Transforming a Grass Roots Program to an Enterprise GIS

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Aqua America is the second largest, publically traded water and wastewater utility

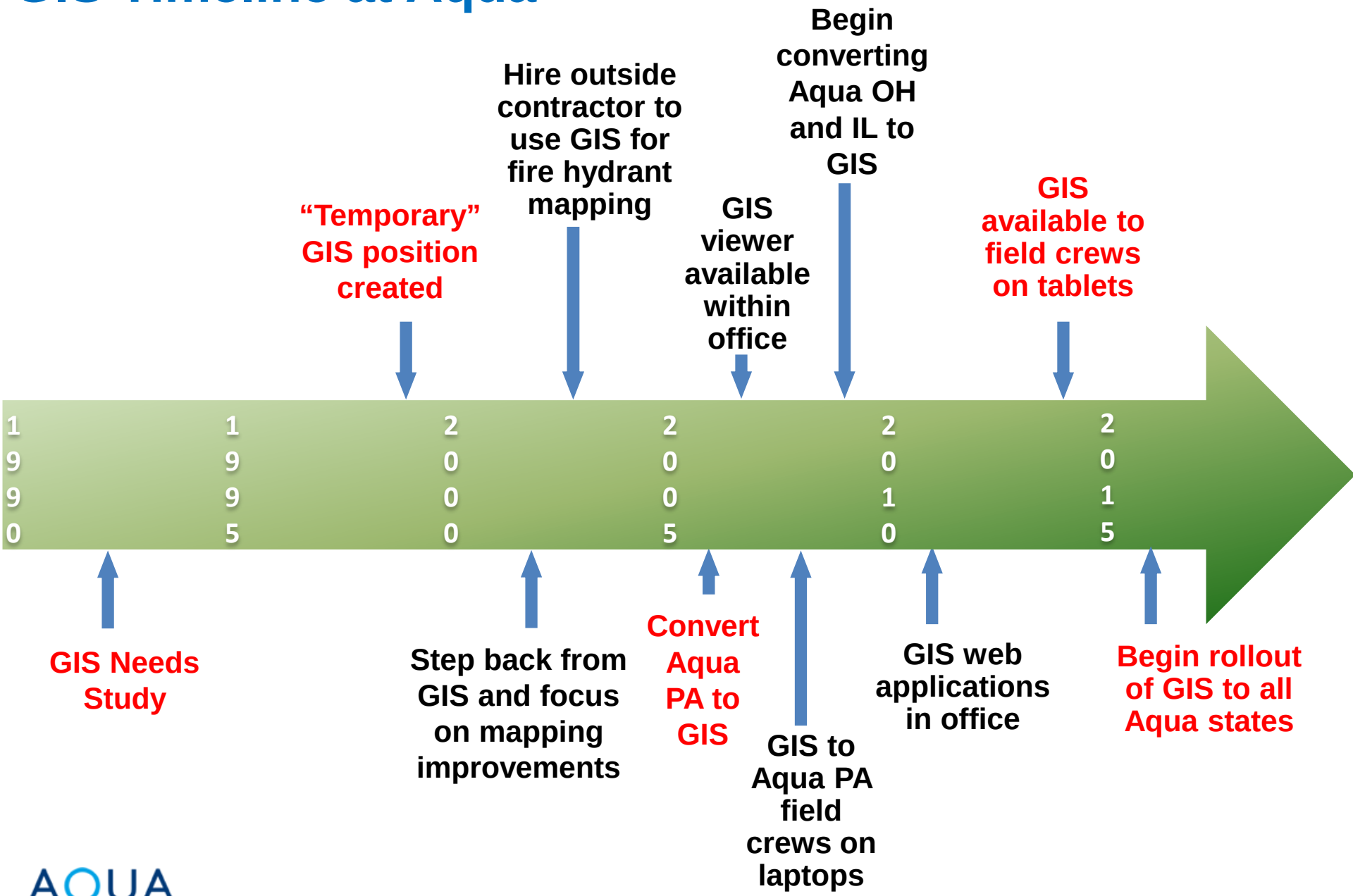
- Investor owned water and wastewater utility (NYSE: “WTR”)
- 3 million people served across 8 states
- Founded in 1886
- 1,600 employees
- 12,000 miles of water main
- 1,500 water & wastewater systems

OPERATING IN 8 STATES

Overview

- Background
- GIS Timeline
- Development of Enterprise GIS
  - Planning
  - IT
  - Technical issues
    - Coordinate system
  - Communication
  - Rollout
- Takeaways

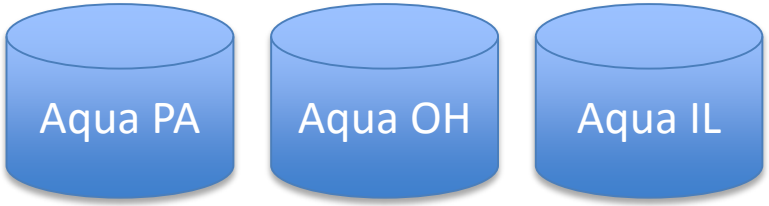
GIS Timeline at Aqua



Aqua GIS – the early days

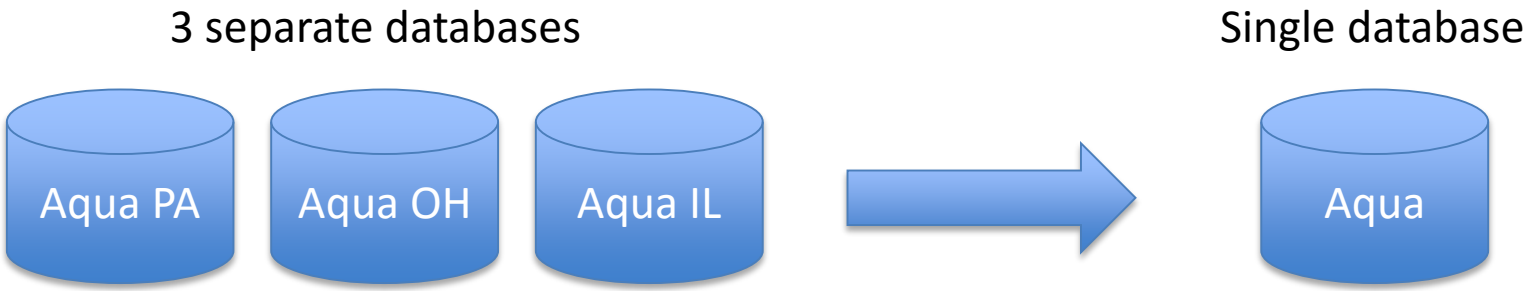
- Engineering initiative to support water main replacement program
- Little or no IT involvement
- The “server under the desk”
- Started by converting > 700 individual maps (plates) for southeast PA
- User access initially through ArcReader
- Eventually converted all water systems in PA
- Separate consulting contract to expand to Aqua OH and Aqua IL

3 separate databases



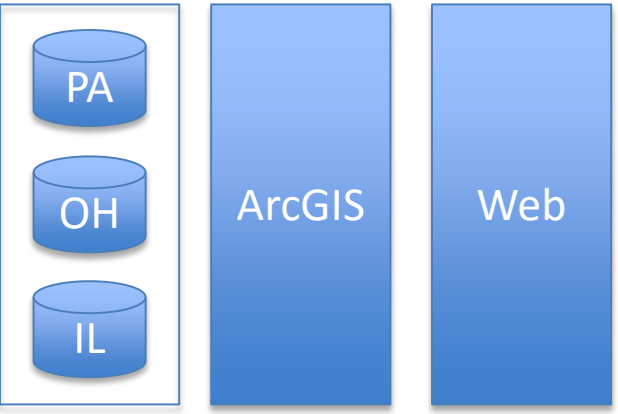
Enterprise GIS Scope of Work

- Install and configure Aqua GIS Production & Test server environments
- Consolidate and optimize Aqua's GIS data model for improved sustainability and performance
- Create "base" and asset GIS data for all Aqua states
- Improve web based capabilities to share GIS information with a variety of end users within Aqua
- Review, document, and optimize all related "back office" scripts and processes



Significant corporate commitment to GIS in 2016…

Original configuration



- Database Server (1) – separate database for each state
- ArcGIS Server (1)
- Web Server (1) – also supported other applications

Current configuration

- Database Server (1) – single database for all of Aqua
- ArcGIS Server (3)
- Web Server (1) – dedicated to GIS
- Image Server (1)

Planning for Success

- Thorough review of staffing needs
- Expectation of supporting advanced capabilities
- Sustainable technology solutions

GIS Staffing Plan

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6.5 FTEs

CURRENT GIS STAFFING MODEL

ESTIMATED FULL-TIME EQUIVALENTS TO SUPPORT GIS PROGRAM

Illinois	1.0	New Jersey	0.5
Ohio	1.5	Texas	0.5
Pennsylvania	4.0	Virginia	0.5
North Carolina	0.5	Indiana	0.5

NOTES:
1) *Includes consultants/contractors*
2) *Assumes GIS Staff would be centralized in Bryn Mawr*
3) *Assumes that existing state resources that support "mapping" would continue to serve that role but under new workflows*

PROPOSED GIS STAFFING MODEL

9 FTEs

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Planning for Success

GIS States Plan: What are the Components?

GIS Maturity

TX, NJ, VA, IN, NC — PA, OH, IL

Base GIS

Base GIS data is at the core of any location based information system:

Base records
- System lists and boundaries
- PWSIDs
- NPDES #s
- Customer points
- Parcel data
- State and municipal boundaries
- Roads
- Regulatory districts

- Pressure zones
- Other utilities' data
- Topography
- Planimetric data (buildings, paved areas, land use)
- Aerial photography
- Hydrography

Quick Wins
- GIS Viewer can be created immediately

Asset GIS

A core pattern of utility GIS usage at Aqua is storage, management, and maintenance of accurate asset records:

Asset records
- Water Distribution systems
- Wastewater collection systems
- Wells, Plants, Pump stations, Tanks (linked to MC)

Planning & Analysis
- Hydraulic modeling

- Water quality
- Regulatory reporting
- Main breaks
- Capital projects

Quick Wins
- Utilize Maintenance Connection GPS coordinates to create initial Asset GIS
- Utilize existing GIS data in states like IN to create initial Asset GIS

Document Management (optional)

The ability to access engineering drawings allows field staff to minimize research time needed in the office before the work day and allows office staff to more reliably maintain assets through increased awareness. Aqua has implemented **AIMS** as the document management solution.

Engineering documents
- As-Builts
- Design drawings

- Tap cards
- Plates

Long Term Benefits
- Digital engineering documents are much easier to access than paper
- Engineering documents typically have detailed information that is unavailable from any other source

GIS Viewer

GIS viewers already established in PA, OH, & IL enable **field mobility**, getting information into and back from the field on tablets. Office staff gain increased **operational awareness** through easy web access to Base GIS data, Asset GIS data, and engineering drawings.

Tablet viewer
- Base records
- Asset records
- Engineering drawings

Office viewer
- Base records
- Asset records
- Engineering drawings
- Reporting

Future components
- Outage maps
- Emergency response
- Customer notification
- Maintenance activities

Asset Management

GIS plays an integral role in the various asset management activities already in place at Aqua and can contribute to more mature asset management applications moving forward.

Activities
- Improvement charge and capital planning
- Qlikview and corporate reporting
- PUC applications
- Salesforce

Future components
- Maintenance Connection/GIS integration
- Banner/GIS integration

Key Concepts
- GIS is a key component of an overall Asset Mgmt plan
- Leverage existing improvements made by other states
- GIS processes established to maintain linear asset data

Planning for Success

AQUA GIS States Plan: How do we achieve this?

Planning Needs
- Establish Steering Committee
- Establish Users Committee

Base GIS

1. Acquire publically available datasets
   - Parcel data
   - State and municipal boundaries
   - Roads
   - Regulatory districts
   - Other utility data
   - Topography
   - Planimetric data
   - Aerial photography
   - Hydrography
2. Develop Aqua specific datasets
   - System lists and boundaries
   - PWSIDs
   - Customer points
   - Pressure zones
3. Develop standard data model and scripts as need to maintain these datasets
4. Assign maintenance responsibility to a GIS staff member

Q1 2016

Costs: Low
- Most data needs to be acquired
- Data may need to be standardized

Asset GIS

1. Obtain Maintenance Connection GPS coordinate data
2. Obtain existing state GIS data (shapefiles, etc.)
3. Obtain existing Google Earth data
4. Plot existing GIS and GPS and evaluate data quality
5. Make any data quality corrections as necessary
6. Load data into existing standardized data models
7. Establish maintenance procedures for keeping asset data up to date
8. Assign maintenance responsibility to a GIS staff member

Q3 2016

Costs: High
- Contribute to Esri ELA
- Contribute to supporting staff

Document Management (optional)

1. Identify existing engineering documents to be scanned
2. Scan engineering documents
3. Deploy AIMS document management system
4. Load scanned drawings into AIMS
5. Where applicable, link scanned documents to GIS
6. Establish maintenance procedures for new engineering documents
7. Assign maintenance responsibility to a GIS staff member

Q4 2016

Costs: Medium
- Cost of scanning paper documents
- AIMS to be replicated

GIS Viewer

1. Develop GIS viewers for office use and field use
2. Build data "cache" for optimized performance
3. Build necessary scripting & automation for keeping the viewers up to date
4. Establish maintenance procedures for the GIS viewers
5. Assign maintenance to a GIS staff member

Develop future components
1. Outage maps
2. Emergency response
3. Customer notifications
4. Maintenance activities

Q1/Q3/Q4 2016

Costs: Low
- Current viewers to be replicated
- Maintained by single staff member

Asset Management

1. Develop permanent integration points between Maintenance Connection & GIS
   - Take advantage of asset based workflows in Maintenance Connection (asset replacement & retirement)
2. Develop permanent integration points between Banner & GIS
   - Location and visualization helps leverage the value of customer data
3. For states that have capital planning needs, deploy GIS tools and workflows already established in other states
4. Assign primary support responsibility for your state to a GIS staff member

Q2 2017

Costs: Medium
- Internal IT resources for integration
- Communication btwn stakeholders

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Building an Enterprise GIS - Systems

Then:

- 3 server setup on ArcGIS for Server 10.1
- ~50 custom SQL and Python integration scripts
- ~400 active tablet users
- ~20 databases
- Minimal IT support
- 6 general “viewer” applications

Now:

- 6 server setup on ArcGIS for Server 10.4.1
- ~10 custom SQL and Python integration scripts
- ~600 active tablet users
- ~4 databases
- Enterprise level IT support
- 2 general “viewer” applications

Building an Enterprise GIS - Data

Then:

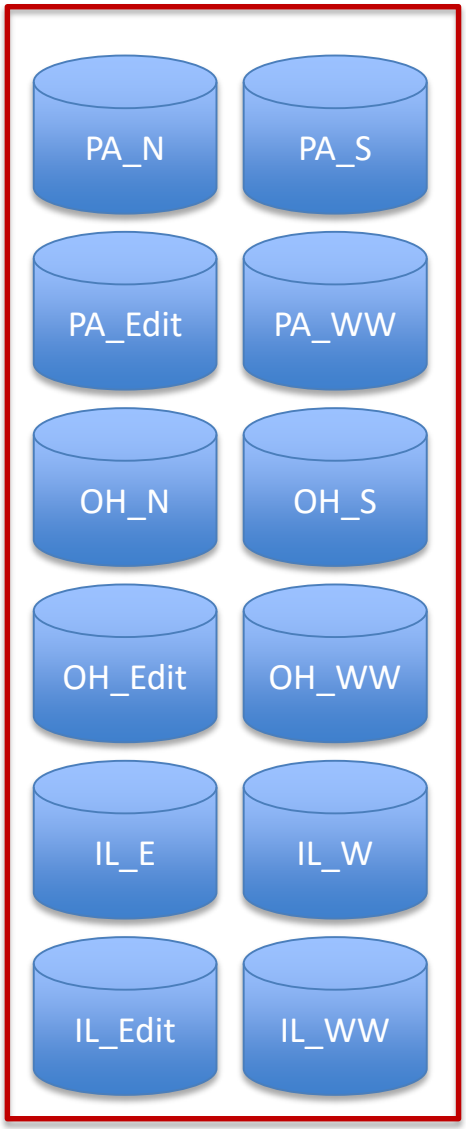
- PA, OH, IL
- 300 water/wastewater systems
- 500,000 customers

Now:

- PA, OH, IL, NJ, IN, VA, NC, TX
- 1,500 water/wastewater systems
- 1,000,000 customers

Over 2 TB of data collected! (~1.4 million selfies)

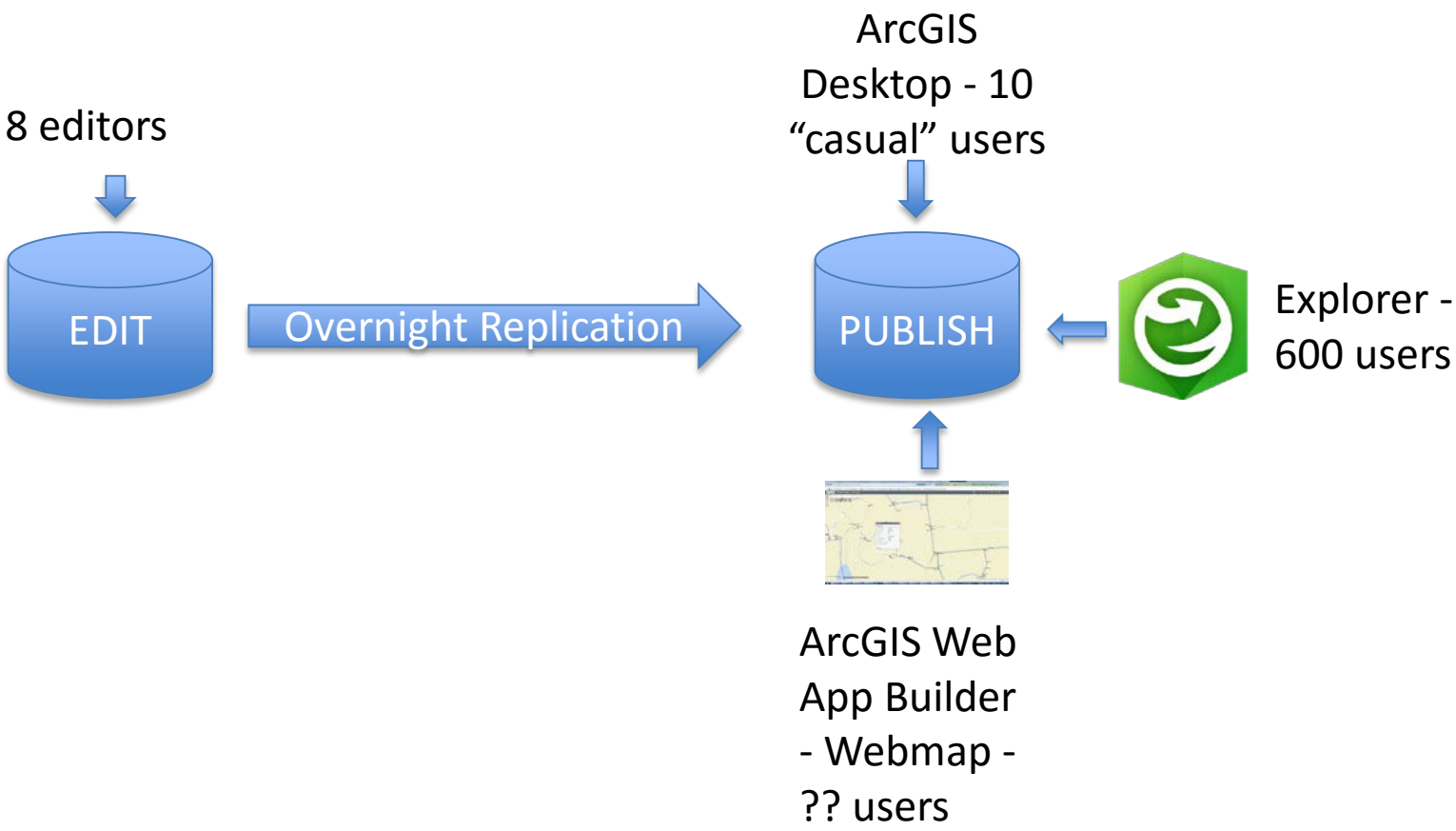
8 editors



ArcGIS Desktop - 10 “casual” users

ArcGIS Web App Builder - Webmap - ?? users

Explorer - 600 users


8 editors
EDIT
Overnight Replication
ArcGIS Desktop - 10 “casual” users
PUBLISH
Explorer - 600 users
ArcGIS Web App Builder - Webmap - ?? users

GIS by the numbers

Number of Hydrants

State	Count	Hyd/Mi
PA	23,866	4.1
OH	18,590	8.5
IL	8,497	7.8
NJ	3,798	5.3
TX	1,256	NA
VA	431	2.1
IN	40	5.7
NC	0	0
Total	**56,478**	

The midwest loves fire hydrants

Are we missing valves in GIS?

Number of Valves

State	Count	Valve/Mi
PA	75,887	13.1
OH	24,107	11.1
NJ	11,536	16.2
IL	11,342	10.5
TX	2,302	NA
VA	1,141	5.7
IN	26	3.7
NC	0	0
Total	**126,341**	

Number of Manholes

State	Count	MH/Mi
IN	8,318	21.1
IL	3,625	19.2
PA	2,987	8.3
VA	2,278	19.7
OH	1,701	25.0
NJ	925	18.2
NC	0	0
TX	0	0
Total	**19,834**	

PA has a lot of low pressure force main

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Takeaways

- Plan, plan, and plan some more
- Make friends with IT
- Communicate early and often
- Be careful not to value the quickest way over the best way
- Be prepared to manage change and expect to manage change
- Implementing a GIS is not an overnight process