Starting point for CCTV, Modeling, Asset Management, Customer Information System, and Machine Learning
- Location intelligence
- Knowledge management
- Coordination and Integration
- Engage public

Smarter decisions

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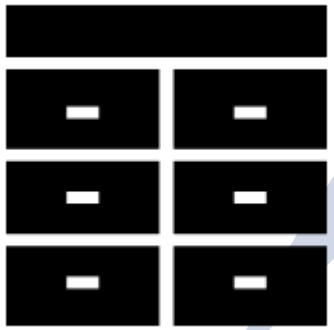
GIS Timeline



Paper civils in filing cabinets

Map books

Digital Field Maps

Custom solutions

3D, Analytics, Connected Systems, Digital Twin

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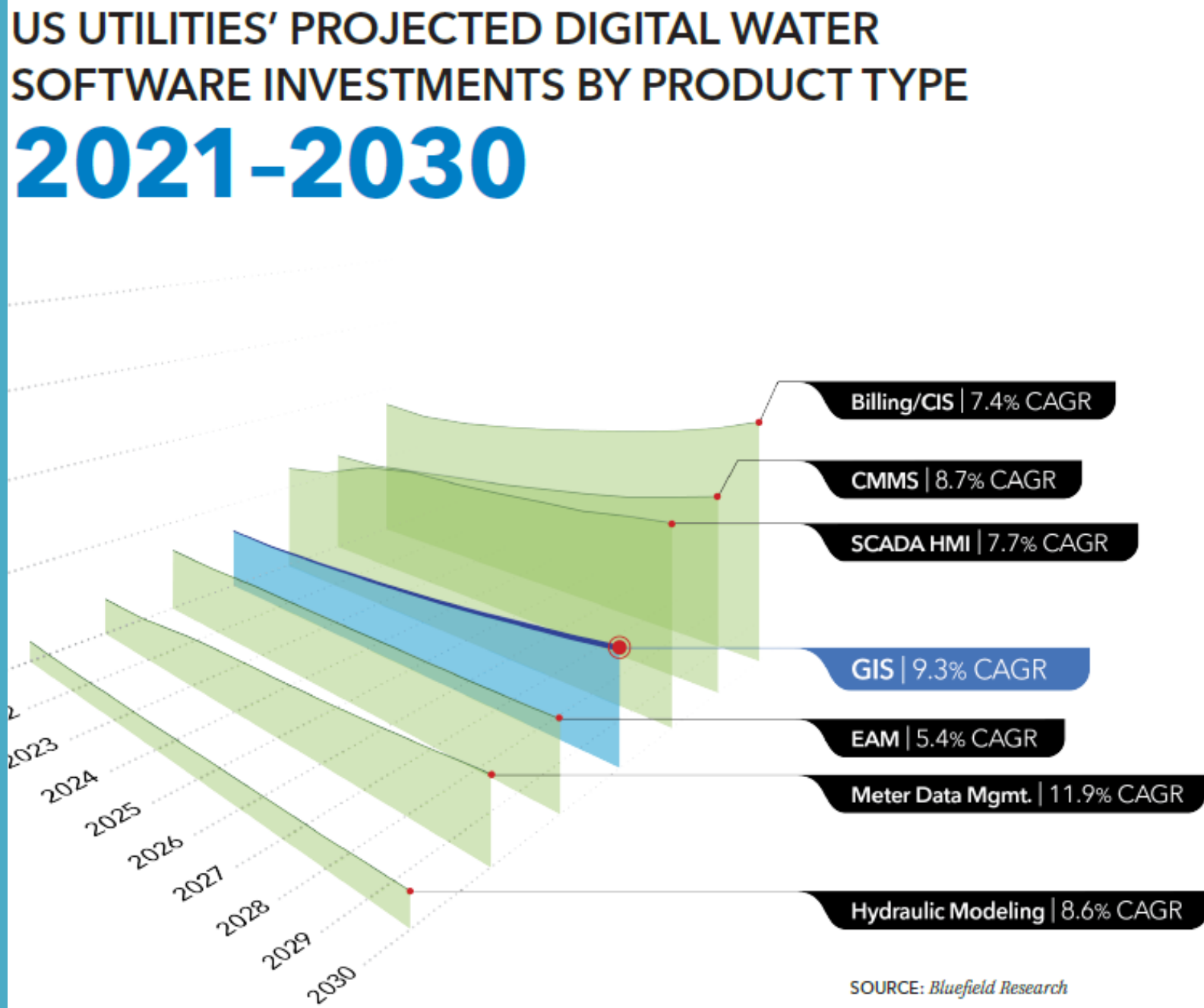
Digital Twin

"A dynamic digital representation of real-world entity(s) and their behaviors using models with static and dynamic data that enable insights and interactions to drive actionable and improved outcomes"

Smart Water Networks Forum 2022



SOFTWARE LANDSCAPE

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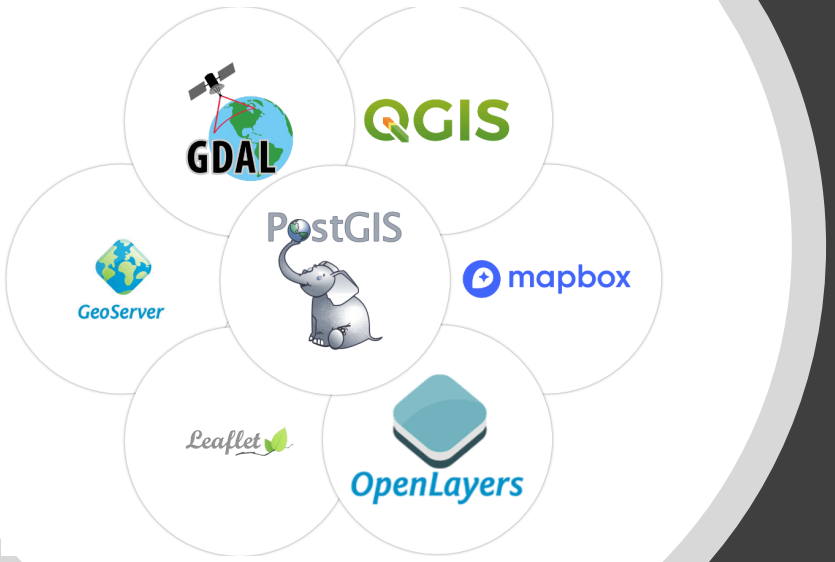

Bentley

AUTODESK

esri

Software Landscape

- ESRI (ArcGIS, SDE)
- AutoDesk (AutoCAD, CAD, Tandem)
- Bentley (CAD)
- Open Source

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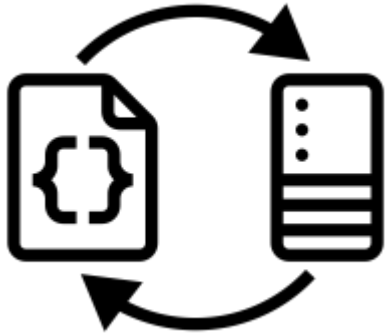
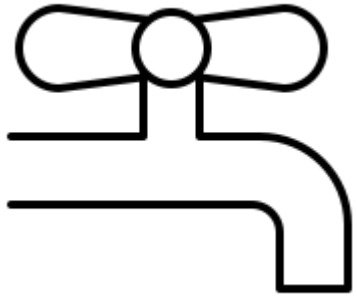
Software Relationship





Vendor

Utilities

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DIGITAL ASSET RECORD

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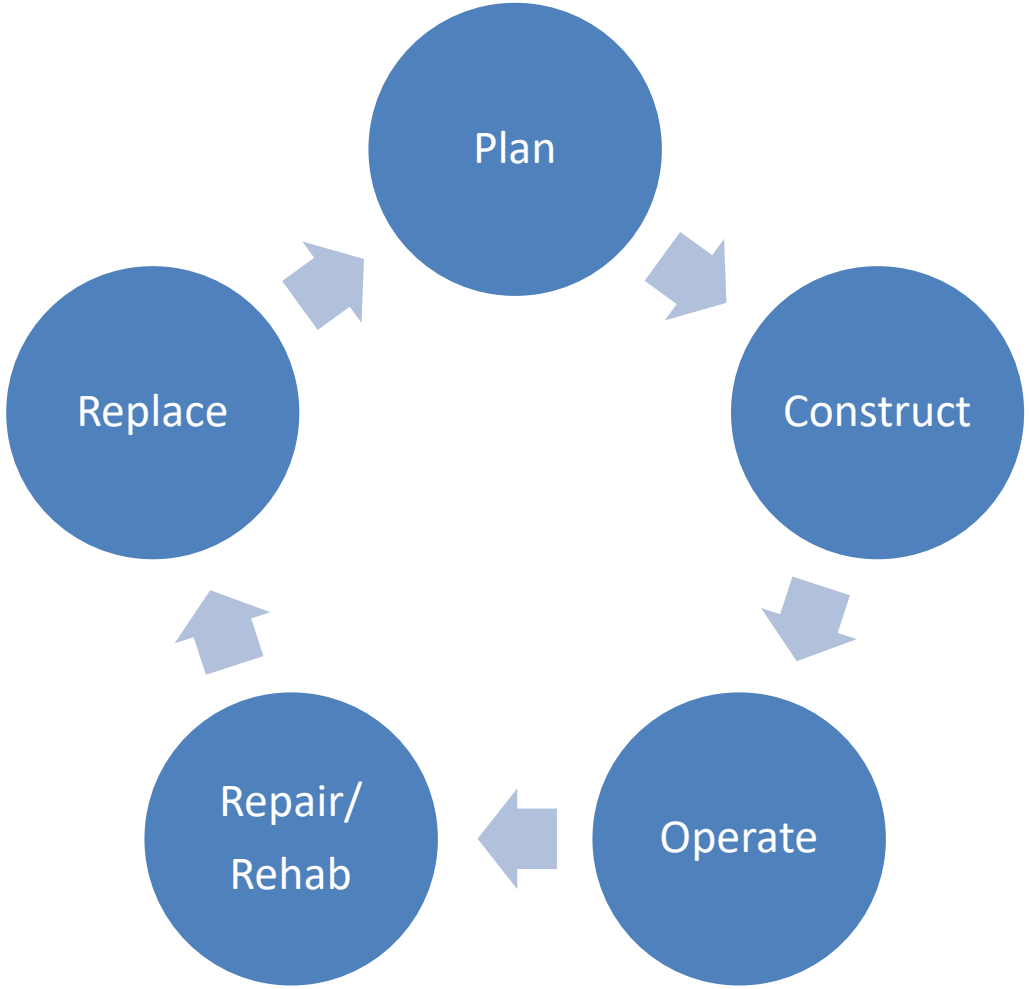
Asset Lifecycle



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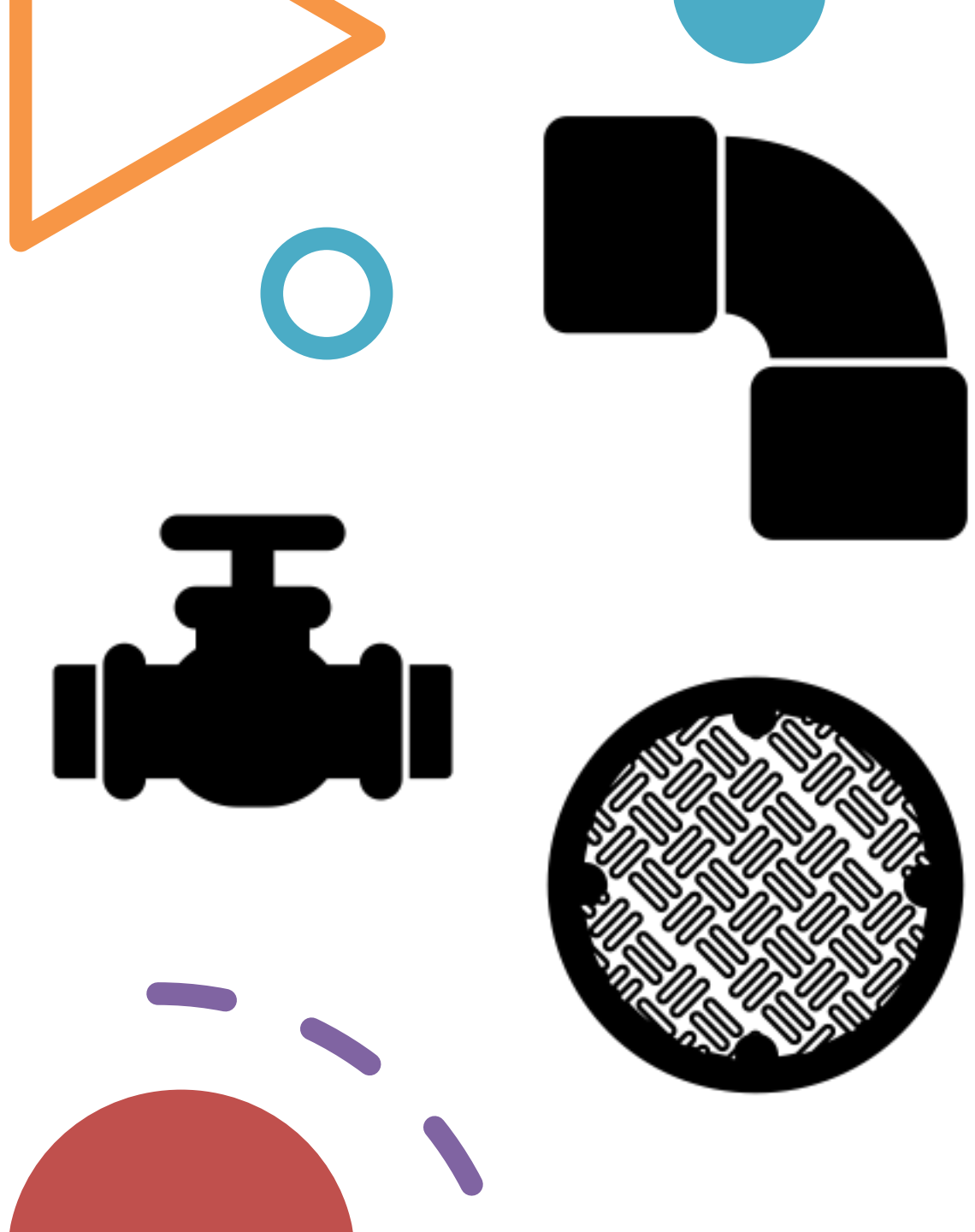
Asset =

Plant, equipment, buildings, property, pipelines, infrastructure and other items that have potential or actual value to the organization.

- Typically broken into Qualifying and Non-Qualifying
- Includes non-physical items such as water rights, property ownership, and data



AWWA Asset Management Definitions Guidebook 2018

Creating GIS Data

- Field Updates
- Projects
- Engineering drawings

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Types of Assets

Horizontal

- Distribution and Collection Systems
  - Pipes, manholes, meters, etc.

Vertical

- Treatment and Pump/Lift Stations
  - Motors, MCCs, SCADA, etc.

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VERTICAL

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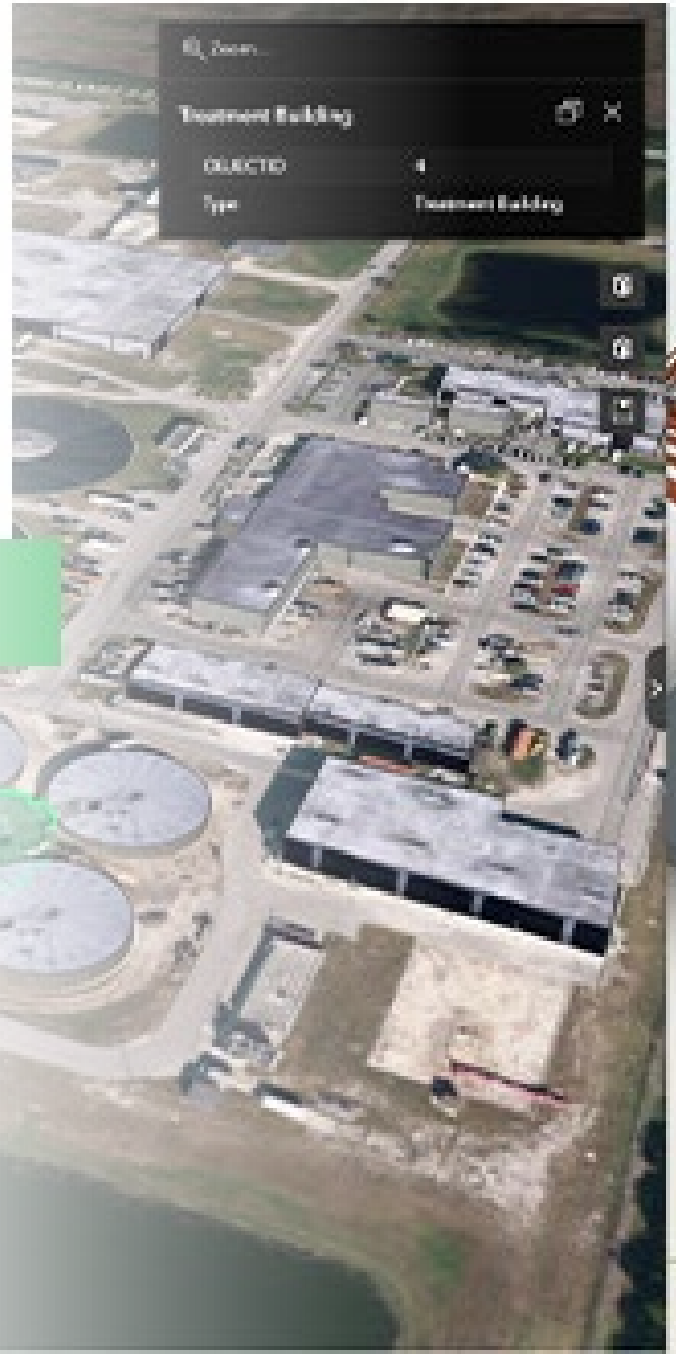
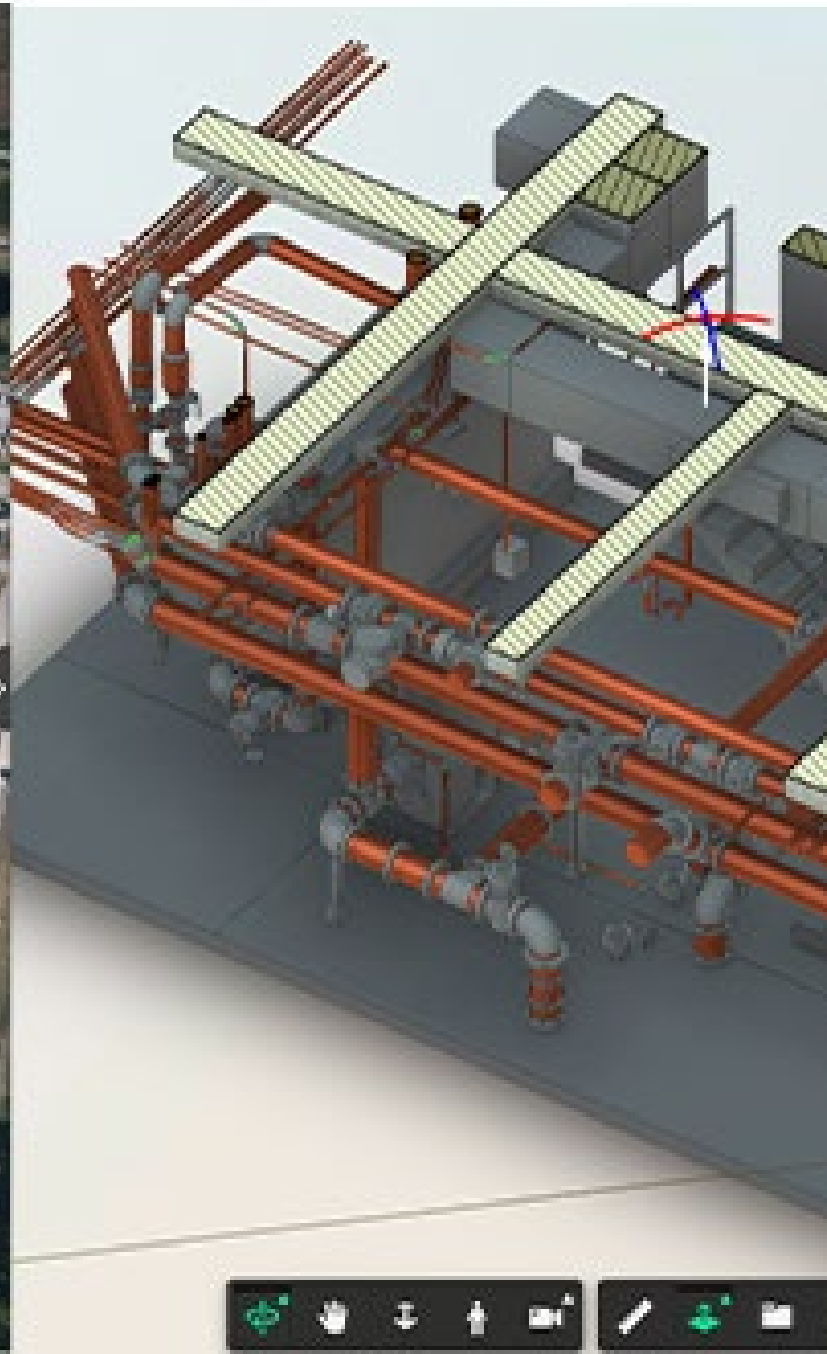
Vertical

- New
- Historically handled through pdfs
- Benefits:
  - One stop shop and source of truth for everyone
    - SCADA
    - Operators
    - Maintenance
    - Design Engineers
  - Links to design drawings, P&IDs, O&M manuals





Source: ESRI

HORIZONTAL

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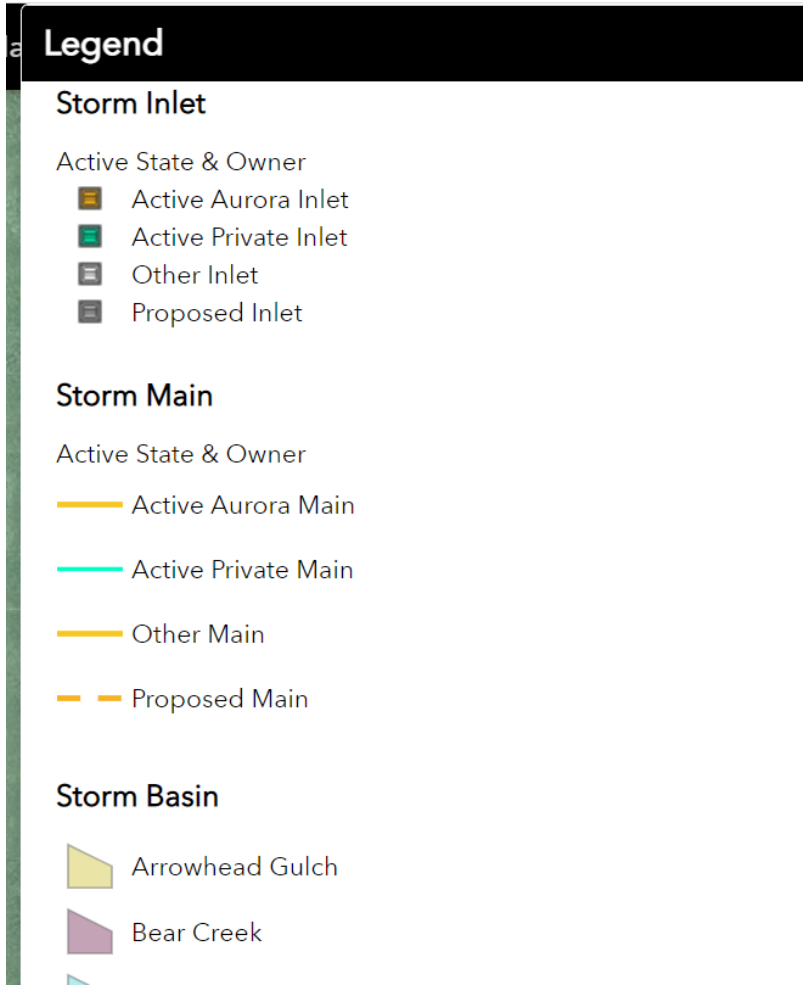
Creating GIS Data

- Spatial
  - Coordinates
  - Projection
- Shapes
  - Points
  - Lines
  - Polygons



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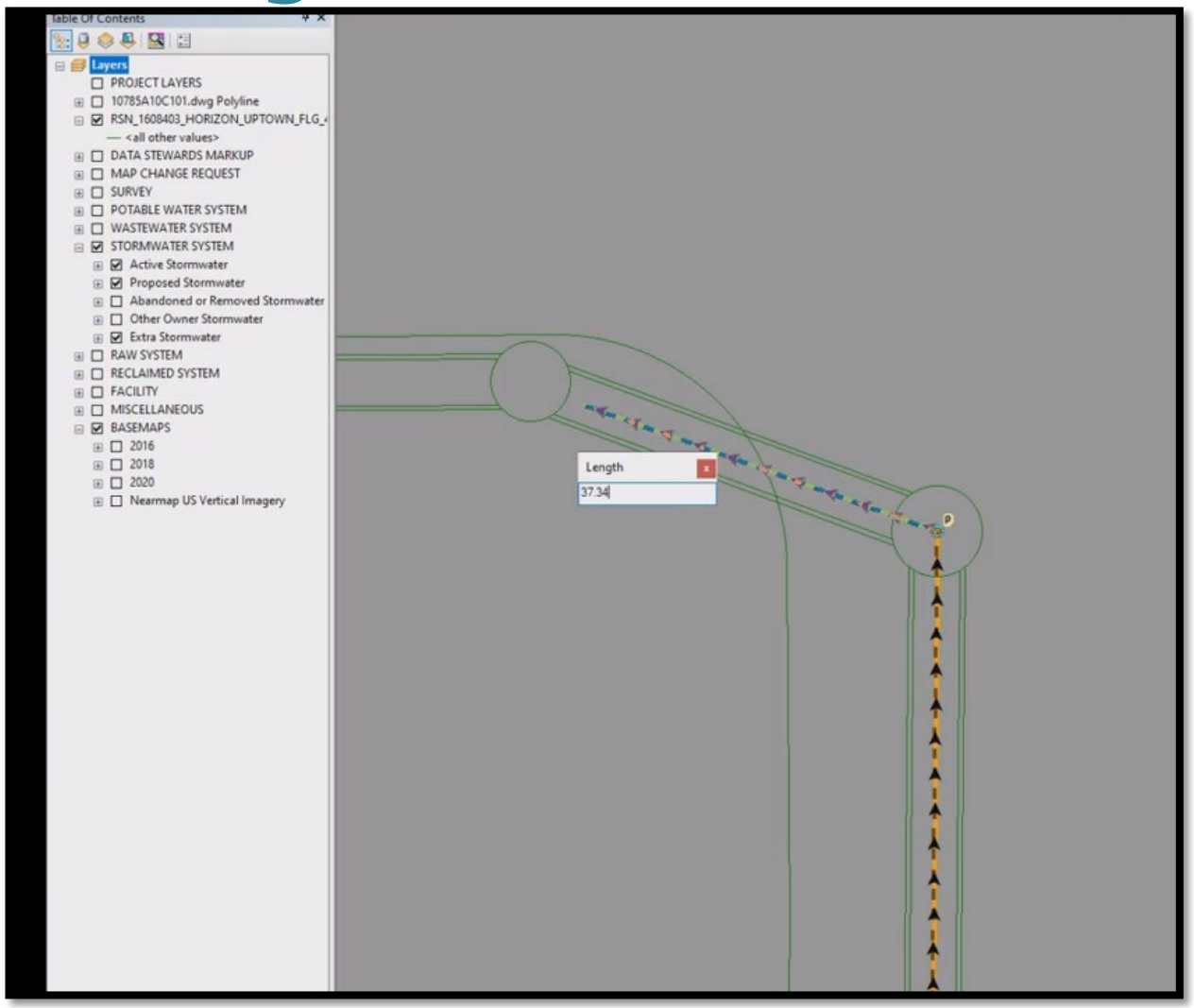
Creating GIS Data

- North Easting
- CAD
- Survey
  - Professional
  - GNSS



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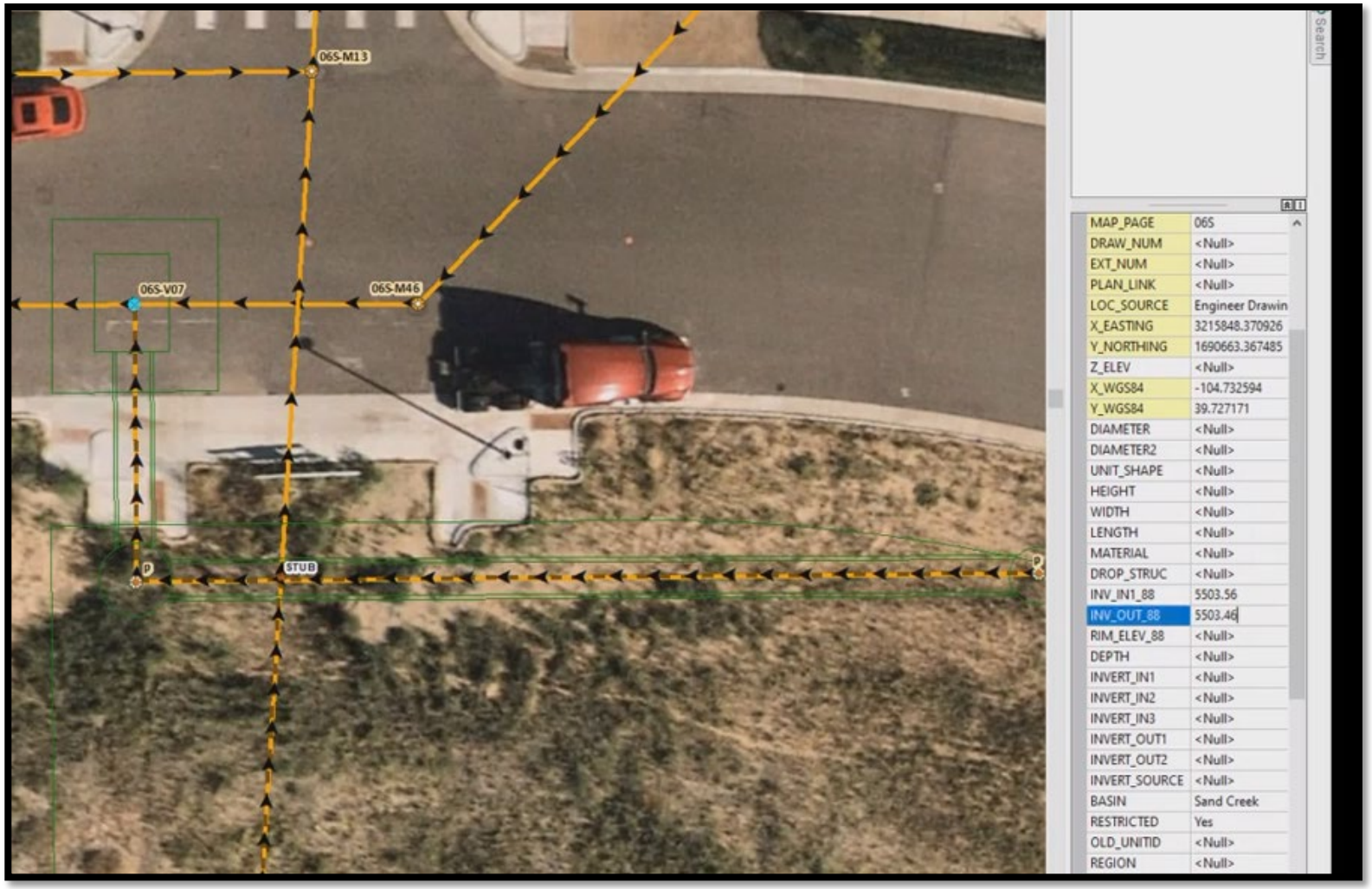
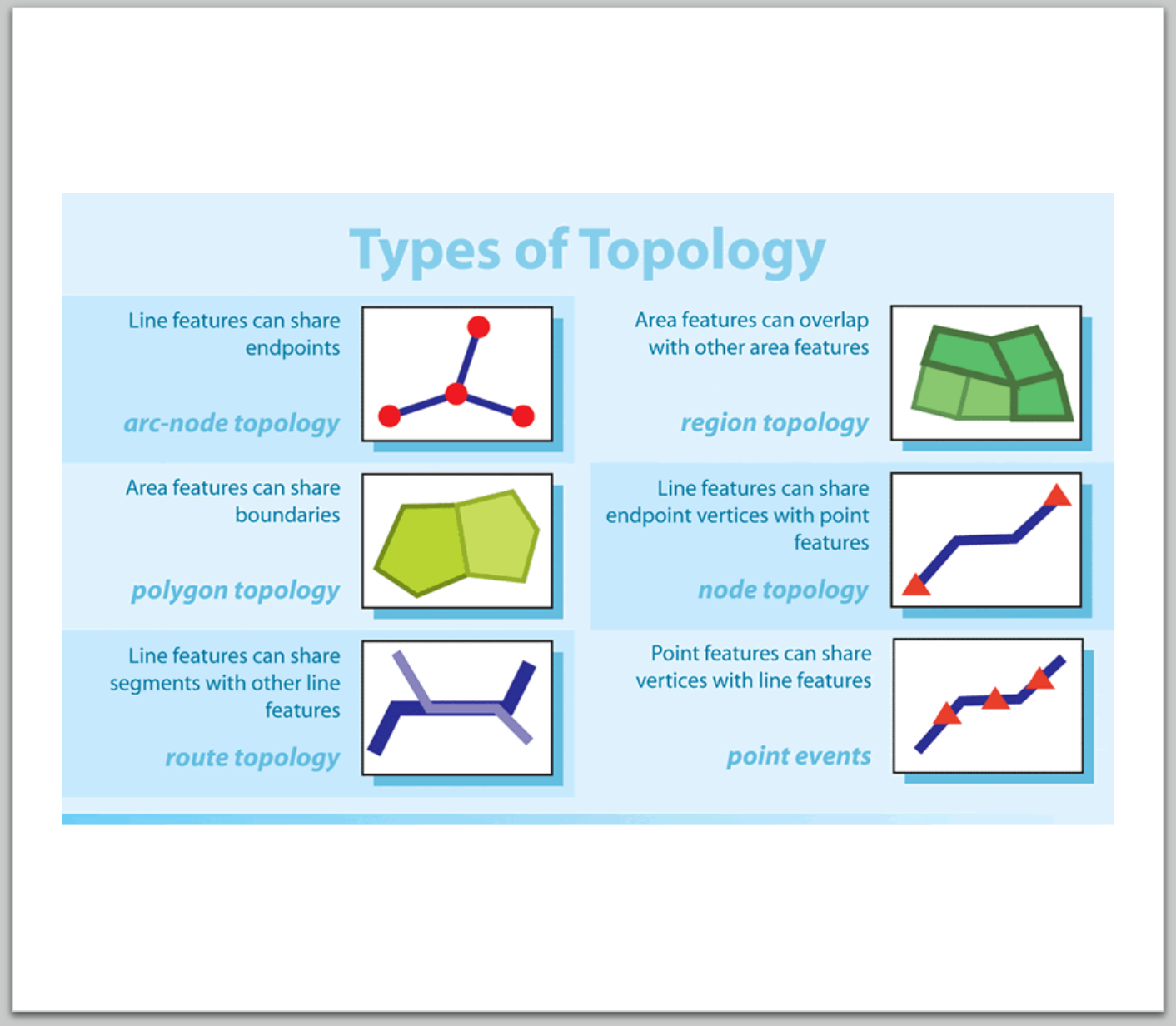
Creating GIS Data

- Attributes
  - Diameter
  - Material
  - Install Date
  - Inverts



Creating GIS Data

- Topology
  - Connection
  - Direction
  - Alignment

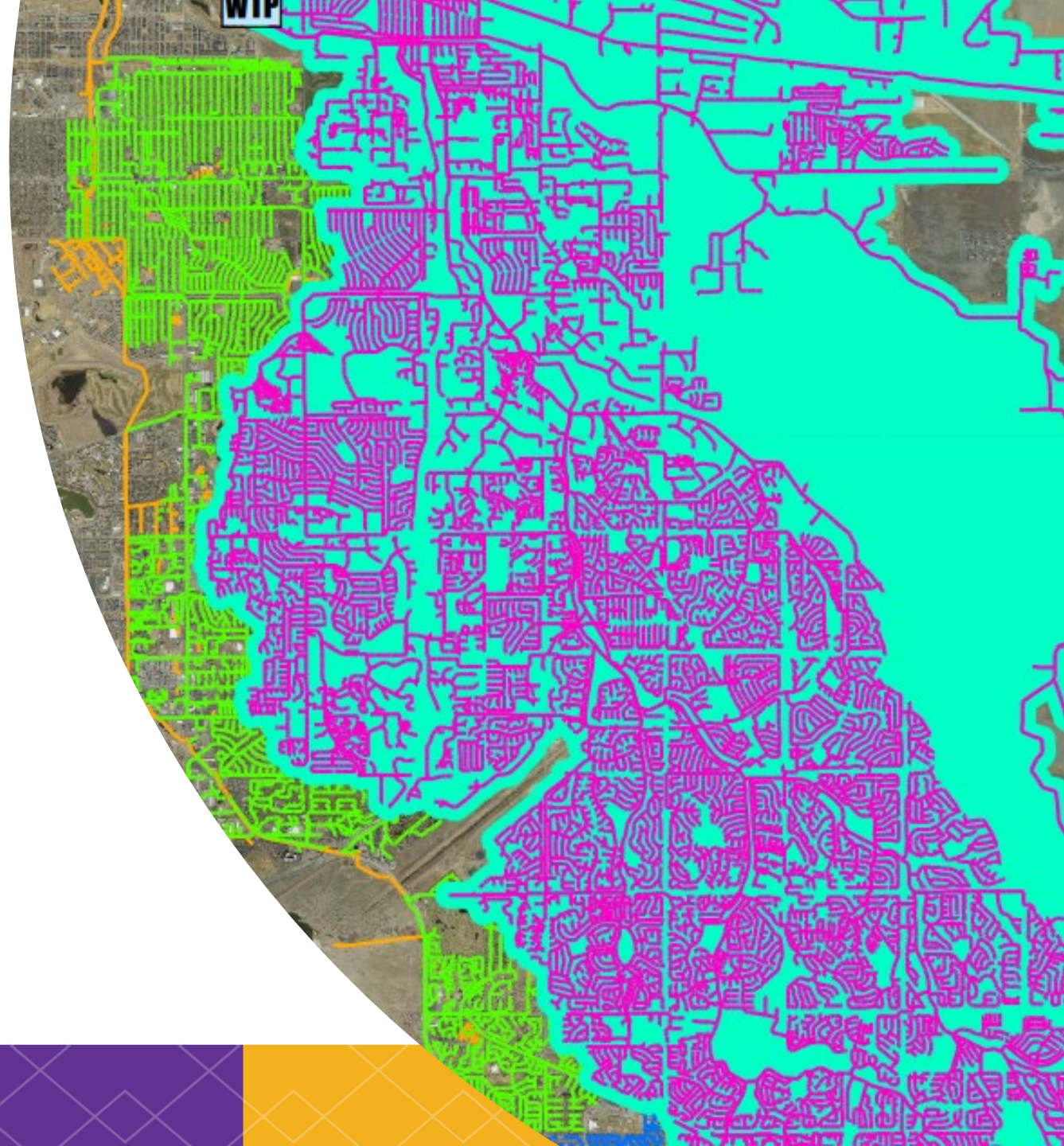


Source: ESRI

NETWORKS AND MODELING

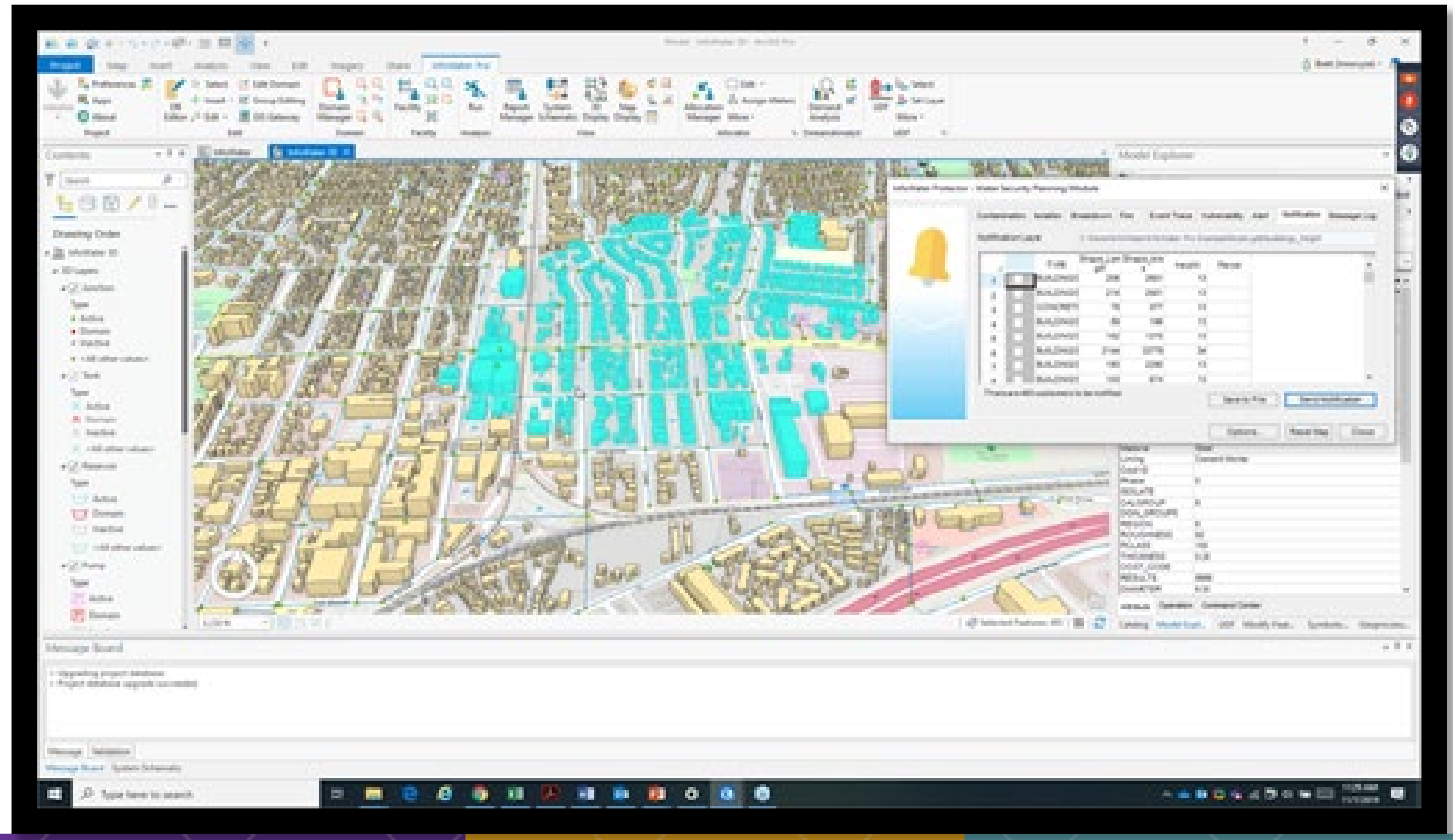
Geometric Network

- Topology + Network Rules
- Allows real world understanding and tracing
  - What is upstream of the SSO?
  - How many people rely on this lift station?
- Requires GIS license and hefty computer



Hydraulic Models

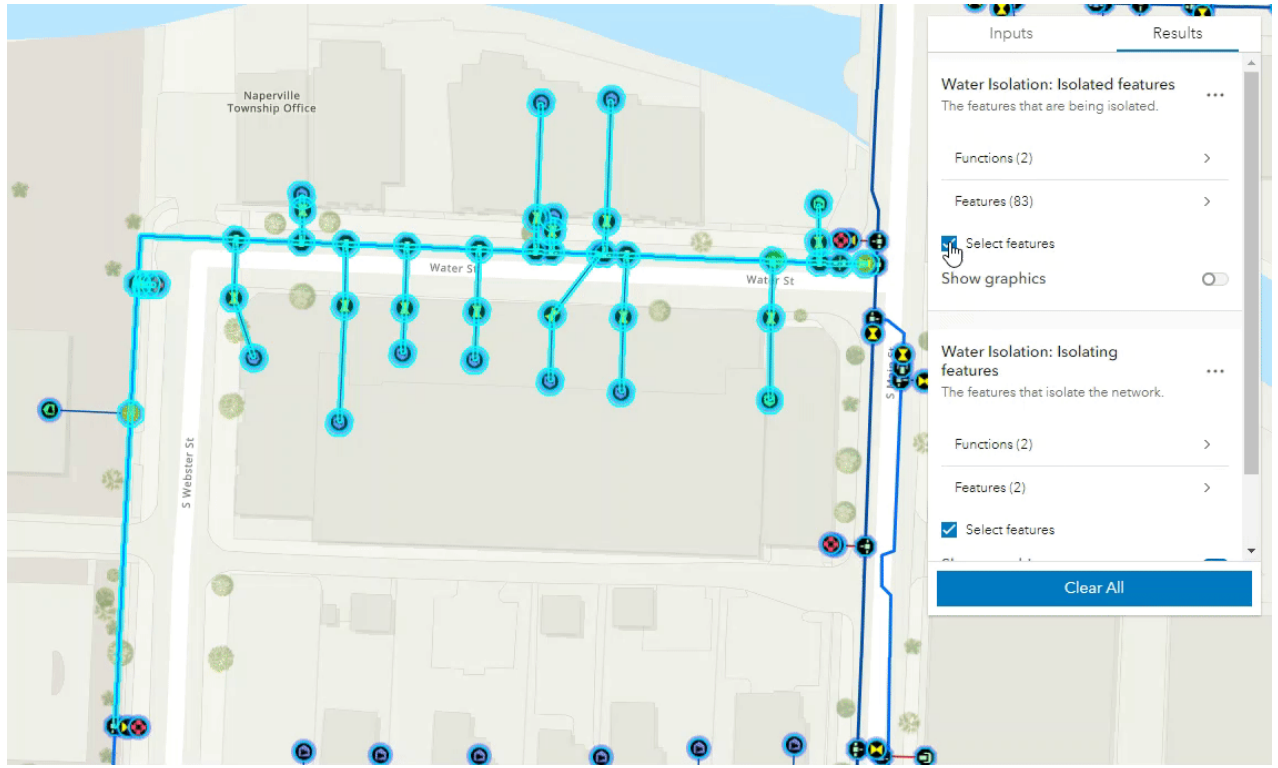
- Mathematical model that allows for the simulation of real-world situations
  - New Developments
  - Pipe breaks
- Requires Hydraulic Modeling license and hefty computer



Source: Innovyze

Utility Network

- New
- Light hydraulic model based on geometric network framework
- Anyone can run a trace on any device, including mobile, quickly
  - What customers are out of service?
  - What valves do I need to close to isolate this pipe segment?



Source: ESRI

MOBILE AND WEB SOLUTIONS

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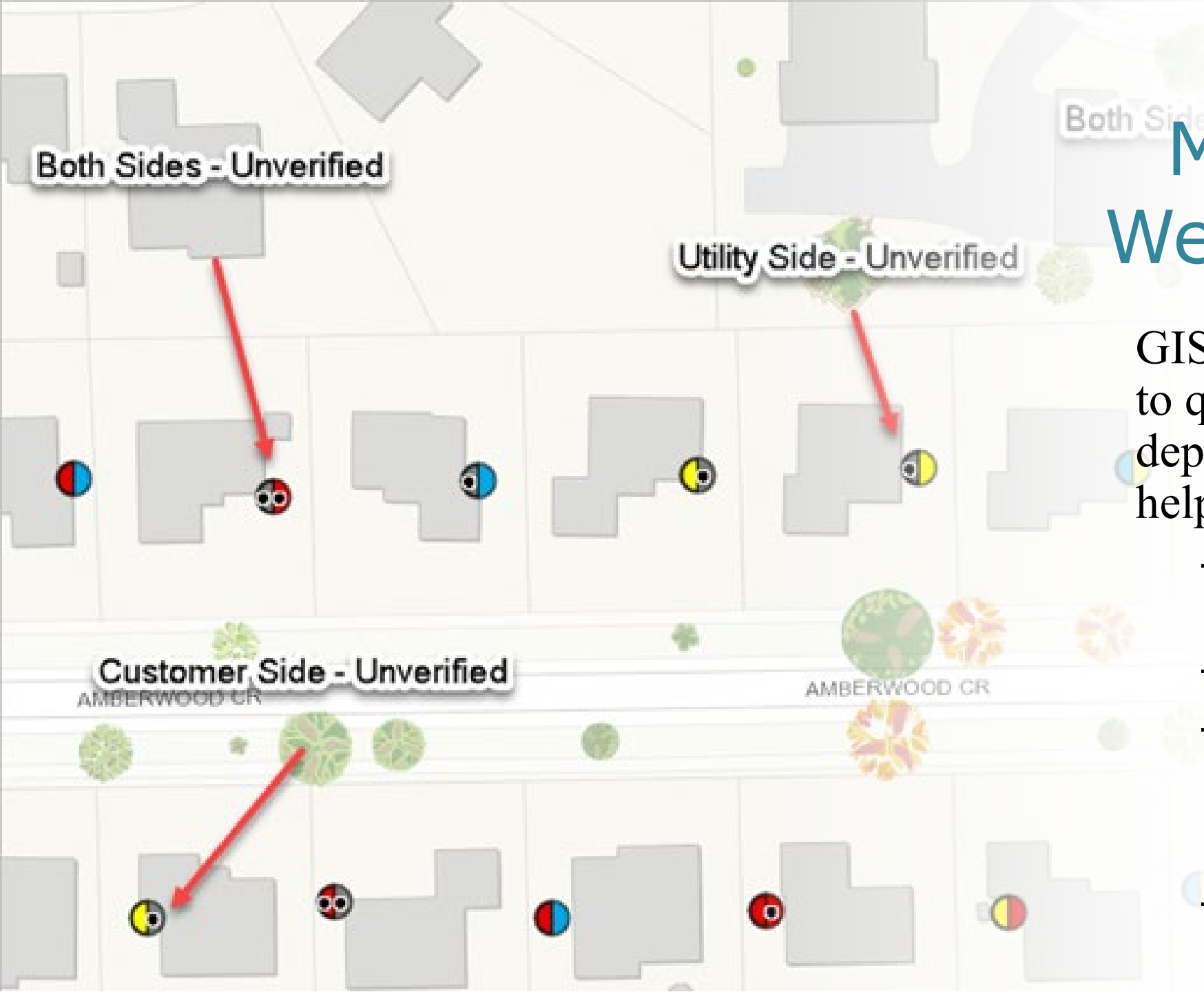

Mobile and Web Solutions

GIS provides a foundation to quickly create and deploy mobile solutions to help utilities

- Lead Service Line Out of Service
- Water Breaks
- Inspections
  - Hydrants
  - Manholes
- Planning Coordination

WHAT'S NEXT?

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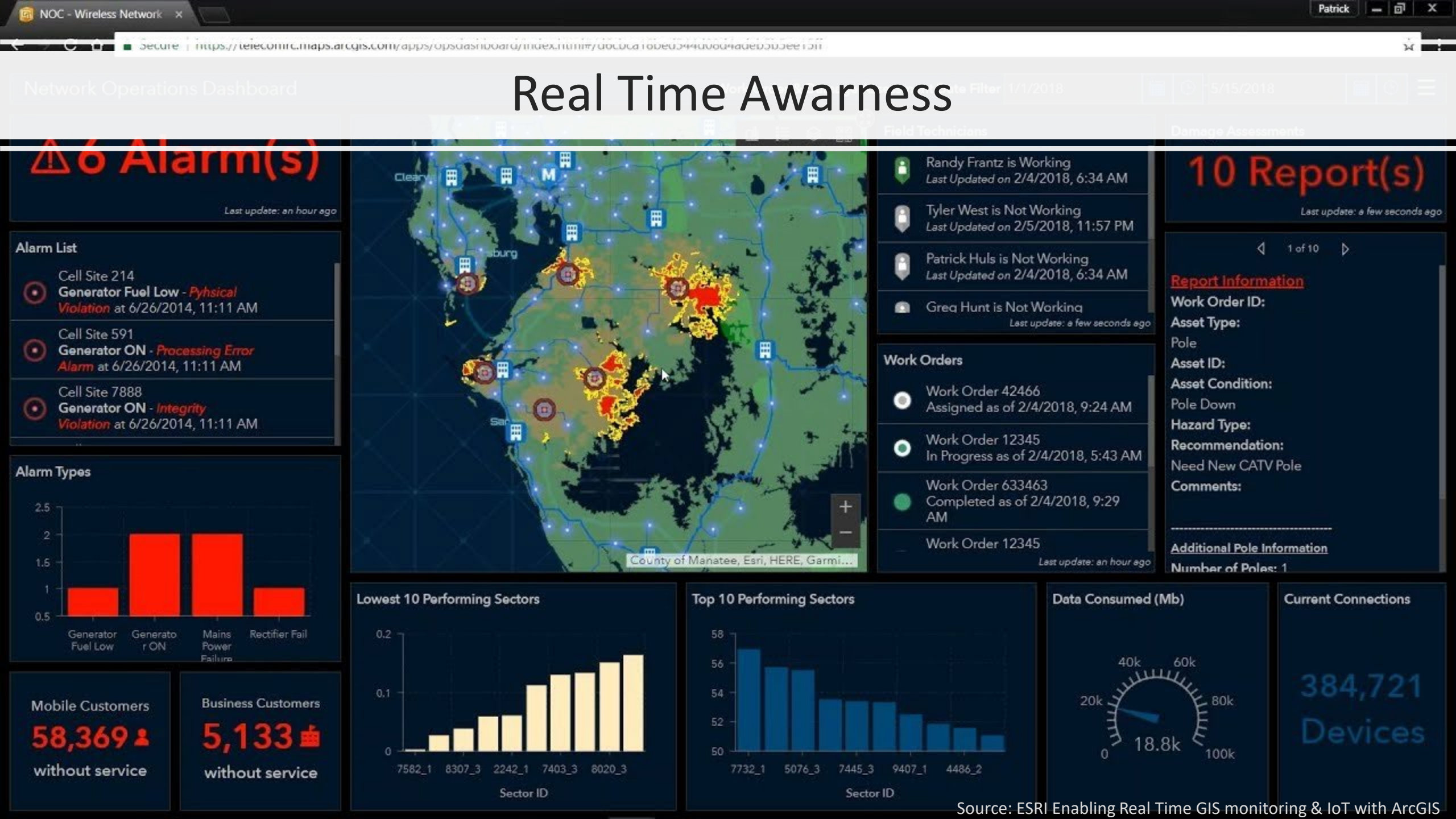
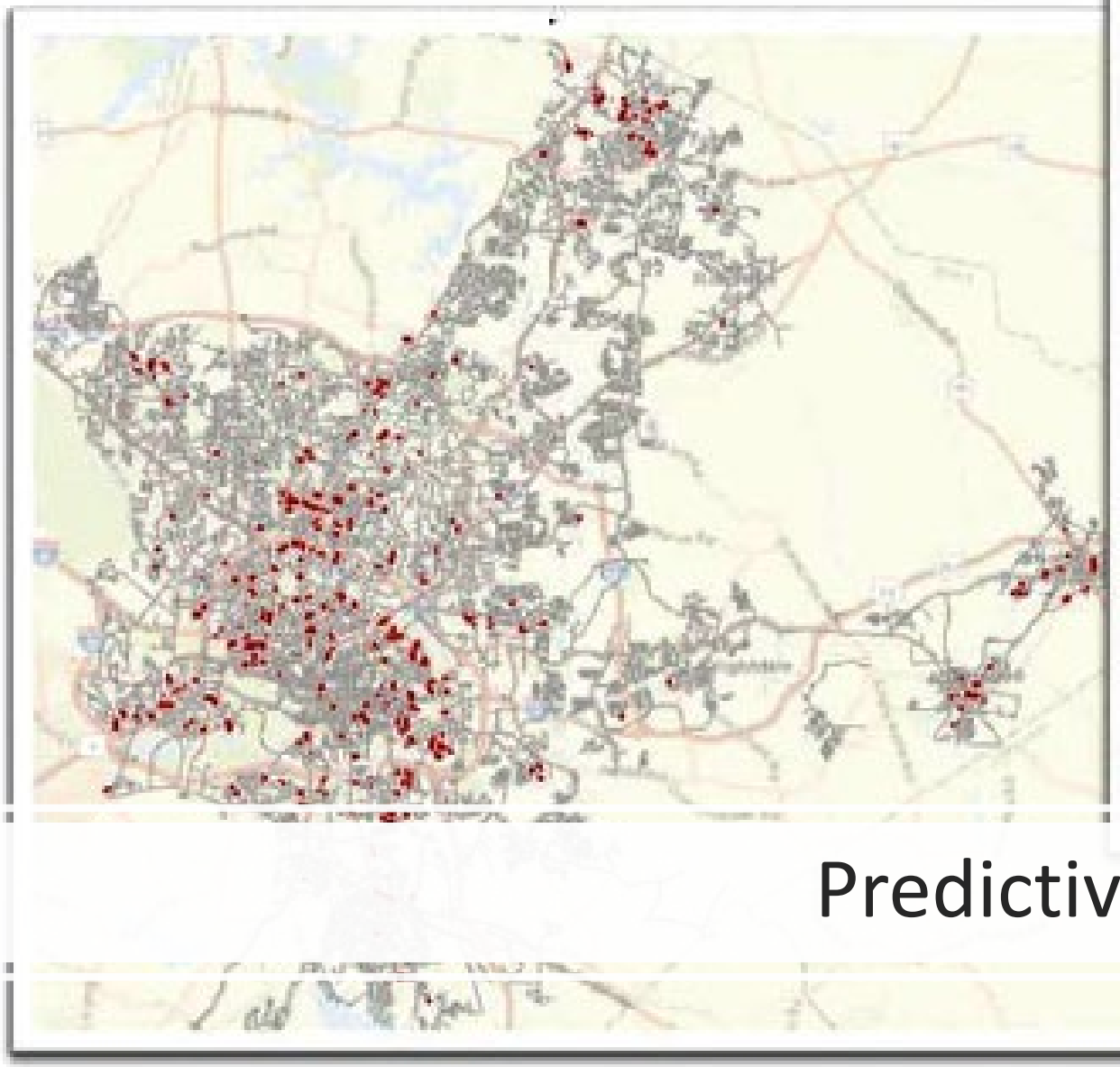
Augmented Reality

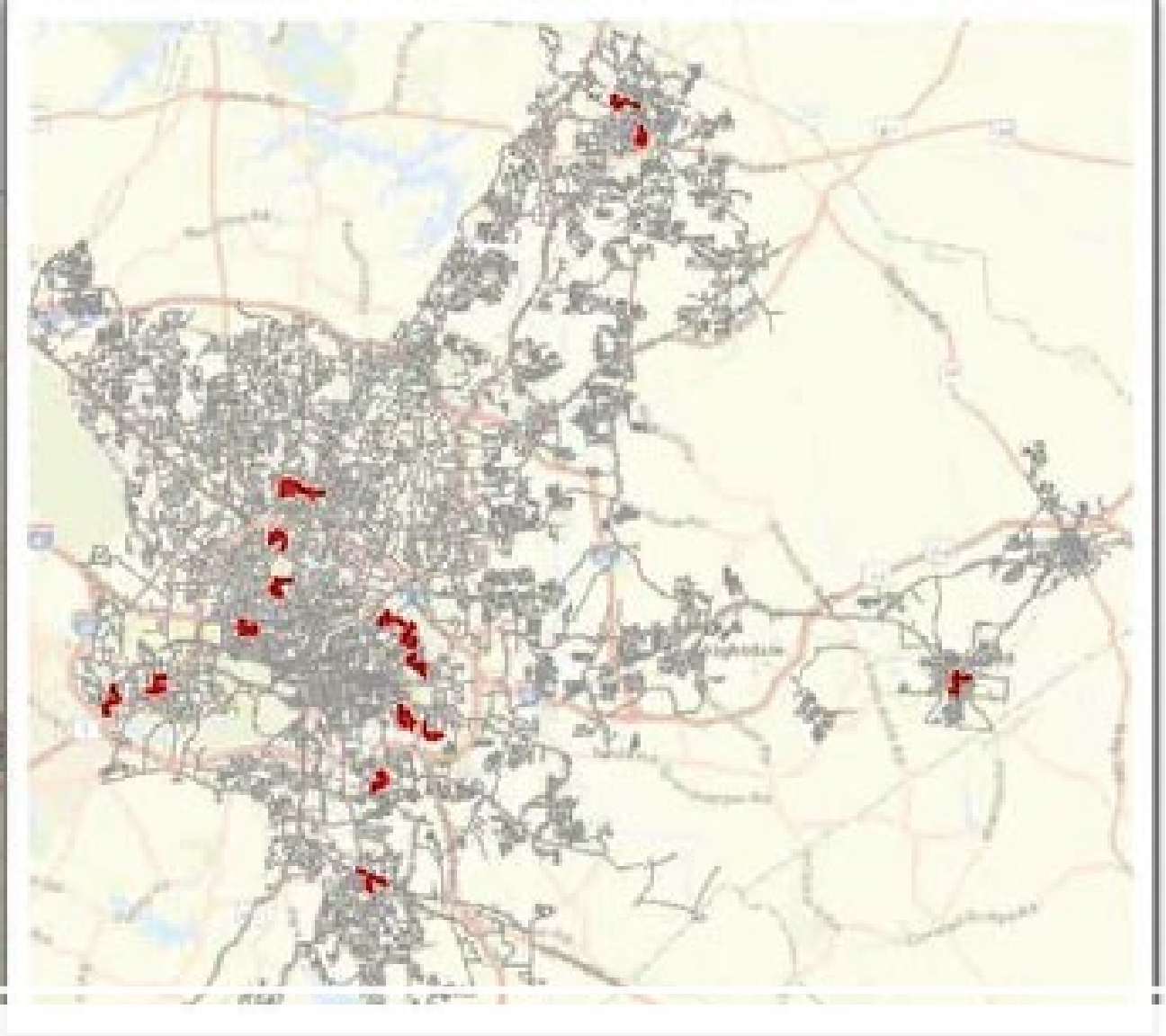
https://www.esri.com/about/newsroom/arcnews/mixing-the-real-with-the-virtual/

Real Time Awarness



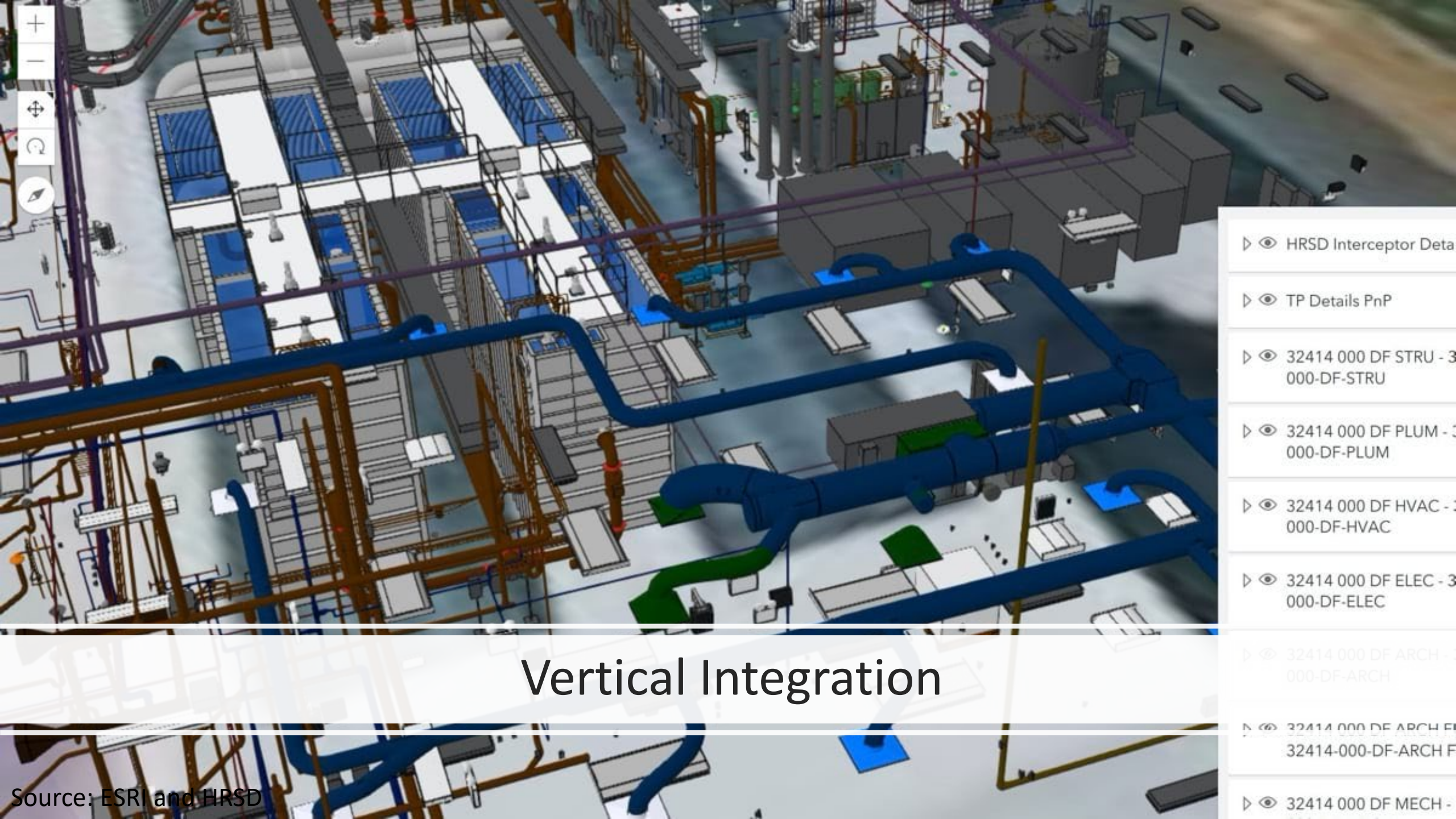
Source: ESRI Enabling Real Time GIS monitoring & IoT with ArcGIS





Predictive Analytic

https://modernpumpingtoday.com/data-science-helps-raleigh-water-avoid-digging-up-the-streets/

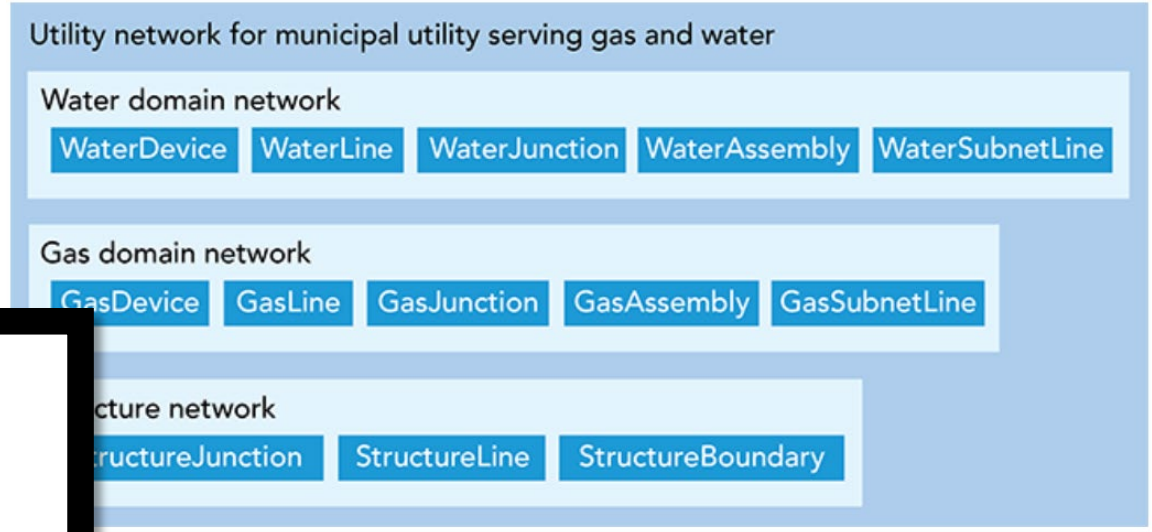


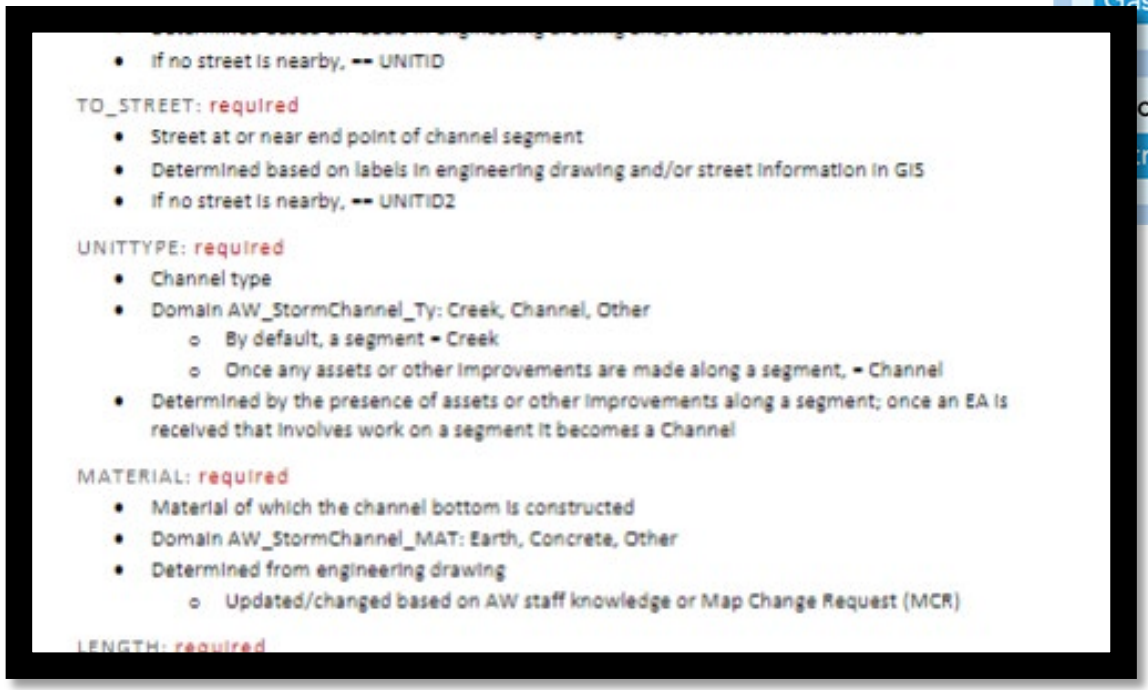
Vertical Integration

Source: ESRI and HRSD

Standardization

- Quick to spin up solutions
- Low tech background





- If no street is nearby, == UNITID

TO_STREET: required

- Street at or near end point of channel segment
- Determined based on labels in engineering drawing and/or street information in GIS
- If no street is nearby, == UNITID2

UNITTYPE: required

- Channel type
- Domain AW_StormChannel_Ty: Creek, Channel, Other
  - By default, a segment = Creek
  - Once any assets or other improvements are made along a segment, = Channel
- Determined by the presence of assets or other improvements along a segment; once an EA is received that involves work on a segment it becomes a Channel

MATERIAL: required

- Material of which the channel bottom is constructed
- Domain AW_StormChannel_MAT: Earth, Concrete, Other
- Determined from engineering drawing
  - Updated/changed based on AW staff knowledge or Map Change Request (MCR)

LENGTH: required

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Source: ESRI

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QUESTIONS?

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