REQUEST FOR QUALIFICATIONS/REQUEST FOR PROPOSAL

Orange Water and Sewer Authority
GIS Data Readiness and Migration Strategic Plan
Issue Date: August 15, 2022

Submittal Deadline: September 12, 2022 at 3 PM

1. INTRODUCTION

Your firm is hereby invited to submit a written statement of qualifications and proposal to provide professional services for the GIS Data Readiness and Strategic Migration Plan.

To be considered by OWASA, responses to this RFQ/RFP must be received by 3:00 p.m. Eastern Time on Monday, September 12, 2022. Refer to Section 5 – Submittal Requirements for details.

2. OBJECTIVES

The primary objectives of the project are to:

a) Create a GIS Strategic Migration Plan to migrate from ArcMap environment to latest ArcGIS Pro/ArcGIS Enterprise architecture. The Plan should include strategies for GIS database migration from geometric network to new data model that supports editing in ArcGIS Pro and a review of current architecture and documentation of GIS integrations with other business systems.

b) Review OWASA's existing ArcGIS Enterprise Implementation Plan, provide any improvements if needed, and implement it in test and production environment.

c) Create GIS Data Readiness Plan and QA/QC data quality checks of GIS data for water, sewer, and reclaimed water geometric networks by reviewing current data quality checks and modifying/adding checks as needed.

d) Provide on-going support for future projects and decisions affected by the GIS Strategic Migration Plan.

3. BACKGROUND AND DESCRIPTION

In 2026, support for ArcMap ends and OWASA must migrate to the new platform, ArcGIS Pro/ArcGIS Enterprise. The new software does not allow editing of the current GIS data model, the geometric network. As a result, GIS data must be migrated to a new data model (i.e. the utility network model, the trace network or other solution). Ultimately, adoption of the Utility Network is desired but evaluation of the trace network as a stepping-stone into the new Pro platform may

be considered. OWASA has 3 geometric networks: water, sewer, and reclaimed water systems.

OWASA owns and maintains over 14 miles of raw water lines, 384 miles of drinking water lines, 336 miles of wastewater collection lines (14 miles of this total are pressurized force mains), and 5 miles of reclaimed water lines. Table 1 shows the water system geometric network features including the feature classes and number of records of each feature. Table 2 shows the sewer network geometric network and Table 3 depicts the geometric network features in the reclaimed water system.

Table 1. GIS Water Network

Feature Dataset: Water_System		
Feature Class Name	**Feature Class Type**	**Number of Features**
Abandoned Valves	Point	777
Backflow Device	Point	2,840
BlowOff	Point	1,232
Flushing Device	Point	12
Hydrants	Point	2,469
Main Fittings	Point	37,289
Meter Boxes	Point	22,855
Meter Vault	Polygon	959
Sample Site	Point	51
Water Lines	Line	50,927
Water Manholes	Point	96
Water Pump	Point	9
Water Pump Stations	Point	8
Water Service Laterals	Line	37,886
Water Tanks	Point	5
Water Valves	Point	13,700
Water Pressure Gauge	Point	10
WTP	Point	1
Yard Hydrant	Point	20

Table 2. GIS Sewer Network

Feature Dataset: Sewer_System		
Feature Class Name	**Feature Class Type**	**Number of Features**
Abandoned Force Mains	Line	53
Abandoned Manholes	Point	360
Abandoned Sewer Mains	Line	534
Force Main Fittings	Point	380
Force Main Manhole	Point	16
Force Main Quick Connect	Point	25
Force Main Valves	Point	215
Gravity Sewer Mains	Line	11,310
Manholes	Point	11,209
Pressurized Sewer Mains	Line	550
Pump Stations	Point	28
Sewer Laterals	Line	219
Sewer Meter	Point	9
Sewer Pump	Point	25
WWTP	Point	1

Table 3. GIS Reclaimed Water Network

Feature Dataset: Reclaimed_System		
Feature Class Name	**Feature Class Type**	**Number of Features**
Reclaim Blow Off	Point	22
Reclaim Fittings	Point	352
Reclaim Hydrant	Point	1
Reclaim Laterals	Line	120
Reclaim Valves	Point	149
Reclaim Water Line	Line	451

The GIS system integrates with several third-party systems such as work order management system (Cityworks), CCTV inspections (WinCan), CMMS billing software, custom reporting services, and other business processes. These integrations should be included as part of the migration plan.

OWASA has a partial implementation of ArcGIS Enterprise software on a single-machine configuration, primarily utilizing ArcGIS Server. An ArcGIS Enterprise Implementation plan has been created by a consultant with recommendations for multi-machine deployment. ArcGIS Server needs to be upgraded to the latest version, and Data Store, web adapters, and Portal need to be

installed in a test and production (multi-machine) environment.

Data Reviewer data quality checks were created with consultant help for the water, sewer and reclaimed water geometric networks. The checks are run in ArcMap monthly to identify problems with edits to the GIS database. The checks primarily look for topological, domain, and attribute errors. These QA/QC checks were not specifically created for data migration to a new data model and need to be reviewed and updated and migrated into Pro Data Reviewer checks.

4. SCOPE OF SERVICES

The professional services required for this project are expected to be completed to meet the objectives outlined above and in general accordance with a scope of services as needed to accomplish the tasks listed below. **However, the final scope of services will be negotiated with the selected firm and may include modified and/or additional tasks.**

1. GIS Strategic Migration Plan may include:
    a. Examine current architecture and document GIS integrations with other business systems that includes stakeholder meetings and interviews
    b. Document database customizations including database views and custom SQL queries linked to GIS data
    c. Review and document GIS editing workflows and procedures

2. ArcGIS Enterprise Implementation Plan review and ArcGIS Enterprise Installation may include:
    a. Review plan, modify as needed, and make recommendations for multi-machine deployment
    b. Install latest Enterprise (Server, Data Store, Portal, and web adapters) software in test environment
    c. After testing complete, install Enterprise in multi-machine production environment

3. GIS Data Readiness may include:
    a. Advise and develop plan to migrate from geometric network to data model supported by ArcGIS Pro. Ultimately, adoption of the utility network model is desired primarily for full valve isolation traces on the water network. Recommend data model (trace network, utility network, or other solution) to implement in the near term and develop migration plan.
    b. Revise and review existing Data Reviewer data quality checks for water, sewer and reclaimed networks. Modify as needed to help with migration to new data model and improve overall data quality. Enable data checks to work in Pro Data Reviewer.
    c. Recommendations for Pro data maintenance and editing procedures.
    d. Review Attribute Assistant Rules in ArcMap, suggest changes, and assist in migrating to Pro Attribute Assistant.

4. Inform budgetary amount for future GIS migration implementation by February 2023.

The draft and final plans, reports, etc. will be provided in electronic and hard copy formats in a manner acceptable to and usable by OWASA. The actual list and format of deliverables will be negotiated with the selected firm.

5. SUBMITTAL REQUIREMENTS

Responses to this RFQ/RFP must be received by OWASA no later than 3:00 p.m. Eastern Time on Monday, September 12, 2022. To be considered, please submit two (2) hard copies and one (1) electronic copy in PDF format of the required qualifications to:

Beth Canada, GISP
GIS Coordinator
Orange Water and Sewer Authority
400 Jones Ferry Road
Carrboro, North Carolina 27510

Submittals should consist of two sections: "**Qualifications**" and "**Proposal**".

The **Qualifications** section shall be limited to a maximum of 10 double-sided pages (i.e., 20 pages printed double-sided onto 10 sheets of 8-1/2"x11" paper), and must include the following:

a) ***Statement of Interest*** [**5 points**] explaining your firm's interest in performing the work on this project, including how the project aligns with your firm's capabilities.
b) ***Project Team/Org Chart*** [**20 points]** showing the proposed project team members, including sub-consultants (if any), identifying their respective roles on the project, and indicating their availability to support this project. Each proposal shall include resumes of key team members. The primary contact shall be clearly identified.
c) ***Project Approach*** [**40 points]** describing your proposed approach to accomplish the work to meet the project objectives, identifying how you will manage any notable risks to meeting the schedule and budget constraints. Provide detailed information that will allow OWASA staff to distinguish your team from other firms that may be competing for this project.
d) ***Project Schedule*** [**10 points**] should outline the anticipated schedule with sufficient delineation of phasing and tasks to demonstrate your understanding of the necessary project activities and reasonable durations, sequencing, risks, etc. for these types of projects.
e) ***Past Experience and References*** [**25 points]** for similar projects completed by your project team in the last (5) years for other clients. Identify who served as project manager and key lead technical roles in those projects.
f) ***Contract Objections****:* It is OWASA's intention to use a contract similar to the one included as Attachment 1. If your firm objects to any element of the contract, please state the objections in the submittal.

The **Proposal** section shall be enclosed in a ***separate, sealed*** envelope marked "Cost Estimate" and should include completed cost estimate sheets and any other necessary cost information.

6. SELECTION PROCESS

OWASA plans to evaluate the qualifications of all firms submitting proposals before considering the Cost Estimate. Please keep in mind that cost, while an important factor, will not be the sole determining factor. The lowest bid will not necessarily be awarded the contract.

OWASA intends to select a firm on a qualifications basis within two weeks of receiving the responses to this RFQ/RFP and expects to complete final scoping and contract negotiation in October 2022. OWASA reserves the right to reject any and all proposals, to waive any and all formalities, and to disregard all nonconforming or conditional submittals.

OWASA may elect to conduct face-to-face interviews with two or more firms being evaluated prior to making a final selection.

If OWASA cannot reach an agreement with the initially selected firm, OWASA will then proceed to negotiate with other firms that submitted qualifications or will reissue the RFQ/RFP.

7. OWASA POINT OF CONTACT

Beth Canada will be OWASA's primary point of contact for all consultant selection matters relating to this project. **All questions regarding this RFQ/RFP must be emailed on or before Monday, September 5, 2022** to Ms. Canada at bcanada@owasa.org. Responses to questions will be posted in an Addendum on the OWASA website on Wednesday, September 7, 2022.

8. SUPPLEMENTAL INFORMATION

Attachment 1 Standard Services Contract
Attachment 2 OWASA ArcGIS Enterprise Strategic Implementation Plan

ORANGE WATER AND SEWER AUTHORITY
SERVICE CONTRACT
ORANGE COUNTY, NORTH CAROLINA

THIS CONTRACT is made, and entered into this the ___day of _____, 20__, by and between **ORANGE WATER AND SEWER AUTHORITY,** a public corporate subdivision of the State of North Carolina, (hereinafter referred to as "**OWASA**", party of the first part and _____, (hereinafter referred to as **"CONTRACTOR"**), party of the second part.

1. SERVICES TO BE PROVIDED AND AGREED CHARGES

CONTRACTOR hereby agrees to provide services and/or materials under this contract (hereinafter referred to collectively as **"SERVICES"**) pursuant to the provisions and specifications identified in "Attachment 1". **OWASA** hereby agrees to pay for services at per unit prices contained in Attachment 1 and pursuant to paragraph "3" of this contract. Attachment 1 is hereby incorporated by reference as if fully set out herein.

2. TERM OF CONTRACT

The term of this **CONTRACT** for services and supplies is from _____ to _____.

3. PAYMENT TO CONTRACTOR

CONTRACTOR shall receive from **OWASA** a sum not to exceed $_____ as full compensation for the provision of services. **OWASA** agrees to pay at the rates specified for services, satisfactorily performed, in accordance with this contract, and the bid proposal both of which are contained in Attachment 1. Unless otherwise specified, **CONTRACTOR** shall submit an itemized invoice to **OWASA** by the end of the month during which services are performed. Payment will be processed promptly upon receipt and approval of the invoice by **OWASA**.

4. INDEPENDENT CONTRACTOR

OWASA and **CONTRACTOR** agree that **CONTRACTOR** is an independent contractor and shall not represent itself as an agent or employee of **OWASA** for any purpose in the performance of **CONTRACTOR'S** duties under this contract. Accordingly, **CONTRACTOR** shall be responsible for payment of all federal, state and local taxes as well as business license fees arising out of **CONTRACTOR'S** activities in accordance with this contract. For purposes of this contract taxes shall include, but not be limited to, Federal and State Income, Social Security and Unemployment Insurance taxes.

CONTRACTOR, as an independent contractor, shall perform said services in a professional manner, with reasonable care, and in accordance with the standards and practices applicable in the industry, including those recommended or required by professional organizations and licensing agencies of the industry.

5. INSURANCE AND INDEMNITY

The **CONTRACTOR** shall indemnify and hold harmless **OWASA** and its officials, agents, and employees from and against all claims, damages, losses, and expenses, direct, indirect, or inconsequential (including but not limited to fees and charges of engineers or architects, attorneys, and other professionals and costs related to court action or arbitration) arising out of or resulting from the performance of this Contract or the actions of the **CONTRACTOR** or its officials, employees, or contractors under this Contract or under the contracts entered into by the **CONTRACTOR** in connection with this Contract. This indemnification shall survive the termination of this agreement.

In addition, **CONTRACTOR** shall maintain, at its expense, the following minimum insurance coverage:

Bodily Injury Liability	$1,000,000
Property Damage Liability	$100,000
Combined Single Limit Bodily Injury and Property Damage	$1,000,000
Workers' Compensation for employer's liability and bodily injury by disease for each employee	$100,000
Workers' Compensation for disease for each employee policy limit	$500,000

CONTRACTOR shall have **OWASA** named as an additional insured on **CONTRACTOR'S** insurance policy.

CONTRACTOR shall furnish a certificate of insurance from an insurance company, licensed to do business in the State of North Carolina and acceptable to **OWASA** verifying the existence of any insurance coverage required by **OWASA**. The certificate will provide for sixty (60) days advance notice in the event of termination or cancellation of coverage.

6. HEALTH AND SAFETY

CONTRACTOR shall be responsible for initiating, maintaining, supervising and assuring compliance with all safety precautions and programs required by law or regulation, including but not limited to OSHA and all other regulatory agencies, while providing services under this contract.

7. NON-DISCRIMINATION IN EMPLOYMENT

CONTRACTOR shall not discriminate against any employee or applicant for employment because of age, sex, race, creed, national origin, or disability. **CONTRACTOR** shall take affirmative action to ensure that applicants are employed and that employees are treated fairly and legally during employment with regard to their age, sex, race, creed, national origin, or disability. In the event **CONTRACTOR** is determined by the final order of an appropriate agency or court to be in violation of any non-discrimination provision of federal, state or local law or this provision, this Contract may be canceled, terminated or suspended in whole or in part by **OWASA**, and **CONTRACTOR** may be declared ineligible for further **OWASA** contracts.

8. GOVERNING LAW

This contract shall be governed by and in accordance with the laws of the State of North Carolina. All actions relating in any way to this contract shall be brought in the General Court of Justice in the County of Orange and the State of North Carolina.

9. TERMINATION OF AGREEMENT

This contract is subject to the availability of funds to purchase the specified services and may be terminated at any time during the term upon thirty (30) days written notice if such funds become unavailable.

This contract may be terminated, for cause, by the non-breaching party after notifying in writing the breaching party of a substantial failure to perform in accordance with the provisions of this contract and if the failure is not corrected within ten (10) days of the receipt of the notification. Upon such termination, the parties shall be entitled to such additional rights and remedies as may be allowed by relevant law.

This contract may be terminated by either party at any time during the term upon thirty (30) days written notice.

Termination of this agreement, either with or without cause, shall not form the basis of any claim for loss of anticipated profits by either party.

10. SUCCESSORS AND ASSIGNS

CONTRACTOR shall not assign its interest in this contract without the written consent of **OWASA**. **CONTRACTOR** has no authority to enter into contracts on behalf of **OWASA**.

11. COMPLIANCE WITH LAWS.

CONTRACTOR represents that it is in compliance with all Federal, State, and local laws, regulations or orders, as amended or supplemented. The implementation or this contract will be carried out in strict compliance with all Federal, State, or local laws regarding discrimination in employment.

12. NOTICES

All notices which may be required by this contract or any rule of law shall be effective when received by certified mail sent to the following addresses:

OWASA
PURCHASING DEPARTMENT
400 JONES FERRY ROAD
CARRBORO, NORTH CAROLINA, 27510

(VENDOR CONTACT INFO HERE)

13. AUDIT RIGHTS

For all services being provided under this contract, **OWASA** shall have the right to inspect, examine, and make copies of any and all books, accounts, invoices, records and other writings relating to the performance of said services. Audits shall take place at times and locations mutually agreed upon by both parties, although **CONTRACTOR** must make the materials to be audited available within one (1) week of the request for them.

14. OWASA NOT RESPONSIBLE FOR EXPENSES

OWASA shall not be liable to **CONTRACTOR** for any expenses paid or incurred by **CONTRACTOR** unless otherwise agreed in writing.

15. EQUIPMENT

CONTRACTOR shall supply, at its sole expense, all equipment, tools, materials, and/or supplies required to provide contracted services unless otherwise agreed in writing.

16. E-VERIFY

CONTRACTOR shall comply with the requirements of Article 2 of Chapter 64 of the General Statutes. Further, if CONTRACTOR utilizes a subcontractor, CONTRACTOR shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes.

17. ENTIRE AGREEMENT

This Agreement and the attached document labeled "Attachment 1" shall constitute the entire understanding between **OWASA** and **CONTRACTOR. There are no written or unwritten understandings or agreements between the parties, except as expressed herein, nor have any representations not contained herein been made to induce the execution of this Agreement. This Agreement** shall supersede all prior understandings and agreements relating to the subject matter hereof and may be amended only by written mutual agreement of the parties.

18. HEADINGS.

The subject headings of the paragraphs are included for purposes of convenience only and shall not affect the construction or interpretation of any of its provisions. This agreement shall be deemed to have been drafted by both parties and no purposes of interpretation shall be made to the contrary.

OWASA	**CONTRACTOR**
Title: Director of Engineering and Planning	**Title:**

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

Title: Director of Finance and Customer Service

Attachment 2: OWASA ArcGIS Enterprise Strategic Implementation Plan

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Introduction

The primary goal of this report is to provide a logical path forward for implementing a production-level ArcGIS Enterprise instance for OWASA. The document will include other relevant details related to this goal, including recommended hardware and software specifications, geodatabase-level recommendations, and other items that may impact the success of the future implementation.

Process

The author of this report interviewed OWASA GIS Coordinator Beth Canada on April 1, 2022. During the call, they discussed the current GIS enterprise in use as well as the longer-term GIS-centric goals of the organization. Numerous topics were touched on including software versions, number of users / editors, GIS applications currently in use, high-level details of the data, and other relevant topics.

On May 9, 2022, another virtual meeting was conducted with the author, Beth Canada, Network Administrator Pat Abernathy, and Database Administrator Ryan Byars to discuss some specific details further.

GIS at OWASA

GIS is managed in the Engineering Department at OWASA. Beth Canada is the GIS Coordinator and oversees the GIS operations, including managing the data, working with various end users on specific needs, and providing web applications for internal use and external data access. She currently manages a vector production geodatabase and numerous web applications, which she is still continuing to roll out in 2022.

Current Environment

At present, OWASA has three key components in use for GIS production, all of which are located behind the network firewall (See Figure 1). First, there is a geodatabase (ArcSDE 10.6.1) that is stored in SQL Server (2017 Standard) that houses the production GIS data. That database 'lives' on a designated SQL Server machine (chatuge.owasa.org).

Secondly, an ArcGIS Server instance is used to provide GIS web services, representing streams of data that originate in the SQL Server geodatabase. These services are utilized by *CityWorks* (asset management and work order application) as well as maps and apps housed on ArcGIS Online. In total, there are between 40 and 50 web services currently managed on-premise.

This server also houses Image Server, an extension for ArcGIS Server typically used for managing and hosting imagery. Along with that are image caches, which were originally created from file geodatabases, and are used for efficiently sharing imagery for the various end uses at OWASA.

The current ArcGIS Server machine is a virtual one, having Windows 2016 Standard, 16 GB of RAM, and Xeon Gold Processors. There is a certificate specifying this url: gisserver.owasa.org.

Finally, an ArcGIS Online organizational account is used to create and manage GIS web applications, some of which have been moved internally due to security concerns.

OWASA uses esri software products for GIS data management, currently at version 10.6.1. This includes the aforementioned ArcGIS Server as well as ArcGIS Desktop installations.

OWASA currently has a Small Utility Enterprise Licensing Agreement (ELA) with Esri for their GIS software needs. This allows access to most of the esri-based products and includes 50 Creator and 50 Viewer users (for ArcGIS Online or ArcGIS Enterprise), along with other specific roles (such as Field Worker and Utility Network).

OWASA currently uses *CityWorks* version 15.6.3 for asset and work order management. This is a crucial tool that integrates with the GIS in that *CityWorks* uses REST end points (web services) to render a map inside of their specific interface and stream related attributes into that application. Also, IDs created in the GIS serve as primary keys for records in *CityWorks* related to GIS assets. As noted above, there are several key web services (REST endpoints) housed on the ArcGIS Server machine.

There are three desktop editors using ArcGIS Desktop (ArcMap) for current editing needs at their PCs.

OWASA currently depends on geometric network functionality inherent in the geodatabase and Esri-based software for network tracing. In the future, OWASA hopes to move to the esri *Utility Network* model for that functionality and more.

A test single-machine deployment of ArcGIS Enterprise (version 10.6.1) has also been set up by Beth Canada.

Organizational Goals

In moving to ArcGIS Enterprise, OWASA wants to:

- Upgrade the GIS components to get current.
- Better manage their GIS content.
- Have a central hub for all GIS applications and data management.
- Implement the ArcGIS Utility Network.

OWASA would like to upgrade the ArcGIS environment to version 10.9.1 (ArcGIS Server / ArcGIS Enterprise) and 10.8.2 (ArcGIS Desktop). Also, starting to utilize ArcGIS Pro is a goal moving forward.

ArcGIS Online

OWASA currently uses ArcGIS Online to host three public facing web applications, which were created using the Web App Builder application on that platform.

Numerous other applications are also present, but are only available to OWASA staff for specific needs. Currently, field crews must use VPN to connect to the secure apps, since they are secured behind OWASA's firewall.

Moving to the Cloud

During the information-gathering for this report, Ms. Canada mentioned that OWASA decision makers were considering moving large amounts of GIS data to cloud storage. That is a typical goal these days, since storage costs have gone down and storing data in the cloud relieves local IT staff of having to manage local hardware and software, as well as providing a level of security for the organization, since it moves some key components off-premise. However, with GIS data, there are some potential pitfalls, mostly concerned with software performance. This will be discussed further momentarily.

Technically, ArcGIS Online is a cloud-based product and is a fine place to store GIS data in certain circumstances. For OWASA, the problem is that ArcGIS Online does not currently support geometric networks or the ESRI Utility Network, which are needed to effectively manage utility data in an Esri environment.

For the remainder of this discussion, the assumption will be moving the GIS databases to a cloud location (i.e. Azure, AWS; etc.) as opposed to using ArcGIS Online.

Housing GIS data in the cloud without a specific mechanism to overcome the relative slow speed of the Internet related to the size of the GIS data being accessed and the slow nature of the complex GIS desktop software can be a problem. If all of your GIS data access and interaction happens through a web application instead of a desktop product, it can work fine. If you strictly utilize web services to access the data from the cloud, then using ArcGIS Pro to access and work with the data is an option, but ArcMap is not an option (since it cannot edit data via web services).

Another option is to RDP to the cloud (via VPN) to interact with the data or to use something like Citrix to overcome the speed limitations.

Storing your GIS data and entire GIS enterprise in the cloud is a valid option, but you must thoroughly plan out the implementation in order to end up with the desired results. Simply moving data up there and trying to access those data using desktop products will not work well.

There are vendors that specialize in helping clients move their entire GIS enterprise to the cloud, so contracting with one of those companies is an option.

On-Premise Options for ArcGIS Enterprise

If OWASA elects to keep the GIS server infrastructure on premise, then there are two primary options for housing ArcGIS Enterprise: a single-machine deployment or a multi-machine deployment.

ArcGIS Enterprise is meant to serve as a GIS content management system and includes the following components:

- Portal for ArcGIS – the management interface, a central hub where users and groups are managed and permissions granted to content and where online maps and apps are created and managed among other functionality. This is where security and access to the maps, apps, and data are handled.
- ArcGIS Server – the piece that supplies the various GIS services consumed by maps and apps on the Portal. The services are generally created from desktop software (ArcGIS Desktop, ArcGIS Pro) and point to various data stores, including SQL Server geodatabases.
- ArcGIS Data Store – provides data storing capabilities for the hosting server. If you want to store your data in an unmanaged environment (as opposed to SQL Server), you can do that with the data store. It works like storing data at ArcGIS Online.
- ArcGIS Web Adaptor – According to esri.com, the Web Adaptor 'integrates ArcGIS Server and Portal for ArcGIS with your existing web servers and your organization's security infrastructure'. One web adaptor must be installed and configured for ArcGIS Server and another for Portal for ArcGIS. This piece of software also acts as a reverse proxy server, providing an additional layer of security for your GIS enterprise.

In a single-machine deployment, all of the above components are installed on a single server. Components can be installed using the Enterprise Builder which is straightforward to use. The web adaptors will be integrated with IIS and your organization's SSL certificate to provide secure apps online.

In a multi-machine deployment (See Figure 2), the components noted above are installed on different servers, with the typical exception being the web adaptors, which usually live on the same web server for all except the largest organizations.

In either case, the enterprise geodatabases should always live on a separate database server, as is the case with OWASA currently.

The advantage of the single-machine deployment is ease of deployment and minimal footprint on your local network. The downside is the potential to outgrow that implementation.

Thus, the advantage of the multi-machine deployment is the scalability, with the disadvantage being that it's more difficult to initially implement and has a larger footprint on your LAN.

GIS Data Issues

Most of the critical GIS data at OWASA lives in a single vector geodatabase. Users access the data using ArcGIS Desktop or web applications. There is only a single edit version, that being the default version.

Currently, OWASA manages water (300 miles of water lines) and sewer (280 miles of sewer lines) data in geometric networks, which allow for sophisticated analysis and tracing functionality. The origin of these data were mylars, which were digitized in the past. As such, there remains lots of positional accuracy errors in the data. OWASA is working on improving the positional accuracy of the data by doing intensive field surveys, locating specific valves using GPS and adjusting the GIS data accordingly.

OWASA also manages some conservation easements and a biosolids program. GIS data represents the easements and locations where the biosolids are deposited along with relevant buffers around those areas.

Raster data at OWASA is accessed via cached web services managed by the Image Server extension for ArcGIS Server, which were created from File Geodatabase Image Catalogs. These data are primarily aerial imagery from various years.

In recent years, Esri has released the Utility Network, which is meant to ultimately replace the geometric networks of the past and is fully integrated with ArcGIS Enterprise. This represents the most modern GIS utility network available with Esri products and will allow for sophisticated functionality such as valve isolation tracing and provide improved data quality control and better integration with organizational business needs.

As of this writing, the Utility Network is designed to only work in an ArcGIS Enterprise environment, so OWASA will need to move to that platform in order to utilize the Utility Network in the future.

OWASA will need to develop a long-term strategy for moving to the Utility Network, including understanding data requirements and what the implementation will entail well ahead of doing that project. Implementing ArcGIS Enterprise is the first step to getting to the Utility Network.

If the Utility Network is adopted, OWASA should create a new production geodatabase for that implementation. Once online, that geodatabase will use Branch Versioning, which is designed to support editing via web services, for ArcGIS Pro and / or specific Web Applications.

CityWorks / *ArcGIS* Compatibility

OWASA is currently using *CityWorks* version 15.6.3, which is certified with ArcGIS Enterprise 10.8.1 or previous versions. OWASA will need to upgrade the *CityWorks* implementation to version 15.7.5 or later to ensure proper functionality once ArcGIS Enterprise is implemented at version 10.9.1.

Desktop Software

ArcGIS Desktop is now at version 10.8.2 and is slated to be retired as of 2026. This author understands 10.8.2 to be the last version of ArcGIS Desktop to be deployed. Thus, OWASA needs to start planning for migrating to ArcGIS Pro. ArcGIS Desktop 10.8.2 can publish services to an ArcGIS Server (Enterprise) 10.9.1 implementation, but that is the last version of ArcGIS Server that will support that. Moving forward, services will have to be published from ArcGIS Pro.

In the short-term, if OWASA adopts ArcGIS Enterprise, ArcGIS Desktop can continue to be used but the organization must start planning to move to ArcGIS Pro for all future desktop GIS needs. Currently, there are three editors at OWASA, so those staff members need to start exploring ArcGIS Pro as soon as possible. There are many training options possible at esri.com as well as through other organizations online, but training could also be provided by a vendor.

A logical way forward would be to document typical editing and analysis workflows in order to develop a training strategy. Generic ArcGIS Pro training will be needed, but at a certain point, the specific editing workflows will need to be addressed. If a vendor knew the current workflows, they could develop a specific training curriculum to ideally meet OWASA's specific needs.

Managing User Accounts

As noted previously, the Small Utility Enterprise Licensing Agreement (ELA) with Esri includes 50 Creator and 50 Viewer users (for ArcGIS Online or ArcGIS Enterprise). This is an important point because these users can only exist at the organizational ArcGIS Online platform or in the ArcGIS Enterprise platform, but not both at the same time.

Since OWASA has 40 field workers at present, careful planning will need to be done so that field workers can access their data and apps at all times during a future transition to ArcGIS Enterprise. Esri would likely work with the organization to be sure that the proper access was available during the transition by offering some temporary accounts if needed.

Recommendations

1. **Upgrade CityWorks to version 15.7.5 or later.**

To ensure compatibility with ArcGIS Enterprise 10.9.1.

2. **Upgrade ArcGIS Desktop users to version 10.8.2 and install ArcGIS Pro for those same users at the latest version available.**

ArcGIS Desktop 10.8.2 represents the latest version of that software. Installing ArcGIS Pro will help with future training needs and access to the Enterprise even if not yet used for production.

3. **Upgrade Test Enterprise server to 10.9.1.**

This needs to be done during the first phase of the overall process. That way, you'll have an adequate testing platform as you implement the production Enterprise environment.

4. **Implement ArcGIS Enterprise 10.9.1 using a hybrid approach** (See Figure 3)**.**

Since OWASA already has a number of applications online, the least disruptive approach would be to do the following:

- Upgrade the existing ArcGIS Server / Web Adaptor instances (including Image Server) from 10.6.1 to 10.9.1, which can be done in-place (on gisserver.owasa.org).
- Install Portal for ArcGIS 10.9.1 on a new server.
- Install Data Store for ArcGIS 10.9.1 alongside Portal for ArcGIS on the same server.
- Install the additional ArcGIS Web Adaptor onto the existing web server (gisserver.owasa.org).
- Set up the identity store to use Active Directory, so that local network credentials can be used for accessing maps and apps.
- Create the appropriate Groups for sharing access to maps and apps on the local Portal.
- Federate the ArcGIS Server instance on gisserver.owasa.org and grant privileges to the appropriate Groups.

Using this methodology means that all of the existing services will not have to be moved or republished in the short term and that everything currently in-place should continue to work.

5. **Upgrade SQL / SDE Enterprise Geodatabase.**

The SQL 2017 / ArcSDE 10.6.1 Enterprise Geodatabase will work with ArcGIS Enterprise 10.9.1 once implemented, but should be upgraded to 10.8.2 (if done using ArcGIS Desktop) or 10.9.1 (if done using ArcGIS Pro) once the ArcGIS Enterprise is up and operational. SQL Server version 2017 is certified with ArcGIS Enterprise 10.9.1, so that version will be fine for this initial work and the subsequent short-term.

6. **Use the ArcGIS Online Assistant to copy content from ArcGIS Online to ArcGIS Enterprise.**

Esri has provided a tool for migrating content between ArcGIS Portals called the ArcGIS Online Assistant (https://ago-assistant.esri.com/). It makes moving content much easier.

One catch has to do with the number of users available to OWASA for ArcGIS Enterprise and / or ArcGIS Online. As noted earlier, OWASA currently has 50 viewer and 50 creator accounts available via their Esri

ELA. Those accounts can only exist on one Portal at a time. Thus, if the same user is going to access ArcGIS Online and ArcGIS Enterprise, that will actually constitute two users.

Because of that limitation, OWASA will need to carefully plan the migration from ArcGIS Online so that all users can access the maps and apps as they need during and after the transition. Likely, Esri would provide some temporary accounts if need be, but this has to be considered when planning the cutover.

It may make sense to copy the maps and apps to Enterprise, leaving ArcGIS Online intact, and bring user accounts over bit by bit to ensure that everything works correctly.

Public-facing applications could be left at ArcGIS Online until the very end (or indefinitely) as they do not consume specific accounts.

7. **Republish services using ArcGIS Pro.**

While not immediately necessary, this will save OWASA trouble in the future since the next upgrade of ArcGIS Enterprise will require that the services be published from ArcGIS Pro since those published from ArcGIS Desktop (ArcMap) will no longer work.

8. **Get detailed ArcGIS Pro training specific to your organization's needs.**

As noted previously, OWASA should document current workflows done in ArcMap for migration to ArcGIS Pro. That documentation will be critical to learning the same processes in ArcGIS Pro. If OWASA wants to bring in a vendor for ArcGIS Pro training, the documentation could drive some specific training tasks. To begin, some generic training will be needed, but the specific tasks will need to be fleshed out for a successful migration to ArcGIS Pro.

There are many options available for generic training online, offsite, or at your site. For specific tasks, hiring a vendor will ensure that attention is spent learning the correct details necessary for your organization and will likely speed up the process of being able to use ArcGIS Pro in a production environment.

9. **Continue with improving positional accuracy of the system.**

The maps and apps currently in use should continue to behave the same once ArcGIS Enterprise has been implemented. The workflows currently being used to improve the overall positional accuracy of the system should continue uninterrupted once the transition of the relevant maps and apps have been completed.

10. **Migrate Image Server to Its Own Server** (See Figure 4)**.**

In the short-term, the Image Server implementation, along with the image services (and caches) can stay on gisserver.owasa.org, where they currently reside. Eventually, OWASA should implement ArcGIS Image Server on its own server for storing imagery long-term as server performance will likely degrade over time due to resource consumption.

For existing imagery, the caches could be migrated to the new image server for long-term access or Mosaic Datasets could be created along with new web services to share those images.

If OWASA implements a dedicated Image Server instance, the server will need to have adequate storage and another Web Adaptor will have to be implemented on the web server (gisserver.owasa.org – along

with the ones for ArcGIS Server and Portal for ArcGIS). Also, that server will ultimately be federated with ArcGIS Enterprise so that its content can be managed using Portal for ArcGIS.

11. **Migrate *CityWorks* services to another ArcGIS Server** (See Figure 5)**.**

In the long term, migrating the required *CityWorks* web services to another server / ArcGIS Server instance may make sense to minimize the load on gisserver.owasa.org. OWASA could keep an eye on the performance of gisserver.owasa.org and make the move if and when the load becomes too much.

The work would involve standing up another server, installing and configuring ArcGIS Server, installing another Web Adaptor on gisserver.owasa.org, and federating the new instance with ArcGIS Enterprise so that its content can be managed using Portal for ArcGIS.

Finally, the appropriate web services can be migrated from gisserver.owasa.org to the new server or republished from ArcGIS Pro.

12. **Start working with a vendor to move your data to the Utility Network.**

The Esri Utility Network represents the future approach to modeling water and sewer networks using Esri-based products. Once the new Enterprise environment has stabilized, OWASA should begin working with a vendor to make that migration. Once complete, that should allow for the most sophisticated analysis and tracing from a Desktop environment as well as in the field.

This process will likely take some time to complete and will occur in several phases, so OWASA should plan accordingly.

Other Details

Recommended specifications (for all servers)

- One (1) Quad-Core Intel ® Xeon ® Gold 5222 3.80 GHz Processor, 16.5 Cache
- 64 GB RAM (2 x 32 GB Dual Ranked RDIMMs)

The main components that affect performance across ArcGIS Enterprise is processing power and memory. Storage can be assessed on a case-by-case basis. Since the servers will be virtual, components can be added as needed. Get the highest quality, fastest processors that you can and copious amounts of memory (RAM). Since OWASA has an ELA (server licensing is usually limited to 4 cores), consider eight (8) cores instead of four (4).

Here's a link to a site where Esri bundles hardware with their software that is useful for determining appropriate specifications: https://www.esri.com/content/dam/esrisites/en-us/media/pdf/hardware-partners/dell/dell-enterprise-server.pdf

Accounts Needed for ArcGIS Enterprise

When implementing ArcGIS Enterprise, it is useful to use the same AD account to own all of the services (ArcGIS Server, Portal, Data Store). It is important that the account's password not change. That will make managing these services much easier over the long term.

For Portal, there will be a local (to the Portal implementation) administrator account that will need to be set up during the implementation. That account will administer Portal; other AD accounts can have administrative functions, but this account will need to be available for the highest-level needs. This account is typically named *PortalAdmin*, but can be whatever you want it to be.

Likewise, for any ArcGIS Servers (including Image), there will be a similar administrative account created during the implementation. It is typically called *SiteAdmin* and will be used for high-level needs and specifically, troubleshooting when necessary. This will be local to the implementation, so a separate one will have to be set up for each instance that gets stood up.

Backups

In addition to snapshot backups of the servers housing ArcGIS Enterprise, there is a utility called *WebGISDR* that should be used for backing up the various components of ArcGIS Enterprise at some regular interval. This needs to be implemented once ArcGIS Enterprise is up and running. Backing up the components separately is advised as these backups can be very useful in the case of low-level corruption that may occur.

Future Upgrades

In the short-term, software upgrades to ArcGIS Enterprise should be able to be done in-place. Consult www.arcgis.com or enlist the help of a vendor to plan the upgrade process. Eventually, the components may need to be migrated due to Operating System requirements. Be sure to consult www.arcgis.com for compatibility matrixes between ArcGIS Enterprise, SQL Server, and Windows.

Figure 1: Current OWASA GIS Server Environment

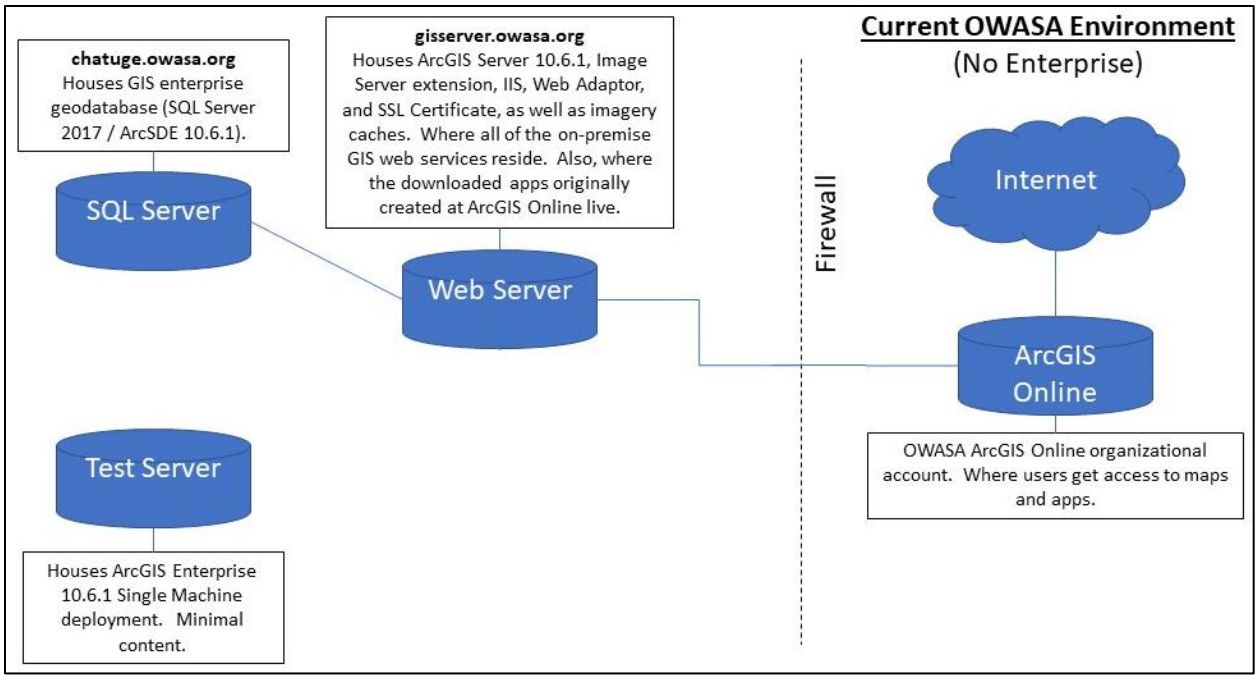


Figure 2: Typical ArcGIS Enterprise Multi-Machine Deployment

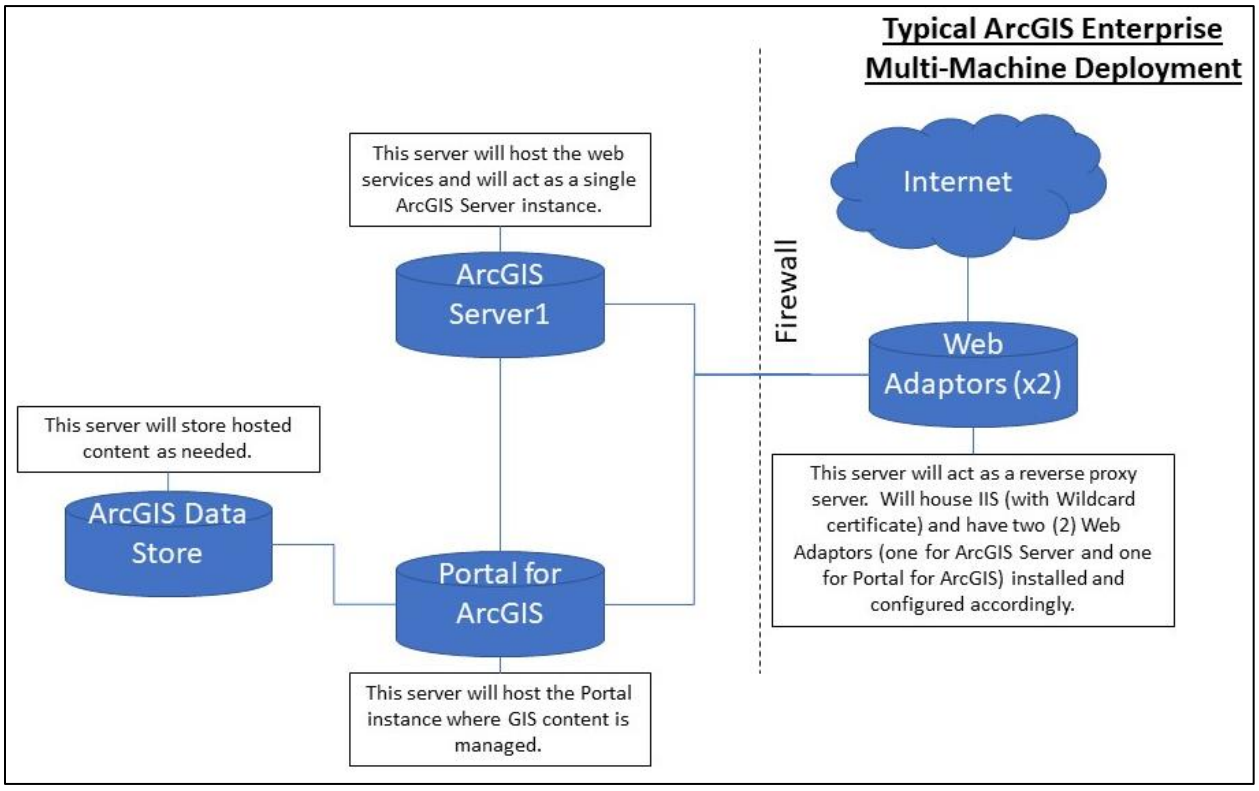


Figure 3: Recommended ArcGIS Implementation (1st Phase)

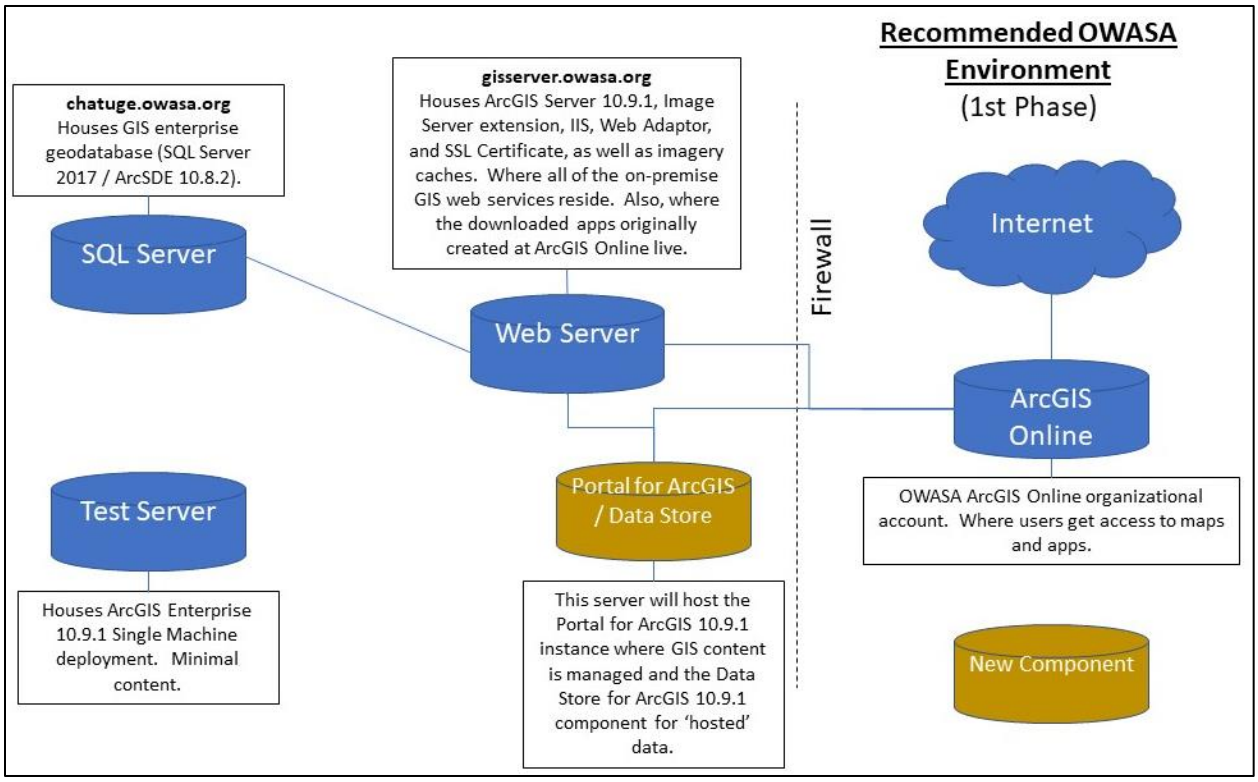


Figure 4: Recommended ArcGIS Implementation (2nd Phase)

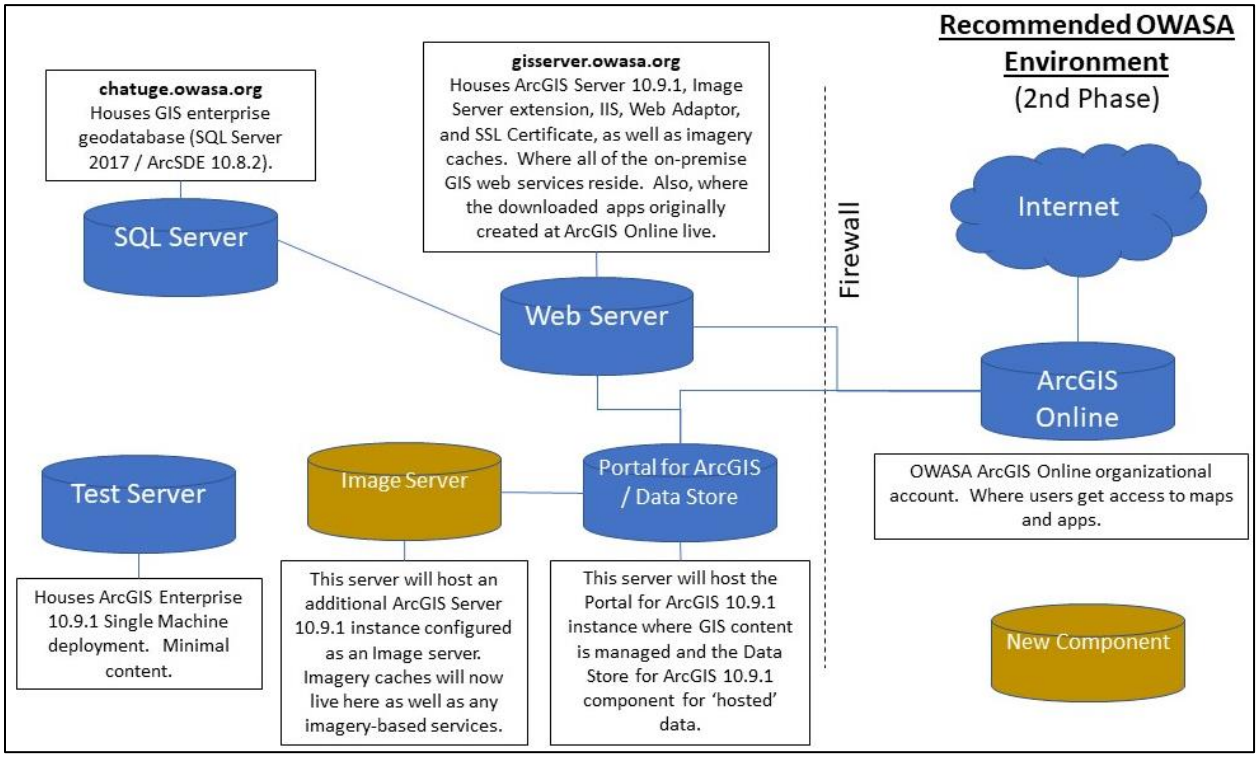


Figure 5: Recommended ArcGIS Implementation (3rd Phase)

