DRAFT

Data Management Plan

San Luis Obispo Valley Basin Groundwater Sustainability Plan

Available for viewing in the September 9, 2020 Agenda Packet:	**Sep 2, 2020**
Recommended the GSAs to receive and file for public comments:	**Sep 9, 2020**
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Per the GSC's recommendation on September 9, 2020, GSP Draft Data Management Plan will be distributed to the City and County GSAs to receive and file. This draft document is now posted on the web portal: www.slowaterbasin.com for public comments. Comments from the public are being collected using a comment form available at www.slowaterbasin.com by clicking on "Submit Comment". If you require a paper form to submit by postal mail, please contact your local Groundwater Sustainability Agency (GSA). All comments submitted will also be posted online for viewing.

DRAFT

San Luis Obispo Valley Basin Data Management Plan

Data Management System to Support Implementation of the Sustainable Groundwater Management Act

Prepared for:

County of San Luis Obispo GSA
City of San Luis Obispo GSA

Prepared by:

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

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1.   Introduction

The purpose of this Data Management Plan (DMP) is to describe the planned Data Management System (DMS) and the process for collection, review, and upload of data used to develop a Groundwater Sustainability Plan (GSP) for the San Luis Obispo Valley Groundwater Basin (SLO Basin). This document does not provide final specifications for a complete DMS. Rather, it describes the data needed to comply with SGMA, the method to be used for data collection, and the plan for DMS development.

1.1   SGMA DMS Requirements

The Sustainable Groundwater Management Act (SGMA) requires development of a DMS. The DMS stores data relevant to development of a groundwater basin's GSP as defined by the GSP Regulations (California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2).

The GSP Regulations give general 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.*

To comply with SGMA, the SLO Basin DMS will store data that is relevant to development and implementation of the GSP as well as for monitoring and reporting purposes.

2.   Data Needs for SGMA

The SLO Basin is in San Luis Obispo County, California. The county spans multiple groundwater basins – 6 of which are engaged in SGMA activity. Each basin complying with SGMA is required to store data in a DMS. Rather than host several systems, a county-wide DMS will be implemented to support county data initiatives for SGMA and other non-SGMA data initiatives.

Figure 1. Groundwater Basins in San Luis Obispo County[1]

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."[2] Furthermore, SGMA outlines six undesirable results as follows:[3]

> *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*

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[1] Source: California Department of Water Resources, SGMA Data Viewer, accessed August 14, 2020.
[2] §10721(v)
[3] §10721(x)

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.

The presence or absence of the six undesirable results in a groundwater basin is determined by monitoring and reviewing data for six sustainability indicators (one for each undesirable result). A set of associated measurable objective and minimum threshold will be assigned for each indicator and will be included in the DMS.

There are multiple metrics by which the sustainability indicators may be observed. The sustainability indicators and their respective metrics, as defined in the GSP Regulations and described by the California Department of Water Resources (DWR) in the Sustainable Management Criteria Best Management Practice (BMP) document,[4] are shown in **Figure 2**.

Figure 2. DWR's Sustainability Indicators and Metrics

Sustainability Indicators	Lowering GW Levels	Reduction of Storage	Seawater Intrusion	Degraded Quality	Land Subsidence	Surface Water Depletion
Metric(s) Defined in GSP Regulations	• Groundwater Elevation	• Total Volume	• Chloride concentration isocontour	• Migration of Plumes • Number of supply wells • Volume • Location of isocontour	• Rate and Extent of Land Subsidence	• Volume or rate of surface water depletion

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

Table 1 describes the types of data that may possibly be monitored for each sustainability indicator. Sustainability indicators do not need to be tracked by every available monitoring type.

Table 1. Monitoring data for the SGMA sustainability indicators

Sustainability Indicator	Monitoring Data Types							
					Water Quality			
	Water Level	Extensometer	GPS	InSAR	Chloride	±10 constituents	Stream stages	Well and/or Site Data
Lowering groundwater levels	✔							✔
Reduction of storage	✔							✔
Seawater intrusion	✔				✔			✔
Degraded quality	✔				✔	✔		✔
Land subsidence	✔	✔	✔	✔				✔
Surface water depletion	✔						✔	✔

The DMS will accommodate data relevant to each sustainability indicator. The monitoring data types listed in **Table 1** represent the various data sets required 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 GSPs and to support annual reporting.

3.   Data Sources

Table 2 illustrates the data sources that will be used to populate the DMS to support GSP development, sustainability indicator monitoring, and annual reporting. The data categories listed below inform the design of the DMS and support the data needs presented previously in Table 1.

Table 2. Data Sources to Populate the DMS

| Data Category	State and Federal Data Sources						Local Data Sources	
	California Statewide Groundwater Elevation Monitoring (CASGEM)	Well Logs	California Data Exchange Center (CDEC)	Geotracker Groundwater Ambient Monitoring and Assessment (GAMA)	United States Geological Survey (USGS)	Irrigated Lands Program	Participating Agencies	Other Groundwater Users*
Well and Site Info	✓	✓		✓	✓		✓	✓
Lithology	✓	✓		✓	✓		✓	
Water Level	✓				✓		✓	✓
Water Quality				✓	✓	✓	✓	
Subsidence					✓		✓	
Precipitation			✓				✓	
Land Use							✓	
Surface Water (Diversions, Stream Gages)			✓				✓	
Pumping							✓	✓

*Private parties and mutual water companies

4.   Data Structure

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

- **Main tables (Blue)** – Each dataset will be associated with EITHER a well or a station (e.g., extensometer). These are the main tables and include point data with unique identification and locations.

- **Sub tables** (**Green**) – Sub tables are related to the main tables and hold additional details about a well or site (e.g., correlation of a well with a water level measurement).

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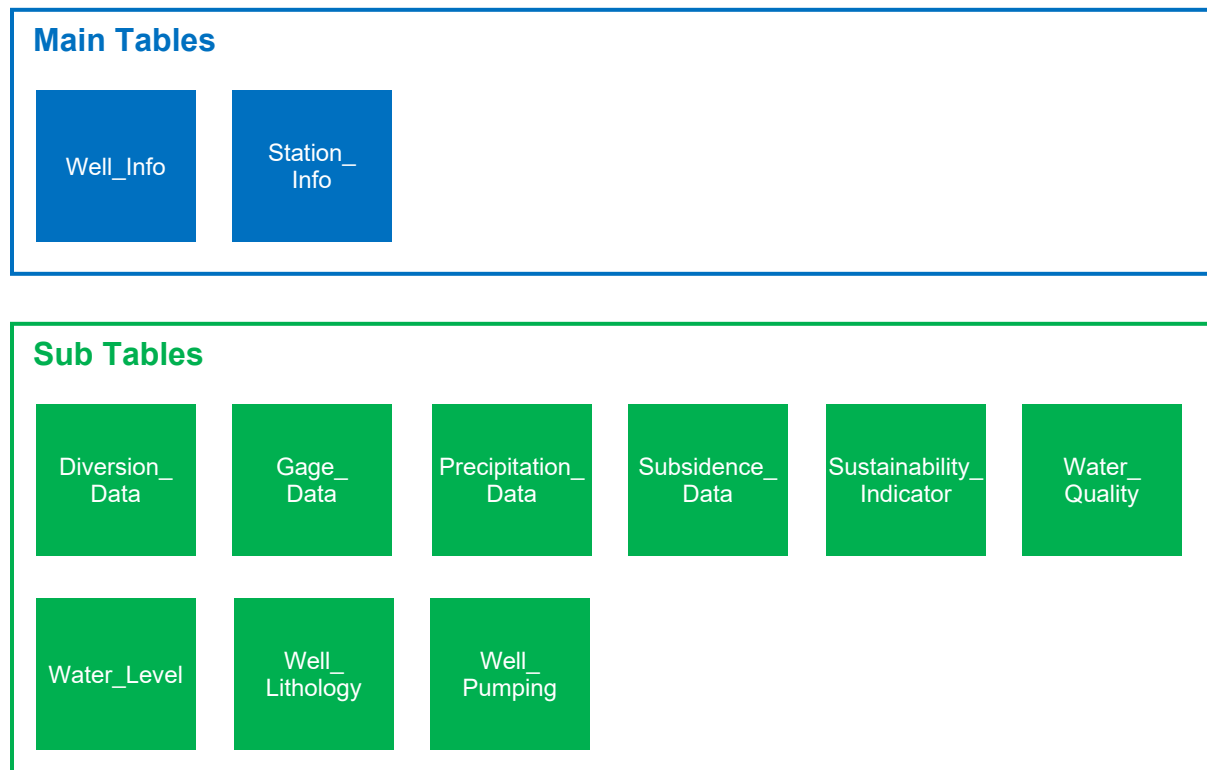
A brief description of the main and sub tables is provided as **Table 3**.

Table 3. DMS Table Descriptions

| Table	Description
Main Tables	
Station_Info	Information about type of station (recharge site, diversion, gage, extensometer, GSP) and location information
Well_Info	General information about well, including well construction and screen information
Sub Tables	
Diversion_Data	Diversion volume measurements for a diversion site or managed recharge
Gage_Data	Measurements collected at river or stream gages
Precipitation_Data	Volumetric measurements collected at precipitation monitoring stations
Subsidence_Data	Measurements collected at subsidence monitoring stations (e.g., extensometer)
Sustainability_Indicator	Minimum Thresholds and Measurable Objectives set for monitoring network sites tracking Sustainable Management Criteria for SGMA compliance
Water_Quality	Contains water quality data for wells or any other type of site
Water_Level	Water level measurements for wells
Well_Lithology	Lithologic information at a well site (each well may have many lithologies at different depths)
Well_Pumping	Pumping or recharge measurements for wells

5. Data Import

Importing data to the DMS consists of three steps, as shown on **Figure 4** and listed below:

1. Data compilation
2. Data review and formatting
3. Upload data

The DMS shall be designed to use this process to import data for all basins in San Luis Obispo County. The DMS development team will upload data to support the SLO Basin GSP. Data for other basins will be loaded by other teams' GSP efforts.

Figure 4. Template Import Process for Local Data
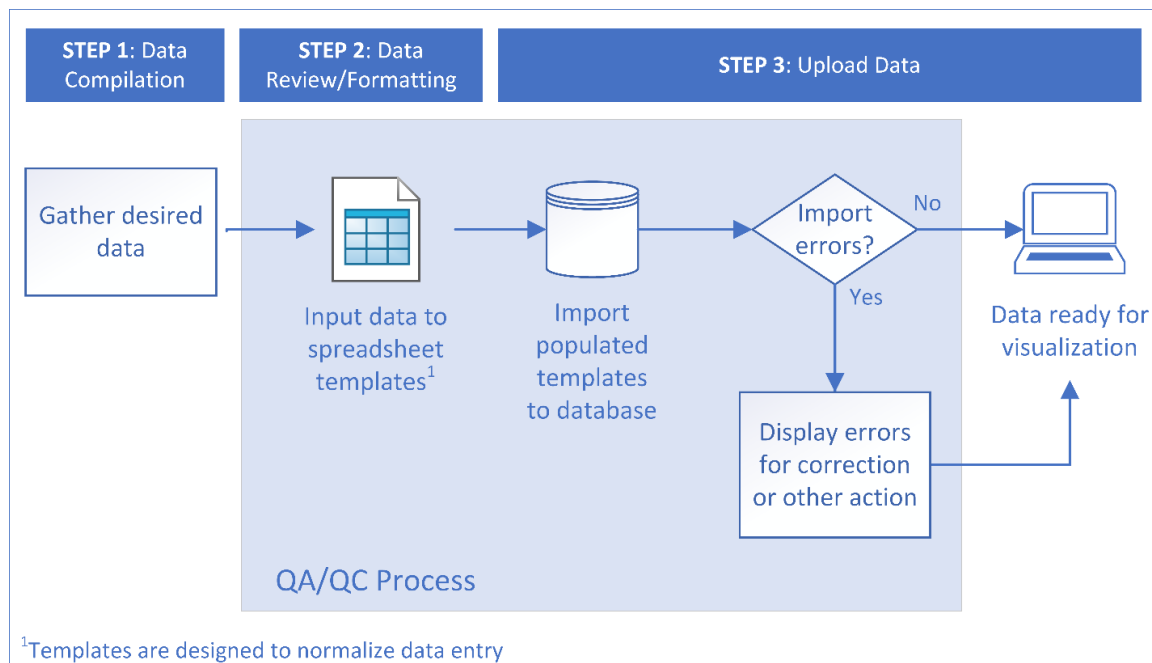
5.1 Data Compilation (STEP 1)

Historical data must be gathered to populate the DMS. Select state and federal data (as provided earlier in **Table 2**) for the SLO Basin will be compiled by the GSAs and their consultant(s). Participating agencies and other stakeholders will compile local data and data for other basins in the County.

5.2 Data Formatting and Review (STEP 2)

After the data is compiled, it shall be normalized by use of Microsoft Excel templates designed exclusively for the DMS. Each of the main and sub tables, described previously in **Section 4**, will have a template.

The tables below list and describe the templates planned for the DMS. There are three types of data templates:

- Groundwater well data templates: for data associated with a well.

- Station data templates: for data associated with a station. A station is defined as any site, that isn't a groundwater well, tracking DMS data (e.g., extensometer).

- Independent data templates: for data that is not associated with a single well or station.

Table 4. Well Data Templates

Template	Description
WELL_INFO	Well site information including construction and location
WELL_SCREEN	Screened intervals associated with a well site
WELL_AQUIFER	Aquifers associated with a well site
WELL_LITHOLOGY	Lithologic information at a well site (each well may have many lithologies at different depths)
WELL_WATER_LEVEL	Water level measurements taken at wells
WELL_PUMPING	Pumping or recharge measurements for wells
WELL_WATER_QUALITY	Water quality data collected at well sites
WELL_SUST_INDICATOR	Minimum Thresholds, Measurable Objectives, and Interim Milestones set for wells (not stations)

Table 5. Station Data Templates

Template	Description
STATION_INFO	Information about a non-well station (e.g., recharge site) and location information
STATION_PRECIPITATION_DATA	Volumetric measurements collected at stations such as precipitation monitoring sites
STATION_SUBSIDENCE_DATA	Measurements from subsidence stations
STATION_GAGE_DATA	Measurements collected at river and stream gages
STATION_WATER_QUALITY	Water quality data collected at non-well stations
STATION_DIVERSION_DATA	Diversion volume measurements for a diversion site or managed recharge
STATION_SUST_INDICATOR	Minimum Thresholds, Measurable Objectives, and Interim Milestones set for stations (not wells)

Table 6. Independent Data Templates

Template	Description
AGENCY	Addresses and other identifying information about the source agencies for data in the system
WATER_YEAR	Water year type (e.g., dry)
DOCUMENT	Document information including file type, name, and file path

The data templates will include rules restricting formatting and alphanumeric properties to provide quality assurance/quality control (QA/QC) and to prevent errors and duplication when importing. The templates include pop-up windows to describe the type of data that should be entered in each column. If a specific filter must be applied, then only values that meet the criteria will appear in a drop-down list. **Figure** 5 provides a screenshot of an example Excel template.

Figure 5. Example Template (Well Pumping)

When data is compiled it must also be reviewed for accuracy. The template restrictions described above provide one level of QA/QC. As a second level of QA/QC, the initial set of compiled historical data will be reviewed by the consulting team before it is migrated into the database. This review will be focused and limited in scope. It will include the following manual checks:

- Identifying outliers that may have been introduced during the original data entry process

- Identifying potential duplication of data

- Removing or flagging questionable data

- Visualizing data in various software platforms outside the DMS to further assess the quality of the data

After the historical data is populated, future data will be reviewed by the County before it is fully imported to the DMS.

5.3   Data Upload (STEP 3)

Once the data is formatted and reviewed it will be uploaded to the DMS and displayed with a visualization tool (described in the next section). When loading the data, an automated check will be run by the DMS to capture errors or duplicates, if any, and a response will be generated to indicate errors so they may be corrected.

The upload templates will be available for download in the DMS interface to load future data.

6. SGMA Data Viewer

The DMS will include a user-friendly web viewer to display the SGMA data including the SGMA-specific sustainable management criteria (SMC) information such as representative monitoring sites, minimum thresholds, measurable objectives, and interim milestones.

The DMS SGMA data 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, and time-series graphs for water quality and subsidence data. The visual design of the Data Viewer (with test data) is shown in **Figure 6.**

Figure 6. Design for Data Viewer
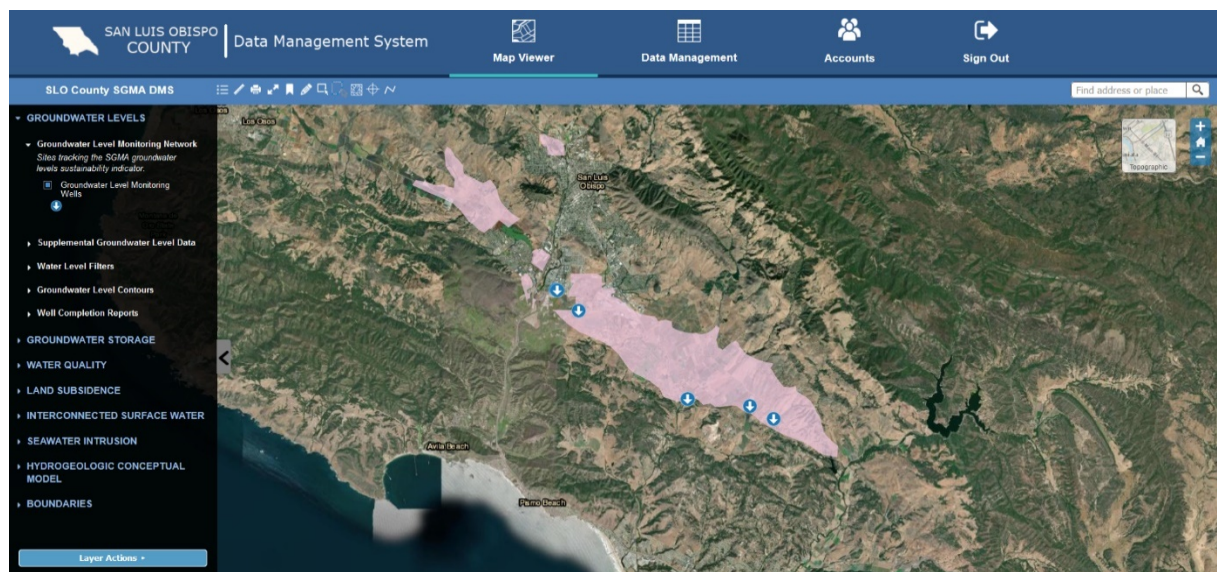
The types of data to be visualized on the map and available via the map's navigation menu are listed in **Table 7.**

Table 7. Map Viewer Navigation

Menu Navigation	Description
Groundwater Levels	Water level data and associated wells with well completion reports.
Groundwater Storage	GSA groundwater storage monitoring network sites.
Water Quality	Water quality well and station data for greater than 100 constituents.
Land Subsidence	Subsidence data from extensometers and other stations plus InSAR data.
Interconnected Surface Water	Data related to the interconnected surface water sustainability indicator such as proximity wells, river and stream gages, precipitation stations, and more.
Seawater Intrusion	Sites tracking the SGMA seawater intrusion sustainability indicator.

Hydrogeologic Conceptual Model (HCM)	Data useful for development of a hydrogeoglogic conceptual model of the basin including suitability of soil for recharge, geologic maps, and fault maps.
Boundaries	GSA and other relevant boundaries.

There are two categories of data displayed on the map viewer: data stored in the DMS and reference data drawn directly from outside sources that is useful for groundwater management. All the data discussed in the previous sections, **3. Data Sources** and **4. Data Structure**, referred to data to be <u>stored</u> in the DMS database. **Table 8** below displays a list of reference data that is available for display in the map viewer but is tied directly to an external source (such as CDEC), not to the data stored in the DMS.

Table 8. Reference Data Not Stored in the DMS Database

Menu Navigation	Data Title	Source
Groundwater Levels	DWR Periodic Groundwater Measurements	• California Natural Resources Agency Open Data Platform https://data.cnra.ca.gov/dataset/periodic-groundwater-level-measurements • Water Data Library http://wdl.water.ca.gov/waterdatalibrary
	DWR Continuous Groundwater Measurements	• https://data.cnra.ca.gov/dataset/continuous-groundwater-level-measurements • http://wdl.water.ca.gov/waterdatalibrary
	USGS Periodic Groundwater Measurements	• https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels
	Seasonal Groundwater Level Reports	DWR Enterprise Water Management database (EWM), which includes water level data previously stored in the DWR Water Data Library and CASGEM databases.
	Well Completion Reports	• https://data.cnra.ca.gov/dataset/well-completion-reports • https://gis.water.ca.gov/arcgis/rest/services/Environment/i07_WellCompletionReports/FeatureServer • https://gis.water.ca.gov/arcgis/rest/services/Environment/i07_WellCompletionReports/MapServer
Water Quality	Water Quality Portal (WQP)	• https://www.waterqualitydata.us/
Land Subsidence	DWR Extensometers	• https://data.cnra.ca.gov/dataset/wdl-ground-surface-displacement
	USGS Extensometers	• https://waterservices.usgs.gov/rest/Site-Test-Tool.html
	TRE ALTAMIRA InSAR Dataset	• Image Server: https://gis.water.ca.gov/arcgisimg/rest/services/SAR • Download @OpenData: https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence
	NASA JPL InSAR Dataset	• Image Server: https://gis.water.ca.gov/arcgisimg/rest/services/SAR • Download @OpenData: https://data.cnra.ca.gov/dataset/nasa-jpl-insar-subsidence
Interconnected Surface Water	CDEC Stations	• http://cdec.water.ca.gov/

Menu Navigation	Data Title	Source
Water Budget	Statewide Crop Mapping 2014	• Feature Server: https://gis.water.ca.gov/arcgis/rest/services/Planning/CropMapping2014/FeatureServer • Map Server: https://gis.water.ca.gov/arcgis/rest/services/Planning/CropMapping2014/FeatureServer • Download and API @OpenData: https://data.cnra.ca.gov/dataset/crop-mapping-2014
Hydrogeologic Conceptual Model	UC Davis SAGBI	• California Soil Resource Lab at UC Davis and UC-ANR.
	Soil Survey Geographic Database	• https://services.arcgis.com/P3ePLMYs2RVChkJx/ArcGIS/rest/services/DownloaderBasinsv2/FeatureServer/0 • http://www.arcgis.com/home/item.html?id=c2b408ba5c0a4fe1a79377906935c1a4
	CGS Geologic Map - 750k Generalized	• Metadata: https://maps.conservation.ca.gov/cgs/metadata/GDM_002_GMC_750k_v2_metadata.html • Webmap: https://maps.conservation.ca.gov/cgs/gmc/ • Service: http://spatialservices.conservation.ca.gov/arcgis/rest/services/CGS/GeologicMapCA/MapServer/21
	Quaternary Surficial Deposits	• Project Website: http://www.conservation.ca.gov/cgs/fwgp/Pages/sr217.aspx • Metadata: https://maps.conservation.ca.gov/cgs/metadata/QSD_metadata.html • Webmap: https://maps.conservation.ca.gov/cgs/qsd/ • Service: https://spatialservices.conservation.ca.gov/arcgis/rest/services/CGS/GeologicMapCA/MapServer
	Fault Activity Map of California	• Metadata: https://maps.conservation.ca.gov/cgs/metadata/GDM_006_FAM_750k_v2_metadata.html • Webmap: https://maps.conservation.ca.gov/cgs/fam/ • Service: https://spatialservices.conservation.ca.gov/arcgis/rest/services/CGS/FaultActivityMapCA/MapServer
Boundaries	GSA Boundaries	• DWR Bulletin-118 basin boundaries or as provided by client
	County Boundaries	• https://data.cnra.ca.gov/dataset/california-counties
	Canals and Aqueducts	• https://data.cnra.ca.gov/dataset/canals-and-aqueducts-local
	Disadvantaged Communities Blocks	• https://data.cnra.ca.gov/dataset/census-block-group-2010
	Disadvantaged Communities Places	• https://data.cnra.ca.gov/dataset/census-place-2016
	Disadvantaged Communities Tracts	• https://data.cnra.ca.gov/dataset/census-tract-2010
	Water Agencies	• https://data.cnra.ca.gov/dataset/water-districts
	CASGEM Groundwater Basins Prioritization – 2019 -	• https://data.cnra.ca.gov/dataset/ca-bulletin-118-groundwater-basins

7. DMS User Types

All data stored in the DMS will be accessible by administrative users, based on user permissions. Some sensitive data, such as private well data, may require a higher level of permission to retrieve. These permissions will be determined by the client.

Monitoring sites and their associated datasets are added to the DMS by managing entity administrators. In addition to user permissions, access to the monitoring datasets is controlled through assigning one of three options to the data type as follows:

- **Private data** – Private data are monitoring datasets only available for viewing, depending on user type, by the entity's associated users in the DMS.

- **Shared data** – Shared data are monitoring datasets available for viewing by all users in the DMS, except for public users.

- **Public data** – Public data are monitoring datasets that are available publicly that can be viewed by all user types in the DMS; public datasets may also be published to other websites or DMSs as needed.

Managing entity administrators can set and maintain data access options for each data type associated with their entity.

8. Data Retrieval

Data may be retrieved in several ways: via the map viewer, by table, or by report type.

- **Map Viewer**: The map viewer will be used to retrieve small amounts of data currently displayed on screen.

- **By Table**: The Exports page will allow for export of entire DMS tables as comma-separated values (CSV) files. **Figure 7** illustrates the design for the Exports page.

- **By Report Type**: Reporting templates will be created to extract the specific group of data required for annual reporting to DWR.

Figure 7. SLO County Exports Page Design