EMA

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

FINAL DRAFT

Data Management Plan

FEBRUARY 2020

GSI Water Solutions, Inc.

GEI Consultants

FINAL DRAFT

Data Management Plan

Santa Ynez River Valley Groundwater Basin Eastern Management Area Data Management System

Prepared for:

Santa Barbara County

Prepared by:

GEI Consultants
2868 Prospect Park Drive, Suite 400
Sacramento, CA 95670

February 21, 2020

Table of Contents

Figures

Tables

1. Definitions

Aquifer	An underground layer of rock that is saturated with (ground)water.
Bulletin 118	California's official publication on the occurrence and nature of groundwater statewide. Produced by the California Department of Water Resources and updated every five years.
CASGEM	The California Statewide Groundwater Elevation Monitoring (CASGEM) is a DWR program that tracks seasonal and long-term groundwater elevation trends in groundwater basins statewide.
CDEC	The California Data Exchange Center (CDEC) is a hydrologic data collection network developed by DWR to track snow reporting gages and precipitation and river stage sensors for flood forecasting.
Confinement	When referring to groundwater, confinement is an effect of an impermeable layer of rock or sediment overlaying a permeable layer filled with water.
Constituents	When referring to water quality, a constituent is a chemical component found in the water such as sodium, chloride, etc.
Diversion site	When referring to surface water, a diversion site is a location where water is diverted from its main path to a new path (e.g., irrigation canal)
DWR	California Department of Water Resources
Extensometer	Measurement device used to track subsidence.
GAMA	The Groundwater Ambient Monitoring and Assessment (GAMA) Program is California's groundwater quality monitoring program created by the State Water Resources Control Board.
Geotracker	A data management system created for the GAMA Program to manage and display groundwater quality and water level information.
InSAR	Interferometric synthetic aperture radar (InSAR) is a technique for mapping ground surface information using satellites.
Isocontour	A line of equal measurement.
Lithology (data)	The lithology data stored in a DMS is information about the characteristics of the subsurface obtained when a well was drilled.
Stream stage	The water level in a river or stream at a moment in time.
Subsidence	Settling or sinking of land elevation due to changes underground (e.g., removal of water, or pumping).
Transmissivity	When referring to a groundwater aquifer, the transmissivity of the aquifer refers to the rate at which water can flow though the aquifer material.

2. Introduction

The purpose of the Data Management Plan (Plan) is to guide the development of the Data Management System and to describe the process for collection, review, and upload of data used to develop the Groundwater Sustainability Plan (GSP) for the Eastern Management Area (EMA) of the Santa Ynez River Valley Groundwater Basin (Basin or Santa Ynez Basin). This document does not provide final specifications for a complete DMS. Rather, it explains the plan for data collection and initial DMS data population and provides a common vision for DMS development.

GEI Consultants, Inc. completed a needs assessment to determine the type of data and information required to complete the GSP, to seek input for consideration in designing the DMS, and to establish the goals of the EMA DMS. The intent of this document is to provide guidance on the approach and process to efficiently develop and populate the DMS.

2.1 SGMA DMS Requirements

Part of the Sustainable Groundwater Management Act (SGMA) implementation in California's groundwater basins is the required development of a DMS. The DMS stores the data relevant to the development of the GSP as defined by the GSP Regulations.

The GSP Regulations (California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2) give broad requirements on data management, stating that a GSP must adhere to the following guidelines for a DMS:

> ***§ 352.6. Data Management System***
>
> *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 [Groundwater Sustainability] Plan and monitoring of the basin.*
>
> *Note: Authority cited: Section 10733.2, Water Code.*
> *Reference: Sections 10727.2, 10728, 10728.2, and 10733.2, Water Code.*
>
> ***§ 352.4. Data and Reporting Standards***
>
> *(c) The following standards apply to wells:*
>
> *(3) Well information used to develop the basin setting shall be maintained in the Agency's data management system*
>
> *Note: Authority cited: Section 10733.2, Water Code.*
> *Reference: Sections 10727.2, 10727.6, and 10733.2, Water Code.*
>
> ***§ 354.40. Reporting Monitoring Data to the Department***
>
> *Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.*

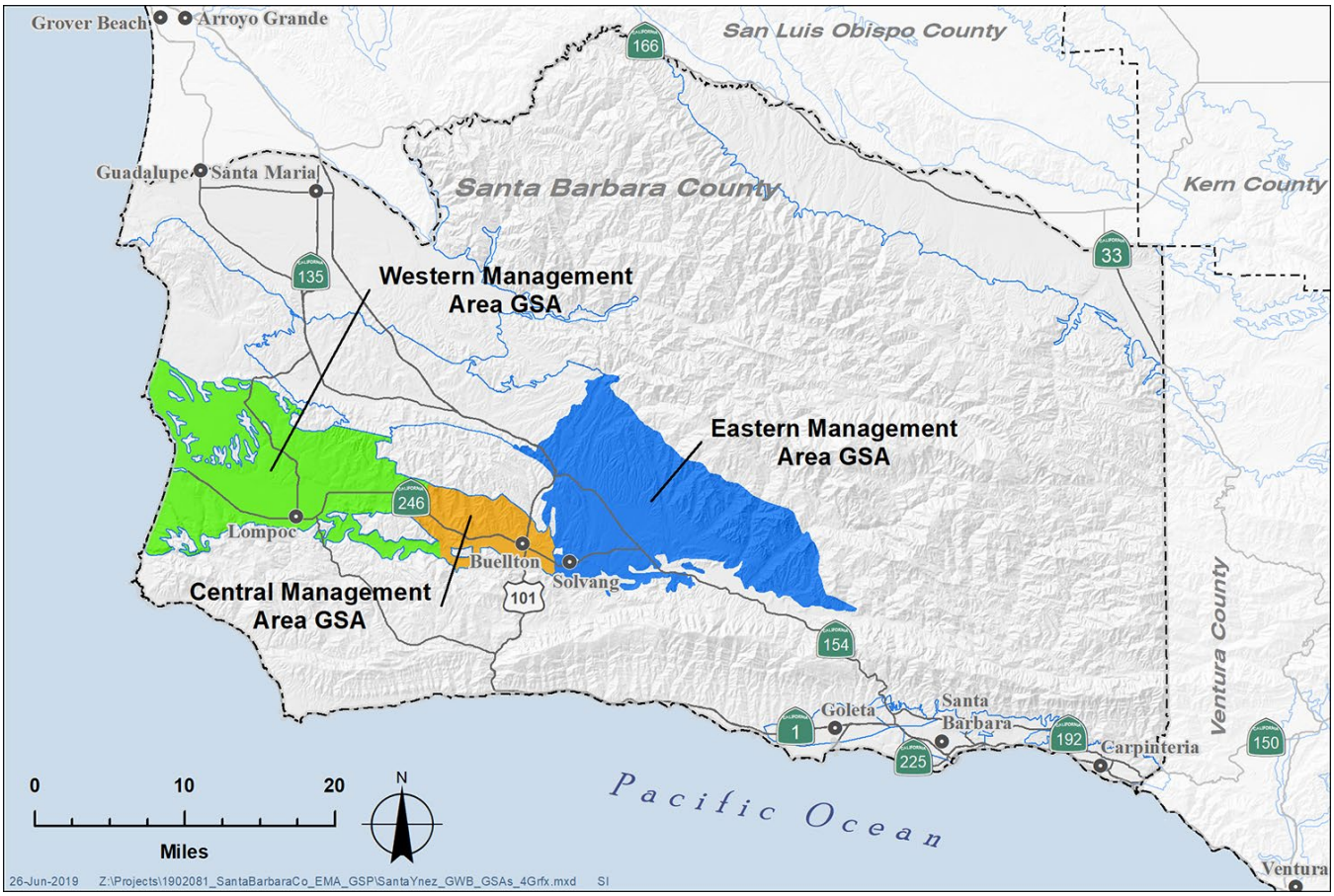
Note: Authority cited: Section 10733.2, Water Code.
Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.

In summary, to comply with SGMA, the EMA will create a DMS that stores groundwater basin information, reports, and data. The data stored in the DMS will aid in the development of a GSP and provide a data framework for the continued monitoring and reporting of the conditions in EMA. All data will be evaluated for validity and acceptable use prior to entry into the DMS. The data will comply with established quality assurance (QA) and quality control (QC) goals and procedures as described in SGMA GSP Regulation § 354.44 (c).

3. DMS Development

There are three GSAs in the Santa Ynez Basin – Eastern Management Area (EMA), Central Management Area (CMA), and Western Management Area (WMA). Each of these GSAs intend to develop an individual GSP for their respective Management Area. The GSPs will be managed under a coordination agreement per SGMA regulations.

Figure 1. Santa Ynez Basin GSAs



3.1 DMS Coordination

SGMA regulations require that each GSP be supported by a DMS (§352.6). For effective coordination and management, the data in each DMS for the Santa Ynez Basin should be consistent in both terminology and in value. For example, it would be inefficient to abbreviate the term "water level" in three different ways (e.g., WL, W.L., lvl). Similarly, it would be problematic to have three different water level values at the same well and with the same timestamp. The goal of GSA coordination during DMS development is for data supporting the three GSPs to be consistent.

There are multiple agencies and consultants working in each of the three Santa Ynez GSA Management Areas (MAs). Consulting teams at GSI Water Solutions, Inc. (GSI) and GEI Consultants, Inc. (GEI) are assisting with preparation of a DMS for the EMA. Consultants at Stetson Engineers, Inc. (Stetson) and GeoSyntec Consultants (GeoSyntec) are assisting with preparation of a DMS for the CMA and a DMS for the WMA. These consultants are holding conference calls followed by summary memoranda to coordinate preparation of the DMSs. Where there are unique data sets generated in one or more of the MAs, the consultants for all three MAs have agreed to work together to ensure that data can be shared across the Basin.

If there is data to be shared on a regular basis, the consultants have agreed to work together to develop a common protocol for sharing data (such as an XML, JSON, or structured Excel file) that all three MAs can utilize. This protocol will be documented and distributed to DMS Administrative users.

3.2 Data Needs

3.2.1 Sustainability Indicator Data

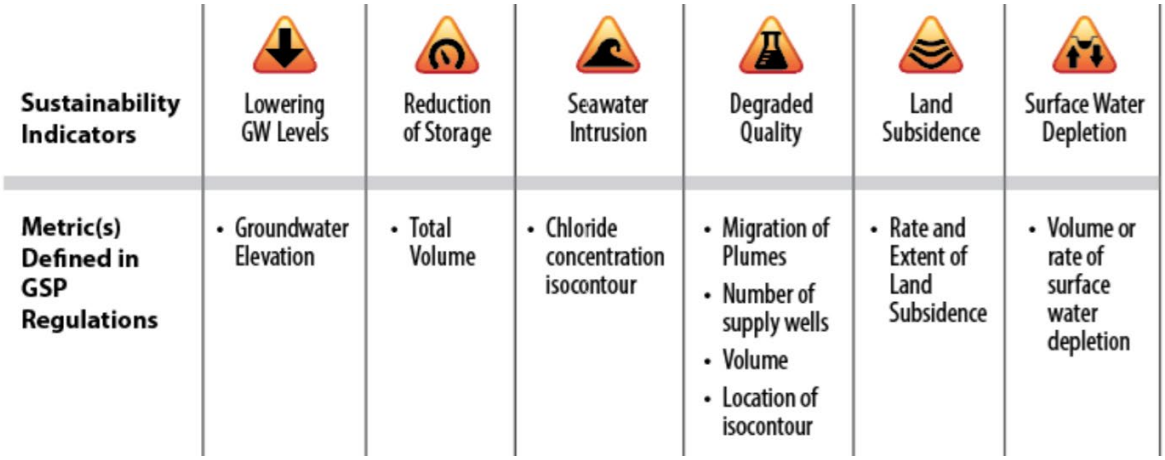
SGMA defines sustainable groundwater management as "the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."[1] SGMA outlines six undesirable results as follows:[2]

> *One or more of the following effects caused by groundwater conditions occurring throughout the basin:*
>
> *(1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.*
>
> *(2) Significant and unreasonable reduction of groundwater storage.*
>
> *(3) Significant and unreasonable seawater intrusion.*
>
> *(4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.*
>
> *(5) Significant and unreasonable land subsidence that substantially interferes with surface land uses.*
>
> *(6) Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.*

[1] §10721(v)
[2] §10721(x)

The presence or absence of the six undesirable results in a groundwater basin is determined by examining the sustainability indicator data for each. The EMA DMS will store data relevant to each sustainability indicator as appropriate. There are multiple metrics by which the sustainability indicators may be observed. These metrics, as defined in the GSP Regulations and described by DWR in the Sustainable Management Criteria Best Management Practice (BMP) document,[3] are shown in **Figure 2**.

Figure 2. DWR's Sustainability Indicator Metrics



The EMA may use the data shown in **Table 1** to track the six sustainability indicators as deemed necessary during GSP development.

Table 1. Data required to monitor the SGMA sustainability indicators

Sustainability Indicator	Tracking Data							
					Water Quality			
	Water Level	Extensometer	GPS	InSAR	Chloride	±10 constituents	Stream stages	Well and/or Site Data
Subsidence	✓	✓	✓	✓				✓
Water levels	✓							✓
Groundwater storage	✓							✓
Seawater intrusion	✓				✓			✓
Surface water/ groundwater interaction	✓						✓	✓
Water quality	✓				✓	✓		✓

[3] https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Sustainable_Management_Criteria_2017-11-06.pdf.

The metrics listed in **Table 1** represent the minimum required data set to populate the DMS for tracking sustainability indicators. However, there is additional data that is readily available and may be included in the DMS to assist with preparation of the GSP and to support annual reporting.

3.2.2 Data Sources

Table 2 illustrates the datasets that are publicly accessible or available and will be used in populating the DMS to support EMA GSP development, sustainability indicator monitoring, and annual reporting. The data categories listed below shape the design of the DMS and support the sustainability indicator needs presented previously in **Table 1**. Most of the data categories listed below are associated with a well with the following exceptions: precipitation, land use, and surface water data.

During the development of the EMA GSP, access to data through the DMS by staff from the participating agencies will be required to prepare various GSP chapters and sections. The data acquired in **Table 2** will be used to prepare the GSP sections. In addition, data collected in **Table 2** will be used to track the sustainability indicators and support annual reporting as required by SGMA.

Table 2. Data Sources to Populate Santa Ynez Basin DMS

Data Category	State and Federal Data Sources						Local Data Sources	
	DWR (CASGEM)	Well Logs	DWR (CDEC)	Geotracker GAMA	USGS	Irrigated Lands Program	Participating Agencies	Other Groundwater Users*
Well and Site Info	✓	✓		✓	✓		✓	✓
Well Construction	✓	✓			✓		✓	✓
Well Construction Screen	✓	✓			✓		✓	✓
Aquifer Properties							✓	
Water Level	✓				✓		✓	✓
Water Quality			✓	✓	✓	✓	✓	
Precipitation							✓	
Land Use							✓	
Surface Water							✓	

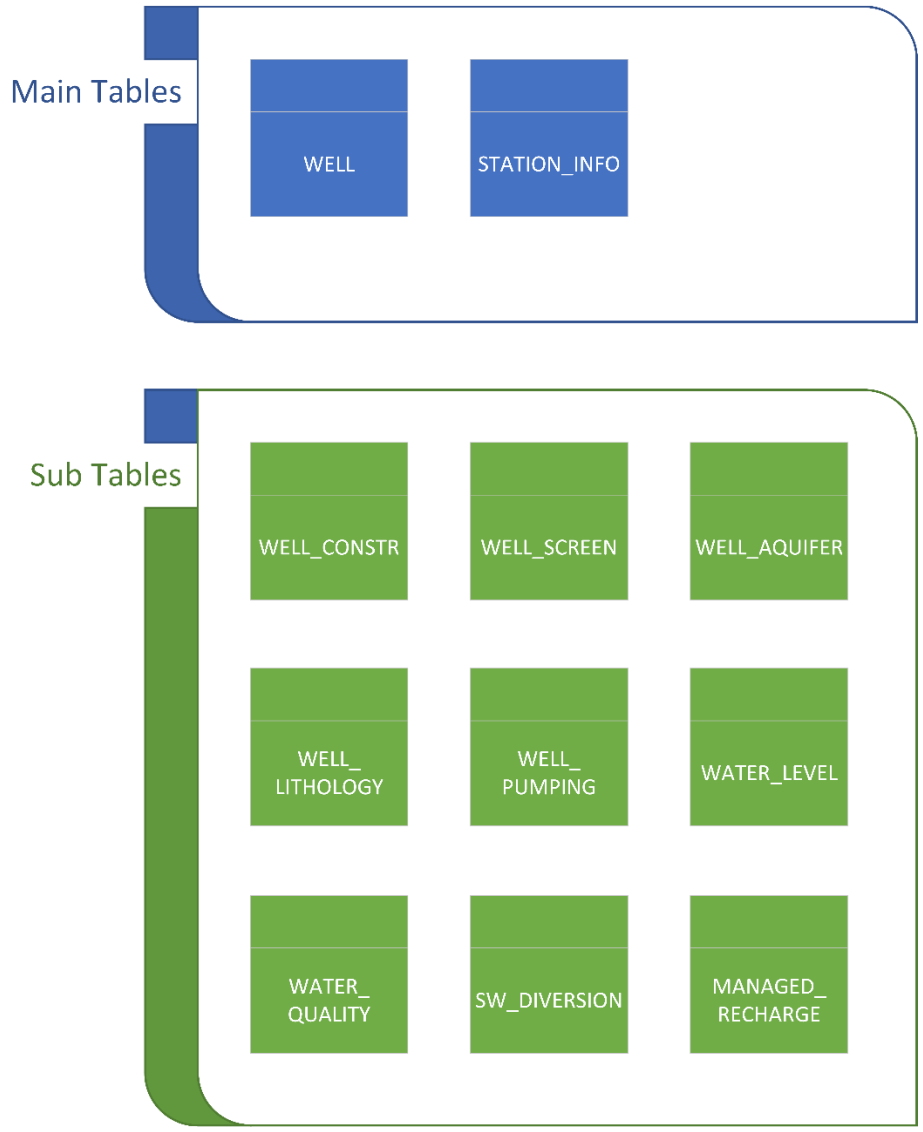
*Private parties and mutual water companies

3.3 Data Structure

The DMS is a database plus an online web viewer. Data stored in the DMS is separated by categories into tables. The tables contain columns and rows of data. Each field holds a specific type of data, such as a number, text, or date. The proposed DMS data tables are shown as **Figure 3**. The figure is color-coordinated to show the relationship between tables:

- **Blue Tables** – Main tables that include point data with a unique identification and unique point location to be added to database (e.g., Well_Info and Site_Info)
- **Green Tables** – Sub tables related to the main table and hold additional details about the well or unique identifier (e.g., correlation of a well point with water level or water quality)

Figure 3. Santa Ynez Basin EMA DMS Tables



A brief description of the main and sub tables is provided as **Table 3**.

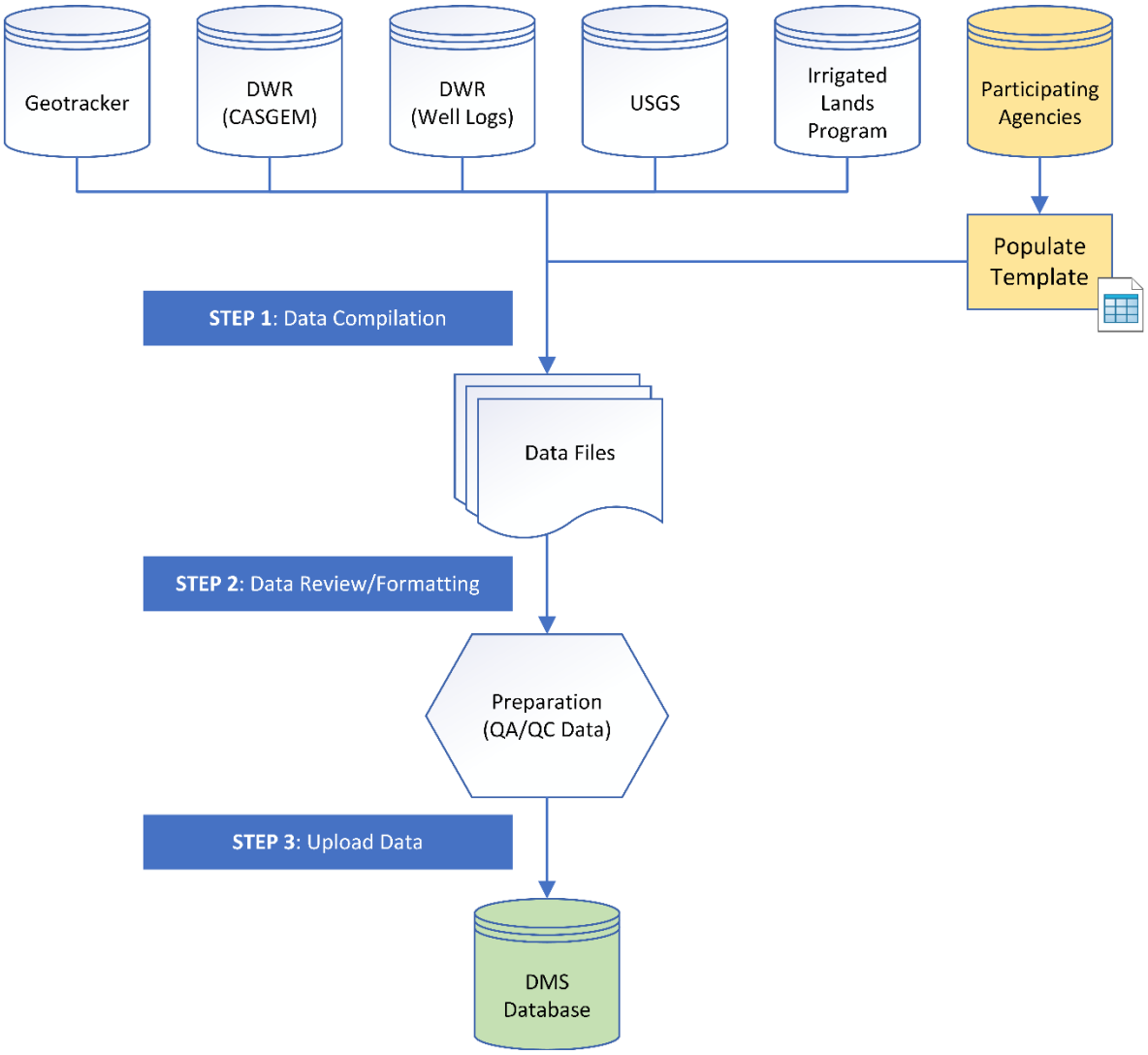
Table 3. DMS Table Descriptions

Table	Description
Main Tables	
Station Info	Information about type of station (well, recharge site, diversion, gage, extensometer, GSP) and location information
Well Info	General information about well, including identifiers used by various agencies
Sub Tables	
Agencies	Agency associated with the well or site
Sustainability Indicators	Minimum Thresholds and Measurable Objectives set for monitoring network sites tracking Sustainable Management Criteria for SGMA compliance
Well Construction	Well construction information, including depth, diameter, etc.
Well Construction Screen	Supplements 'Well Construction' with well screen information (one well can have many screens)
Well Geologic Aquifer	Information about the aquifer parameters of the well such as pumping test information, confinement, and transmissivity
Well Geologic Lithology	Lithologic information at a well site (each well may have many lithologies at different depths)
Water Level	Water level measurements for wells
Well Pumping	Pumping measurements for wells, annual or monthly
Managed Recharge	Recharge measurements for a recharge site, annual or monthly
SW Diversion	Diversion volume measurements for a diversion site, annual or monthly
Water Quality	Contains water quality data for wells or any other type of site

3.4 Data Input Process

Inputting data to the DMS consists of three steps, as shown on **Figure 4**. The steps include: 1) data compilation; 2) data review/formatting; and 3) data upload and visualization.

Figure 4. Data Input Workflow



3.4.1 STEP 1: Data Compilation

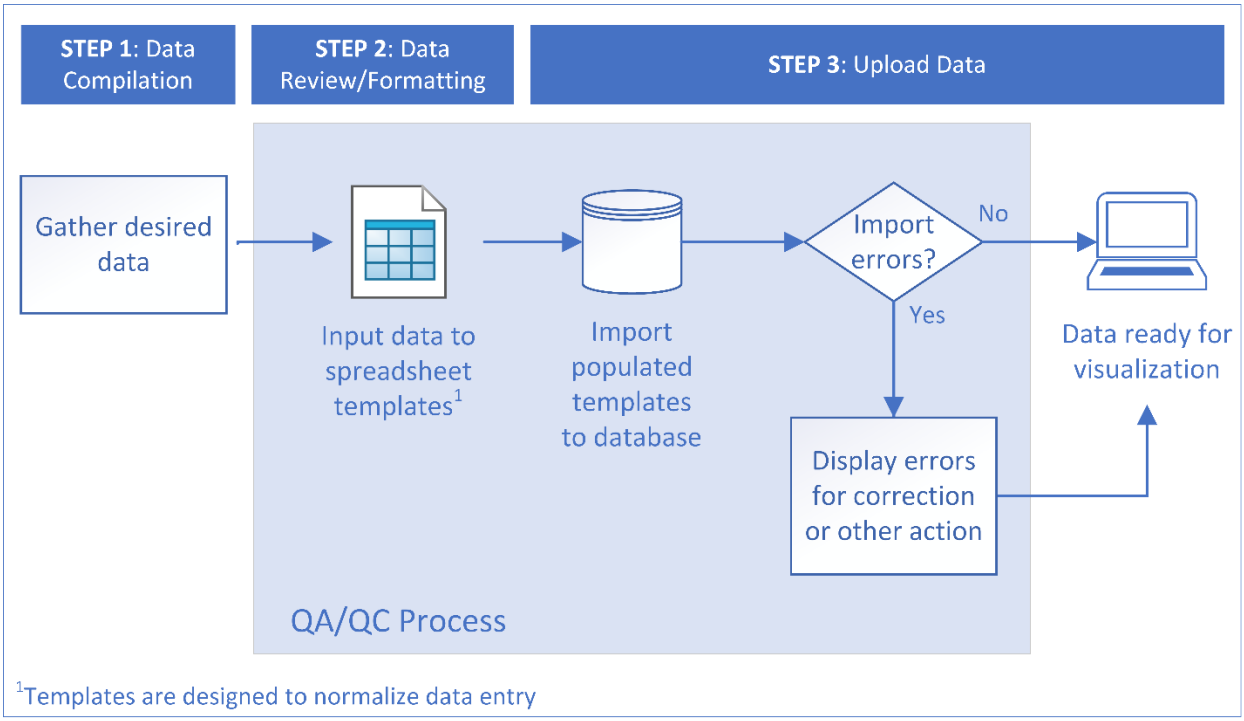
State and Federal data available via online public databases will be brought directly from the data source to the DMS by the DMS development team. Local EMA data compiled from participating agencies and other sources will be put into templates designed to normalize data entry. DMS Administrative users will be provided documentation describing how to use the tool and templates.

Historical data will be entered into the DMS by the DMS development team. Future data will be collected by the EMA GSA and entered to the DMS using the provided templates.

3.4.2 STEP 2: Data Review and Formatting

Local data is normalized by transfer to templates with a set of rules restricting formatting, alphanumeric properties, and other filters. This template process is shown as **Figure 5**.

Figure 5. Template Import Process for Local Data



The templates include validation parameters similar to CASGEM templates. CASGEM templates are shown in **Figure 6** as an example of the templates to be used to populate the DMS. The templates will have pop-up windows to describe what should be filled in for each column. If a specific filter must be applied, then only values that meet the criteria will appear in a drop-down list.

Figure 6. CASGEM Template Examples

CASGEM ID	Local or State Well Number	Date (MM/dd/yyyy)	24-hour Time, PST (hh:mm)	NM Code	QM Code
389011N1213514W001	Airport Well 4 MW	11/19/2018	6:49		
389011N12135	t Well 4 MW	12/14/2018	6:24		
389011N12135	t Well 4 MW	1/14/2019	7:23		
389011N12135	t Well 4 MW	2/14/2019	7:18		
389011N12135	t Well 4 MW	3/14/2019	7:44		
389011N12135	t Well 4 MW	4/16/2019	8:55		
388604N12135	-1	11/19/2018	9:15		

CASGEM ID
Please enter system generated CASGEM ID.
Example: xxxxxxNxxxxxxxWxxx

CASGEM ID	Local or State Well Number	Date (MM/dd/yyyy)	24-hour Time, PST (hh:mm)	NM Code	QM Code	Reading at RP
389011N1213514W001	Airport Well 4 MW	11/19/2018	6:49			43.950
389011N1213514W001	Airport Well 4 MW	12/14/2018	6:24			
389011N1213514W001	Airport Well 4 MW	1/14/2019	7:23			
389011N1213514W001	Airport Well 4 MW	2/14/2019	7:18			
389011N1213514W001	Airport Well 4 MW	3/14/2019	7:44			
389011N1213514W001	Airport Well 4 MW	4/16/2019	8:55			

No Measurement Code
Please select No Measurement Code.

All the Main and Sub Tables displayed in **Figure 3** will have a template. Additional tables and templates can be added if specified by the EMA GSA members during the DMS data compilation process.

The compiled data will be reviewed by the EMA agencies and GEI Consultants before it is migrated into the database. The data review process will be focused and limited in scope during the development of the Draft GSP. It will include the following checks:

- Identifying outliers that may have been introduced during the original data entry process
- Removing or flagging questionable data
- Visualizing data in various software platforms outside the DMS to further assess the quality of the data

3.4.3 STEP 3: Upload Data

Once the data has been compiled, input to the templates, and reviewed, it will be uploaded to the DMS and displayed on a visualization tool (GIS map) interface. The visualization tool is described in Section 4. When loading the data, an automated check will be conducted by the DMS to capture errors, if any, and a response will be generated to indicate errors to the team.

Moving forward, the upload templates will be used by the participating agencies to load future data using a webpage interface.

4. Web Interface

The DMS begins with a database, stored locally or online, and is accompanied by a viewer that allows administrators to see the data in a user-friendly interface. The proposed EMA DMS configuration is a database built in Oracle plus a web application designed in JAVA.

In addition to the data stored in the DMS, the EMA data viewer will be designed to display SGMA-specific sustainable management criteria (SMC) information such as representative monitoring sites, minimum thresholds, measurable objectives, and interim milestones.

The EMA data viewer will be designed as a GIS web-based interface. The DMS information will display both with a map view and a detail view. Clicking on a point on the map will reveal details of the selected well or feature. The viewer will generate a hydrograph for points with water level data.

The data viewer will do more than display the information stored in the DMS. The data viewer will have additional features such as GSA, local agency, and Bulletin 118 basin boundaries to provide context and facilitate EMA interaction with the DMS data. See **Figure 7** for an example design for the EMA data viewer.

Figure 7. Example Design for EMA Data Viewer