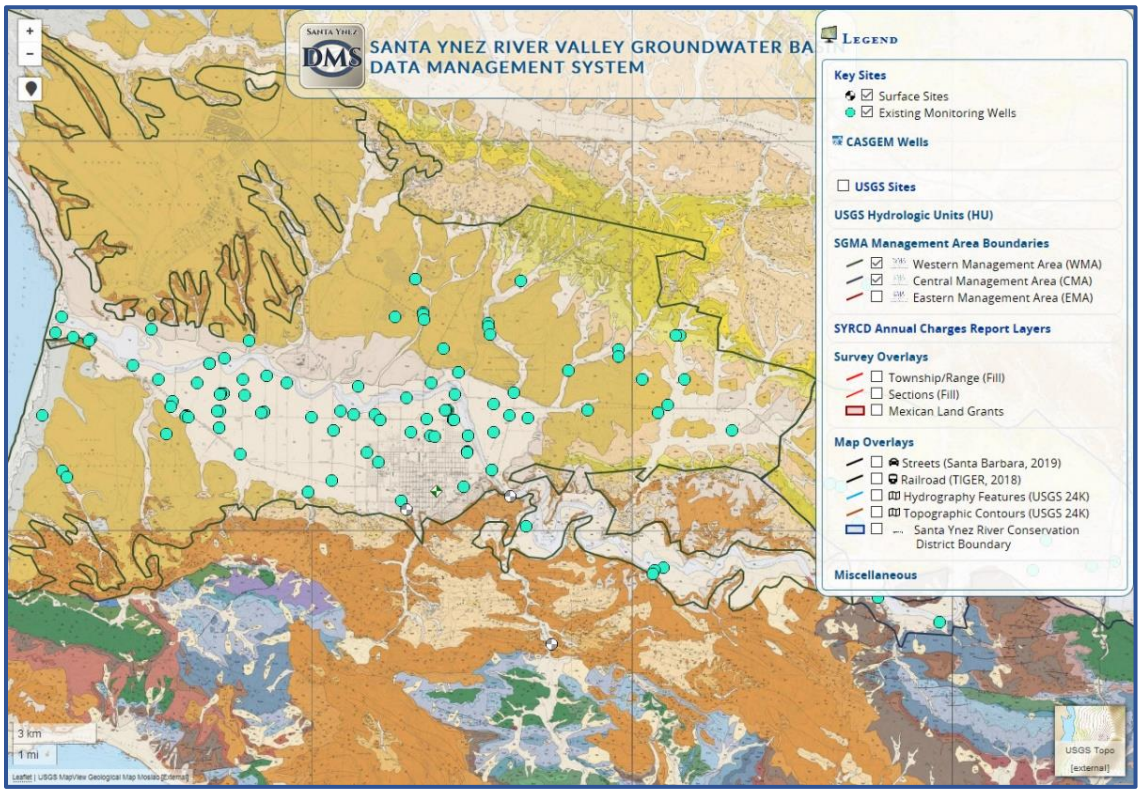
DRAFT FINAL
DATA MANAGEMENT PLAN



Screenshot including streaming geologic maps from the U.S. Geological Survey.

WMA

Santa Ynez River Valley Groundwater Basin
Western Management Area
Groundwater Sustainability Agency

Prepared by:

STETSON ENGINEERS INC.

DUDEK

Geosyntec consultants

FEBRUARY 2020

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GLOSSARY OF TERMS/ABBREVIATIONS

Acronym/Abbreviation	Definition
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
BibTeX	*Software Name (Bibliography for TeX)*
CA	California
CASGEM	California Statewide Groundwater Elevation Monitoring
CEDEN	California Environmental Data Exchange Network
CMA	Central Management Area
CSD	Community Services District
CSS	Cascading Style Sheets
CSV	comma-separated values
DMS	Data Management System
DOGGR	Division of Oil, Gas, and Geothermal Resources
DOI	Digital Object Identifier
DWR	California Department of Water Resources
elog	electrical log
EMA	Eastern Management Area
Esri	*Company name (formerly Environmental Systems Research Institute)*
GIS	geographic information system
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HTML 5	Hypertext Markup Language, version 5
HTTP	Hypertext Transfer Protocol
JPEG	Joint Photographic Experts Group
JSON	JavaScript Object Notation

Acronym/Abbreviation	Definition
LAMP	Linux, Apache, MySQL, PHP (or Perl, or Python)
LAS	Log ASCII
MariaDB	*Software Name*
MLA	Modern Language Association; in the context of a citation style
MySQL	*Software Name*
PHP	PHP: Hypertext Preprocessor
QGIS	*Software Name (formerly Quantum GIS)*
REST	Representational state transfer
RIS	Research Information Systems
SFTP	SSH File Transfer Protocol
SGMA	Sustainable Groundwater Management Act
SQL	Structured Query Language
SSH	Secure Shell
SYRVGB	Santa Ynez River Valley Groundwater Basin
SYRWCD	Santa Ynez River Water Conservation District
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
VPS	virtual private server
WAT	California Water Code
WMA	Western Management Area
XML	Extensible Markup Language
XMP	Extensible Metadata Platform

1 INTRODUCTION

State of California law, the Sustainable Groundwater Management Act (SGMA), requires that all groundwater basins identified by the state as medium- or high-priority groundwater basins achieve sustainability by January 2042. To meet this target, state law requires the creation and implementation of a Groundwater Sustainability Plan (GSP) covering all of the identified groundwater basins. Each basin can have a single plan or multiple plans submitted under a coordination agreement. The SGMA law requires a Data Management System (DMS), a tool to organize and maintain data as part of GSP preparation and implementation. The DMS will be used throughout the GSP process.

The Santa Ynez River Valley Groundwater Basin (SYRVGB) is located in Santa Barbara County in the central coast region of California (Figure 1-1). California Department of Water Resources (DWR) made a determination in 2014 that the SYRVGB was a medium-priority groundwater basin and subject to a January 31, 2022, deadline for developing a GSP. To best address specific concerns and conditions unique to portions of the basin, the SYRVGB has been divided into three management areas run by separate Groundwater Sustainability Agencies (GSAs). The Western Management Area (WMA) GSA is responsible for preparing the GSP for its portion of the SYRVGB with the remainder of the SYRVGB managed by the two other management areas: the Central Management Area (CMA) and Eastern Management Area (EMA). This document describes how the DMS is being implemented as part of the GSP development for the WMA (Figure 1-2).

The WMA consists of the western portion of the SYRVGB as shown in Figure 1-2. The subareas of the WMA consist of the Lompoc Plain, Lompoc Terrace and Lompoc Upland, the Santa Ynez River alluvium west of the confluence with Santa Rosa Creek, and the Santa Rita Upland. The WMA committee comprises representatives of five-member public agencies. The three public agencies wholly within the WMA all run public water systems: the City of Lompoc, Vandenberg Village Community Services District (CSD), and Mission Hills CSD. The two remaining public agencies, the Santa Ynez River Water Conservation District (SYRWCD) and the Santa Barbara County Water Agency, are water management agencies that do not directly supply drinking water but their authorities extend into all three management areas. The WMA includes portions of both Vandenberg Air Force Base and Federal Correctional Institution Lompoc; however, these are both federal entities and are not subject to SGMA.

This report describes the structure and content of the DMS being prepared for the WMA. Chapter 2 reviews the goals of the DMS, which include meeting the statutory requirements under SGMA, as well as aiding in the development of the GSP. Chapter 3 describes the architecture of the DMS, including the technical computer software, hardware, and data storage components. Chapter 4 describes the data sources (e.g., federal, state, and local resources) that will be housed in the DMS. Chapter 5 describes user access features, including the procedures to login, query,

and import/export data from and to the DMS. Chapter 6 identifies the security considerations in the DMS and the various administrative duties and roles in developing and maintaining the DMS.

The WMA and CMA have reserved the following domain name for access to their DMS:

https://sywater.info/

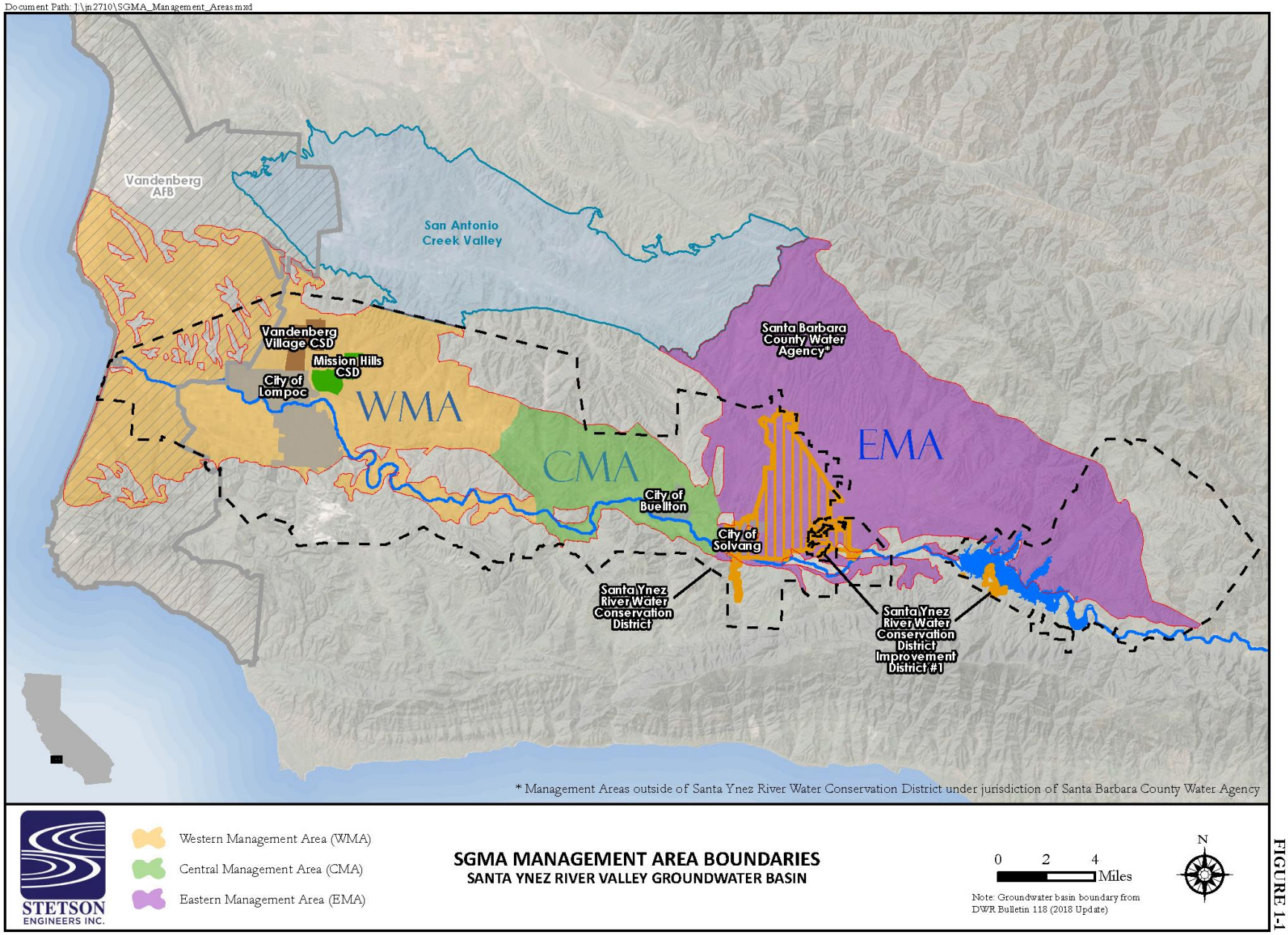
1.1 Goals of the Sustainable Groundwater Management Act

The California legislature identified the following specific goals that intended to be achieved as a result of the execution of the SGMA (CA WAT Section 10710.2):

> In enacting this part, it is the intent of the Legislature to do all of the following:
>
> (a) To provide for the sustainable management of groundwater basins.
>
> (b) To enhance local management of groundwater consistent with rights to use or store groundwater and Section 2 of Article X of the California Constitution. It is the intent of the Legislature to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater.
>
> (c) To establish minimum standards for sustainable groundwater management.
>
> (d) To provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.
>
> (e) To avoid or minimize subsidence.
>
> (f) To improve data collection and understanding about groundwater.
>
> (g) To increase groundwater storage and remove impediments to recharge.
>
> (h) To manage groundwater basins through the actions of local governmental agencies to the greatest extent feasible, while minimizing state intervention to only when necessary to ensure that local agencies manage groundwater in a sustainable manner.
>
> (i) To provide a more efficient and cost-effective groundwater adjudication process that protects water rights, ensures due process, prevents unnecessary delay, and furthers the objectives of this part.

To achieve the goals identified by SGMA, the DMS will be a central source for groundwater data, specifically for the WMA, providing up-to-date technical information regarding basin

conditions. Collecting and centralizing these data is a step towards meeting the goals of protecting water rights and ensuring local agencies continue to manage groundwater while minimizing state intervention. In addition to meeting these intentions, SGMA specifically requires the use of a DMS.


Document Path: J:\jn2710\SGMA_Management_Areas.mxd
Vandenberg AFB
San Antonio Creek Valley
Vandenberg Village CSD
Mission Hills CSD
City of Lompoc
WMA
CMA
EMA
Santa Barbara County Water Agency*
City of Buellton
City of Solvang
Santa Ynez River Water Conservation District
Santa Ynez River Water Conservation District Improvement District #1
* Management Areas outside of Santa Ynez River Water Conservation District under jurisdiction of Santa Barbara County Water Agency
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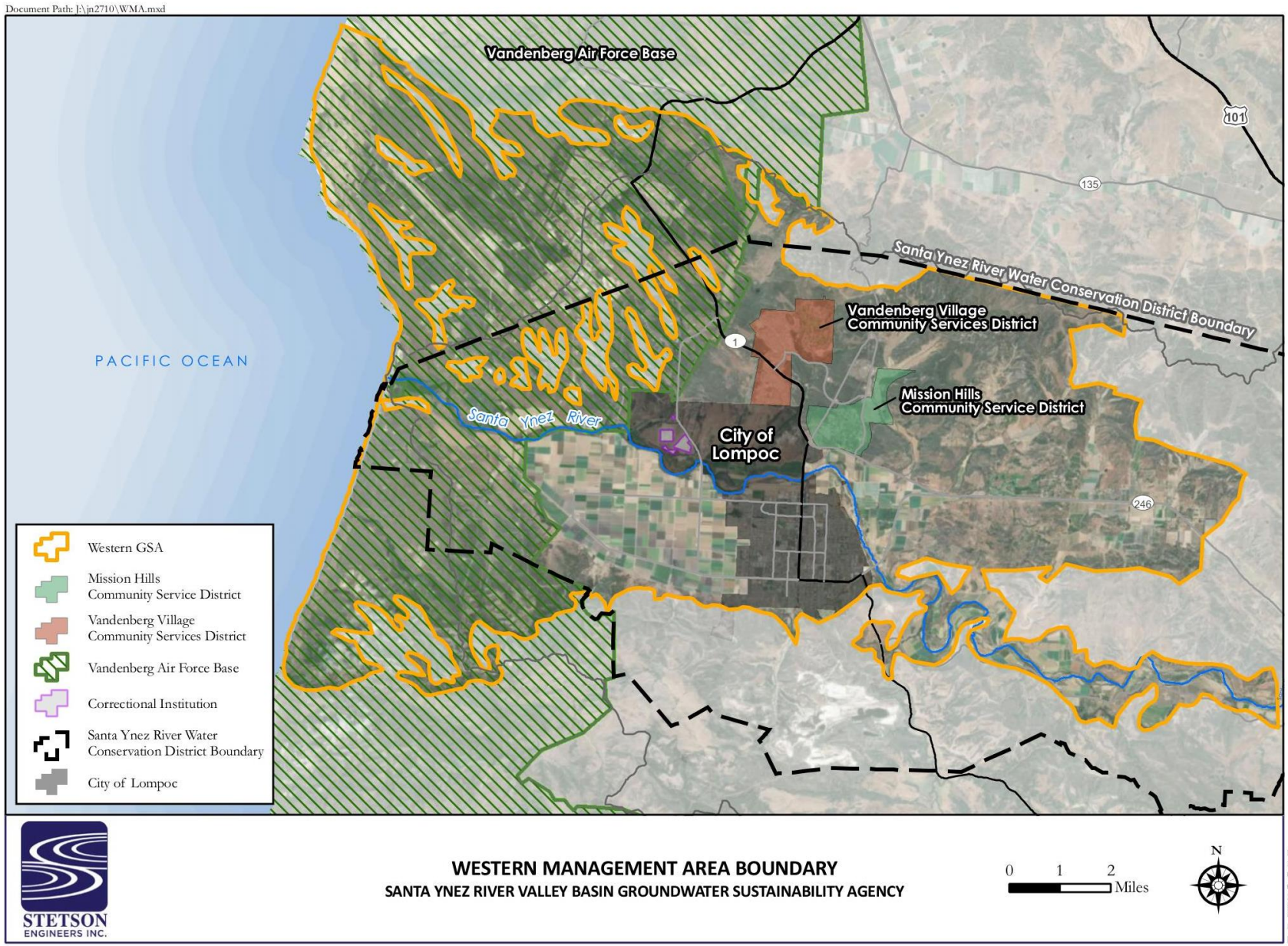
Western Management Area (WMA)
Central Management Area (CMA)
Eastern Management Area (EMA)
SGMA MANAGEMENT AREA BOUNDARIES
SANTA YNEZ RIVER VALLEY GROUNDWATER BASIN
0 2 4 Miles
Note: Groundwater basin boundary from DWR Bulletin 118 (2018 Update)
N

FIGURE 1-1


Document Path: J:\jn2710\WMA.mxd
Vandenberg Air Force Base
PACIFIC OCEAN
Santa Ynez River Water Conservation District Boundary
Vandenberg Village Community Services District
Mission Hills Community Service District
Santa Ynez River
City of Lompoc
101
135
1
246
Western GSA
Mission Hills Community Service District
Vandenberg Village Community Services District
Vandenberg Air Force Base
Correctional Institution
Santa Ynez River Water Conservation District Boundary
City of Lompoc
STETSON ENGINEERS INC.
WESTERN MANAGEMENT AREA BOUNDARY
SANTA YNEZ RIVER VALLEY BASIN GROUNDWATER SUSTAINABILITY AGENCY
0 1 2 Miles
N
FIGURE 1-2

2 GOALS OF DATA MANAGEMENT SYSTEM

DMS implementation goals include improving data collection and storage, and assisting in the understanding and future reporting about groundwater conditions in the WMA. The SGMA GSP Regulations, Section 352.6., on Data Management Systems states:

> Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin.
>
> Source: CA WAT Section 10733.2. Reference: CA WAT Sections 10727.2, 10728, 10728.2, and 10733.2.

Per these regulations, there are two main goals of the DMS, (1) to support the development of the GSP and (2) to provide a data framework for the continued monitoring of the WMA. The DMS will serve as the central repository of information during the development and implementation of the GSP.

2.1 Support of Hydrogeologic Conceptual Model Development

One of the first uses of the DMS is in supporting the development of the hydrogeologic conceptual model. The hydrogeologic conceptual model describes the regional geologic structural setting and current conditions of the WMA groundwater basin, as well as the components of water exchange throughout the hydrogeologic system.

The DMS contains information about the existing wells in the basin. For each of these wells, existing data have been or will soon be populated within the tables of the DMS, including groundwater level data, well construction information, well logs, geophysical data, pumping test data, water quality data, and pumping data. In addition, the DMS houses data related to land subsidence, surface water flows, and total water use in the WMA.

Use of the DMS will allow for rapid determination regarding which parameters currently have data gaps and/or uncertainty to aid in the preparation of the Data Gaps Analysis and the course of action required to acquire any additional data that are needed to support sustainable groundwater management. The Data Gaps Analysis is a required assessment of the monitoring network as part of the GSP and the 5-year assessment. It requires each GSP to identify any lack of information that significantly affects the understanding of basin setting or evaluation or of the efficacy of the GSP implementation.[1]

[1] Groundwater Sustainability Regulations 23 CCR Section354.38

2.2 Monitoring Network

The DMS is being used to store and access the WMA data, which will include the WMA Monitoring Network data. The Monitoring Network is a SGMA concept, which will consist of the groundwater monitoring, surface water monitoring, and other sites where data will be collected to evaluate if the basin is sustainable during the implementation phase of the project.

According to the SGMA, "sustainable management" means that none of the following six indicator criteria occur:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
2. Significant and unreasonable reduction of groundwater storage
3. Significant and unreasonable seawater intrusion
4. Significant and unreasonable degradation of water quality
5. Significant and unreasonable land subsidence
6. Depletion of interconnected surface water and groundwater that has significant and unreasonable adverse impacts on beneficial uses of the surface water

SGMA requires that the GSP identify how each sustainability indicator criteria will be quantified from measurements from the Monitoring Network. The GSP is required to include quantitative goals in terms of minimum thresholds and 5-year interim milestones for each sustainability indicator criteria and, during implementation phase, meet the identified minimum thresholds and interim milestones.

As part of ensuring reliability of results, SGMA identifies particular requirements for groundwater monitoring, surface water monitoring, and other sites to be included in the Monitoring Network. For some existing monitoring sites in SYRVGB, this includes additional criteria that must be met before the existing monitoring site can be used as part of the Monitoring Network for SGMA. Data collected from the WMA Monitoring Network will follow the GSP Regulations Best Management Practices, specifically *Monitoring Protocols, Standards, and Sites* (DWR 2016c), and *Monitoring Networks and Identification of Data Gaps* (DWR 2016b). Existing sites may be supplemented as needed to ensure each indicator criteria is sufficiently monitored.

The output from the DMS will be constructed for easy input into the DWR's GSP submittal tool, which will be used for SGMA monitoring report submittals.

3 SYSTEM ARCHITECTURE

The DMS system architecture is based upon the needs and requirements of the WMA. If during the development of the SGMA project, additional or different needs are identified, aspects of the architecture may be adjusted to satisfy these needs.

The plan for the DMS is that a user's primary mode of interaction will be to open and interact with a web application through a modern web browser. Several user levels and roles have been established with different access privileges, and some roles have limited administrative capacity.

3.1 Platforms

The DMS platform for the WMA will be a web application built on the Linux Apache MySQL PHP (LAMP) web stack, which is a mature open source platform, scalable to the needs of the WMA. The LAMP web stack consists of the following set of software:

- L Linux operating system, currently the DMS is on a Fedora Linux distribution
- A Apache webserver
- M MySQL-compatible database (database) server, currently the DMS is on a MariaDB installation
- P PHP scripting

In additional to the database server, a map server is also being run on the system to provide access to certain kinds of complex geospatial data. A map server is an intermediary program that takes the source geographic information system (GIS) data and provides it on demand in a format that client interface programs can access. Currently, this map server is the QGIS server program and the MapProxy cache program. Additional user notification is provided through an email service, currently through the Postfix program.

End user interaction with the DMS is through a web application, which interfaces with the LAMP stack with a standard web front end, using JavaScript, CSS, and HTML 5, which requires the user to have a modern web browser.

3.2 Scripts

In addition to the components of the DMS that react to the user input or push telemetry, the DMS as a system includes scheduled programming. Most of these scripts are written in Perl or Python. Scripting is for various automated items, which include automated pull requests to telemetry, automated quality control, automated user notification, and general automated application maintenance.

3.3 Data Location

The DMS is planned to be contained and stored within a single server, which will include the data and scripting as described in Section 3.4, Data Types. The DMS web application is designed to function without any external dependencies; however, some external third-party map data may be provided as links rather than mirrored within the system. Externally linked map data and layers are not controlled by the DMS and may become unavailable, which requires the user have an internet connection to access.

The DMS is currently located on a virtual private server (VPS) rented from a datacenter. VPS hosting is a fixed server with dedicated resources for a set price, unlike cloud hosting where resources are not fixed, and price is related to metered usage of resources. The VPS was selected for more predictable pricing. The current VPS provider for the WMA DMS is Host Winds.

Because the DMS data are contained within a single server, the DMS can easily be transferred to many other server configurations, maintaining flexibility for future requirements.

3.4 Data Types

There are a range of data types that are included as part of the DMS. To the extent possible, data will be inserted in the database; however, there is additional information that is not easily included in the database (e.g., technical reports, some well and surface site files, complex geospatial data).

3.4.1 Database

The primary use of the database will be to host indexed data that can contain the following types of data:

- **Time-Invariant Location Data** – This data is used for indexing and describing locations (e.g., wells and surface sites such as stream gages).
- **Time-Variant Data** (e.g., groundwater water levels, pumping data, or streamflow) – This data generally consists of a location index, a measurement time, a measurement type identifier, a value, and a value qualifier
- **General Information –** This information is used in the interpretation of the previously listed data types (e.g., U.S. Geological Survey [USGS] parameter code list, various set regulatory tables). Each well will have corresponding database fields containing the well identifier data, site information, construction details, and well screen information.
- **Basin Condition Document Metadata –** Metadata fields include publication data, author, alternative Digital Object Identifier (DOI) or URL web address, and geographic extents; not all documents will have all metadata fields. DOI is a persistent document identifier that is designed as fixed way to resolve a document through an intermediary

service that maintains a link to the active resource, unlike a URL, which is a direct link to where it is currently located.

- **Web Application Access Data** – This data includes web users, web user roles, and items such as the web user contact information, specific access-granted roles, and encrypted copies of web user passwords. Other data included here would be access logs which track usage of the web application, including web user, IP addresses, login times, and browser details.

The DMS database plan is to exclude stakeholder information used for communication and outreach.

3.4.2 Technical Report Format

A second set of data, which are indexed by the database but not contained within, are digital copies of published and unpublished documents regarding conditions within the basin. These are saved in the standard PDF. These will be provided and saved using unique identifiers, and the metadata will be stored in the database.

3.4.3 Well and Surface Site Data

Additional data types indexed by, but not contained, in the database include the following:

- Photographs of the wells and surface sites are expected to be stored outside of the database in JPEG format. Panoramic images, if they are included, are expected to have the included metadata (XMP format) set properly.
- Well completion reports are expected to be stored as PDFs. Most of the data interpreted from the well completion reports will be entered into the database tables. These may include, as part of the report package, pump test summaries and geophysical data (e.g., electrical logs and gamma ray logs).
- Interpreted well logs are expected to be stored as comma-separated value (CSV) files.

3.4.4 Geospatial Data

In addition to the geospatial data included in the database, there are other geospatial datasets that are included as part of the DMS. These include both vector and raster datasets, and a summary of these geospatial data types are as follows:

- Geographic vector datasets that that are relatively simple in terms of styling and small in terms of file size are generally saved in as GeoJSON format. This format is a structured version of the JSON (JavaScript Object Notation), a JavaScript data-interchange format, specifically for geospatial data. Additionally, the DMS may have programming (JavaScript) that adds interactivity based on the fields contained in the file.
- For large or complex vector datasets or raster datasets, the datasets are stored in the original format (e.g., Esri shapefile) and made accessible through the map server following

the Web Map Service protocol. When data are requested by the user, the map server renders the GIS format data into image tiles, which are then sent to the user.
- For some large or complex datasets, data may be pre-rendered and stored as a series of image tiles.

The selection of the method of storing and transmitting a geospatial dataset depends on the details of the dataset and needed output, as well as on constraints (e.g., available computing resources).

In addition to the key geospatial data that are hosted on the DMS server, the DMS may link to external geospatial data hosted by third parties. Currently, this linked external third-party geospatial data are primarily from federal and State of California servers, and include various aerial imagery, supplemental topographic data, and geological maps with copyright restrictions. Third-party data by nature are not controlled or managed by the DMS, so availability may be subject to change. The server currently provides a cache of some of these third-party data services to reduce the impact on these third-party services.

To protect confidentiality of data, access to the map server and other data requires an active login to the DMS website, which is not available to third parties.

3.5 Backup

The following two separate types of backup are used to ensure reliability of the DMS:

- **Cloud backup**, which includes automated nightly backup snapshot to a cloud storage system. This currently uses the restic program, which includes built-in encryption and authentication to protect data and ensure data integrity. Backup using this method occurs automatically, and backup snapshots in this system are removed automatically after 60 days.
- **Physical backup**, which are a transfer of a copy of the entire DMS to a dedicated physical hard drive located at a different and physically secured location. These backups are conducted on a periodic basis, currently once a quarter. The process currently has several manual steps in downloading and transferring copies of the files. Backup snapshots are expected to be available for years.

In addition to the whole DMS backup, portions of the programming code common to other DMS projects are entered into one of several distributed version control to track changes and quickly roll out patches and improvements. The centralized location of these files (i.e., the repositories) are currently on GitHub, a subsidiary of Microsoft. These repositories are utilized whenever changes are made to the common code base.

3.6 Intra-Basin Consistency/Formats

The SYRVGB was divided into three management areas for SGMA to address specific concerns and conditions unique to portions of the basin: the WMA, CMA, and EMA (Figure 1-1).

There are two consultant teams performing GSP activities in the SYRVGB. The two teams are working together to ensure intra-basin coordination to submit three GSPs, one for each Management Area.

Management Area	Physical Description	Committee Agencies
WMA Santa Ynez River Valley Groundwater Basin Western Management Area Groundwater Sustainability Agency	• Santa Ynez River alluvium west of the confluence with Santa Rosa Creek to the Narrows • Lompoc Plain • Lompoc Terrace • Burton Mesa • Lompoc Upland • Santa Rita Upland.	• City of Lompoc • Vandenberg Village Community Services District • Mission Hills Community Services District • Santa Ynez River Water Conservation District • Santa Barbara County Water Agency
CMA Santa Ynez River Valley Groundwater Basin Central Management Area Groundwater Sustainability Agency	• Santa Ynez River alluvium east of the confluence with Santa Rosa Creek to just west of the City of Solvang • Buellton Upland	• City of Buellton • Santa Ynez River Water Conservation District • Santa Barbara County Water Agency
EMA Santa Ynez River Valley Groundwater Basin Eastern Management Area Groundwater Sustainability Agency	• Santa Ynez River alluvium from City of Solvang east • Santa Ynez Upland	• City of Solvang • Santa Ynez River Water Conservation District, Improvement District No.1 • Santa Ynez River Water Conservation District • Santa Barbara County Water Agency

The WMA and CMA both have a similar management history and similar datasets from SYRWCD, so currently both WMA and CMA use the same database and general interface. Some specific data tables and data views are only relevant to a single management area. Data management plans for the CMA and EMA were prepared separately.

The EMA is being organized through a different consultant utilizing a separate and different system. Currently, the plan is to develop a common protocol to share data with the EMA.

The primary method of consistency between the three management areas of the SYRVGB will be to use a common dataset generated by third parties. The WMA and CMA team has provided the EMA team with source datasets from the USGS, County of Santa Barbara, and U.S. Bureau of Reclamation (USBR).

Where there are unique datasets generated in one or more of the management areas, the EMA consultant has agreed to work together to ensure that any unique data can be shared across the basin. If there are data to be shared on a regular basis, the EMA consultant and the WMA and CMA consultant team have agreed to work together to develop a common protocol for sharing data (e.g., an XML, JSON, or structured Excel file[2]) through which all three management areas can communicate.

[2] XML (Extensible Markup Language) is a markup language for making documents that are human and machine-readable, and can contain data structures. JSON is the JavaScript data-interchange format likewise can contain data structures. Excel file refers to the common Microsoft Excel document formats of the CSV, XLS (Excel 97-Excel 2003), XLSX (an XML-based format for 2007), which also can contain data structures.

4 DATA SOURCES AND QUALITY

The existing historical and current water resources monitoring and management programs within the WMA will be utilized and incorporated into the DMS as described in the following sections, including federal, state, and local programs.

4.1 Data Sources

4.1.1 Federal Data Sources

A key federal source of data will be the USGS, which includes historical groundwater elevations and surface water flows. Data are stored electronically in the National Water Information System files and are retrievable from the USGS Water Resources website. This dataset is reviewed by the USGS and available through well-formatted interfaces, called REST Application Programming Interfaces (APIs), which provide data in a structured XML format upon request. Included is location information, necessary measurement information[3] in addition to the measurement result, a description of the measurement being conducted, and the units of measurement. In addition, the WMA has numerous USGS hydrogeological studies, whose data will be incorporated in the WMA DMS.

Another federal dataset is from the USBR, which holds the water rights permits for the Cachuma Reservoir, located about 35 miles upstream of Lompoc. As part of the conditions of this permit, USBR collects monthly groundwater level data along the Santa Ynez River alluvium and within the Lompoc Plain.

4.1.2 State Data Sources

State of California sources of data include the DWR's California Statewide Groundwater Elevation Monitoring (CASGEM) Program. DWR works cooperatively with local agencies (County of Santa Barbara), referred to as CASGEM "Monitoring Entities," to collect and maintain groundwater elevation data in a manner that is readily and widely available to the public through the CASGEM online reporting system.[4]

The state will be a source for well drilling information. DWR has compiled well completion reports for successful and unsuccessful groundwater wells and has made these available online with

[3] Additional metadata about the measurement. For water level data, this includes indicators that the measurement is impacted by recent or nearby pumping, estimated, etc. For water quality data, this may include method accuracy, as well as meaning of non-detect or other "zero" values.

[4] As of 2019, there are four CASGEM wells in SYRVGB: one in the CMA and three in the WMA. The County of Santa Barbara is the current source agency for collecting and sending to DWR the groundwater level data for both the CASGEM wells and CASGEM voluntary wells.

redacted personal information (per CA WAT Section 13752[2])[5]. These well completion reports describe aspects of the installed well and generally include driller well logs that describe the nature of the formations encountered while drilling. Because there are over 2,000 wells in the SYRVGB, data from wells determined to be "key wells" will be included in the DMS. These key wells are the wells which are most useful for assessing the basin. A key well has a known and accurate well location (geographically and vertically), depth of the well, availability and completeness of the lithological log, availability of geophysical logs, and proximity to other wells or key features. Not all wells will be designated as a "key well".

Additionally, information about petroleum and gas wells will be retrieved from the California Division of Oil, Gas, and Geothermal Resources (DOGGR) database. This dataset includes geophysical well logs, generally as an analog PDF rather than in the digital Log ASCII (LAS) format. Key wells in this dataset will be identified, and information such as geological horizons and other pertinent geologic data will be entered in the DMS.

These databases will be reviewed, and well sites with useful information will be incorporated into the WMA DMS. The State Water Resources Control Board's water rights database will also be queried for information to import into the WMA DMS (e.g., location information).

For water quality, two additional state databases will be utilized for the WMA DMS, including the State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program database and California Environmental Data Exchange Network (CEDEN).

For climate data, the California Irrigation Management Information System stations in the Santa Ynez River watershed will also be utilized in the WMA DMS. This data may also be used for the determination of water use in the basin.

4.1.3 County Data Sources

The Santa Barbara County Water Agency currently conducts precipitation monitoring and, as of Spring 2019, conducts annual groundwater level monitoring that was previously conducted by the USGS. Precipitation and groundwater data from the county will be included in the WMA DMS.

The Santa Barbara County Water Agency provided copies of their staff "field notebook," which documents the water level collection activities. The field documentation was originally developed by the USGS and includes various digital images, some of which are photos of wells, scans of water level documents such as owner contact information, site sketches, and other notes. As appropriate, these data will be incorporated into the DMS.

[5] CA WAT Section 13752(b) "[...] the disclosure of a report [...] shall comply with the Information Practices Act of 1977 [...]"

The Santa Barbara County Department of Environmental Health Services has well records of wells that were drilled within the WMA. The data are organized by the Assessor's Parcel Number. These records are in hard copy form and are located at the Department of Environmental Health Services Santa Maria office. Many of the records were digitized as part of the data collection effort and are under review for possible inclusion in the DMS. Confidential or personal information will be redacted.

4.1.4 Municipal, Water District, and Other Data Sources

Data obtained from the WMA member agencies will be imported into the WMA DMS. This includes hydrogeologic data from the City of Lompoc, Vandenberg Village Community Services District, and Mission Hills Community Services District. In addition, available groundwater data from the SYRWCD and the Vandenberg Air Force Base will be obtained and imported into the WMA DMS. Data that are confidential will not be included in the WMA DMS.

SYRWCD records are expected to be the primary source of groundwater pumping data, as water users in the WMA and CMA have been required to report groundwater pumping on a bi-annual basis since start of the water supply reports in the 1979. The effort will be in digitizing many of these historical paper records.

4.2 Data Quality and Quality Control Plan

The SGMA GSP Regulations Section 354.44 (c) states that "Projects and management actions shall be supported by best available information and best available science." The above sources constitute the "best available information" for the WMA that is consistent with scientific and engineering professional standards of practice.

Data will be evaluated for validity and acceptable use for the GSP preparation. Data compilation and review will identify potential data gaps or unacceptable levels of uncertainty, which may facilitate focused discussions with the WMA GSA. When different sources of data have different values for the same parameter (i.e., well location or land surface elevation), a source and comments data field (column) will be associated with the current value.

Initially, all data will be collected and imported into the WMA DMS. Sites will be reviewed and screened in a three-tiered process for the purposes of potential inclusion in the WMA Monitoring Network. Sites in the Monitoring Network will be shared with the other two management areas:

Tier 1: Data Meets All Criteria for Inclusion in the GSP

Tier 1 data will be used in the future monitoring program for the WMA GSP. These data meet all the compliance criteria outlined in the SGMA regulations for inclusion in a SGMA Monitoring Network (i.e., SGMA GSP Regulations Section 352.4). Measurable objectives and minimum

thresholds will be established as part of the evaluation of the SGMA sustainability indicators. Data will be field validated for inclusion in the WMA Monitoring Network.

Data evaluated as part of the Tier 1 review will be included in the DMS. This tier of data will be shared with the other management areas as part of intra-management area coordination agreement.

Tier 2: Meets Partial Criteria – May or May not be included in the GSP

Data that do not meet all the criteria for inclusion in the WMA GSP monitoring network may be useful in developing the hydrogeologic conceptual model. For example, if a well has a significant amount of historical water level data but lacks well casing or total depth information, or conversely, if a well has a lithological well log available but no historical water level data, these wells can still be used to develop the hydrogeologic conceptual model. Because SGMA GSP Regulations Section 352.4 (c) (3) states, "Well information used to develop the basin setting shall be maintained in the Agency's data management system," these additional wells are an important part of the WMA DMS.

Wells and surface sites that are identified in this tier of the process will be included in the DMS, but professional judgment will be used as to the relevance and usefulness of these data for the GSP. This tier of data may or may not be included as part of intra-management area coordination with the CMA and EMA.

Tier 3: Minimum Criteria – Not for Inclusion in the GSP

Data that do not meet the criteria for the WMA GSP (Tier 1) or have no useful information (Tier 2) will be included in Tier 3. As a default, this tier of data will be "turned off" (i.e., not visible) in the DMS but will be held in the DMS in case additional information is obtained in the future that would change the tier classification of the data. A low amount of effort will be employed on these sites, and wells as part of this layer will generally be excluded from intra-management area coordination with the CMA and EMA.

5 USER ACCESS

Users will primarily access the DMS through a web application; users will be assigned specific roles and given specific permissions to access the DMS. The web interface will require the user to access the DMS through a modern web browser; older browsers may provide less or no functionality.

5.1 Allowed Users

Development and use of the DMS is for the development and implementation of the GSP on behalf of the WMA GSA. It is intended that staff of the WMA GSA committee will have access to the DMS, as will the consultant team working for the WMA GSA committee.

Management Area	GSA Agencies
WMA Santa Ynez River Valley Groundwater Basin Western Management Area Groundwater Sustainability Agency	• City of Lompoc • Vandenberg Village CSD • Mission Hills CSD • Santa Barbara County Water Agency • Santa Ynez River Water Conservation District
CMA Santa Ynez River Valley Groundwater Basin Central Management Area Groundwater Sustainability Agency	• City of Buellton • Santa Barbara County Water Agency • Santa Ynez River Water Conservation District

5.1.1 Administrative Access

A selected staff member from one of the WMA GSA Agencies will have administrative access rights. Administrative access allows for adding, removing, and editing web user permissions, and the ability to upload and remove documents and data.

5.1.2 Staff and Other User Access

Identified staff from WMA member GSAs will have general access to view documents and data, including direct access to the map server. Documents and data may be restricted by management area or agency. Information that forms the eventual Monitoring Network to be submitted to DWR will be available to all staff. Other access may be granted as approved by the GSA Committee

5.2 Login Procedures

Access to the DMS will be controlled through a username and password login system with a username having a specific defined role on the website; each role has specific defined privileges to access data or conduct limited administrative actions.

In most cases, the user's registered email can be used in lieu of the username. User information will be set to automatically populate the username and login information by default. To protect web user passwords if the DMS is ever compromised, web user passwords will be stored as encrypted hashes.

5.2.1 Account Recovery

The DMS includes automated retrieval of account access if username and/or passwords are forgotten. The application will email the web user to the email address on file, sending a recovery link that will allow the user to reset their password and regain access the DMS. This feature requires the web user to maintain control of their email account.

5.3 Queries

As described in Chapter 3, access through to the underlying MySQL-compatible database is mediated through the PHP programming.

DMS data in the database is generally accessed through two approaches: a well/site-specific approach or a data source approach.

5.3.1 Site-Specific Query

The site-specific approach has the user identify the data, well, or surface site of interest. The location of interest is selected by the user either through a map interface or through pages with a search and list features. Data are then provided about that well or surface site.

Well or site information may include well properties, images of the well or well log, geophysical logs, or time-series data (e.g., production, water level elevation, or depth to water) pulled from various databases.

This site-specific approach allows for additional insights to be provided to the user, such as the land surface at the site, well perforations, and relationship between water level depth and water level elevation at that well.

If public access is granted by the GSA committee, that access will be restricted to protect private or confidential information. Geospatial location information (e.g., particular well locations) may

be truncated and/or randomized through this interface to de-identify personal or private information.

5.3.2 Data Source Approach

This approach has the user navigate to a page for each specific source of data. This includes groundwater level data and water quality, geophysical, well construction, surface water, and other data. The page consists of a map showing the sites the data were collected from, a list of sites, and the available data at each site. The user can select data either through the map or through the list, and can easily compare several sites for the given source. Using the interface, the user can compare one or more datasets to established thresholds, limits, or other criteria established by the GSA, state, or federal agency.

The way data will be viewed will be further developed as various datasets are incorporated into the DMS.

5.3.3 Mixed Graph Approach

This graphing feature allows pulling together two or more datasets that are not necessarily related by location or source of data. An example of this would be stream gage and depth to groundwater data, surface water and groundwater data, and water quality data. The DMS will include a search feature for identifying what datasets are available.

5.3.4 Library Search

The library currently provides several ways to search the metadata, including by title, year, and keywords.

5.4 Data Export

5.4.1 Water Data Export

All available graphs currently have a data export feature that exports the data queried in the graph to a Microsoft Excel file, in addition to providing download options into various image formats.

5.4.2 Library Metadata Export

The library functions include export features to a set of selected citation manager formats, including RIS, Microsoft Word XML, and BibTeX.

Citation management software is used in track works cited or used in the document and formatting to match specific bibliography and citation styles. Using citation management software is a best practice when writing for a publication, as various publications generally specify a bibliography and citation style such as the Chicago or MLA.

5.4.3 Library Document Download

Individual PDFs can be downloaded directly through the web interface. The DMS supports full pause and resume download functionality. The pause and resume feature on the server requires that the client software supports the HTTP range request, a feature that is available in all modern web browsers.[6]

5.5 Data Import

5.5.1 Library Data Import

Certain user roles allow editing of the library metadata, as well as uploading and deleting PDFs through the web user interface.

5.5.2 Water Data Import

Currently, the ability to import water data is limited to the DMS administrators. Some datasets that originate from third parties with published APIs (e.g., the USGS data through National Water Information System) may be automatically fetched and updated on a scheduled basis.

Additionally, if telemetry is deployed, the DMS may be configured to accept specific push requests, and DMS scripting can be configured for automated pull requests.

5.6 Annual Reports and Monitoring Network

SGMA Section 10728 on Annual Reporting by the GSA to DWR states:

> "On the April 1 following the adoption of a groundwater sustainability plan and annually thereafter, a groundwater sustainability agency shall submit a report to the department containing the following information about the basin managed in the groundwater sustainability plan:
>
> (a) Groundwater elevation data.
> (b) Annual aggregated data identifying groundwater extraction for the preceding water year.
> (c) Surface water supply used for or available for use for groundwater recharge or in-lieu use.
> (d) Total water use.
> (e) Change in groundwater storage."

[6] Browser support for the HTTP Range request: https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Range#Browser_compatibility, accessed 2019-08-15.

The WMA DMS will be the primary tool used to compile these data each year for the annual report. The WMA DMS will contain the sites used in the WMA Monitoring Network (Section 2.2). The DMS is planned to automate the generation of the tables and figures for the annual report. The output from the DMS will be constructed to easily input to the DWR GSP submittal tool, which includes the process for the annual monitoring report submittal.

6 ADMINISTRATION

The DMS platform is built on top of a LAMP web stack, and depending on the administrative task, administration requires interaction with different portions of the stack, and different access levels. Some web user roles have limited ability to access or administer parts of the DMS platform; most administration tasks on the DMS will be conducted by the consultant team.

6.1 Security

Security covers several topics and concerns related to malicious actions such as damaging the system, intercepting information, denying access to the system, falsely spoofing the system, or using the system to cause damage to others. Since the DMS is expected to be connected to the internet, there are expected to be constant low-level attacks. A general defense-in-depth strategy has been employed.

6.1.1 Linux User Access Limitations

Currently the DMS firewall allows only specific whitelisted IP addresses to connect to the SFTP/SSH port (22) as the root user. This denies potential access to the thousands of daily attempted unauthorized logins.

General SFTP (port 22) user access can be granted to provide a secure way to share data. SFTP access spaces are in a chroot jail[7] and are denied shell access in order to limit the amount of potential damage from inappropriately disclosed usernames and passwords.

6.1.2 Database Access Limitations

Access to the database is not directly available to remote users through the standard MySQL port (3306) for direct login. All access must be from the local server (e.g., from PHP) or from a Linux user logged-in through an encrypted connection. This limits the potential for unencrypted data to be intercepted.

This is enforced at several levels. At the MySQL database level, all users are required to login from the localhost, additionally the server firewall blocks all incoming connections to that port.

6.1.3 Database Access User Levels

Access to the database is limited through a series of database users, each with specified user privileges allowing for certain actions on the database, as well as unique passwords. The DMS web interface communicates with the database using the least privileged user level in each instance.

[7] Term meaning setting an apparent root directory. Users and processes cannot identify files outside the root directory, and so this has the effect of disallowing access to any files outside of the specified directory tree, separately from any file permissions-based restrictions.

6.1.4 Software Database Protection

The DMS web interface has been programmed with an understanding of the potential for SQL injections. Strategies employed to limit this attack vector include input sanitation and parameterized SQL queries, as well as using connections with limited privileges.

6.1.5 Map server Access Limitations

The map server runs through the Apache web server, but access to the map server is intentionally limited so all access is from the local server (e.g., the PHP program). The primary reason for this limitation is to limit potential denial of service attacks against the DMS server, as the map server can be resource intensive.

In addition, the PHP program provides additional checks that the web user has logged in, as well as additional cache support enabling an overall faster experience for the web user.

6.1.6 Web User Password Protection

Strong passwords are encouraged for all web users of the DMS by providing examples of strong passwords and by providing calculation of the information density of the proposed password. User passwords are partially protected by a several second time out when incorrect passwords are entered, limiting the rate at which web passwords can be tested by a potential attacker.

As described in Section 5.2.1, an automated account recovery is provided. This automated recovery emails a recovery URL to the email address on file. This recovery URL is a random, time-sensitive, unique URL. This method of account recovery relies on the user securing and maintaining control of their associated email account.

6.2 Administration

Generally, administration of the database and DMS is to be primarily conducted by the WMA consultant team.

6.2.1 Web user Access and Roles

Web user roles and access privileges can generally be modified through the web interface, if the web user has been granted administrator role privileges. In addition to consultants, staff members from the lead agency (SYRWCD) are expected to have administrator privileges (Section 5.1.1). Otherwise, user privileges can be directly altered by modifying the database.

6.2.2 Database Administration

Currently, database administration requires a connection to the server (a Linux user login), as well as username and password for the database user with the required privileges for the administration task. A web user role with database administration through the web interface may be developed if needed.

6.2.3 Other Data Administration

Administration of the non-database data (e.g., well and surface site images, or GIS data) will be performed by the WMA consultant team. This requires modifying files in specific locations or modifying configuration files in the case of the map server.

These modifications require access to the primary Linux user. A web user role with a file manager administration through the web interface may be developed if needed.

6.2.4 Server Administration

Administration of the server (root access) will be performed by the WMA consultant team. Server administration requires the appropriate password and connection from a whitelisted IP address.

7 SUMMARY

This Data Management Plan describes both the proposed content and structure for the DMS that will meet the statutory requirements under SGMA. Data for the WMA will now be collected, reviewed, stored, and will be made available as described in this document; however, this plan will be amended based on ongoing needs of the WMA in developing the GSP.

The plan includes a discussion of the general architecture of the DMS, including aspects of the software to be used and strategies for incorporation of various types of data. As described, the DMS uses open source software for most of the architecture components. The plan identifies how all data types (e.g., GIS data and reports) will be handled in the DMS.

The plan discusses the expected sources of relevant data (e.g., federal, state, county, local, municipal) and how they will be collected for inclusion into the DMS. There is an identification of a tiered scheme for data collection and verification efforts, in order to focus efforts on higher impact data.

The plan also includes a general description of the web interface and access to the data stored within the system, and also outlines a process for exporting and importing various datasets into the system.

Finally, more details are provided with regards to various administration concerns, security steps taken to protect the system, as well as various ways in which administration of the system is planned.

The next step in the DMS process will be the continued population of the various datasets as outlined in this plan for the data compilation effort.

As the data compilation effort and population nears a completion, a technical memorandum will be produced to describe the data compilation effort as completed, including the data collected and sources. The technical memorandum will also provide updates and significant changes to the functions of the web based DMS.

8 REFERENCES CITED

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