Merced Subbasin Groundwater Sustainability Plan Data Management System

Draft for Stakeholder Committee and Coordinating Committee Review

April 2019

TABLE OF CONTENTS

SECTION **PAGE NO.**

List of Tables

List of Figures

No table of figures entries found.

ACRONYMS

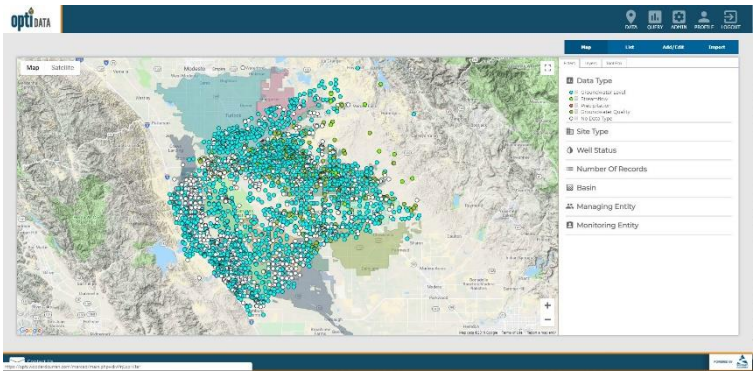
CASGEM	California Statewide Groundwater Elevation Monitoring
CDPH	California Department of Public Health
cfs	cubic feet per second
CSD	Community Services District

CVDRMP	Central Valley Dairy Representative Monitoring Program
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
DHS	Department of Health Services
DMS	Data Management System
DWR	Department of Water Resources
GAMA	Groundwater Ambient Monitoring and Assessment Program
GIS	Geographic Information System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
mg/L	milligrams per liter
MSL	Mean Sea Level
NTU	Nephelometric Turbidity Unit
NWIS	National Water Information System
pCi/L	picoCuries per liter of air
SGMA	Sustainable Groundwater Management Act
TON	Threshold Odor Number
USGS	United States Geological Survey
ug/L	micrograms per liter
umhos/cm	micromhos per centimeter

This chapter includes the Data Management System Section that satisfies § 352.6 of the Sustainable Groundwater Management Act Regulations, which requires each agency to 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. This section contains three main subsections:

- Overview of the Merced Subbasin Data Management System
- Functionality of the Data Management System
- Data Included in the Data Management System

1.1 OVERVIEW OF THE MERCED SUBBASIN DATA MANAGEMENT SYSTEM



The Merced Subbasin Data Management System (DMS) is implemented using the Opti platform. The DMS serves as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results.

The DMS is web-based and publicly accessible using common web browsers including Google Chrome, Firefox, and Microsoft Edge. It is a flexible and open software platform that utilizes familiar Google maps and charting tools for analysis and visualization. The site may be accessed here: https://opti.woodardcurran.com/merced

1.2 FUNCTIONALITY OF THE DATA MANAGEMENT SYSTEM

The DMS is a modular system that includes numerous tools to support Groundwater Sustainability Plan (GSP) development and ongoing implementation, including:

- User and Data Access Permissions
- Data Entry and Validation
- Visualization and Analysis
- Query and Reporting

The DMS can be configured for additional tools and functionality as the needs of the Groundwater Sustainability Agencies (GSAs) change over time. The following sections briefly describe the currently configured tools. For more detailed instructions on the usage of the DMS, please refer to the Opti User Guide.

1.2.1 User and Data Access Permissions

User access permissions are controlled through several user types that have different roles in the DMS as summarized in Table 1-1 below. These user types are broken into three high-level categories:

- System Administrator users manage information at a system-wide level, with access to all user accounts and entity information. System Administrators can set and modify user access permissions when an entity is unable to do so.
- Managing Entity (Administrator, Power User, User) users are responsible for managing their entity's site/monitoring data and can independently control access to this data. Entity users can view and edit their entity's data and view (not edit) shared or published data of other entities. An entity's site information (wells, gages, etc.) and associated data may only be edited by Administrators and Power Users associated with the entity. Note: *The Merced Subbasin GSAs is currently configured as the Managing Entity for all datasets.*
- Public users may view data that is published but may not edit any information. These users may access the DMS using the Guest Login feature on the login screen.

Monitoring sites and their associated datasets are added to the DMS by Managing Entity Administrators or Power Users. In addition to the user permissions, access to the monitoring datasets is controlled through three options:

- Private data is monitoring data that is only available for viewing, depending on user type, by the entity's associated users in the DMS.
- Shared data is monitoring data that is available for viewing by all users in the DMS (excludes Public Users).
- Public data is monitoring data that is available publicly and can be viewed by all user types in the DMS and may be published to other sites or DMSs as needed.

The Managing Entity Administrators have the ability to set and maintain the data access options for each dataset associated with their entity.

Table 1-1: Data Management System User Types

Modules/Submodules	System Administrators	Entity			Public
		Admin	Power User	User	
Data: Map	●	●	●	●	○
Data: List	●	●	●	●	○
Data: Add/Edit	●	●	●		
Data: Import	●	●	●		
Query	●	●	●	●	○
Admin	●				
Profile	●	●	○	○	○

● Indicates access to all functionality, ○ Indicates access to partial functionality (see explanations in following sections)

1.2.2 Data Entry and Validation

To encourage agency and user participation in the DMS, data entry and import tools are easy-to-use, accessible over the web, and help maintain data consistency and standardization. The DMS allows Entity Administrators and Power Users to enter data either manually via easy-to-use interfaces, or through an import tool utilizing Excel templates, ensuring data may be entered into the DMS as soon as possible after collection. The data is validated by Managing Entity's Administrators or Power Users using a number of quality control checks prior to inclusion in the DMS.

1.2.2.1 Data Collection Sites

Site information is input for groundwater wells, stream gages, and precipitation meters manually either through the Data Entry tool or when prompted in the Import tool. In the Data Entry tool, new sites may be added by clicking on New Site. Existing sites may be updated using the Edit Site tool. During data import, the sites associated with imported data are checked by the system against the existing site list in the DMS. If the site is not in the existing site list, the user is prompted to enter the information via the New Site tool before the data import can proceed.

The information that is collected for sites is shown in Table 1-2. Required fields are indicated with an asterisk.

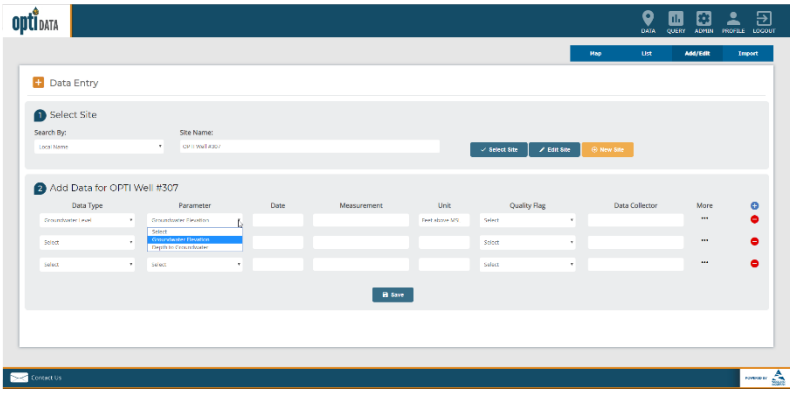
Table 1-2: Data Collection Site Information

Basic Info	Well Info	Construction Info
Site Type*	State Well ID	Total Well Depth
Local Site Name*	CASGEM ID	Borehole Depth
Local Site ID	Ground Surface Elevation	Casing Perforations
Latitude/Longitude*	Reference Point	Casing Diameter

Basic Info	Well Info	Construction Info
Description County Managing Entity* Monitoring Entity* Type of Monitoring Type of Measurement Monitoring Frequency	Reference Point Elevation Reference Point Location Reference Point Description Well Use Well Status Well Type Aquifers Monitored Groundwater Basin Name/Code Comments Upload File	Casing Modifications Well Capacity Well Completion Report Number Comments

*** Required fields; all other fields are optional**

1.2.2.2 Monitoring Data Entry



Monitoring data including but not limited to groundwater elevation, groundwater quality, streamflow, and precipitation, may be input either manually through the Data Entry tool or using templates in the Import tool. The Data Entry tool allows users to select a site and add data for the site using a web-based tool. The following information is collected:

- Data Type (e.g. groundwater elevation, groundwater quality, streamflow, or precipitation)
- Parameter for selected Data Type, units populate based on selection
- Date of Measurement
- Measurement Value
- Quality Flag (e.g. quality assurance description for the measurement such as “Pumping”, “Can’t get tape in casing”, etc. as documented by the Data Collector)
- Data Collector
- Supplemental Information based on Data Type (e.g. Reference Point Elevation, Ground Surface Elevation, etc.)

Data import templates include the same data entry fields and are available for download from the DMS. The Excel-based templates contain drop down options and field validation similar to the data entry interface.

1.2.2.3 Data Validation

Quality control helps ensure the integrity of the data added to the DMS. The entities that maintain the monitoring data that were loaded into the DMS may have performed previous validation of that data; no effort was made to check or correct that previous validation and it was assumed that all data provided was valid. While it is nearly impossible to determine complete accuracy of the data added to the DMS since the DMS cannot detect incorrect measurements due

to human error or mechanical failure, it is possible to verify that the data input into the DMS meets some data quality standards. This helps promote user confidence in the data stored and published for visualization and analysis.

Upon saving the data in the data entry interface or importing the data using the Excel templates, the following data validation checks are performed by the DMS:

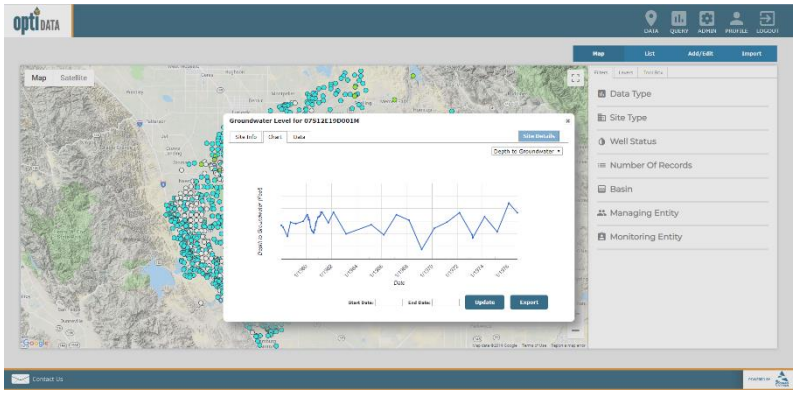
- Duplicate measurements: The database checks for duplicate entries based on the unique combination of site, data type, date, and measurement value.
- Inaccurate measurements: The database compares data measurements against historical data for the site and flags entries that are outside the historical minimum and maximum values.
- Incorrect data entry: Data field entries are checked for correct data type, e.g., number fields do not include text, date fields contain dates, etc.

Users are alerted to any validation issues and may either update the data entries or accept the values and continue with the entry/import. Users may access partially completed import validation through the import logs that are saved for each data import. The partially imported data are identified in the Import Log with an incomplete icon under the Status field. This allows a second person to also access the imported data and review prior to inclusion in the DMS.

1.2.3 Visualization and Analysis

Transparent visualization and analysis tools enable utilization of the same data and methodologies, allowing stakeholders and neighboring GSAs to use the same data and methods for tracking and analysis. In the Merced DMS, data visualization and analysis are performed in both Map and List views.

1.2.3.1 Map View



The Map view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a map-based interface. The sites are color coded based on associated data type and may be filtered by different criteria such as number of records or monitoring entity. Users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

1.2.3.2 List View

The List view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a tabular interface. The sites are listed according to site names and associated entities. The list can be sorted and filtered by different criteria such as number of records or monitoring entity. Similar to the Map view, users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

1.2.3.3 Analysis Tools

The Toolbox is available in the Map view and offers Administrative and Entity users access to the Well Tiering tool to support monitoring plan development. The flexibility of the DMS platform allows for future analysis tools, including contouring, total water budget visualization, and management area tracking.

1.2.4 Query and Reporting

The DMS has the ability to format and export data and analysis at different levels of aggregation, and in different formats, to support local decision making and for submission to various statewide and local programs (i.e., SGMA, CASGEM, GAMA, etc.).

1.2.4.1 Ad-hoc Query

The data in the DMS can be queried and reported using the Query Tool. The Query Tool includes the ability to build ad-hoc queries using simple options. The data can be queried by:

- Monitoring or Managing Entity
- Site Name
- Data Type

Once the type of option is selected, the specific criteria may be selected, e.g., groundwater elevation greater than 100 ft. Additionally, users may include time periods as part of the query. The query options can build upon each other to create reports that meet specific needs. Queries may be saved and will display in the saved query drop-down for future use.

The query results are displayed in a map format and a list format. In both the map and list views, the user may click on a well to view the associated data. The resulting data of the query may be exported to Excel.

1.2.4.2 Standard Reports

The DMS can be configured to support wide-ranging reporting needs through the Reports Tool. Standard report formats may be generated based on a predetermined format and may be created at the click of a button. These report formats may be configured to match state agency requirements for submittals, including annual reporting of monitoring data that must be submitted electronically on forms provided by the Department of Water Resources (DWR).

1.3 DATA INCLUDED IN THE DATA MANAGEMENT SYSTEM

Many monitoring programs exist at both the local and state/federal levels. A cross-sectional analysis was conducted within the basin to document and assess the availability of data within the basin, as well as statewide or federal databases that provide data relevant to Basin.

The DMS can be configured to include a wide variety of monitoring data types and associated parameters. Based on the analysis of existing datasets within the basin and the GSP needs, the data types shown in the table below were identified and are currently configured in the DMS.

Table 1-3: Data Types and Their Associated Parameters Configured in the DMS

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Elevation	Depth to Groundwater	Feet	Yes
	Groundwater Elevation	Feet above MSL	Yes
Groundwater Quality	1,1,1-Trichloroethane	ug/L	Yes
	1,1,2,2-Tetrachloroethane	ug/L	Yes
	1,1,2-Trichloroethane	ug/L	Yes
	1,1-Dichloroethylene	ug/L	Yes
	1,2-Dibromo-3-chloropropane	ug/L	Yes
	1,2-Dichloroethane	ug/L	Yes
	1,2-Dichloropropane	ug/L	Yes
	Alachlor	ug/L	Yes
	Aluminum	mg/L	Yes
	Antimony	ug/L	Yes
	Arsenic	ug/L	Yes
	Atrazine	ug/L	Yes
	Barium	mg/L	Yes
	Barium	ug/ L	Yes
	Benzene	ug/ L	Yes
	Beryllium	ug/ L	Yes
	Bicarbonate	mg/ L	Yes
	Cadmium	ug/ L	Yes
	Calcium	mg/ L	Yes
	Carbofuran	ug/ L	Yes
	Carbon tetrachloride	ug/ L	Yes
	Chloride	mg/ L	Yes
	Dicamba	ug/ L	Yes
	Dinoseb	ug/ L	Yes
	Endrin	ug/ L	Yes
	Fluoride	mg/ L	Yes
	Glyphosate	ug/ L	Yes
	Heptachlor	ug/ L	Yes
	Heptachlor epoxide	ug/ L	Yes
	Magnesium	mg/ L	Yes
	Manganese	ug/ L	Yes
	MBAS	mg/ L	Yes
	Methoxychlor	ug/ L	Yes
	Molinate	ug/ L	Yes
	Nitrate	mg/ L	Yes
	Pentachlorophenol	ug/ L	Yes
	Picloram	ug/ L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	Potassium	mg/ L	Yes
	Sodium	mg/ L	Yes
	Sulfate	mg/ L	Yes
	Thiobencarb	ug/ L	Yes
	Toxaphene	ug/ L	Yes
	Dissolved Nitrate	mg/ L as N	Yes
	Dissolved Nitrate	mg/ L as NO3	Yes
	1,1-Dichloroethane	TON	Yes
	1,2,4-Trichlorobenzene		Yes
	1,2-Dibromoethane (EDB)	ug/L	Yes
	1,3-Dichloropropene (Total)	mg/L	Yes
	1,4-Dichlorobenzene	ug/L	Yes
	2,4,5-TP (Silvex)	ug/L	Yes
	2,4'-D	ug/L	Yes
	Aluminum - Total	ug/L	Yes
	Antimony - Total	ug/L	Yes
	Apparent Color		Yes
	Arsenic - Total	ug/L	Yes
	Atrazine (Aatrex)	ug/L	Yes
	Barium - Total	ug/L	Yes
	Bentazon	ug/L	Yes
	Benzo(a)pyrene	ug/L	Yes
	Beryllium - Total	ug/L	Yes
	Bicarbonate Alkalinity	ug/L	Yes
	Boron - Total	ug/L	Yes
	Cadmium - Total	ug/L	Yes
	Calcium	NTU	Yes
	Calcium - Total	mg/L	Yes
	Carbonate Alkalinity	ug/L	Yes
	Chloride	ug/L	Yes
	Chromium - Total	ug/L	Yes
	Chromium (Total)	pCi/L	Yes
	Chromium (VI)	ug/L	Yes
	cis-1,2-Dichloroethylene	pCi/L	Yes
	Copper - Total	ug/L	Yes
	Cyanide, Total	ug/L	Yes
	Dalapon	ug/L	Yes
	DBCP	ug/L	Yes
	Di(2-ethylhexyl)adipate	ug/L	Yes
	Di(2-Ethylhexyl)phthalate	ug/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	Diquat	ug/L	Yes
	EDB	ug/L	Yes
	Endothall	ug/L	Yes
	gamma-BHC (Lindane)	ug/L	Yes
	Hexachlorobenzene	ug/L	Yes
	Hexachlorocyclopentadiene	ug/L	Yes
	Iron - Total	ug/L	Yes
	Lab Turbidity	NTU	Yes
	Lead - Total	ug/L	Yes
	Magnesium - Total	mg/L	Yes
	Manganese - Total	ug/L	Yes
	Mercury - Total	ug/L	Yes
	Nickel - Total	ug/L	Yes
	Nitrate - N	mg/L	Yes
	Nitrate (as N)	mg/L	Yes
	Nitrate (as N)	ug/L	Yes
	Odor Threshold	TON	Yes
	Oxamyl (Vydate)	ug/L	Yes
	pH		Yes
	Potassium - Total	mg/L	Yes
	Radium 228	mg/L	Yes
	Selenium - Total	ug/L	Yes
	Silica - Total	mg/L	Yes
	Silver - Total	ug/L	Yes
	Simazine (Princep)	ug/L	Yes
	Sodium - Total	mg/L	Yes
	Specific Conductance	umhos/cm	Yes
	Specific Conductance	mg/L	Yes
	Strontium - Total	ug/L	Yes
	TDS	mg/L	Yes
	Technical Chlordane	ug/L	Yes
	Thallium - Total	ug/L	Yes
	Total Alkalinity	mg/L	Yes
	Total Hardness	mg/L	Yes
	Total PCBs	ug/L	Yes
	Uranium - Total	ug/L	Yes
	Vanadium - Total	ug/L	Yes
	Zinc - Total	ug/L	Yes
	TDS	tons/acre-foot	Yes
	NO3N	mg/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	NO3-N	mg/L	Yes
	Total Nitrate	mg/L as NO3	Yes
	Total Nitrate	mg/L as N	Yes
	1,2-Dichlorobenzene	ug/L	Yes
	Dissolved Nitrate	mg/L	Yes
	Various Parameters	Various	
Surface Water Quality	Various Parameters	Various	
Streamflow	Streamflow	cfs	Yes
Precipitation	Precipitation	inches	Yes
	Reference Evapotranspiration (ETo)	inches	Yes
	Average Air Temperature	Degrees F	Yes

Additional data types and parameters can be added and modified as the DMS grows over time.

The data was collected from a variety of sources, as shown in Table 1-4 below. Each dataset was reviewed for overall quality and consistency prior to consolidation and inclusion in the database.

The groundwater wells shown in the DMS are those that are included in data sets provided by the monitoring data sources shown below for groundwater elevation and quality. These do not include all wells currently used for production and may include wells historically used for monitoring that do not currently exist. Care was taken to minimize duplicative wells in the DMS. As datasets were consolidated, sites were evaluated based on different criteria (e.g., naming conventions, location, etc.) to determine if the well was included in a different dataset. Datasets for the wells were then associated with the same well, where necessary.

After the data was consolidated and reviewed for consistency, it was loaded into the DMS. Using the DMS data viewing capabilities, the data was reviewed for completeness and consistency to ensure the imports were successful.

Table 1-4: Sources of Data Included in the DMS

Data Source	Datasets Collected	Date Collected	Activities Performed
CV-SALTS (includes data from CDPH, DWR, CVDRMP, GAMA, and USGS)	Well Location Well Type (Limited) Well Depth (Limited) Groundwater Quality	8/13/2018	• Removed duplicate records • Matched existing records with other data sources (GAMA, DWR) • Determined if well was screened above, below or outside of Corcoran Clay (for wells with depth data)
Central Valley Dairy Representative Monitoring Program (CVDRMP)	Well Location Well Type Groundwater Quality	9/14/2018	• Converted well addresses to Lat/Long • Matched records to wells in CV-SALTS
Department of Water Resources (DWR)	Well Location Well Type	9/2018	• Removed duplicate records

Data Source	Datasets Collected	Date Collected	Activities Performed
	Groundwater Quality		
HydroDMS	Well Location Well Type Well Depth (Limited) Groundwater Elevation Groundwater Quality	Data collected as part of the 2015 IRWMP	• Determined if well was screened above, below or outside of Corcoran Clay
Groundwater Ambient Monitoring and Assessment (GAMA) (includes data from DHS, DWR, and USGS)	Well Type Well Location Well Depth (Limited) Groundwater Quality	9/10/2018	• Removed duplicate records • Determined if well was screened above, below or outside of Corcoran Clay (for wells with depth data)
Local Data (Le Grand CSD, Meadowbrook Water Company, Santa Nella Water District)	Well Type Well Depth Well Location Groundwater Quality	5/2017 - 7/2017	• Tabulated lab results
National Water Information System (NWIS)	Well Type Well Depth (Limited) Well Relation to Corcoran Clay (Limited) Well Location Groundwater Quality	9/2018	• Removed duplicate records • Determined if well was screened above, below or outside of Corcoran Clay (for wells with depth data)