GIS Supports Sustainable and Effective Water Utility Practices

An Esri® White Paper
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Introduction

The US Environmental Protection Agency (EPA) recently published *Moving Toward Sustainability: Sustainable and Effective Practices for Creating Your Water Utility Roadmap* in an effort to assist water utilities with improving their operations. Based on lessons learned and practical experience derived from the industry, the report aims to assist utility leaders with implementing proven and effective best practices to support the creation of a road map toward sustainable operations. The report states many benefits of implementing proven and progressive practices, such as saving money by optimizing the planning and delivery of services; protecting the environment by meeting regulatory requirements; having a reliable source of water; improving resiliency to short- and long-term disasters; and getting greater support from decision-making bodies, customers, and stakeholders through improved understanding.

ArcGIS®, Esri's geographic information system (GIS) technology, supports many of the practices discussed in the EPA report. The purpose of this white paper is to show ways managers can use ArcGIS to implement sustainable water utilities practices. It also shows the benefits ArcGIS brings to ten core management areas that have been defined in the report. The description of each core area includes a clear scope and set of proven and progressive best practices that support operational sustainability. For each core area, this paper will provide a list of ArcGIS capabilities that can be used to help utilities define and, ultimately, achieve their road map for sustainability. A summary of the key benefits to implementing ArcGIS is also provided.

GIS Supports Sustainable Practices

Based on hundreds of ArcGIS implementations around the world, Esri has identified water utility business practices that GIS significantly improves:

■ Asset management requiring authoritative repositories to store, manage, and maintain accurate spatial and descriptive information about assets.

■ Intelligent decision making brought about by transforming assets and operations information into actionable intelligence to improve both reactive and proactive services, optimize investments, and plan for capital projects.

■ Coordination with mobile workers by getting information into and out of the field more quickly and making that information more usable for field crews. This is typically enabled through easy-to-use mobile GIS applications that run on field computers, tablets, or smartphones that synchronize data with office systems.

■ Emergency response based on operational awareness and shared knowledge about how assets, employees, and utility networks are performing. This typically takes the form of applications (apps) that are accessed through a browser, tablet, or smartphone and often include integration with other systems such as SCADA, asset, and outage management systems.

■ Transparency created by sharing reliable information in the form of interactive maps with the utility stakeholders such as customers, local elected officials, other utilities in the service area, regulatory agencies, and organizations concerned with the environment.

These broad themes, which provide tremendous value for water utilities, cut across many of the core management areas identified in the EPA report. However, more specifically, the table below provides a list of several ArcGIS functions that can be leveraged to support the sustainable practices identified for each core management area.

Management Areas	Scope	Proven GIS Applications
Utility Business Planning	Various forms of capital, long-range, and strategic planning	Mapping project areas; analyzing risk; leveraging asset scoring; integrating and analyzing of multiple spatial layers for decision making; sharing/collaborating with internal and external stakeholders
Product Quality and Operational Optimization	Compliance with regulatory requirements, energy and materials usage technology, and standard operating procedures (SOP)	Water quality sampling, sample site planning and analysis; digital data collection and monitoring; real-time data sharing from field to office; water loss and repair management; valve exercising; water meter replacement tracking and analysis; water age analysis; real-time spatial monitoring; green infrastructure management; GIS layer integration across multiple departments; automated system integration through common locations; dashboards to track key indicators
Customer Satisfaction and Stakeholder Understanding and Support	Engagement and education efforts, customer feedback and response mechanisms, promotion and public relations	Communication with customers and stakeholders through maps and apps; sharing information through embedded maps on website; community education using Esri story maps; quick dissemination of spatial information for emergencies (outage maps); integration with customer information systems; planning and design of water and wastewater systems; support for business development efforts (visualization and mapping of building zones, land use, smart zones, etc.)

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Management Areas	Scope	Proven GIS Applications
Employee and Leadership Development	Organizational structure, workplace culture, institutional knowledge, succession planning, and employee development	Talent attraction through state-of-the-art GIS tools and technology; identity management to support access and control; standardized workflows to ease training requirements; access to organization-wide spatial information to support cross-training and build institutional knowledge; collaboration with other utilities through shared GIS portals
Financial Viability	Rates that reflect the full cost of service, accounting practices, fees, reserves, debt management, and the creation of additional revenue streams	Asset inventory; asset and maintenance cost tracking; analysis to support rate and cost of service studies; asset registry for asset value and depreciation; automated reporting of assets to support audits; property management
Infrastructure Stability	Management of infrastructure and other physical assets	Asset-based work orders; historical tracking and analysis of work orders; inventory and mapping of critical customers and infrastructure; linking of photographic documentation to assets; sewer line inspection and cleaning; failure analysis to drive decision making; asset replacement analysis; spatial visualization of SCADA information; underground project coordination; asset maintenance and condition scoring; hydraulic modeling and analysis; asset management optimization through industry standard integration with SCADA and computer maintenance management system
Operational Resiliency	Risk assessments, safety and security measures, all-hazard disaster planning, emergency response and recovery, cybersecurity, and continuity of operations planning	Risk assessment analysis for high-consequence assets; maps and apps to support emergency response; damage assessment data collection; cloud-based emergency maps; emergency operations coordination; staff tracking; regional risk modeling and analysis; water distribution monitoring for trends and exceedance; mapping and visualization support for water quality surveillance and response system; climate modeling and adaptation planning

Management Areas	Scope	Proven GIS Applications
Water Resource Adequacy	Water resources, including water productivity and water reliability	Integration of GIS layers for demand modeling forecasting; source water vulnerability mapping and analysis; water loss tracking, analysis, and management; water conservation management (main breaks, water violations, green infrastructure, incentive program tracking); regional planning for water reuse; support of long-term supply and demand analysis; consumption mapping and analysis
Community Sustainability	Social, economic, and environmental impacts relevant to utility operations	Identification of customers and business affected by construction; embedded maps in utility websites to communicate the location and impact of projects; infrastructure management to reduce social, economic, and environmental impact from flooding, sewer overflows, and main breaks
Performance Measurement and Continual Improvement	Considerations taken by utilities when managing achievement and measuring continuous improvement of performance	Support for integrated and automated reporting and tracking of critical performance metrics related to infrastructure; dashboards providing real-time or slice-in-time metrics; analysis to report metrics based on areas or zones; mobile GIS data collection and real-time sharing from the field

In some cases, many of the ArcGIS capabilities listed in the table above support the sustainable practices through typical ad hoc GIS workflows such as mapping project areas and overlaying several GIS layers to evaluate spatial relationships. GIS models generate metrics such as the number of main breaks per mile. In other cases, supporting a best practice may require one or a few specific apps to support some of the more complex practices such as water loss tracking, analysis, and management. Esri has created several industry-specific solutions for water utilities to support these requirements or more complex workflows. ArcGIS for Water Utilities is an industry-specific configuration of ArcGIS for water, wastewater, and storm water utilities that provides focused solutions using desktop, mobile, web, and portal technologies. A complete overview of the ArcGIS for Water Utilities solutions can be found at solutions.arcgis.com/utilities/water/.

Benefits of Implementing ArcGIS

Almost everything a water utility does is naturally based on location, such as distribution and collection networks, customers, facilities, service areas, pressure zones, and crew locations. This is why a geography platform is needed to provide the foundation for sustainable water utility operations. The benefits of ArcGIS as the geography-based platform for water utilities are many. Here are a few of the benefits a GIS offers:

■ An authoritative repository for maintaining comprehensive and accurate asset information reduces time in the field spent searching for assets; facilitates better planning for maintenance, replacement, and growth; and provides tools for network analysis such as system tracing and hydraulic modeling.

■ Field GIS results in a more productive work force, reduces travel time and costs, increases the dynamic interaction of workflows, and provides real-time information flow between the field and the office.

■ Web GIS that integrates information from multiple sources into intuitive maps. It provides single, comprehensive views of the utility in the form of maps and dashboards. Web GIS applications can be leveraged within many other business systems.

■ Portal technology that opens access to geospatial data to everyone in the utility. This allows them to collaborate with contractors and other agencies. People across the department can discover, use, make, and share maps on any device, anywhere, anytime.

In today's environment of aging infrastructure, an aging work force, increasing regulations, and transparency requirements of the communities served, achieving sustainable water and wastewater services requires a geography-based platform. Esri platform technology enables everyone in the water utility to access the information they need and provides a means to collaborate with other employees regarding the location and status of assets, staff, and customers. ArcGIS transforms a water utility into a more informed, efficient, fiscally responsible, and transparent organization.

Esri inspires and enables people to positively impact their future through a deeper, geographic understanding of the changing world around them.

Governments, industry leaders, academics, and nongovernmental organizations trust us to connect them with the analytic knowledge they need to make the critical decisions that shape the planet. For more than 40 years, Esri has cultivated collaborative relationships with partners who share our commitment to solving earth's most pressing challenges with geographic expertise and rational resolve. Today, we believe that geography is at the heart of a more resilient and sustainable future. Creating responsible products and solutions drives our passion for improving quality of life everywhere.

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