Colusa and Glenn County Data Management System Summary Report

Prepared for the County of Colusa and County of Glenn

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Acronyms

Acronym	Description
AF	Acre-Feet
ASCE	American Society of Civil Engineers
AWMP	Agricultural Water Management Plan
BMP	Best Management Practice
CASGEM	California Statewide Groundwater Elevation Monitoring
CDEC	California Data Exchange Center
CDL	Cropland Data Layer
CEDEN	California Environmental Data Exchange Network
cfs	Cubic Feet Per Second
CIMIS	California Irrigation Management Information System
DMS	Data Management System
DWR	Department of Water Resources
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
ETa	Actual Evapotranspiration
ETo	Reference Evapotranspiration
FMMP	Farmland Mapping and Monitoring Program
ft	Feet
GAMA	Groundwater Ambient Monitoring and Assessment Program
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
GPS	Global Positioning System
GSA	Groundwater Sustainability Agencies
GSP	Groundwater Sustainability Plan
GUI	Graphical User Interface
GWL	Groundwater Level
HCM	Hydrogeologic Conceptual Model
IDC	IWFM Demand Calculator
IM	Interim Milestone
IWFM	Integrated Water Flow Model
in	Inches
InSAR	Interferometric Synthetic-Aperture Radar
IT	Information Technology
JPL	Jet Propulsion Laboratory
kc	Crop Coefficient
MO	Measurable Objective
MS	Microsoft
MT	Minimum Threshold
NCEI	National Centers for Environmental Information
NCWA	Northern California Water Association
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
NWQMC	National Water Quality Monitoring Council
PRISM	Parameter-elevation Regressions on Independent Slopes Model

Acronym	Description
QA	Quality Assurance
QC	Quality Control
SaaS	Software-as-a-Service
SEBAL	Surface Energy Balance Algorithm for Land
SGMA	Sustainable Groundwater Management Act
STORET	EPA STOrage and RETrieval
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UCCE	University of California Cooperative Extension
UR	Undesirable Result
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WAMP	Waterfind Water Accounting and Management Platform
WCR	Well Completion Report
WDL	Water Data Library
WQP	Water Quality Portal

Appendices

Appendix A. Initial Evaluation of Available DMS Systems and Visualization Software
Appendix B. Data Management System (DMS) User Guide
Appendix C. Programmer Guide
Appendix D. Data Inventory

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This report summarizes initial development of a data management system (DMS) to support groundwater sustainability agencies (GSAs) in Colusa and Glenn counties in satisfying the requirements of the Sustainable Groundwater Management Act of 2014 (SGMA or Act). These requirements include the preparation, adoption, and implementation of groundwater sustainability plans (GSPs) as described by the Act and associated GSP Regulations (Regulations). This work has been completed through coordination of Proposition 1 Stressed Basins grants awarded by the California Department of Water Resources (DWR) to the counties of Colusa and Glenn. Each individual grant included tasks to evaluate high priority data requirements and compile available data, evaluate data gaps and priorities to fill data gaps, review of available DMS platforms, and implement an initial DMS to support GSP preparation. A result of the coordinated effort is a greater quantity of data compilation and greater functionality of the initial DMS than could have been accomplished in isolation. Costs associated with the work benefitting both counties were divided between the individual grants, while costs directly attributable to a specific county were allocated to the county receiving the benefit of the work.

The initial DMS includes development of a tabular DMS in an open manner using Microsoft Access to allow future customization or porting to another platform, if desired in the future. It is anticipated that existing available DMS platforms will improve as SGMA is implemented and new platforms will be developed commercially, by public agencies (e.g. DWR), or both.

This report includes the following chapters:

1. Introduction and Overview
2. SGMA Data Management and Reporting Requirements – Description of GSP Regulations related to the DMS, data requirements to prepare a GSP, and pre-GSP high priority data types and sources.
3. DMS Core Functionality – Recommended features of a tabular DMS, including functionality for data acquisition, formatting, quality control and assurance, storage, and visualization and reporting.
4. Existing Data Management and Reporting Systems – Existing systems employed by GSAs or other participating agencies that could maintain the DMS in the future.
5. Evaluation of Alternative Data Management Platforms – Review of existing DMS applications that could potentially be selected as a long-term DMS. This chapter is supported by an evaluation of available DMS systems and visualization software prepared by the County of Glenn and included as Appendix A.
6. Phased DMS Implementation Plan – Description of recommended actions for subsequent phases of DMS implementation.
7. Phase I DMS Implementation – Description of initial DMS development. This chapter is supported by a user guide and programmer guide for the initial tabular DMS included as Appendices B and C, respectively.

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2.1 GSP REGULATIONS

Pursuant to the California Water Code (§10733.2), DWR prepared emergency regulations which, among other things, specify the components of GSPs. The Regulations were adopted unanimously by the California Water Commission on May 18, 2016. Requirements regarding DMSs are provided in §352.6 of the Regulations:

> *§ 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 Plan and monitoring of the basin.*

The DMS is cited elsewhere in the Regulations as follows:

- § 352.4. Data and Reporting Standards – Well information used to develop the basin setting must be maintained in the DMS
- § 354.40. Reporting Monitoring Data to the Department – Monitoring data must be stored in the DMS and included in required annual reports and submitted electronically on forms provided by DWR
- §357.4. Coordination Agreements – Agencies developing multiple GSPs for a basin must describe a coordinated DMS developed for the basin

As indicated, the Regulations are somewhat general in nature as to the specific requirements of the DMS but also broad considering the range of data types and sources involved in the development of a GSP. Specific functions described are limited to "storing" and "reporting"; however, as discussed in Chapter 3, it is anticipated that additional functionality will be desired and potentially critical.

DWR has yet to provide any formal guidance on DMSs, though informally has indicated the possibility of supporting GSPs in DMS development through development of a Best Management Practice (BMP) or other guidance document. This guidance, when available, would further support development and implementation of a long-term DMS for GSP development and overall SGMA compliance.

2.2 GSP DATA REQUIREMENTS

Types of data required for preparation and implementation of a GSP have been identified through review of the Regulations. These data are summarized in Table 2.1. For each data type, primary components of the Basin Setting portion of the GSP are identified. These data also contribute to development of other sections of the GSP, including Administrative Information, Management Areas, Sustainable Management Criteria, and Monitoring Network. Specific data requirements included in the Regulations are further summarized in this section. Each of these will require a combination of spatial and tabular data to be stored in the DMS.

Table 2.1. Summary of GSP Data Requirements.

Data Type	Primary GSP Components			Potential Data Sources
	Hydrogeologic Conceptual Model	*Groundwater Conditions*	*Water Budget*	
Topography	•	•	•	USGS
Surficial Soils	•		•	NRCS
Geology/Hydrogeology	•	•	•	DWR, USGS, local/regional studies
Aquifer/aquitard properties	•	•	•	DWR, USGS, local/regional studies
Meteorological (e.g., temp, precipitation, ET)			•	DWR, PRISM, CIMIS, NOAA, USBR, UCCE
Hydrology/Streamflow	•		•	DWR, USGS, local entities
Land/Water Use (e.g., crop, irrig. source and method)			•	DWR, USDA, FMMP, AWMPs, UWMPs, UCCE, County Ag Commissioners, General Plans, Local Entities
Surface water diversions			•	Local entities, SWRCB, DWR, USBR
Groundwater pumping	•	•	•	AWMPs, UWMPs, DWR, USGS, local entities
Groundwater Conditions	•	•	•	DWR, USGS, local entities
Well information	•	•	•	DWR, USGS, local entities
Groundwater levels	•	•	•	DWR, USGS, local entities
Groundwater quality	•	•		DWR, USGS, local entities
Land Subsidence	•	•	•	USGS, DWR, NASA
Future Conditions (e.g., population, climate)		•	•	DWR, USGS, USBR, UWMPs, CA Dept. of Finance, Census

2.2.1 Plan Contents (Article 5)

Article 5 of the Regulations describe the required contents of a GSP. Article 5 includes three subarticles.

2.2.1.1 Subarticle 1. Administrative Information

Subarticle 1, Administrative Information, requires the following information:

- Area covered and GSA boundaries
- Other jurisdictional boundaries
- Land use, water use sector, water source type
- Well types and densities

2.2.1.2 Subarticle 2. Basin Setting

Subarticle 2, Basin Setting, is subdivided into four sections: Hydrogeologic conceptual model (HCM), groundwater conditions, water budget, and management areas.

The HCM section of the GSP requires the following information:

- Scaled hydrologic cross-sections
- Topography
- Surficial geology
- Soil characteristics
- Recharge and discharge areas
- Surface water bodies
- Source and point of delivery for imported supplies

The groundwater conditions section of the GSP requires the following information:

- Groundwater elevation contours for principal aquifers
- Long-term groundwater hydrographs
- Depictions of change in groundwater storage, including annual groundwater use and water year type
- Seawater intrusion maps and cross-sections
- Map of known groundwater contamination sites and plumes
- Maps of land subsidence
- Identification of interconnected surface water systems and estimates of quantity and timing of depletion
- Identification of Groundwater Dependent Ecosystems (GDEs)

The water budget section of the GSP requires the following information:

- Surface water inflows/outflows by source type
- Inflows to groundwater system by source type
- Outflows from groundwater system
- Change in annual groundwater storage
- Quantification of overdraft, if applicable
- Water year type
- Estimated sustainable yield
- 50 years historical precipitation, evapotranspiration, and streamflows
- Current land use and evapotranspiration
- Projected changes in land use, population, and climate
- Projected surface water supply

The management areas section of the GSP requires the following information:

- Minimum thresholds and measurable objectives
- Maps and other information to describe management area conditions

2.2.1.3 Subarticle 3. Sustainable Management Criteria

Subarticle 3, Sustainable Management Criteria, requires the following information:

- Minimum thresholds (MTs) are defined by the Regulations as the numeric value for each sustainability indicator used to define undesirable results (URs). These represent quantitative indicators of undesirable results by site and sustainability indicator. MTs may be represented by water levels, volume of groundwater in storage, ground surface elevations, stream flows/losses, etc. The number of MTs will depend on potential URs, number of management areas, and extent of representative monitoring employed.
- Measurable Objectives (MOs) are defined by the Regulations as the specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin. Like MTs, MOs are quantitative indicators of groundwater conditions and use the same metrics. MOs may include a margin of flexibility to allow for interannual variability caused by variations in hydrology or other factors.
- Interim Milestones (IMs) are defined by the Regulations as the target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan. Like MTs and MOs, IMs are quantitative indicators of groundwater conditions and use the same metrics. IMs only apply in areas of existing URs.

2.2.2 Technical and Reporting Standards (Article 3)

Article 3, Technical and Reporting Standards, requires the following information:

- For general monitoring sites, a site ID and description must be provided, along with a description of the type of monitoring, measurement type and units, monitoring frequency, location and elevation, and installation standards.
- For groundwater wells, additional information must be included, such as the CASGEM well number, reference point elevation for water level measurements, well use, well status (active or inactive), and construction information, including the construction type (single, clustered, nested, or other) and construction details (casing perforations, borehole depth, and total depth).
- Maps prepared for the GSP must also have available data layers, shapefiles, geodatabases, and other information used in map preparation.
- Models used in developing the GSP must have available input and output files, as requested by DWR.

2.3 PRE-GSP HIGH PRIORITY DATA

Through discussion with County staff, and at a workshop held October 20, 2017, high priority data to support pre-GSP technical activities were identified. These data include well completion reports, groundwater levels, groundwater quality, land subsidence, precipitation, streamflows,

diversions, land use, and evapotranspiration. These data have been compiled and organized as part of this effort. A summary of the data gathered is shown in Table 2.2 below and described briefly in the following subsections. The DMS User Guide (Appendix B) contains detailed descriptions of the process used to gather and process the different data sets.

Table 2.2. Summary of High Priority Data Gathered.

Source	Time Step	Data Type	Minimum Date	Maximum Date
USBR	Monthly	Diversions	12/1/1990	1/1/2015
DWR	Daily	Evapotranspiration	10/1/1989	12/31/2015
DWR	Daily	Land Subsidence (Extensometer)	3/1/2005	8/16/2017
DWR-WDL	Sampling	Groundwater Level	1/31/1923	8/22/2017
DWR, County Ag Commissioners	Annual	Land Use	1/1/1990	12/31/2015
NCEI	Daily	Precipitation	1/1/1904	11/10/2017
PRISM[1]	Daily	Precipitation	1/1/1981	12/28/2017
CDEC	Daily	Streamflows	1/1/1992	1/25/2018
USGS	Daily	Streamflows	1/1/1920	11/2/2017
DWR-WDL	Daily	Streamflows	10/1/1938	9/30/2016
USGS/DWR	Sampling	Groundwater Quality	7/21/1941	7/25/2017
Colusa and Glenn counties	Sampling	Well Completion Reports	1/1/1912	11/22/2017

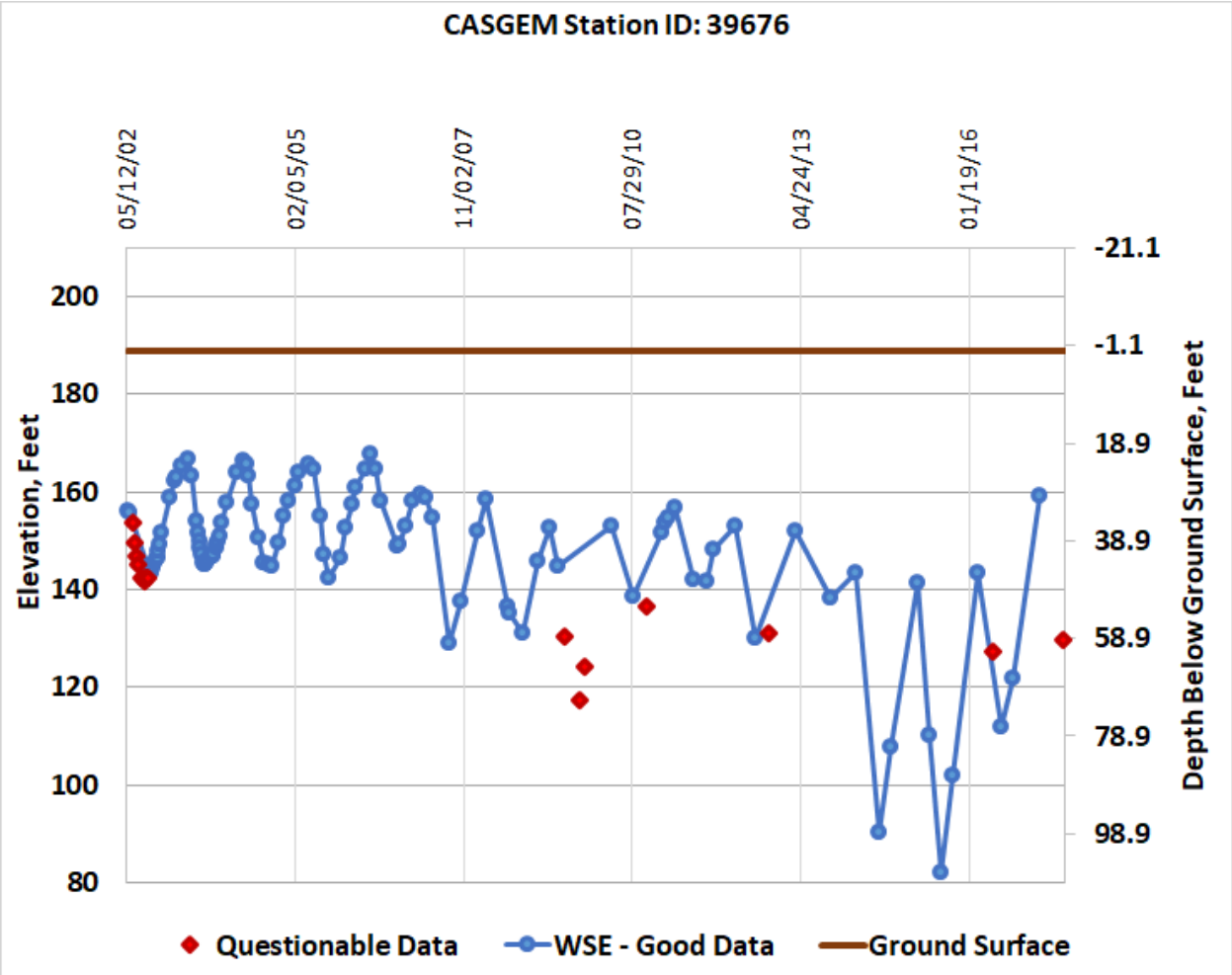
2.3.1 Groundwater Levels

Groundwater level data for Colusa and Glenn Counties were obtained from the DWR Water Data Library (http://wdl.water.ca.gov/waterdatalibrary) and imported to the database. This is described in the DMS User Guide, Appendix B.

The final, loaded data set consists of 111,293 records spanning the 1/31/1923 to 8/22/2017 time period. Additional quality control was not performed on this dataset as basic quality control has already been performed by DWR.

A graphing utility was developed to provide time series graphs of groundwater elevation and depth to groundwater. An example groundwater level hydrograph for an observation well in Glenn County is provided in Figure 2.1. In addition, functionality to create and export data sets for mapping groundwater level contours using GIS software was also developed.

[1] Parameter-elevation Regressions on Independent Slopes Model: http://prism.oregonstate.edu/



CASGEM Station ID:	39676	Basin Description:	Colusa
Site Code:	397008N1221208W001	County Name:	Glenn
State Well Number:	21N02W05M001M	Is Voluntary Reporting:	N
Local Well Designation:	21N02W05M001M	Total Depth (ft):	490
Latitude:	39.7008	CASGEM Station Use Description:	Observation
Longitude:	-122.1208	WCR Number	801406
Location Method:	Surveyed to a benchmark	Number of Perforation:	1
Location Accuracy:	0.1 ft.	Bottom of Perforations (ft):	452
Basin CD:	5-021.52	Top of Perforations (ft):	442

Figure 2.1. Sample Groundwater Level Graphing Output.

2.3.2 Precipitation

The entire history of data for all 8 sites with daily precipitation records available on the NCEI website for the two counties was downloaded, and quality control was completed in the DMS. A list of sites is provided in Appendix D. Additionally, daily precipitation estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM,

http://prism.oregonstate.edu) were downloaded for the centroids of 48 townships covering the Colusa and Glenn County valley floor area for 1/1/1981 through 12/28/2017. These data are developed using PRISM based on precipitation information from nearby weather stations. Quality control of the PRISM data was performed in the tabular DMS.

Output for precipitation data sets consist of quality controlled daily, monthly, and annual tabular reports and daily and annual graphical reports. A sample daily report is shown in Figure 2.2.

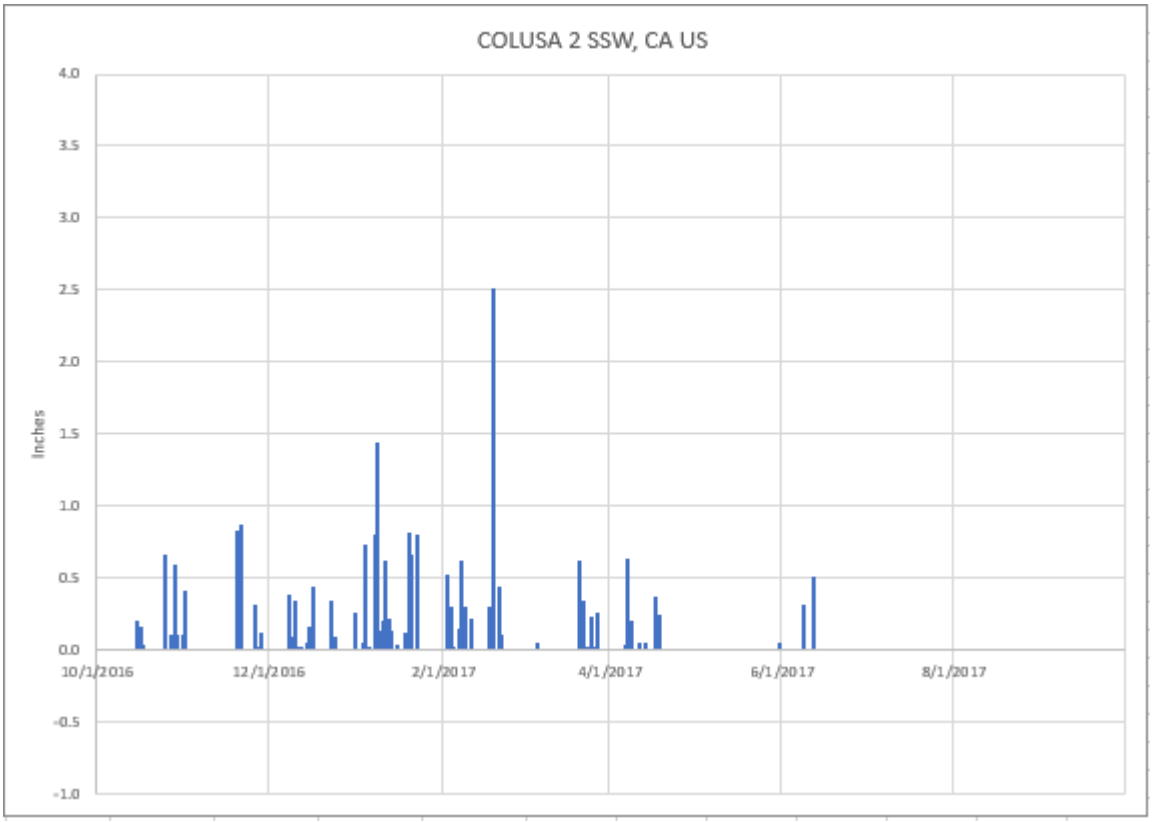


Figure 2.2. Example Daily Time Series Precipitation Graph .

2.3.3 Streamflow

Streamflow data for 41 sites within and surrounding the two counties were downloaded and quality-controlled within the tabular DMS. These sites are listed in Appendix D. The streamflow data were obtained from CDEC, DWR-WDL, and USGS. Some sites may not ultimately be used for GSP development or incorporated into the monitoring network. It is anticipated that this determination will be made in subsequent phases of GSP preparation.

Output for streamflow data sets consist of quality controlled daily, monthly, and annual tabular reports and daily and annual graphical reports.

2.3.4 Diversions

Monthly diversions were downloaded from the USBR Mid-Pacific Region's Central Valley Operations website (https://www.usbr.gov/mp/cvo) for the 1990-2015-time period. The following four USBR tables were formatted and loaded into the tabular DMS:

USBR Table 21: Central Valley Project Diversions

USBR Table 27: Tehama-Colusa Canal Deliveries

USBR Table 28: Sacramento River Deliveries

USBR Table 29: Sacramento-San Joaquin Valley Streamflow Data

A summary of diversion sites is provided in Appendix D.

2.3.5 Land Use

Information describing land use in Colusa and Glenn counties was obtained from a combination of DWR land use surveys and county agricultural commissioner cropping reports. DWR land use surveys were available for each county for 1993, 1998, 2003, 2009, and 2014. Agricultural commissioner crop reports were compiled for 1990 to 2015 for each county. Raw land use data from the DWR and ag commissioner sources were summarized according to the following land use categories and subcategories:

- Agricultural Lands
  - Field and Truck Crops
    - Corn
    - Cotton
    - Dry Beans
    - Melons
    - Misc. Field
    - Misc. Truck
    - Safflower
    - Sudan
    - Sugarbeets
    - Sunflower
    - Tomatoes
  - Grain
  - Idle
  - Orchards and Vineyards
    - Almonds
    - Citrus
    - Misc. Deciduous
    - Olives
    - Pistachios

        - Prunes
        - Vineyard
        - Walnuts
    - Pasture and Hay
        - Alfalfa
        - Pasture
    - Rice
- Developed Lands
    - Semiagricultural
    - Urban
- Native Lands
    - Grasslands
    - Riparian
- Wetlands
    - Seasonal and Permanent Wetlands
    - Water

2.3.6 Evapotranspiration

Evapotranspiration (ET) was estimated for each land use category using a combination of satellite-based remote sensing and reference evapotranspiration (ETo) from the California Irrigation Management Information System (CIMIS) station at Colusa. Evapotranspiration was estimated on a daily basis for the period 1990 to 2015. Daily weather data were quality controlled using standard procedures of the American Society of Civil Engineers (ASCE).

First, crop coefficients (kc) representing the ratio of actual ET (ETa) to ETo were estimated for each land use based on an analysis using Landsat satellite imagery and the Surface Energy Balance Algorithm for Land (SEBAL) completed for DWR in 2009. Individual images were analyzed representing approximately two- to four-week intervals during the primary growing season. For each image date, crop coefficients were calculated for each land use based on field delineations in the Colusa and Glenn 2009 DWR land use surveys. Then, these crop coefficients were interpolated to develop an annual time series for each land use.

To estimate ET for the full period of interest, daily ETo was estimated using CIMIS for 1990 to 2015, and then multiplied by the crop coefficients developed based on the 2009 SEBAL analysis.

2.3.7 Groundwater Quality

DWR provides historical groundwater quality data on request and provided consolidated historical groundwater quality results for Colusa and Glenn counties on March 9, 2018. Historical groundwater quality data for Colusa and Glenn counties were also downloaded from the USGS Water Resources Information System (WRIS) database on January 3, 2018 using the National Water Quality Monitoring Council (NWQMC) Water Quality Portal (WQP) at https://www.waterqualitydata.us/portal/. The WQP is an online cooperative service sponsored by USGS, U.S. Environmental Protection Agency (EPA), and National Water Quality Monitoring

Council that integrates publicly available water-quality data from the USGS National Water Information System (NWIS) database and the EPA STOrage and RETrieval (STORET) data warehouse (NWQMC, 2018).

The water quality data set encompasses the 1941 through 2017 time period and consists of over 120,000 measurements.

The groundwater quality data were not loaded into the tabular DMS at this time, as it was determined through consultation with the counties that these data represent a lesser priority dataset during this preliminary phase of GSP development. It is anticipated that data to be included in the tabular DMS will be determined in future phases through further assessment of groundwater conditions and development of associated sustainable management criteria. It is stored in a supporting file of the tabular DMS and could be incorporated in the future. Data in the two data sets are assumed to have at least some overlap.

2.3.8 Land Subsidence

Land subsidence data were downloaded from DWR-WDL. The extensometer data files are in subfolders per site location (5 sites). Each subfolder has an excel spreadsheet that was used to process the data files..

The data set covers the period from 2005-2017. There are over 20,000 measurements at the five sites. The land subsidence data was not loaded into the tabular DMS at this time, as it was determined through consultation with the counties that these data represent a lesser priority dataset during this preliminary phase of GSP development. This data set is stored in a supporting file of the tabular DMS and is anticipated to be incorporated in the future, particularly if extensometers are constructed in areas of known or suspected subsidence. Additionally, InSAR data and data from prior GPS surveys could be incorporated in future phases through further assessment of groundwater conditions and development of associated sustainable management criteria.

Through consultation with County staff, the following recommended features of a tabular DMS were identified: data acquisition, formatting, quality control and assurance, storage, and visualization and reporting. This chapter describes these functions and provides a basis for evaluating alternative DMS options, including commercial systems currently available or that may be available in the future. Additionally, these core functions serve as a basis for development of an initial DMS to support near-term GSP development activities. As part of this effort, a preliminary tabular DMS has been developed and is described in Appendices B and C. A process diagram illustrating key functions and components of the tabular DMS is shown in Figure 3.1. These are described in greater detail below and in the User Guide (Appendix B) and Programmer Guide (Appendix C).

3.1 DATA ACQUISITION

Data acquisition refers to the process of importing raw data into the tabular DMS in its native format. Acquisition methods include manual and automated methods. As implied, manual entry consists of manually entering data into the DMS. One example of manual entry includes entering data from a well completion log into a form in the DMS. Automated methods may include importing a flat file or linking directly to a remote data source. Flat files include text files, delimited data files, MS Excel spreadsheets, etc. Direct linkages could include linkages to web sites, online databases, etc. The preferred acquisition for a given data type and source will vary, and may change over time. Manual methods provide the greatest flexibility with regard to the type of source, for example allowing input from paper records, but require greater time and effort to perform a task. Manual methods are also subject to data entry error. Automated methods can help speed up data acquisition and reduce the risk of entry error, but require standard formats that may change over time. Manual methods tend to require less technical proficiency while automated methods require regular maintenance by technical personnel.

3.2 FORMATTING

Once data is acquired in its native format, it can be formatted into a standard format to allow for review and combination with other data. Formatting may include structural changes to how the data is organized and stored, unit conversions for consistency among data sources and with reporting requirements, and spatial transformations to support accurate and consistent display in GIS viewers or for calculations that depend on horizontal and/or vertical location data.

To provide consistency and simplify quality control and assurance, visualization, and reporting processes, a standard structure is recommended for all tabular data. An example of this process is shown in Figure 3.1, where raw data from multiple sources is formatted and stored in a raw master table.

3.3 QUALITY ASSURANCE AND CONTROL

Together, quality assurance and quality control represent processes to manage the quality of data within the DMS.

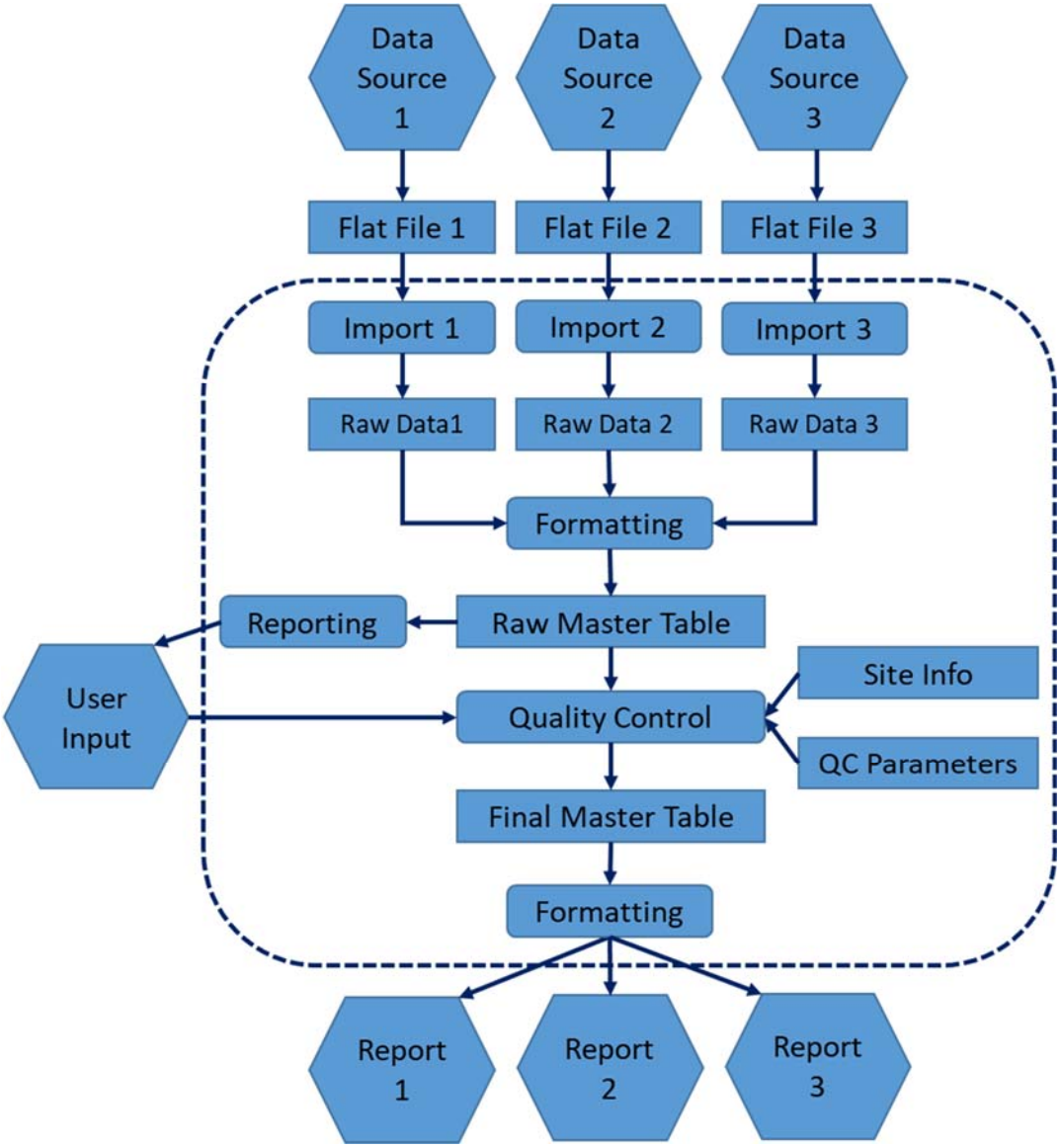


Figure 3.1. Tabular DMS Key Functions and Components.

3.3.1 Quality Assurance (QA)

QA can be described as the process of managing for data quality. Key aspects of QA in the DMS include verifying the reliability and quality of raw data being brought into the DMS and tracking any changes made to data within the DMS for formatting and/or any modifications to improve data quality as part of quality control (QC), described below. With regards to raw data, data management should include documentation of the source and time at which raw data was acquired, and by whom. Once imported into the DMS, both original and modified records should be stored and maintained. The flow of data from the source to the final quality controlled records should be fully traceable. The final quality controlled record should provide information related to who

performed the QA/QC, an indication of the reason any records were modified, and the date the records were last modified.

3.3.2 Quality Control (QC)

Similar to data acquisition, QC typically includes a combination of automatic and manual processes.

Automated QC may include flagging of values outside of a specified range and gap filling of minor data gaps and flagged values. Specified ranges for flags may be established based on known physical limits, statistical measures, or user-specified values based on review of historical data.

Methods to fill data gaps vary depending on the nature of the data gap and the type of data for which gap filling is applied. Techniques include the following:

- Interpolation between accepted values;
- Extrapolation based on trends;
- Replacement with the previous or next accepted value;
- Average of prior and following accepted values;
- Correlation to values from another, similar site; or
- Correlation to other data types.

Manual QC processes include review of raw, provisional, and final data in graphical and/or tabular form by a qualified individual. Based on this review, data judged to be erroneous can be filled and corrected. Another example of manual QC would be performing specialized analysis to fill major gaps in a record, which may include a combination of different gap filling approaches over time for a given site. It is recommended that all key data receive some level of manual review when brought into the DMS.

Following QA/QC, final data is stored in a final master table, as shown in Figure 3.1.

3.4 STORAGE

Data storage is another key functionality to consider when selecting or developing a DMS. Data may be stored locally, remotely, or both. Key considerations for different storage options include the initial storage requirement, scalability, reliability and accessibility of the storage location.

It is recommended that the DMS incorporate functionality to back up the data. Data backed up should be stored at a separate location from the primary DMS.

3.5 VISUALIZATION AND REPORTING

A key function of the DMS to support QC, analysis and interpretation, education and outreach, reporting, and other aspects of GSP development and implementation is the ability to visualize information in both graphical and tabular form. Graphical visualization may include graphs, charts, maps, and 3-D renderings. There may also be value in animations showing historical or

projected changes over time to support stakeholder engagement in defining sustainable management criteria and evaluating potential projects and management actions.

Specific purposes of developing reports from the DMS may include the following:

- Internal review and communication among technical staff
- Data management diagnostics to ensure data quality and completeness
- Tracking of sustainability as defined by minimum thresholds and measurable objectives
- Stakeholder engagement
- Regulatory compliance (GSP content, and annual and 5-year reporting)

Reports may include electronic or printed information to support direct review (pdfs, web content, hard copies, etc.) or exported digital information in the form of MS Excel workbooks, MS Access databases, direct linkages to other databases, etc.

CHAPTER 4
Existing Data Management and Reporting Systems

Existing data management and reporting systems utilized by Colusa and Glenn counties were discussed with staff from each county, with the objective of characterizing existing systems and whether and how they might support implementation and maintenance of a DMS under SGMA. Key findings of the evaluation include the following:

- MS Office software was recently upgraded in each County. Both counties also possess GIS capability
- It is uncertain what the role of each county will be in DMS implementation and maintenance moving forward. For the Colusa Subbasin, it may be desirable for one or both groundwater authorities formed in 2017 to individually or cooperatively maintain one or more DMS. Alternatively, it may be desirable for a GSA member agency other than the authorities to host the DMS due to a member agency potentially possessing superior hardware, software, or other capabilities. For the West Butte and Corning Subbasins, discussions will need to take place to determine how consistent data management will occur.
- Under agreements related to the formation of the groundwater authority in each county for the Colusa Subbasin and the Colusa County portion of the West Butte Subbasin, the authorities are expected to lead technical efforts, including maintaining data related to SGMA for the first two years. Beyond the initial two-year period, it is anticipated that a long term plan and any associated agreements will be developed and implemented.
- Colusa County has an Information Technology (IT) department that maintains all technology related resources, including computers, networks, and software applications. In Glenn County, IT services are provided by an outside consultant.
- Well permits are currently tracked by the Environmental Health department in each county. In Glenn County, this is accomplished using an MS Access database with minimal electronic tracking. Most information is stored in paper files in both counties. There have been discussions in the past in both counties about collecting and logging well-specific location information.
- Land use information is maintained by the Planning and Public Works department in Glenn County. In Colusa County, Planning and Public Works are separate departments, with the Public Works department having a GIS specialist on staff. In Glenn County, members of the Planning and Public Works department possess the greatest capability with regards to GIS. In both counites, there is interest in integrating more information on water systems.

Based on the evaluation of existing data management and reporting systems, it is recommended that the GSAs have additional, focused discussion during the next phase of GSP development to answer remaining questions with the objective to develop an effective DMS and related processes. These questions include:

1. Will more than one DMS be maintained for each subbasin within Colusa and Glenn counties?
2. Will information for multiple subbasins be maintained in a single DMS?

3. Who will maintain each DMS? What levels of access will different users have?
4. Where will the DMS be hosted physically?

The most cost-effective approach will likely involve developing a single DMS for each subbasin that is coordinated with the DMS for each neighboring subbasin and housed by the GSA member agency with the best hardware, software, and DMS management capabilities.

Additional information discussing phased implementation of the DMS is provided in Chapters 6 and 7.

It was originally envisioned that each county would select and implement a long-term, proprietary DMS as part of this effort; however, the position of each county at this time is that it is premature to select a DMS for three reasons:

1. The selection process should be conducted by the GSA (or GSAs) that will eventually use the DMS,
2. DMSs are evolving rapidly at the moment, and the range of choices will likely be wider in the future and better options will potentially be available, and
3. DWR's system for reporting as part of GSP implementation has not yet been developed and should be considered in developing a local DMS or selecting a proprietary DMS, along with technical support that may develop in the near future such as a DMS Best Management Practice or other guidance document(s).

With these considerations in mind, County of Glenn staff completed a preliminary evaluation of available DMS systems and visualization software. In addition to currently utilizing the ArcHydro set of data models and tools within ArcGIS to support geospatial and temporal data analyses, staff profiled the following four applications:

- EarthSoft's EQuIS data management and decision support system (www.earthsoft.com)
- Water Sage integrated water and land information platform (www.b3insight.com)
- Waterfind Water Accounting and Management Platform (WAMP), a cloud-based, software-as-a-service (SaaS) platform (www.waterfindusa.com/wamp/)
- RMC Opti information management tool

The evaluation is provided in Appendix A.

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A phased DMS implementation plan was developed in consultation with staff in each county. For the initial phase of DMS development, the following high-priority implementation goals were identified:

- Focus initially on the Basin Setting to support GSP development, including identification of key data to support development of the hydrogeologic conceptual model (HCM), evaluation of groundwater conditions, and water budget.
- Include identification of data for existing and potential monitoring locations to be incorporated into the SGMA monitoring network.
- Gather readily available data from federal, state, and local sources
- Apply QA/QC procedures to data needed in the near-term
- Characterize subsequent phases of DMS development to guide long-term implementation

Based on the high-priority implementation goals, Phase I of DMS development was completed as described in Chapter 7. It is anticipated that Phase II of DMS development will be initiated in the first quarter of 2020 and continue for up to 15 months, through March of 2021. The estimated budget for Phase II of DMS implementation for the Colusa Subbasin is approximately $100,000 and includes $25,000 for purchase of a proprietary DMS or additional refinements to the Phase I DMS[2]. For the Corning Subbasin, the estimated budget for Phase II of DMS implementation is approximately $60,000[2]. For the West Butte Subbasin, the cost of Phase II of DMS development is approximately $32,000[2]. Additional details describing the estimated budget and costs are included in the GSP grant applications submitted by the Colusa Groundwater Authority, County of Glenn, and Butte County Department of Water and Resource Conservation to DWR under Proposition 1 in November 2017. Through coordination of GSP development among subbasins underlying Colusa and Glenn counties, it is anticipated that efforts can be leveraged to reduce per-subbasin costs.

[2] These estimates are based on Proposition 1 GSP development grant applications submitted for each subbasin and selected for final award on April 4, 2018. The Colusa Subbasin application was submitted by the Colusa Groundwater Authority, while the Corning Subbasin application was submitted by the County of Glenn. The West Butte Subbasin application was submitted by the Butte County Department of Water and Resource Conservation as part of an application also including the East Butte, Vina, and Wyandotte Creek subbasins. In the case of the Butte County application, the total cost of DMS development is divided among subbasins and is approximately $128,000.

Table 6.1. Phased DMS Implementation Activities.

DMS Function	DMS Development Phase		
	Pre-GSP (Phase I)	**GSP Preparation (Phase II)**	**GSP Implementation**
Data Acquisition	Focus on high priority data. Gather readily available public and local information.	Gather remaining, lower priority available data needed for GSP preparation and update higher priority datasets. Develop new datasets as needed to support GSP preparation. Further develop import procedures to accommodate new datasets and streamline existing dataset processing.	Further develop import procedures to accommodate new datasets and streamline existing dataset processing. Acquire and import additional data annually or more frequently to support reporting requirements.
Formatting/ Organization	Develop format(s) and organizational structure to facilitate quality control, reporting, and visualization as part of pre-GSP phase and GSP preparation phase.	Modify formats as needed to transition to long term DMS, which may include proprietary or other systems. Reorganize data as needed to facilitate integration into long term DMS.	Modify formats as needed to maintain DMS. Reorganize data as needed to facilitate required reporting and DWR formats.
Quality Control	Develop and implement QC procedures for high priority data sets. Test and refine procedures.	Develop and implement additional QC procedures and capabilities for additional datasets. Test and refine new and existing procedures. Utilize proprietary or other system QC procedures on existing and new datasets.	Continue implementation of QC procedures as data is integrated into DMS over time. Periodically review and refine QC procedures. Evaluate quality of data over time to identify and address high priority data gaps.
Visualization and Reporting	Identify visualization requirements with focus on GSP preparation. Implement initial capabilities to support QC of high priority data sets. Define reporting requirements based on available information. Implement simple, high priority reporting and data export capabilities to support pre-GSP activities (e.g. QC of high priority data sets).	Expand visualization capabilities to include generation of figures, charts, and maps required to be included within the GSP. Additionally, develop capability to generate figures, charts, and maps for annual and 5-year reporting. Further define reporting requirements and implement reports to support GSP preparation and annual and 5-year reporting in implementation phase.	Update figures, charts, maps, tables, and other report features to facilitate ongoing management activities and to meet reporting requirements.
Storage	Store data locally in a format to support migration to longer term storage location during GSP preparation. Implement simple backup procedures.	Evaluate storage options, select preferred option, and implement for long-term data storage and backup.	Maintain long-term data storage and backup. Evaluate and implement modifications to storage practices as new technology emerges.

CHAPTER 7
Phase I Data Management and Reporting System Implementation

This chapter describes the implementation of an initial DMS to support GSP development for the subbasins underlying Colusa and Glenn counties. The initial DMS was developed to collect, QA/QC, and store high priority data types needed for GSP development.

7.1 INITIAL DMS OVERVIEW

The initial DMS was developed primarily using Microsoft Office applications and ArcGIS. A schematic of the DMS components is provided in Figure 7.1. The main components of the DMS include:

- Tabular DMS housing primarily timeseries data and other non-spatial data sets
- Geospatial Database housing spatial data sets
- Water Budget Database used to perform water budget calculations
- Historical Documents and Data archives storing historical documents and datasets

Each of these components are described below.

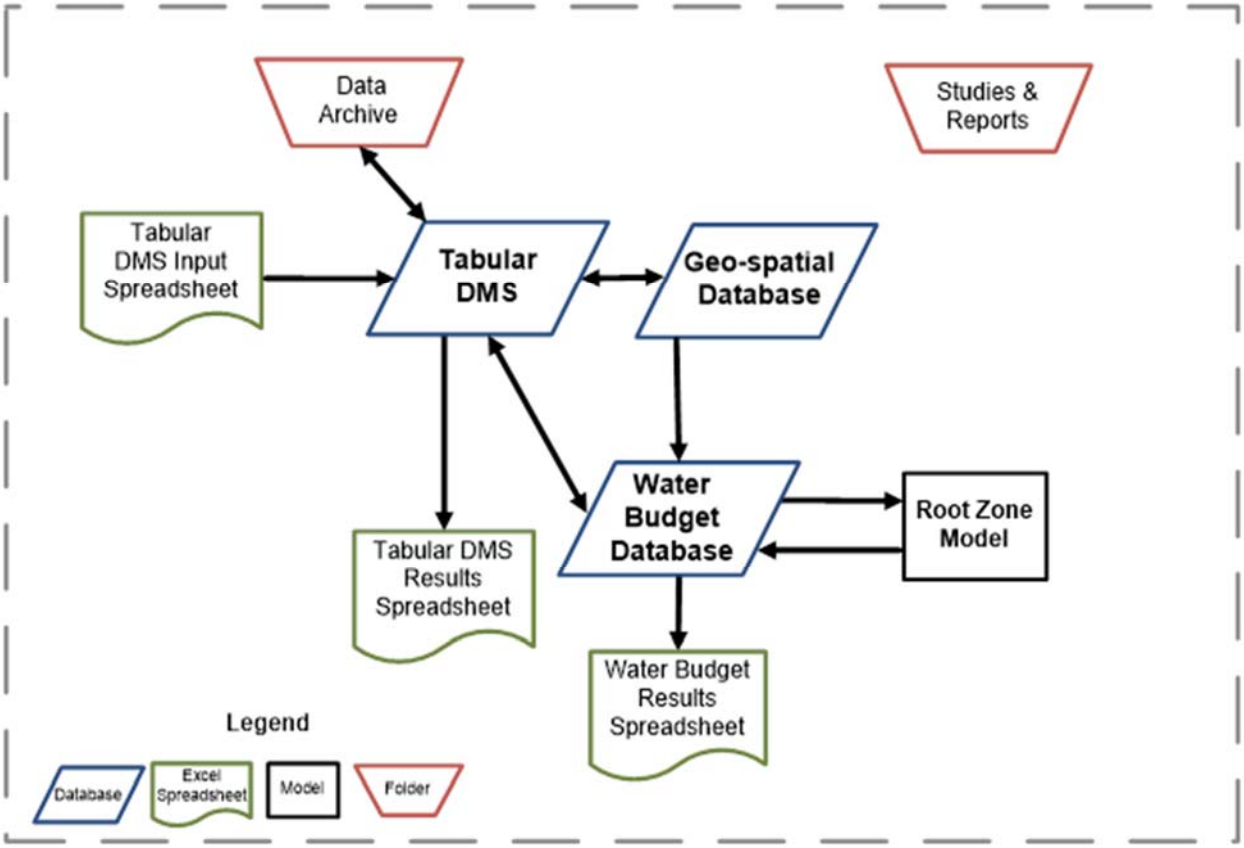


Figure 7.1. DMS Overview.

7.2 TABULAR DMS

The tabular DMS is composed primarily of an MS Access database and Excel spreadsheets. In addition, a file structure has been developed to help manage database input and output files (Data Archive). The tabular DMS utilizes Visual Basic programming to automate functionality of the application. A user interface was developed using forms to guide the user through the application. The user interface is described in detail in Appendix B: DMS User Guide. Tables and queries used in the database are described in detail in Appendix C: DMS Programmer Guide.

The user guide outlines the steps to acquire, import, and QC various datasets stored in the DMS. It was decided that a daily time step would be the minimum time step allowed in the database due to size constraints of MS Access databases (2 GB). Any data where the time step was more frequent than daily was summarized by day and loaded into the database. If daily data were not available, then monthly data was loaded into the database. The data can be loaded into the database on any schedule (i.e., data can be loaded yearly, monthly, every six months, etc.). There are no automatically scheduled tasks within the database. All functionality is initiated by the user via forms.

The tabular DMS links directly to output spreadsheets where users can visualize the time series data sets. Linkages between the tabular DMS and the geospatial database could be implemented using existing GIS applications by the counties or be developed during GSP development, as needed. Examples would include direct linkages to visualize time series data from the tabular DMS in real time or automated procedures to directly import and interpolate groundwater level data to develop water level contours. It is envisioned that various data sets developed in the geospatial database could be queried and imported into the tabular DMS for reporting, visualization, and storage. In addition, data from the tabular DMS could be exported for use in the GeoSpatial database for various spatial analyses, such as development of groundwater level contours.

An inventory of data in the tabular DMS and the final dataset storage location is provided in Table 7.1. The total tabular DMS size after loading all the data is approximately 300 MB. This leaves sufficient storage for additional data sets to be added in the future.

Table 7.1. Tabular DMS Data Inventory

Source	Time Step	Parameter	Minimum Date	Maximum Date	Number of Records	QC Status	Location	Final Data Table Locations
CDEC	Daily	Streamflow	1/1/1992	1/25/2018	85,005	Complete	Tabular DMS	QC_Final Data
NCEI	Daily	Precipitation	1/1/1904	11/10/2017	235,692	Complete	Tabular DMS	QC_Final Data
PRISM	Daily	Precipitation	1/1/1981	12/28/2017	648,528	Complete	Tabular DMS	QC_Mon Vol
USBR	Monthly	Diversion/ Delivery Volume	12/1/1990	1/1/2015	31,971	Not Performed	Tabular DMS	QC_Final Data
USGS	Daily	Streamflow	1/1/1920	11/2/2017	44,887	Complete	Tabular DMS	QC_Final Data
WDL	Daily	Streamflow	10/1/1938	9/30/2016	274,453	Complete	Tabular DMS	QC_Final Data
WDL	Variable	Groundwater Level	1/31/1923	8/22/2017	111,293	Performed by DWR	Tabular DMS	GWL
Glenn County	At Time of Drilling	Well Completion Reports	1/1/1970	11/22/2017	4,225	Performed During Entry	Tabular DMS	QC_Well CompletionData
Colusa County	At Time of Drilling	Well Completion Reports	1/1/1955	8/27/2015	3,504	Substan-tially Comp-leted Previously	Tabular DMS	QC_Well CompletionData

The following data and files are included as part of the preliminary tabular DMS:

- GlennColusaDMS.accdb – MS Access database application containing tables, queries, and forms developed as part of the preliminary DMS. For additional detail describing use of the application, see the User Guide and Programmer Guide included as Appendices B and C, respectively.
- Input – Input files for datasets imported to the tabular DMS described in Table 7.1.
- Output – Output files for data exported from the tabular DMS for reporting, analysis, etc.
- Supporting Files – Various supporting data and files for the preliminary tabular DMS.

7.3 HCM GEOSPATIAL DATABASE

A variety of geospatial datasets were compiled as part of preparation of the HCM and are included as part of the preliminary DMS. Various data layers included in the HCM geospatial DMS are summarized in Table 7.2.

Table 7.2. HCM DMS Data Inventory

File	Category	Type	Format	Description
External_Files\C2VSim_Watersheds	External	Polygon	Shapefile	C2VSim small watershed delineations
External_Files\CA_County	External	Polygon	Shapefile	California county boundaries
External_Files\DWR_Bulletin118\ Bull_118_20161229	External	Polygon	Shapefile	California Bulletin 118 groundwater basins
External_Files\DWR_Bulletin118\ CASGEM_Prioritization_2014	External	Polygon	Shapefile	CASGEM 2014 groundwater basin prioritization
External_Files\DWR_Geology	External	Polygon	Shapefiles	Outcrop and subsurface extents for Tehama and Tuscan formations
External_Files\ DWR_LandUseSurvey	External	Polygon	Shapefiles	DWR land use surveys for Glenn and Colusa counties for 2014
External_Files\Hillshade	External	Raster	SID	Hillshade at 30-meter resolution
External_Files\NAIP_Imagery	External	Raster	SID	2011 NAIP aerial imagery for Glenn and Colusa counties
External_Files\NHD_Hydrology\ NHDH1802.gdb	External	Multiple	Geodatabase	National Hydrography Dataset
External_Files\SAGBI	External	Polygon	Shapefiles	Soil Agricultural Groundwater Banking Index
External_Files\SSURGO_Soils	External	Polygon	Geodatabases	Soil Survey Geographic Database (SSURGO) soil map units by watershed
External_Files\USGS_DEM	External	Raster	ArcGrid	USGS topography (digital elevation models)
External_Files\USGS_Geology\ SacramentoValleyGeology.gdb	External	Polygon	Geodatabase	USGS Sacramento Valley surficial geology
Internal_Files\GeoVolumes_V1.idb	Internal	Multiple	Geodatabase	3-D geologic model
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Monitoring wells used to develop groundwater level contours for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Monitoring network wells for groundwater levels
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Land subsidence monitoring sites, including GPS benchmarks, continuous GPS sites, and extensometers
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Surface water monitoring locations
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Populated place names
Internal_Files\InternalDataFiles.gdb	Internal	Point	Geodatabase	Contour wells from Olmstead and Davis (1961)
Internal_Files\InternalDataFiles.gdb	Internal	Polyline	Geodatabase	Depth to water contours for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Polyline	Geodatabase	Groundwater surface elevation contours for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Polyline	Geodatabase	Base of fresh water and other structural contours from Harwood and Helley (1987)
Internal_Files\InternalDataFiles.gdb	Internal	Polygon	Geodatabase	Study area boundary

File	Category	Type	Format	Description
Internal_Files\InternalDataFiles.gdb	Internal	Polygon	Geodatabase	Water agency boundaries
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Depth to water for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Groundwater surface elevation for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Land surface elevation mosaic for HCM
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Plate 1 from Harwood and Helley (1987)
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Base of fresh water from Olmstead and Davis (1961)
Internal_Files\InternalDataFiles.gdb	Internal	Raster	Geodatabase	Plate 5 from Olmstead and Davis (1961)

7.4 WATER BUDGET DATABASE

The water budget database was developed to store datasets associated with development of preliminary water budget for the subbasins underlying Glenn County and to complete the associated calculations. The database has been developed to provide the foundation for developing automated monthly water budget calculations in a future phase, if needed. Various datasets from the tabular DMS were imported into the Water Budget database. The tabular DMS has been designed to link directly to the Water Budget to facilitate updates of these datasets in the future. Queries from the water budget database were pasted into a water budget results spreadsheet manually; however automated linkages could be developed in the future. The water budget results spreadsheets for each subbasin underlying the county display tables and figures to support visualization and reporting of the water budget results for inclusion in the GSP. Ultimately, water budgets for the GSP will likely be prepared based on outputs from an integrated hydrologic model application developed for the basins overlying each county; however, the tables and charts developed to report water budgets as part of this effort could be adapted to utilize integrated model outputs directly. Information provided in the water budget component of the DMS, including a preliminary root zone model (as shown in Figure 7.1) includes the following:

- Water Budget Workbooks by Subbasin – Excel workbooks containing preliminary water budget summary information for the portions of the Colusa, Corning, and West Butte subbasins in Glenn County
- GlennCountyWB.accdb – MS Access database application to perform water budget calculations for the portions of the Colusa, Corning, and West Butte subbasins in Glenn County
- Land Use Directory – Compilation of historically available DWR land and water use surveys for Colusa and Glenn counties
- GlennCountyIDC_v2_urban Directory – IWFM Demand Calculator (IDC) application and associated files to estimate agricultural, urban, native, and wetlands water use to support preliminary water budget development.

7.5 STUDIES AND REPORTS

The Studies and Reports folder houses documents reviewed and relied upon as part of GSP development. Documents available in electronic format at the time of preparation of this report are included as part of the preliminary DMS, and include documents relied upon for the HCM, monitoring network evaluation, preliminary water budgets, and integrated hydrologic model evaluation. The following report types are included in the Studies and Reports component for the preliminary DMS:

- AWMPs – Agricultural Water Management Plans compiled for water suppliers to support preliminary water budget development.
- B118 GW Basin Descriptions – Most recent Bulletin 118 groundwater subbasin descriptions for the Colusa (2006), Corning (2006), and West Butte Subbasins (2004)[3].
- BMPs – SGMA Best Management Practice documents prepared by DWR.
- GMPs – Existing Groundwater Management Plans for the study area.
- Subsidence – Available reports describing subsidence in the study area.
- UWMPs – Urban Water Management Plans and other available urban water use information for the study area.
- Water Quality – Reports describing water quality for the study area.
- Other – Other geologic, hydrogeologic, or miscellaneous studies and reports for the study area.

[3] Years in parentheses represent the year of the most recent basin description update.

Initial Evaluation of Available DMS Systems and Visualization Software

Glenn County currently has an enterprise license for ESRI. ESRI applications, including ArcMap, are housed on the home Citrix server which County employees may access. At minimal added cost, the County may use ESRI applications when appropriate for groundwater evaluation and visualization.

Arc Hydro is a set of data models and tools that operates within ArcGIS to support geospatial and temporal data analyses. There are two key components Arc Hydro Data Model and Tools. The components together provide a basic database framework and analysis tools. Arc Hydro Tools toolbox can be used both in ArcMap and in ArcCatalog.

Arc Hydro Groundwater (AHGW) is a geodatabase design for representing groundwater datasets within ArcGIS. The data model helps to archive, display, and analyze multidimensional groundwater data, and includes several components to represent different types of datasets, including representations of aquifers and wells/boreholes, 3D hydrogeologic models, temporal information, and data from simulation models. The Arc Hydro Groundwater Tools help to import, edit, and manage groundwater data stored in an AHGW geodatabase. Subsurface Analyst is a subset of the AHGW Tools that is used to manage 2D and 3D hydrogeologic data, and create subsurface models including generation of borehole representations, cross sections, surfaces, and volumes."

Arc Hydro tools do the following:

- Generate and populate an Arc Hydro geodatabase from vector and raster data sources.
- Establish relationships between core spatial layers.
- Apply geometric networks for upstream and downstream tracing and resource accumulation.
- Perform advanced water resource functions (e.g., watershed delineation and characterization).
- Develop node-link hydro schema.
- Use an XML data exchange framework for data integration with external models.
- Develop data inputs for external hydrologic and hydraulic models.

http://ahgw.aquaveo.com/XS2D.pdf

The following additional systems and tools were considered with the use of Arc Hydro and Arc Hydro Groundwater in mind in regards to compatibility with systems and tools to be used in conjunction as potential visualization tools.

Software Evaluations

The following includes summaries and a question & answer section regarding attributes and capabilities of multiple company's tools and systems. Each company provided answers to this section. These questions are followed by an "Additional Notes" section compiled by county staff from information gained during demonstrations. Tools and systems include data aggregation platforms, data management and analysis systems and management dashboards among others. Each tool/system summary and question & answer section varies slightly due to the variability of tool/system capabilities. Not all questions were applicable to the nature of each tool or system.

EarthSoft

Earthsoft offers multiple tools including EQuIS Data Gathering Engine, EQuIS Professional, EQuIS Live and EQuIS ArcGIS among others with popular third-party interfaces. Interfaces include EnviroInsite, Surfer, GMS, RockWorks, EVS, LogPlot, gINT, WinLoG, ArcGIS, and many more. EQuIS Data Gathering Engine (EDGE) is a comprehensive collection of integrated environmental field tools for data collection, using modern software and mobile computing technologies. Earthsoft's EQuIS Professional advanced automated workflow manages, analyzes and visualizes environmental data in the field, in the office and across the organization (consultant level users or EQuIS-trained). EQuIS Live can manage a large amount of time-series data from data loggers both stationary and portable. EQuIS offers training workshops and online training. Earthsoft and ICO offer hosted EQuIS online and EQuIS is all .NET, available in both Oracle and SQL Server.

System Requirements:

- EQuIS runs on any Windows-based operating system from the latest Windows XP and Windows Server 2008.
- EQuIS supports ArcGIS 10 and 9.3 system (read more for requirements).
- ArcGIS 9.3 and ArcGIS 10 are fundamentally different and have different system requirements.
- ArcGIS may have more stringent system requirements.

Price: The cost of EQuIS depends on number and type of users, hosting preference, and required data types. Following the demonstration, we will work with you to determine the most cost-effective solution to meet your needs.

Additional Notes: EQuIS serves the purpose of data aggregation and management (DMS) including managing field data collection and historical data aggregation. It is high volume data management in one centralized system. Including data visualization and HCM capability.

EQuIS Professional-Power user data management

EQuIS Enterprise-Casual user data management

EQuIS EDGE-Electronic Data Collection and live integration of field data via data logger or field collection with tablet into EQuIS Enterprise/Professional

EQuIS Alive- Is a separate module for biologic, taxonomic data and vegetation mapping (Related to managing Groundwater Dependent Ecosystems)

EnviroInsite-Is a visualization tool being integrated into EQuIS, it has 3D cross-sectional capabilities etc.

Core Questions:

1) What are the housing parameters of the system or tool?

Answer: EQuIS can be hosted on-premises or via Software-as-a-Service subscription model utilizing Microsoft Azure.

2) What are the different user access levels (share internally and public access) and components of user access (# of end users)?

Answer: EQuIS supports custom roles, content specific permissions, row-level security, and public data viewing. Administrators may create roles, assign permissions to roles, and assign users to roles. EQuIS provides a dual user interface to accommodate casual and advanced database users. Users are classified as either Power (reporting, regulatory deliverables, GIS, modeling, permissioned access to data tables) or Casual (end-user, public, management, data viewing, data visualization, roll-up reporting, querying). EQuIS provides different licenses for each user type and does not cap the number of potential end users.

3) What are associated Hydrologic Conceptual Model and integrated HCM capabilities? More specifically input files (input data) and results (output) from IWFM, SVSim or Modflow groundwater models.

Answer: EQuIS can store water levels, minimum thresholds, horizontal and vertical hydraulic conductivity, porosity, specific storage, specific yield, storage coefficient, transmissivity, precipitation, and other necessary data points for hydrologic modeling. During the implementation phase, specific models (e.g. MODFLOW, FEFLOW, etc.) are discussed with the client, and the necessary input files are configured.

EQuIS EnviroInsite is a sub-surface graphics and visualization extension of the EQuIS database. EnviroInsite can be used to render 2D and 3D model output files in ASCII format to provide static imagery (cross-section, sub-surface hydrology, contouring, geochemical plots, etc.) as opposed to a dynamic model.

4) Is there a water budget component?

Answer: EQuIS accommodates water level elevations in addition to recharge/discharge measurements for water budget calculations. During the needs assessment phase, EarthSoft will assess reporting needs and if necessary, build reports and configure custom calculations to meet your requirements.

5) Can products etc. be generated and populated from vector and raster data sources?

Answer: EQuIS EnviroInsite can load and display vector sources such as DXF, DWG, SHP and raster image formats such as TIFF, PNG, and MrSID.

6) How does the system/tool integrate different types of data sets (land use, geology, water quality, water budget, and well data) for comparison, visualization and geospatial analysis?

Answer: The EQuIS database schema consists of dozens of data and reference tables. Each data type (geography, geology, water quality, geotechnical, etc.) has specific schema devoted to its key fields. Custom fields can be added to accommodate other data. Data is integrated into over 200 standard reports, graphs, and figures that are built into EQuIS. EQuIS also contains a crosstab reporting engine for custom report building. Visualization and geospatial analyses are enabled by direct connections to ESRI's ArcGIS (web and desktop), EQuIS EnviroInsite, and a number of 3rd party industry standard platforms including surfer, EVS, GMS, FEFLOW, gINT, RockWorks, and Logplot.

7) Does the system have reporting capability (regulatory deliverables)?

Answer: Yes, current regulatory deliverables include US EPA, GeoTracker, AGS, ERPIMS, HazSite, Scribe, SEDD, and NIRIS. Custom regulatory exports are configured during the EQuIS implementation phase.

8) What kind of land subsidence or related data is included or can be integrated (InSAR, Lidar, Caltrans/BLM surveys and National Geodetic Survey continuous monitoring station data)?

Answer: EQuIS does not include any data out of the box; it provides the database infrastructure for data storage, and tools to support data collection, analysis, visualization, and quality control. Data is stored in a sample/result format, and this would apply to land subsidence data as well. For example, elevation change over time at a given monitoring point can be recorded in EQuIS. Tabular data from InSAR, Lidar, and surveys can be migrated into EQuIS for use in analyses.

<u>Additional Questions</u>:

9) Is there a component which can track stakeholder outreach? (Member profile/Notification system)

Answer: EQuIS tracks stakeholder outreach through custom forms, but does not currently provide a member profile section. Additionally, EQuIS provide automatic notifications to stakeholders for exceedance of minimum threshold groundwater elevations.

10) Where is the parcel data sourced from (Parcel Quest)?

Answer: Parcel data is not included in EQuIS. Parcel layers may be rendered from ArcGIS Server as layers in the EQuIS Enterprise map widget. Raw data can also be associated with certain parcels in EQuIS for reporting.

11) Can cross-sectional data be included 2-3D?

Answer: Yes. EQuIS stores geologic and hydrogeologic data and EQuIS EnviroInsite can be used to visualize this information in cross-sections, fence diagrams, boring logs, strip logs, and geochemistry plots.

12) How far back is time step data saved?

Answer: Time series data is saved perpetually, unless the user chooses to delete the data. EQuIS Live (connect to data loggers) includes functionality to aggregate older data automatically (so raw data does not need to be stored perpetually).

13) Are there expected to be future modifications to system/tool?

Answer: Yes. EarthSoft supports a global clientele and is always developing new environmental data management modules and improving existing workflows. Client systems are kept up-to-date through an agreed upon update schedule, either through on-premises hosting or via Software-as-a-Service.

14) Can the system/tool use ArcGIS or Arc Hydro visualization components?

Answer: EQuIS for ArcGIS connects to ArcMap, ArcScene, ArcEditor, and ArcInfo but not ArcHydro. We can explore further integration with ArcHydro.

15) If the systems uses a third party visualization tool, what are they and are there any licensing parameters?

Answer: EQuIS supports the following data visualization processes: connect to 3rd party software (requires purchase of 3rd party software), connect to EQuIS EnviroInsite (requires additional license from EarthSoft), out-of-the-box reports/graphs/figures (included with standard EQuIS configuration), EQuIS Enterprise web-based visualization (included with standard EQuIS configuration).

16) Does the system/tool have access to cross-section and geologic information and if so where is the data sourced from?

Answer: Geologic data can be migrated into EQuIS for use in visualization, modeling, and reporting. An example of historical data migration might be groundwater elevations pulled from GeoTracker. This information can be mapped to the EQuIS data format and loaded into EQuIS for use in visualization, modeling, and reporting.

17) Is pesticide use information readily available or easy to incorporate?

Answer: Pesticide data is not included in EQuIS, however, pesticide use data (i.e. concentrations of DDT in a monitoring well) can be migrated to EQuIS.

18) Is the system/tool capable of setting predefined conditions (minimum thresholds and measurable objectives) with alert capabilities?

Answer: Yes. Minimum thresholds, measurable objectives, and contaminant action levels can be setup in EQuIS. Artificial intelligence allows the user to configure automatic notifications based on these events. For example, if groundwater elevation drops below a minimum threshold in a stakeholder well, EQuIS will send a notification email to the project team and/or stakeholder.

19) Can tool/system be utilized in the field during data collection via tablet?

Answer: Yes. Depending on the complexity of your field workflow, we will suggest either the EQuIS Data Gathering Engine (EDGE), or EQuIS Collect. EDGE is tablet specific and supports a complex field workflow (data loggers, sample planning, field instrument health, etc.), and EQuIS Collect is an app (iOS, Android, Windows) with a custom form builder to support simpler workflows. Following an in-depth needs assessment, we can suggest the most appropriate field data collection tool.

20) Are there records retrieving capabilities (well logs, water rights information)?

Answer: Historical data can be migrated into EQuIS using EQuIS EDDs (Electronic Data Deliverables), which are standard formats for loading data in EQuIS. EarthSoft's Government Services Group provides data migration services from spreadsheets, Access databases, and State run data systems like CEDEN and GeoTracker.

Water Sage

Water Sage is an integrated water and land information platform with data from more than 500 sources both public and third party. The platform connects to water rights, groundwater, streamflow, land information, delivery infrastructure and other large data bases with a map based research system. One website for mapping, document and records retrieval, and analysis. Integrated documents and records include decrees, water court resumes, well permits, diversion records, irrigation records, and more as updated. Customized data sets and visualizations through saved projects can be created including tabular data interactive charts. Query, analyze and export in all exportable excel, PDF, shape file and KZM formats.

Customization option for data integration. Supported Browsers: Internet Explorer 10+, Edge 13+, Firefox 40+, Chrome 43+, Safari 9+

Specific features of Water Sage California include:

- Up-to-date GSA boundaries, PGMAs, Local agencies with ongoing updates and features added
- Asses groundwater trends, depth to water, aquifer changes and well ownership
- Contains well data from 6 different data bases some include CASGEM, Water Data Library and Geotracker ensuring no duplicates
- Continuous flow monitoring data
- A few data parameters include water quality measurements by chemical, TDS, salinity, turbidity with ongoing updates including more data parameters
- Links up to water right documents, assessor maps, historical data etc.
- Search data sets by multiple identifiers and within featured boundaries
- Easy share maps and data sets

Price per year/Subscription: $4,800 per user login, with the more users you purchase the greater the discount. Depending on the agreement there's always flexibility.

WaterSage NOTE from staff: The responses in this survey are up to date as of January 2018. The platform is constantly expanding in functionality, geography, and data. Any analysis of the platform after the stated timeframe above should be conducted with more up to date information.

Core Questions:

1) What are the different user access levels (share internally/public access) and components of user access (# of end users)?

Answer: Water Sage has multiple user access levels. There are capabilities to create different roles and data access levels, as sensitive data can be integrated and made private for organizations based on a user's login.

Projects can be shared internally via email if the recipient has a Water Sage login. Alternatively, projects can also be shared with other platforms via file/data export.

2) What are associated Hydrologic Conceptual Model and integrated HCM capabilities?

Answer: At this time Water Sage California does not contain an individual HCM component. However, because Water Sage is data agnostic, customer or industry data such as an HCM can be integrated into the platform.

3) Does visualization component have a transferable interface and what visualization method is currently used?

Answer: Water Sage is a proprietary geospatial platform with built in reporting and analytics. Currently there is not a 3D visualization component for HCM.

4) Is there a water budget component?

Answer: Water Sage's philosophy is to provide users with the most comprehensive, up to date data available so professionals can streamline data collection and management processes. With this information, water budgets and other detailed analysis are conducted outside of the platform to match constantly changing client and regulatory requirements. Water Sage will never create strict, inflexible workflows that lock users into a single process.

5) Can products etc. be generated and populated from vector and raster data sources?

Answer: Yes. Data can also be exported in industry standard forms such as an excel workbook or CSV. Data can also be exported to other mapping file formats for visualization in other geospatial platforms.

6) Can the system integrate large sets of different types of water resources data (Sustainability Indicators) in order to track and visualize trends geospatially?

Answer: Because Water Sage is data agnostic, customer or industry data such as Sustainability Indicators can be integrated into the platform.

7) Does the system have reporting capabilities (regulatory deliverables)?

Answer: As discussed previously, Water Sage provides users with the most comprehensive, up to date data available to support regulatory reporting and requirements. There are no out of the box regulatory reports.

8) What kind of land subsidence or related data is included or can be integrated (InSAR, Lidar, Caltrans/BLM surveys and National Geodetic Survey continuous monitoring station data)?

Answer: While there is subsidence data included in the platform from UNAVCO, it is not substantial. However more data can be integrated upon customer request.

<u>Additional Questions</u>:

9) Is there a component which can track stakeholder outreach?

Answer: Water Sage provides professionals with land parcel and ownership information to drive stakeholder engagement. There is no out of the box stakeholder engagement functionality at this time.

10) Where is the parcel data sourced from?

Answer: Parcel data is aggregated from accessor office sources and is proprietary to Water Sage.

11) Can cross-sectional data be included either 2-3D?

Answer: Not at this time. Currently the platform is 2D and cross-sectional data is not included.

12) How far back is time step data saved?

Answer: With the exception of real-time stream gauge data (due to the amount of information), historical data is included in the platform.

13) Are there future modifications to system/tool?

Answer: Yes, for example evapotranspiration data may be included in the future. Informational layers are added per a "substantial" number of customer requests and it is not necessarily always a customization cost.

14) Can the system/tool use ArcGIS or Arc Hydro visualization components?

Answer: Files are exportable in ZIP format and can be used in ArcGIS and Arc Hydro.

15) If the systems uses a third party visualization tool, what are they and are there any licensing parameters?

Answer: Water Sage doesn't use a 3rd party visualization tool, all reporting and analytics are proprietary. There is no separate licensing requirement.

16) Does the system/tool have access to cross-section and geologic information and if so where is the data sourced from?

Answer: Not at this time, however because Water Sage is data agnostic, customer or industry data such as geologic can be integrated into the platform.

17) Is pesticide use information readily available or easy to incorporate?

Answer: Pesticide use information is included in the platform in data set and informational layers.

18) Is the system capable of setting predefined conditions (minimum thresholds and measurable objectives) with alert capabilities?

Answer: While real time monitoring data can be integrated into the platform, there are no capabilities to set minimum thresholds and alerts at this time.

19) Can tool/system be utilized in the field during data collection via tablet?

Answer: Data collection functionality is on the future product roadmap. Options include a mobile application and form builder that would allow data capture from various field types.

20) Is there any recharge data included or potential for incorporation?

Answer: Because Water Sage has the most comprehensive groundwater database, there is extensive information on groundwater levels and recharge potential. Because Water Sage is data agnostic, additional customer or industry data such can be integrated into the platform.

Waterfind

Waterfind is an Australian organization – with an office in Fresno - that is recognized as a global leader in the water industry. Waterfind has 15 years of experience in water markets and over 10,000 customers. Additionally, Waterfind is the only quality assured (ISO 9001:2015) water trading organization in the world.

Waterfind launched its efforts in California in late 2014 by developing the Water Accounting and Management Platform (WAMP), a cloud-based, software-as-a-service (SaaS) platform, which is purpose built to assist Groundwater Sustainability Agencies (GSAs) with administering and implementing the Sustainable Groundwater Management Act (SGMA). The WAMP is a patent pending platform that enables users to: create water budgets without the use of a meter, engage members online, and improve the quality of data. The WAMP is broken down into five modules: Lite; Core; Operations; SGMA; and Water Markets.

As a SaaS platform, the WAMP will continue to evolve and mature in line with GSA needs. The 2018 Product Roadmap (listed below) describes each of the five modules and proposes high level developmental timelines.

Product Roadmap 2018

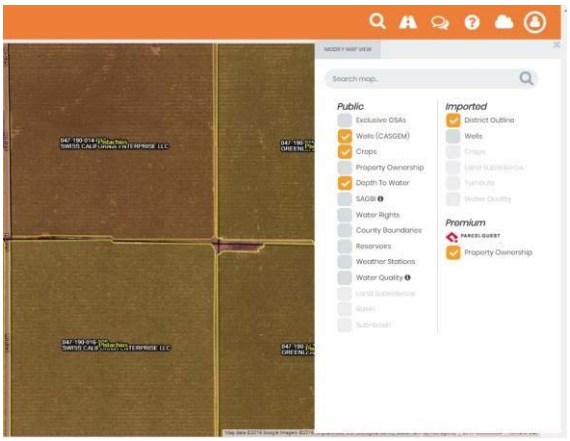
Module	SPR 18	SUM 18	FALL 18
Lite	MILESTONE - Lite V1.0 Full integrated California wide data sources and base reports		
Core	MILESTONE - WAMP CORE V1.20 Full undesirable effects capture, includes Water Quality, Land Subsidence. Extended Data Management and Integration. Core reporting, improved dashboard views.		
Operations	MILESTONE - WAMP OPERATIONS V1.0 Billing - invoicing and accounting system integration. Water Rights Registry - Manage water rights across California.		
SGMA	MILESTONE - WAMP SGMA Beta release Sustainable Plan Management Undesirable Effects Tracking & Reporting		
Water Markets	MILESTONE - Water Markets Lite V1.0 Water Market Interface - support the temporary and permanent transfer of water. Transfer Settlement and Approval - automated processing and approvals of water transfers.		

WAMP Lite

WAMP Lite is composed of an Interactive Map Feature, Data Browser Feature, and Reports Feature.

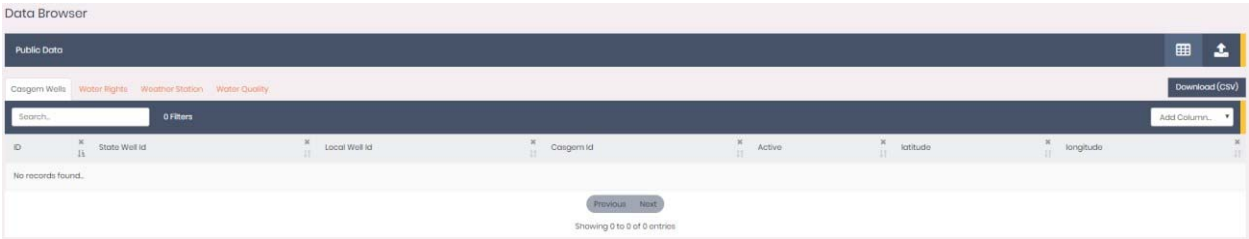
Interactive Map

View publicly available data on interactive map.



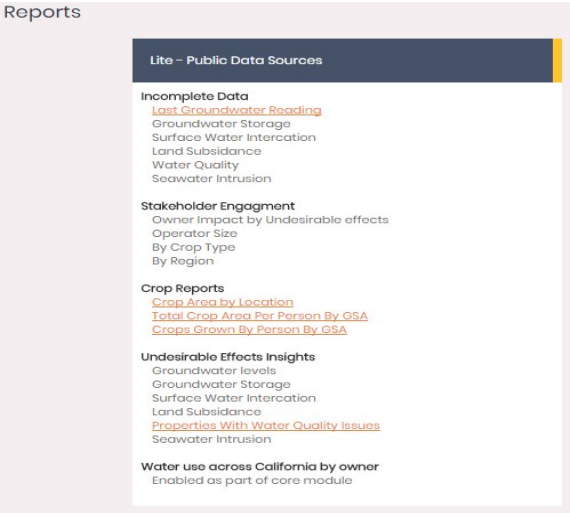
Data Browser

Browse through publicly available data and download browsing data via excel.



Reports

Generate a series of excel reports that aggregate publicly available data.



WAMP Core:

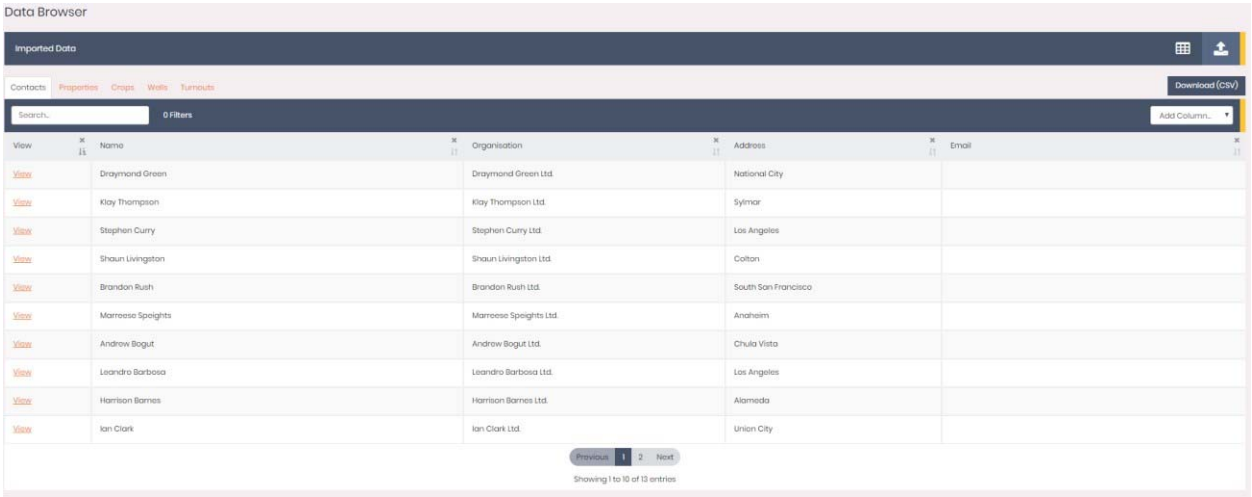
WAMP Core is composed of all WAMP Lite features and includes a Dashboard Board feature, Account Budget feature, Crop Budget feature, Scenario Analysis feature, Data Import feature (QA/QC capabilities), Integration History feature, and a two-way CRM feature.

Interactive Map

Compare publicly available data with data imported at a local level.

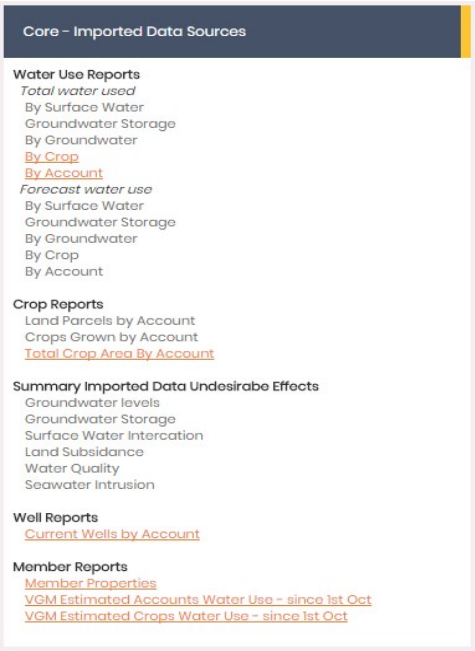
Data Browser

Browse publicly available and local data sources; and download browsing data via excel spreadsheet.



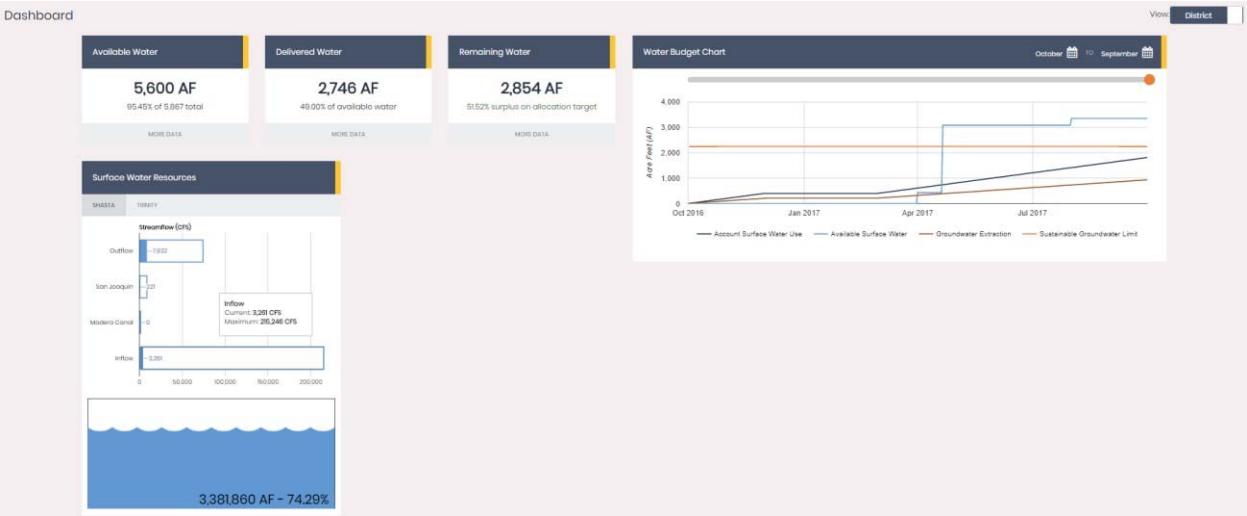
Core Reports

Generate a series of excel reports that aggregate locally imported data.

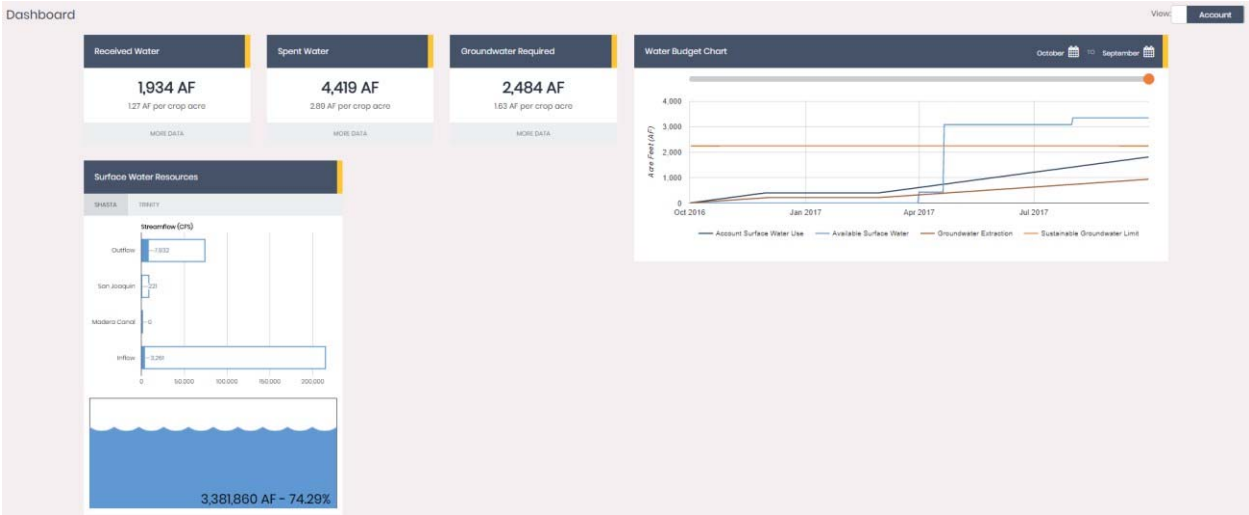


Dashboard

Account for the District's inflows, outflows, and available water.

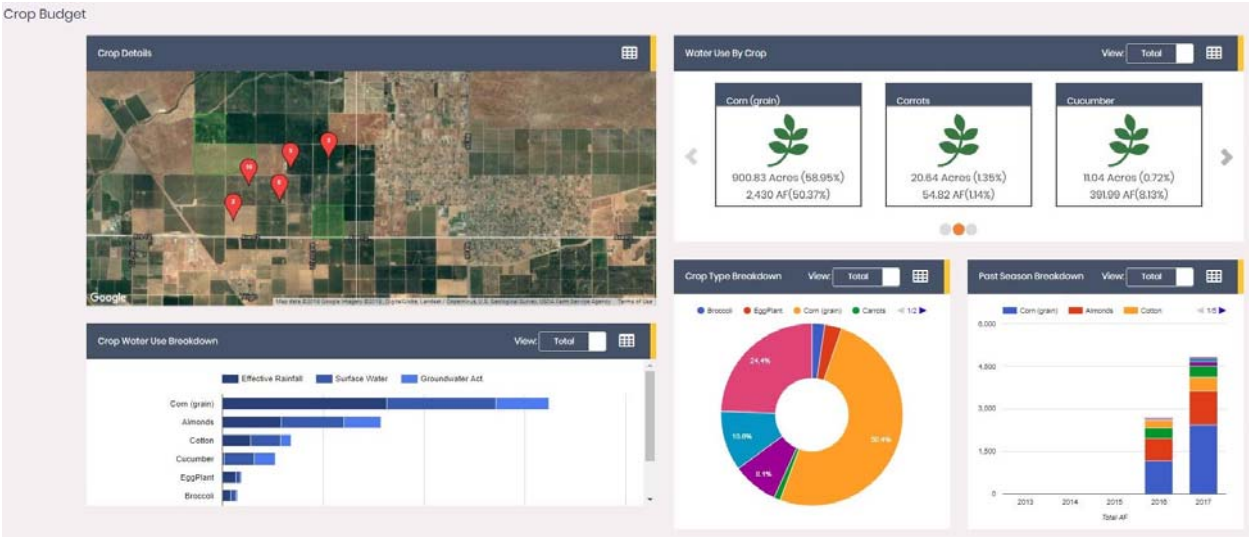


Calculate water budgets at the district level and member level.



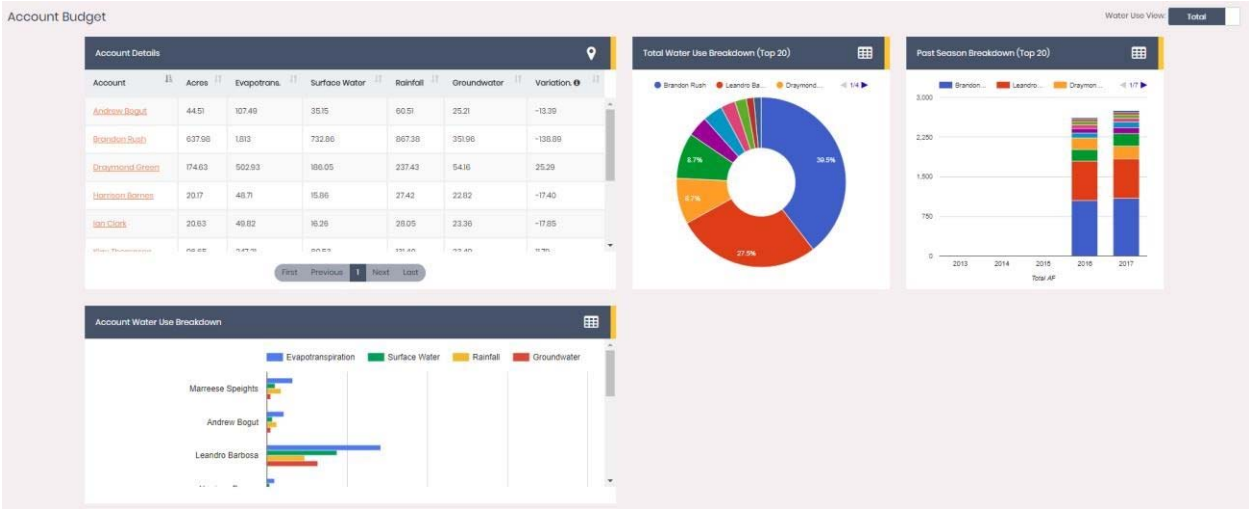
Crop Budget

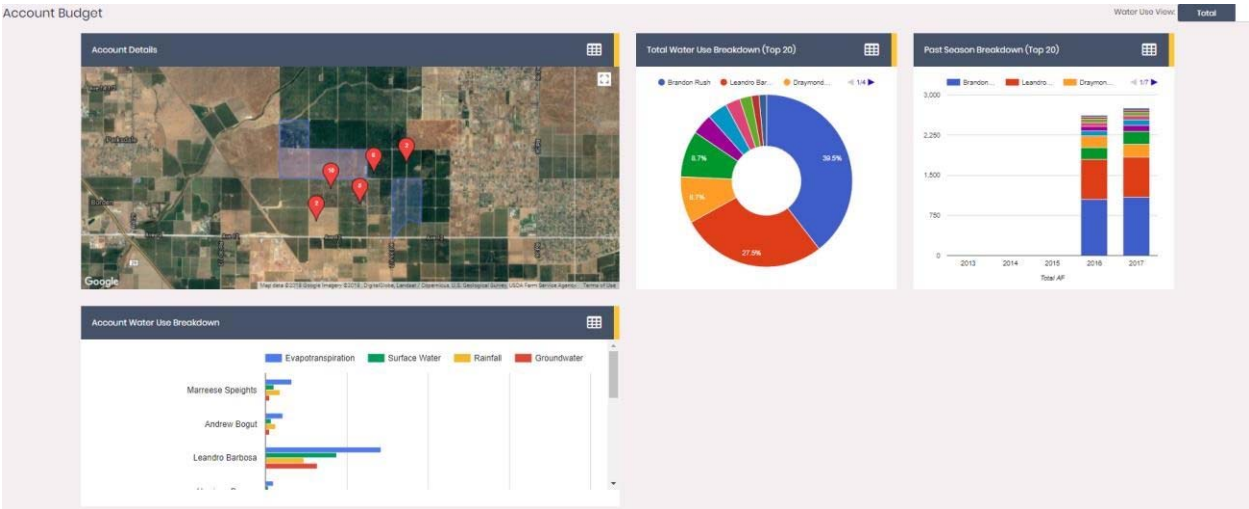
Account for crop water consumption at a district level, crop by crop level, and member level.



Account Budget

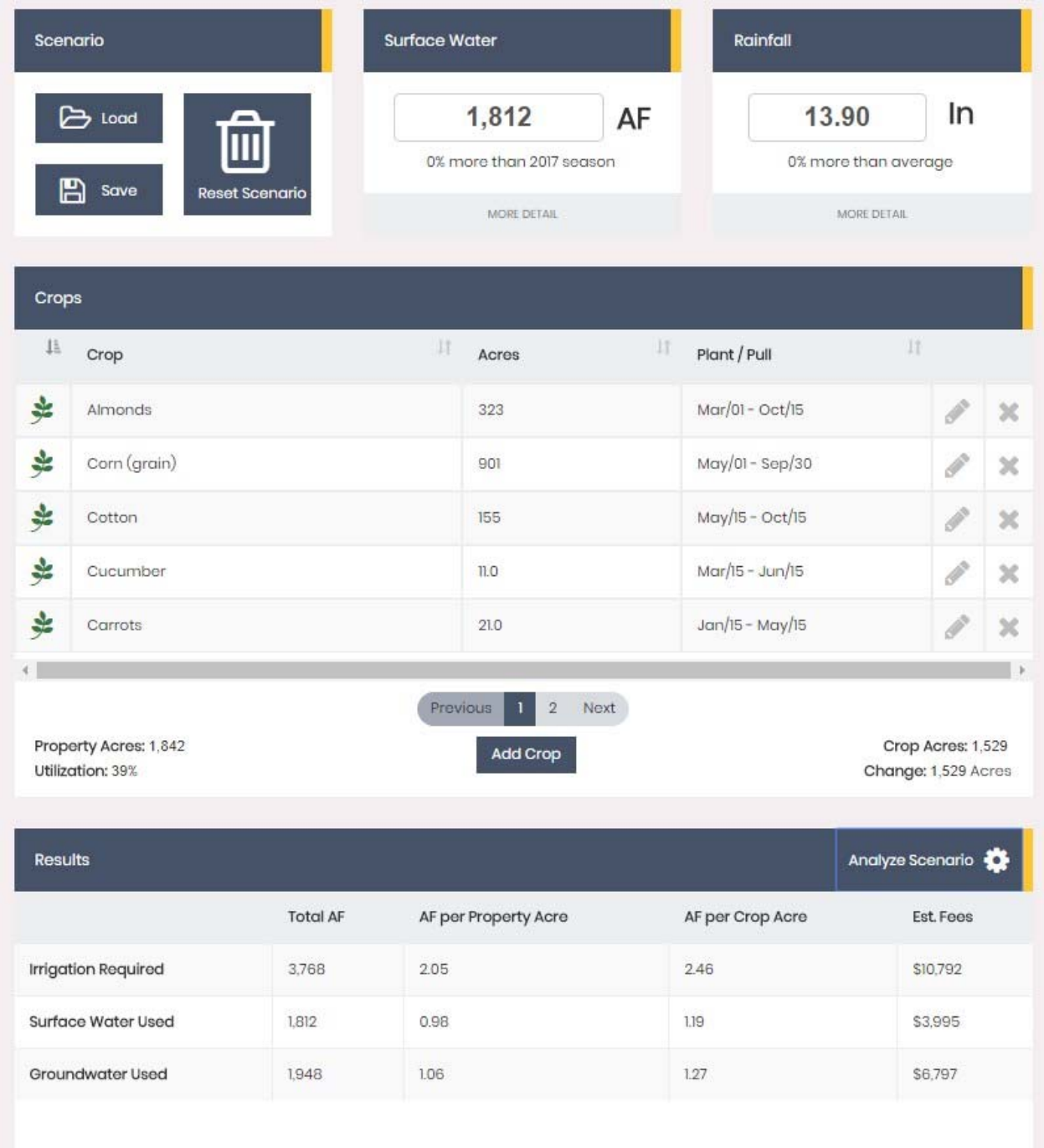
Analyze water consumption on a member by member basis.





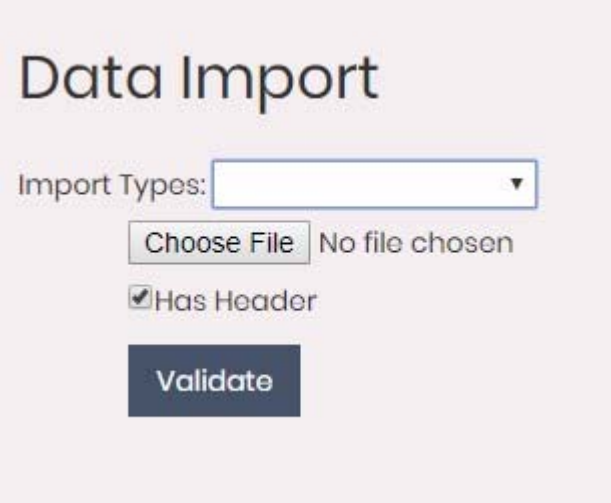
Scenario Analysis

Analyze how changes in land use and water availability influence the cost of required irrigation.



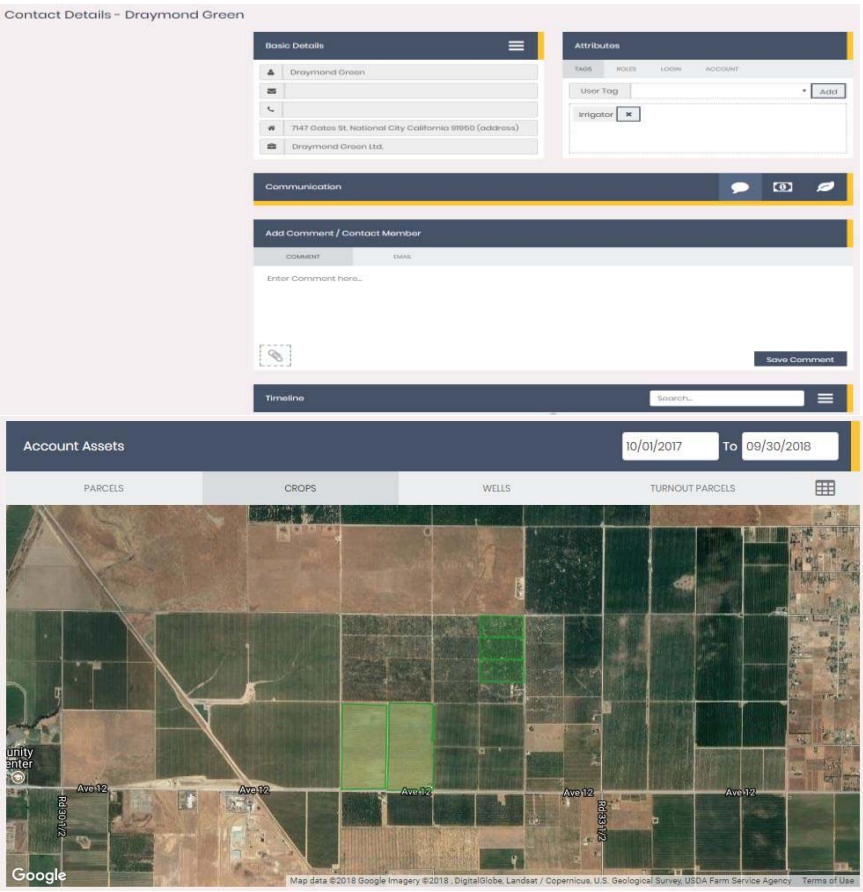
Data Import

Import local data and quality check imported data sets.



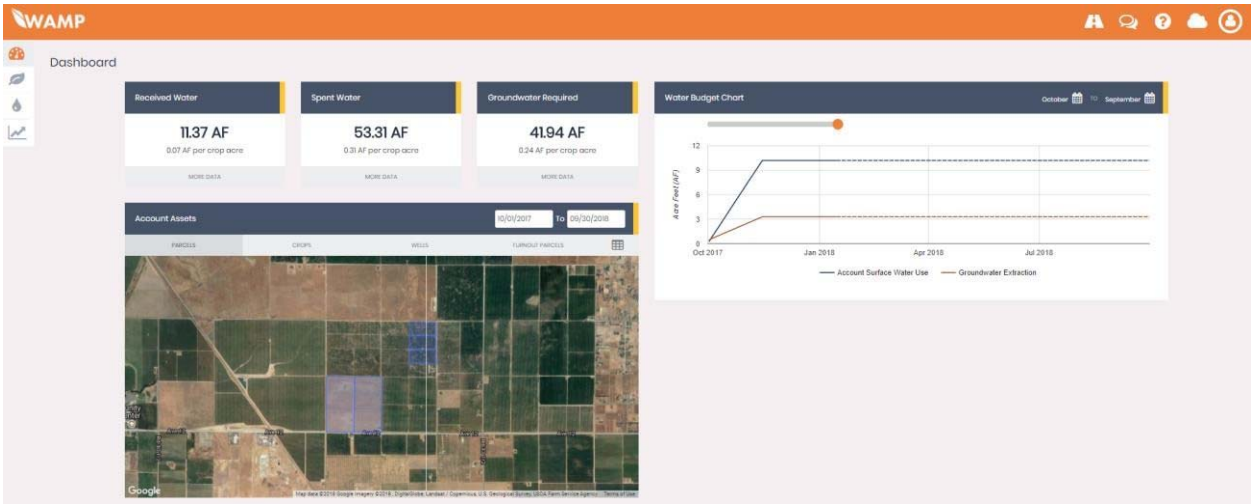
Customer Relations Management (District View)

Engage members online via CRM feature and manage stakeholder assets.



Member Vault (Member Online)

Stakeholders (farmers) can log into system, view water budgets, and conduct scenario analyses.



Operations Module

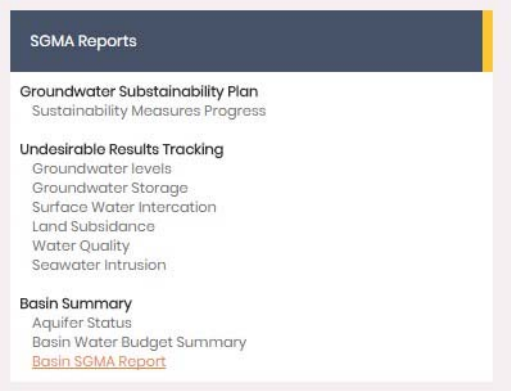
The WAMP's Operations module will integrate with pre-existing invoicing and accounting systems, establish a Water Rights Registry, and will generate a host of Operations reports.

Potential Operations Module Reports

SGMA Module

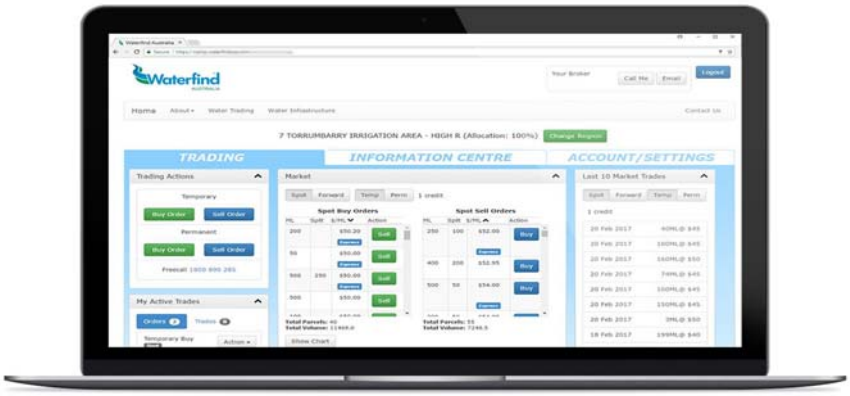
The SGMA module will enable Groundwater Sustainability Plan (GSP) management and Undesirable Results reporting and tracking. This module will also enable GSAs to generate reports that are compliant with Article Three and Article Four of the GSP regulations.

Potential SGMA Module Reports



Water Markets Module

Waterfind's pre-existing water trading platform will integrate with the WAMP to provide a Water Market Interface (which supports the temporary and permanent transfer of water) and enable the transfer, settlement, and approval of a water trade.



Price: $30,000 per year, per GSA; there will be a fee of $3,000 per user once the module is at the commercial release stage.

Additional Notes: Waterfind is a water accounting and management Platform (WAMP CORE and LITE). Waterfind platform provides access to California land use and water information, through the use of interactive maps, a data browser and standard reports. Data sources include water rights, CASGEM wells, weather stations, groundwater quality and quantity, crops, property ownership, land subsidence etc. Supports full basin delineation and management, reporting and water budgeting. WAMP has an interactive mapping tool, data browser, report generator, dashboard, member management and water budgets builder etc.

- Well location information is centric due to its source
- Evapotranspiration information is calculated with crop coefficients form UC extensions and other sources
- LITE does not communicate with CORE all data grabs are exported form LITE and imported into other systems for analysis including CORE for water budgeting. However,

Core has some automatically populated information such as depth to groundwater (DWR source).

- LITE GAMA water quality data layer includes nitrates not arsenic information

<u>Core Questions</u>:

1) What are the housing parameters of the system or tool?

Answer: Both CORE and LITE modules are hosted on Amazon Web Services hosting infrastructure. There are two housing locations (Oregon and Sydney, Australia) - with industry standard data protections.

2) What is the main difference between CORE an LITE products?

Answer: LITE is a platform based tool which includes publicly available land and water use mapping, reports (excel) and a public data browser. LITE is currently in the beta phase with data sets still being added. The main difference is the CORE module allows you to import and manage your own data. In addition, the CORE module has the Dashboard feature, Crop Budget feature, Account Budget feature, Scenario Analysis feature, Data Cleansing and Import feature (the QA/QC process which is offered), Customer Relations Management (CRM) and Member Online feature – CORE includes all LITE features.

3) Is there a difference in the stakeholder outreach components between CORE and LITE?

Answer: Yes, WAMP Lite does not include the CORE's CRM or Member Online feature. Some information can be automatically populated using data sets and parcel information to create a stakeholder profile. Additional information can be entered at a stakeholder's discretion to create individual water budgets. The Member Vault (Member Online feature) can be used as an outreach tool to send messages and alerts to stakeholders with a profile.

4) What are the different user access levels (share internally/public access) and components of user access (# of end users)?

Answer: There can be up to 10 operational Administrative user logins with a subscription to CORE ($30,000 per year, per GSA). Each stakeholder of the GSA can access their own data through the Member Online feature. LITE is currently being offered free of charge during the BETA testing phase. However, there will be a fee of $3,000 per user once the module is at the commercial release stage.

5) What are associated Hydrologic Conceptual Model and integrated HCM capabilities? More specifically input files (input data) and results (output) from IWFM, SVSIM or Modflow groundwater models.

Answer: The WAMP can provide input for Hydrological Conceptual models. The data browser has been designed to easily export data, so information can be imported into external systems.

Waterfind is currently working with a consultant to incorporate additional HCM capability.

6) Does visualization component have a transferable interface and what visualization method is currently used? Can visualization component visualized model results?

Answer: There is not currently a visualization tool associated with modeling.

7) Is there a water budget component?

Answer: The system automatically calculates and tracks water budgets as data is loaded (including evapotranspiration calculations). The dashboard component in CORE can display water budgets on an individual and basin-wide scale using the Waterfind format. Additionally, the Account Budget and Crop Budget features provide relevant water budget information.

8) Can products etc. be generated and populated from vector and raster data sources?

Answer: Yes, both vector and raster data sources can be overlaid on our maps. Vector data needs to be converted to WKT format, and raster data needs to be converted to an image before being overlaid on mapping features.

9) How does the system/tool integrate different types of data sets (land use, geology, water quality, water budget, and well data) for comparison, visualization and geospatial analysis?

Answer: The Interactive Mapping feature can integrate different types of publicly available and local geospatial data (land use, water quality, well data, etc.).

10) Does the system have reporting capabilities (regulatory deliverables)?

Answer: Yes, reports can be generated in the form of excel spread sheets. Waterfind is actively working with the DWR to generate SGMA compliant reports – with respect to Article Three and Article Four of the GSP regulations.

11) What kind of land subsidence or related data is included or can be integrated (InSAR, Lidar, Caltrans/BLM surveys and National Geodetic Survey continuous monitoring station data)?

Answer: There currently is not substantial land subsidence data available in the platform. However, Waterfind would like to include InSAR data in the future (and other land subsidence information).

<u>Additional Questions</u>:

12) Explain member vault capabilities. Are there member notification abilities?

Answer: Stakeholders of GSAs can log into the WAMP system to view and modify their assets via the

Member Vault (Member Online feature). Members have access to the Dashboard feature, Crop Budget feature, Account Budget feature, and Scenario Analysis feature. In addition, any changes made to member assets (parcels, crops, wells, and turnouts) are flagged for confirmation by administrators.

13) Can cross-sectional data be included 2-3D?

Answer: Not currently.

14) How far back is time step data saved?

Answer: There are no restrictions on how far data can be saved. If you have data, we can load it.

15) Are there expected to be future modifications to system/tool?

Answer: Yes, the WAMP will continue to evolve in line with the needs of GSAs.

16) Can the system/tool use ArcGIS or Arc Hydro visualization components?

Answer: The ArcGIS data (such as shape files) can be converted to WKT format and displayed on our maps.

17) If the systems uses a third party visualization tool, what are they and are there any licensing parameters?

Answer: CORE subscribers have the option to sub-license ParcelQuest property data (property boundary and ownership information). Licensing parameters (for CORE subscription) have been scoped to support full module functionality.

18) Does the system/tool have access to cross-section and geologic information and if so where is the data sourced from?

Answer: Not currently.

19) Is pesticide use information readily available or easy to incorporate?

Answer: Not currently provided but could be added to LITE as a data layer.

20) Is the system capable of setting predefined conditions (minimum thresholds and measurable objectives) with alert capabilities?

Answer: Not currently, but this type of functionality is scheduled for future releases.

21) Can tool/system be utilized in the field during data collection via tablet?

Answer: Yes, the WAMP can be accessed at any location if there is internet access.

22) Is there any recharge data included or potential for incorporation?

Answer: Not currently. SAGBI is included as a data layer in the LITE module.

23) Are there records retrieving capabilities (well logs, water rights information)?

Answer: CASGEM wells are populated with hydrographs, however, there are no well logs attached to wells on platform (LITE). Does include some water rights information

RMC Opti

RMC & Woodard & Curran's Opti platform is an information management tool built upon a flexible framework that can be configured and customized to meet the client's needs. Opti includes the following features:

- Online toolbox for centralized project tracking, stakeholder outreach, data management, and reporting.
- Web-based transparent data management and analysis, track undesirable results, and develop water budgets.
- Privacy to data from different user access levels.
- Centralized project information, document management and collaboration tools to support coordination project prioritization and selection, public outreach, and integrated project and document tracking.
- Integrated performance tracking including management dashboards that track and present criteria and management objectives to demonstrate no undesirable results.

Opti is installed and configured based on the client's needs. Tools may be developed and/or customized to the user's preferences after an initial requirements gathering session with a team of end users. W&C works closely with the users during all phases of development and implementation to ensure user buy-in and satisfaction with the end product.

High-Level Technical Specifications:

- Web-based
- PHP/MySQL/Apache platform
- Geospatial visualization using Google or ESRI tools
- Bulk import and data validation
- Shared data entry
- Different levels of user access
- Announcement and event posting
- Weekly notifications
- Search and custom reporting
- Export to Excel

Price: Price varies

Additional Notes: Based on discussion price is dependent on volume of data integration and QA/QC process etc. The low end of pricing generally starts around $20-30,000.

Core Questions:

1) What are the housing parameters of the system or tool?

Answer: Opti is currently installed and maintained on Amazon cloud services (EC2 and RDS) with weekly database backups and strict security protocols. Options are available to meet client needs for a system that is: 1) hosted and maintained by W&C, 2) hosted and maintained by the client, or 3) a combination of the 1 and 2.

2) What are the different user access levels (share internally/public access) and components of user access (# of end users)?

Answer: The access levels include the following -

- System (Lead Agency): Admin, Power User, User
- Agency (Participating Agencies): Admin, Power User, User
- Public

The System level accounts are for the lead Agency, the Agency accounts are for the Participating Agencies (submitting data), and the Public accounts are for users that do not belong to an agency account and only want to view published data. Admin accounts manage user and data privacy settings for the system or agency, Power Users update and manage data, and Users view data. The data access/privacy is set by the Admin accounts as:

- Private – Only viewed and analyzed within the Agency
- Shared – Only viewed and analyzed within the users of the database
- Public – Anyone can view the published data (may be published to websites, etc.)

There are no limitations to the number of users in the database.

3) What are associated Hydrologic Conceptual Model and integrated HCM capabilities? More specifically input files (input data) and results (output) from IWFM, SVSIM or Modflow groundwater models.

Answer: Woodard & Curran (formerly RMC and WRIME) is a leader in integrated hydrologic modeling with unparalleled expertise in IWFM, SVSIM, and MODFLOW. We developed the precursor model to IWFM and are currently working with DWR to develop SVSIM and C2VSIM. Our data management team works side-by-side with the modeling team and has developed databases, interfaces, and geoprocessing tools to visualize and analyze modeling data. Our database is structured such that any data can be stored, managed, and visualized.

4) Does visualization component have a transferable interface and what visualization method is currently used?

Answer: Visualization is through a web interface using a number of integrated tools, both open source or proprietary depending on client needs. Geospatial analysis and visualization can be implemented using either Google Maps, Google Earth, or the JavaScript API for ArcGIS. Data can also be exported to Excel for additional analysis in other tools.

5) Can visualization component visualized model results?

Answer: Please see above. Our database is structured such that numerous data can be stored, managed, and visualized.

6) Is there a water budget component? (Explain Dashboard uses)

Answer: The integrated database enables reliable estimates of total water budget with or without a model (model results can be input into the database, see above). If a data-based approach to developing the water budget is defined by the client, it can be implemented into the data management system as a custom tool due to the flexibility of the Opti platform. W&C is currently working with DWR to define a water budget framework.

7) Can products etc. be generated and populated from vector and raster data sources?

Answer: The database is designed to be open and flexible and can store and visualize numerous data sources.

8) How does the system/tool integrate different types of data sets (land use, geology, water quality, water budget, and well data) for comparison, visualization and geospatial analysis?

Answer: The database is designed to be open and flexible and can store and visualize numerous data sources.

9) Does the system have reporting capabilities (regulatory deliverables)?

Answer: Standard reports can be designed and generated from the database to meet reporting requirements to other State/Federal agencies. Search and custom reporting tools are also available and may be saved to the user's profile. Direct reporting to regulatory agencies is possible if web services are published to allow a "push" of data to the regulatory agency's database.

10) What kind of land subsidence or related data is included or can be integrated (InSAR, Lidar, Caltrans/BLM surveys and National Geodetic Survey continuous monitoring station data)?

Answer: The database is designed to be open and flexible and can store and visualize numerous data sources. The data included will depend on what data is available and the visualization tools selected for implementation (e.g., Google Maps vs ArcGIS API).

<u>Additional Questions</u>:

11) Are there stakeholder outreach components and tracking/member notification abilities?

Answer: Yes, the Opti platform also includes outreach and coordination tools with stakeholder notification capabilities for announcements and site updates.

12) Where is the parcel data sourced from (Parcel Quest)?

Answer: Opti is configured to include data based on client's needs. The flexibility of Opti allows storage of data in the Opti database or configured to access data from other databases provided the external data owners have published the appropriate services for data consumption.

13) Can cross-sectional data be included 2-3D?

Answer: Opti intentionally does not include advanced cross-sectional data visualization tools that can be found in other geology-based applications in order to serve a focused purpose and reduce clutter. Opti does include visualization of lithology data if the data is digitally available.

14) How far back is time step data saved?

Answer: This is dependent on the data imported into the database.

15) Are there expected to be future modifications to system/tool?

Answer: Yes, especially as GSPs are being developed and implemented. New features/tools may be added as needs are defined. The flexibility and open nature of Opti allows for enhancements to meet almost any data and analysis need.

16) Can the system/tool use ArcGIS or Arc Hydro visualization components?

Answer: Yes, the mapping interfaces may utilize the ArcGIS API and link to the clients published GIS services.

17) If the systems uses a third party visualization tool, what are they and are there any licensing parameters?

Answer: Third party tools are used for various visualization components (charting, etc.). Many of the visualization tool choices are based on utilizing open source tools for efficiency, flexibility, and lack of licensing costs. ArcGIS licensing requirements may apply depending on tools implemented.

18) Does the system/tool have access to cross-section and geologic information and if so where is the data sourced from?

Answer: This is dependent on the data imported into the database.

19) Is pesticide use information readily available or easy to incorporate?

Answer: This is dependent on the data that is readily available and imported into the database.

20) Is the system capable of setting predefined conditions (minimum thresholds and measurable objectives) with alert capabilities?

Answer: Yes, if thresholds are set for data parameters, alerts can be set to notify users when the thresholds are reached. Opti has a Basin Management Objective tool designed for this purpose and has been implemented in previous versions of the tool.

21) Can tool/system be utilized in the field during data collection via tablet?

Answer: Yes, the data entry tools can be configured for mobile devices that have cellular or WIFI data access.

22) Is there any recharge data included or potential for incorporation?

Answer: This is dependent on the data that is readily available and imported into the database.

23) Are there records retrieving capabilities (well logs, water rights information)?

Answer: Opti is configured to include data based on client's needs. The flexibility of Opti allows storage of data and files/records in the Opti database or configured to access data from other databases provided the external data owners have published the appropriate services for data consumption.

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Appendix B: Data Management System (DMS) User Guide

Prepared in cooperation with the counties of Colusa and Glenn as part of the
Proposition 1 Sustainable Groundwater Management Act Support Project

May 2018

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1. Introduction

The Data Management System (DMS) is a database tool designed to support users in managing hydrologic data relevant to the development of a Groundwater Sustainability Plan (GSP).

The DMS allows management of groundwater, surface flow, and precipitation data through 1) guided data entry, 2) quality control (QC) checks, 3) output file development, and 4) centralization of basic utilities for managing data across multiple sites and time periods.

This guide describes the steps involved in operating the DMS to prepare input files, enter data into the database, conduct quality control checks, and generate output files summarizing groundwater levels, flows, and precipitation across user defined locations. Throughout this guide, forms, tables, labels, and buttons found within the DMS or data sources are shown in **bold** text. File names are shown in ***italicized bold*** text.

The initial phase of DMS development has been completed. Basic functionality related to high priority data sets has been developed, and initial testing has been performed. It is anticipated that further development will be accomplished in subsequent phases, or an alternative open-source or proprietary DMS will be selected for long-term GSP implementation. These considerations are discussed in greater detail in the DMS summary report to which this user guide is an appendix.

For the initial phase of DMS development, priority was placed on datasets directly supporting evaluation of existing monitoring networks, with a focus on groundwater levels, and time series datasets to support development of a preliminary hydrogeologic conceptual model (HCM) and water budgets as part of this and subsequent efforts. Lower priority data sets, including water quality and subsidence have not been incorporated into the DMS application at this time. It is anticipated that these additional data will be incorporated in subsequent phases as they become available[1].

2. Overview

This section provides an overview of the DMS, including information on initializing the database, accessing and navigating the basic functions within the DMS, and reviewing the files accompanying the database.

2.1 Initializing the DMS

Before the DMS is used the first time, the database file structure must be installed on the host computer at a specific file location. If the application needs to be installed in a different location than the one specified below, linkages between the database and output and input files must be updated. These are easy to update; however, it involves Visual Basic coding modifications to set up the new location.

To set up the DMS:

[1] Subsidence and water quality data are somewhat limited at this time in both counties, and additional information is anticipated to become available over the course of GSP development through subsidence monitoring by DWR and others and through groundwater quality trend monitoring through the Irrigated Lands Regulatory Program and CV-SALTS.

1) Save DMS package ("DMS" folder) under the following directory:

   C:\DMS

   - Do not change any folder names or the name of the DMS database file (.accdb)
   - Do not change any file names within the Input and Output folders

2) Ensure that the DMS folder follows the file structure shown in Figure 1.

3) A shortcut can be created and moved to the desktop for ease of access to the application

   a. Right click while the mouse is over the application (GlennColusaDMS.accdb) file

   b. Select the Create shortcut button

   c. Drag and drop the newly created shortcut on the desktop or other easily accessible location on the host computer

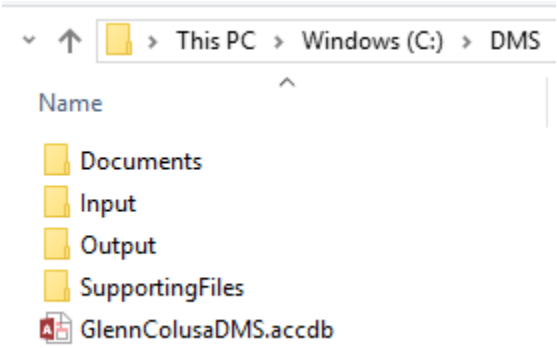


Figure 1. DMS Folder and File Structure

2.2 Navigating the DMS

The DMS is opened and accessed through the file ***GlennColusaDMS.accdb***.

Accessing this file opens a view of the database that includes both a graphical user interface (GUI) form titled **Overview** as well as a navigation menu (**All Access Objects**) that lists all underlying tables, queries, and forms comprising the database (Figure 2). Although these forms and tables may be accessed at any time through the **All Access Objects** menu, the GUI is designed to easily guide the user through each data management step. Thus, it is useful to maximize the GUI windows and minimize the navigation menu unless otherwise needed.

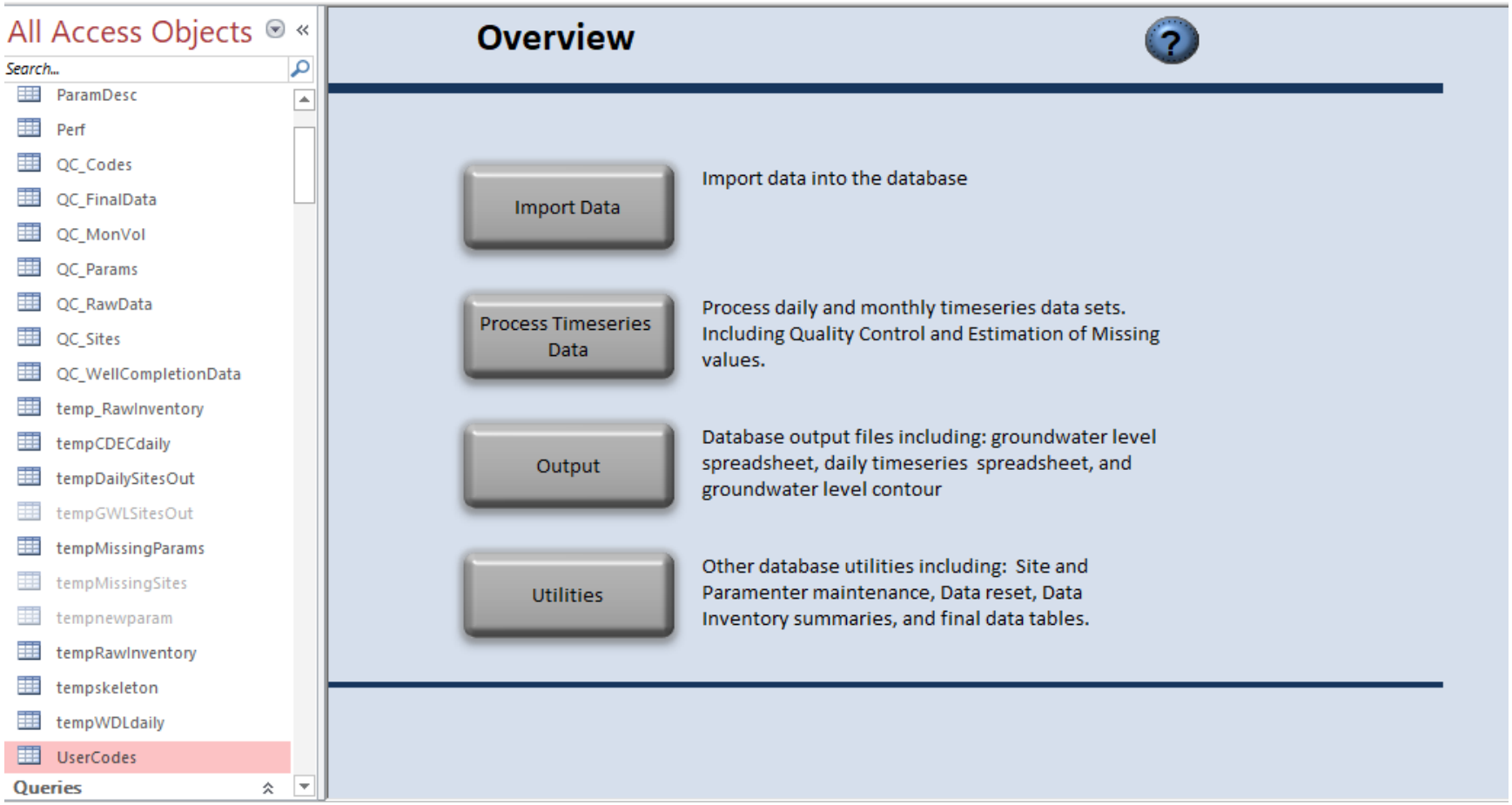


Figure 2. View of DMS database navigation menu and GUI

The **Overview** form serves as a starting point for all tasks conducted using the DMS (Figure 3). From here, the user may navigate to the main menus associated with each stage of data management (importing data, conducting QC checks, outputting results).

Pressing the **Close** button on any of these main menus will return the user to the **Overview** form.

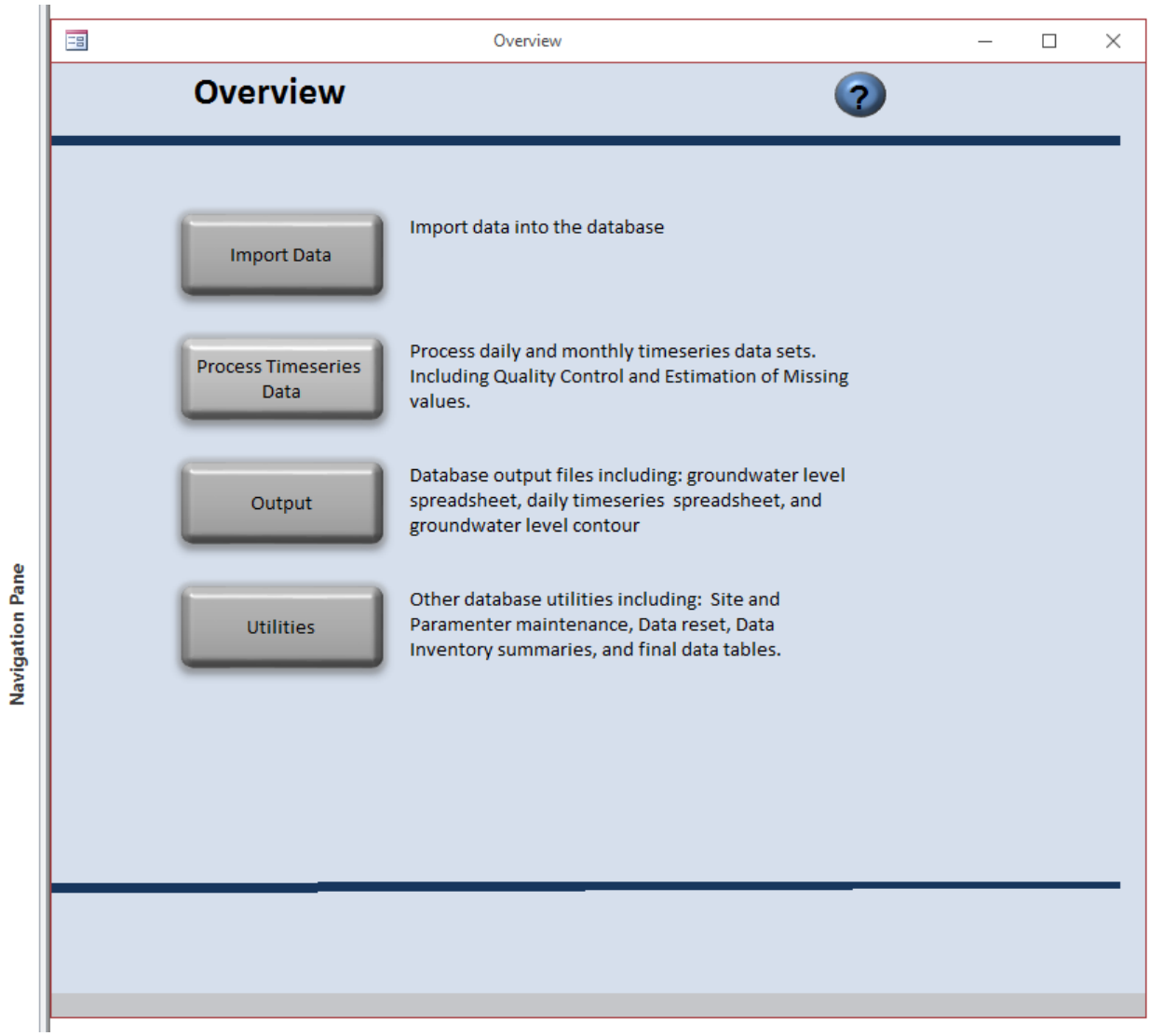


*Figure 3. DMS **Overview** form*

Inputs for the DMS may include daily flow data, groundwater level (GWL) data, daily precipitation data, USBR deliveries, and well completion reports. These are first downloaded and copied into specially designed file templates included with the DMS database. Next, the DMS is used to import, compile, and organize all data records through the **Import Data** button. From these raw data, users can evaluate the quality and accuracy of data, set limits on acceptable value ranges, and provide estimates for missing or inaccurate values through the **Process Timeseries Data** button. Following these checks, the DMS **Output** button allows users to generate output tables for groundwater level contours as well as assorted graphs and spreadsheets to summarize historical groundwater levels, surface flows, and precipitation across

any chosen region and time period. Additional functions for changing parameters within the database are also provided in the **Utilities** button.

2.3 Types and Sources of Data Managed

The DMS manages data of the types and sources outlined in Table 1.

These data files are first downloaded from their original sources by the user and are copied into specially designed file templates included as part of the DMS file package (within the ***Input*** folder). These procedures are detailed in the User Guide section 3. Importing Data.

Table 1. Data Types and Sources Managed by the DMS

Parameter	Units	Source	Source Location
Flow volume, daily	Cfs	United States Geological Survey (USGS)	https://waterdata.usgs.gov/nwis/sw
		Water Data Library (WDL)	http://www.water.ca.gov/waterdatalibrary/
		California Data Exchange Center (CDEC)	https://cdec.water.ca.gov/
Groundwater level (GWL)	Ft	Water Data Library (WDL)	http://www.water.ca.gov/waterdatalibrary/
Precipitation, daily	In	PRISM Climate Group	http://prism.oregonstate.edu/explorer/bulk.php
		National Centers for Environmental Information (NCEI)	https://www.ncdc.noaa.gov/cdo-web/datatools/records
Delivery volume, monthly	Ac-ft	United States Bureau of Reclamation (USBR)	https://www.usbr.gov/mp/cvo/deliv.html
Other Data Types			
Well Completion Reports (WCR)			

2.4 DMS Flow Diagram

A flow diagram outlining the process of navigating and using the DMS is shown in Figure 4. Steps are provided in sequence, assuming that the user is entering new data records for new parameters at new sites. While managing the DMS over time, though, some operations may be returned to or repeated as the user's needs change (e.g. appending new records to a list of existing records at a site). Such cases are identified in each section of the User Guide as needed.

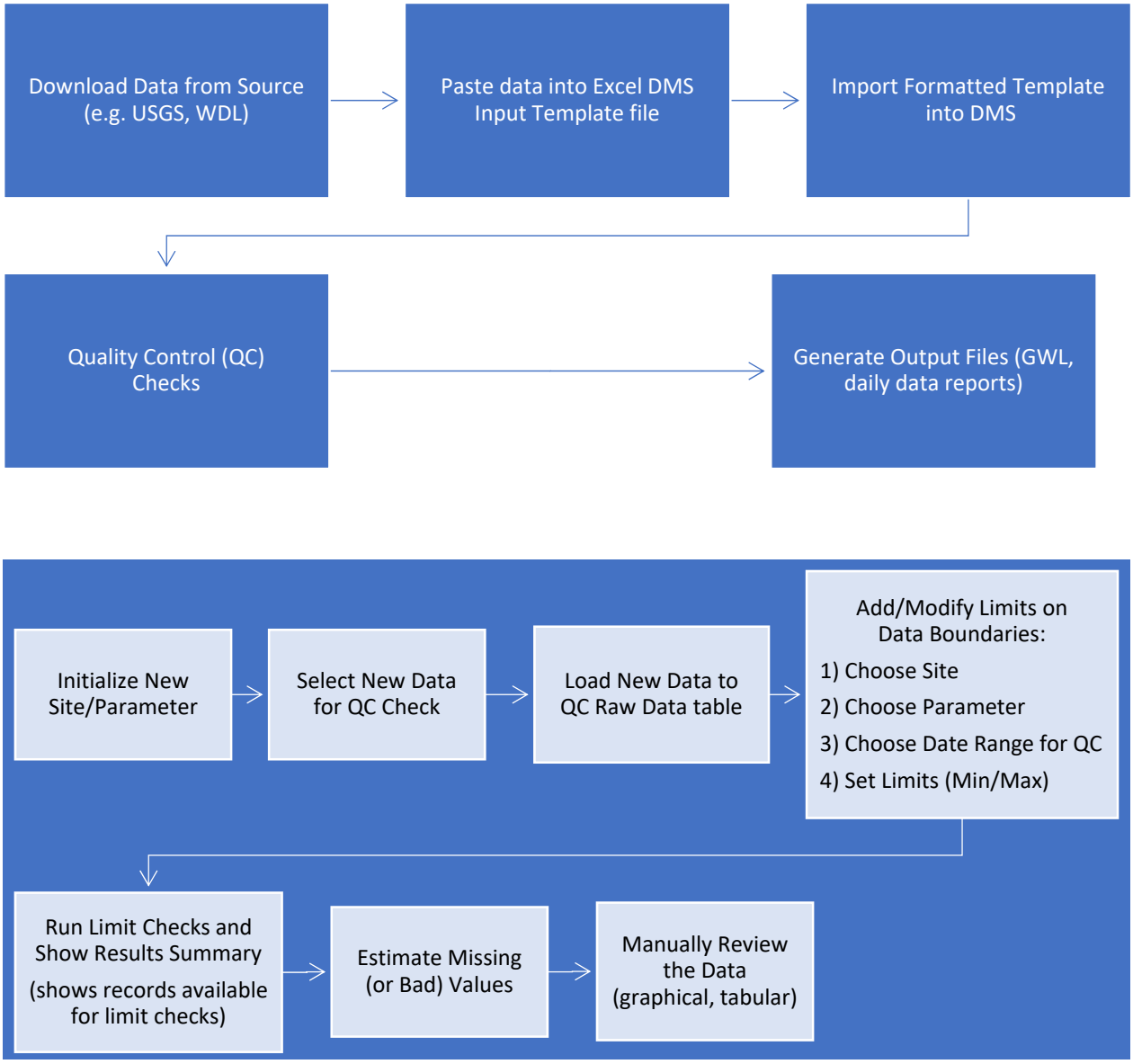


Figure 4. DMS Flow Diagram

2.5 Output Files

As the database is populated with records, the DMS allows users to compile output tables for groundwater level contours as well as assorted graphs and spreadsheets to summarize and visualize historical groundwater levels, surface flows, and precipitation over time.

Individual sites may be used to generate both data tables and graphs relating groundwater level, flow, or precipitation during any chosen time period. Multiple sites may be selected to generate combined data tables for providing regional information over a desired time period.

These output tables and graphs can be used directly toward data reporting. Alternatively, the DMS may also be used to filter and compile data records into exportable tables and spreadsheets that can then be used in other applications. These alternative uses are described more fully in the User Guide section 5. Outputs.

3. Importing Data

3.1 Data retrieval from sources

The DMS manages the following types of data:

1) Daily flow volume
    a. United States Geological Survey (USGS) (https://waterdata.usgs.gov/nwis)
    b. Water Data Library (WDL) (http://www.water.ca.gov/waterdatalibrary/)
    c. California Data Exchange Center (CDEC) (https://cdec.water.ca.gov/queryTools.html)
2) Groundwater level (GWL)
    a. Water Data Library (WDL) (http://www.water.ca.gov/waterdatalibrary/)
3) Daily precipitation
    a. PRISM Climate Group (Climate Data) (http://prism.oregonstate.edu/explorer/bulk.php)
    b. National Centers for Environmental Information (NCEI) (https://www.ncdc.noaa.gov/cdo-web/datatools/selectlocation)
4) USBR monthly delivery volumes (https://www.usbr.gov/mp/cvo/deliv.html)
5) Well Completion Reports

Before their addition to the DMS, data files must be manually downloaded from their original sources by the user. Data must then be copied into specially designed template files included as part of the DMS file package (within the ***Input*** folder). For ease of use, these templates generally follow the conventional formatting of the primary sources described below. Multiple stations can be added to the input files and imported into the database at the same time.

Data is imported into the DMS following the steps detailed below.

3.1.1 Downloading USGS Data

Surface Flow Data

1) Navigate to the USGS Water Data homepage (https://waterdata.usgs.gov/nwis).

2) Select the **Site Information** button on the USGS Water Data homepage (Figure 5) and on the following webpage.

3) In the **Choose Site Selection Criteria** section, select one or more of the following criteria appropriate to your search:

    a. **Site Location** (e.g. choose "State/Territory" to select sites in California or "Lat-Long box" to select sites in a defined region)

    b. **Site Identifier** (e.g. choose **"**Site Number" or **"**Multiple Site Numbers" if seeking record for one or more known sites)

4) Press the **Submit** button to continue.

5) In the **Select sites which meet all of the following criteria** section, enter appropriate search criteria for all desired sites (e.g. select "California" for all sites in California) (Figure 6, top).

6) In the **Choose Output Format** section, select "Detailed descriptions with links to available data for each site" (Figure 6, bottom).

7) Press the **Submit** button to continue.

8) Under the **Available Data for this Site** drop-down menu, select "Time-series: Daily data."

9) Under the **Available Parameters** section of the following menu, select the parameter "Discharge (Mean)" (Figure 7).

10) Under the **Output Format** section, select "Tab-separated" and enter the desired time period (period of record recommended).

11) Press the **GO** button to download data.

12) Save the downloaded file in the USGS_downloads folder under the Input file directory

13) Put a copy of the original input file in the Archive Inputs folder. Rename the file with current date. This preserves a copy of the data that has already been loaded into the database.

14) Copy daily flow data (Figure 8, left) and input into the template ***USGS_input.xlsx*** (Figure 8, right). As needed, reformat the data to match the template. ***Do not change the template name, column names, order of the workbook tabs or workbook tab names.***

15) Save new data in the template and close. The template should now be ready to import.

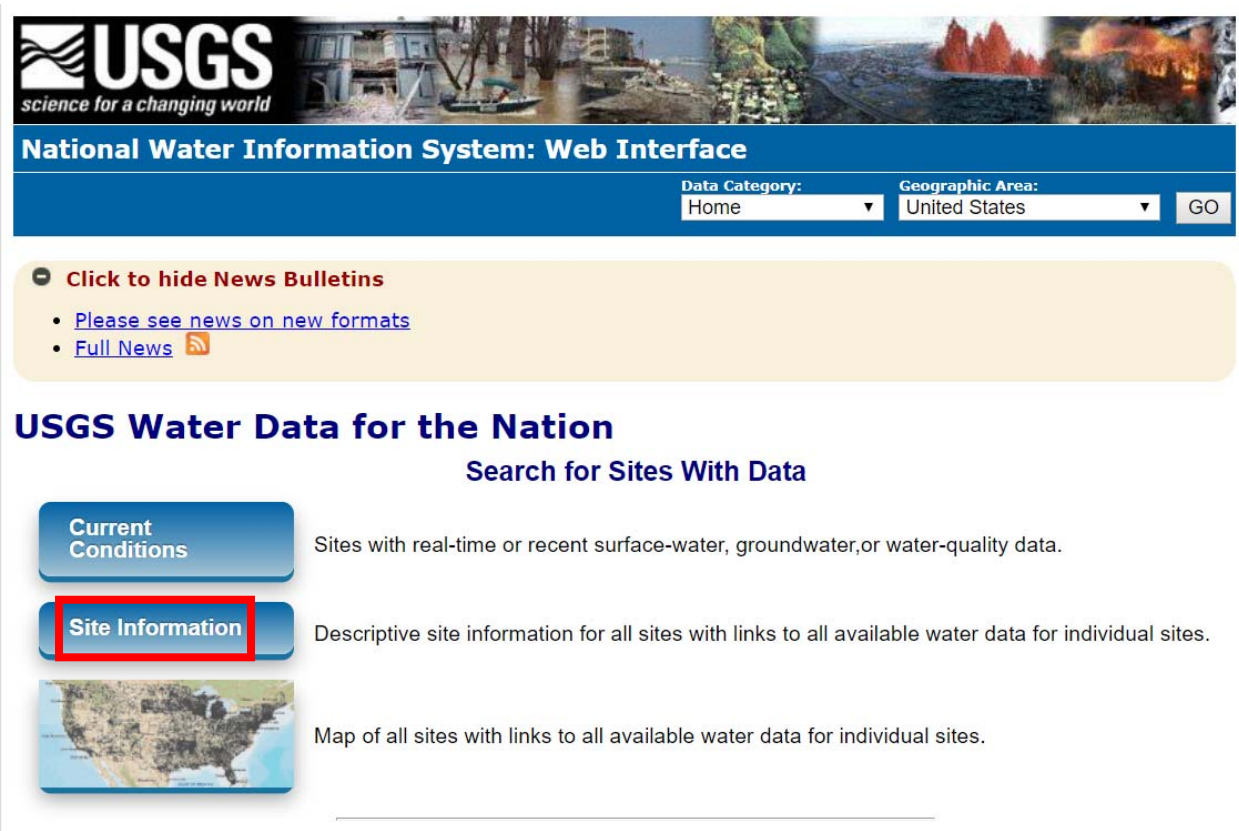


Figure 5. USGS Water Data website

Figure 6. USGS Water Data Selection Criteria

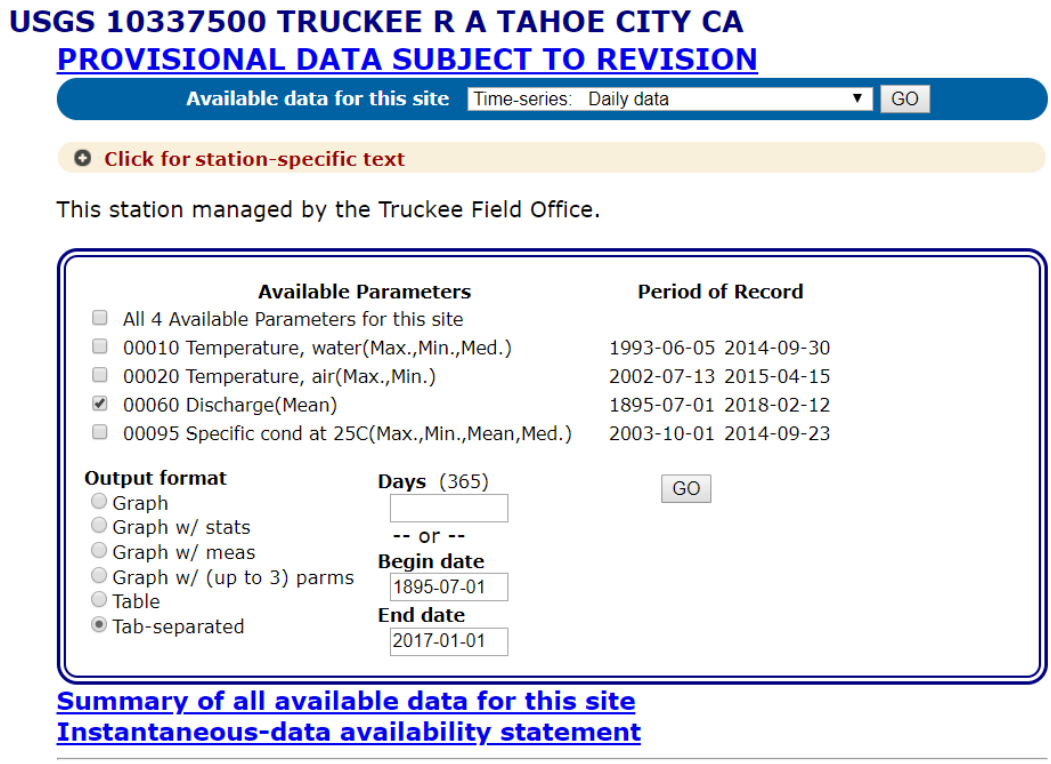


Figure 7. USGS Water Data Output Format Selection

```
# ---------------------------------- WARNING ----------------------------------------
# Some of the data that you have obtained from this U.S. Geological Survey database
# may not have received Director's approval. Any such data values are qualified
# as provisional and are subject to revision. Provisional data are released on the
# condition that neither the USGS nor the United States Government may be held liable
# for any damages resulting from its use.
#
# Additional info: https://help.waterdata.usgs.gov/policies/provisional-data-statement
#
# File-format description:  https://help.waterdata.usgs.gov/faq/about-tab-delimited-output
# Automated-retrieval info: https://help.waterdata.usgs.gov/faq/automated-retrievals
#
# Contact:   gs-w_support_nwisweb@usgs.gov
# retrieved: 2018-02-13 18:51:53 EST       (sdww02)
#
# Data for the following 1 site(s) are contained in this file
#    USGS 10337500 TRUCKEE R A TAHOE CITY CA
# -------------------------------------------------------------------------------------
#
# Data provided for site 10337500
#            TS   parameter     statistic     Description
#          7588       00060     00003     Discharge, cubic feet per second (Mean)
#
# Data-value qualification codes included in this output:
#
#     A  Approved for publication -- Processing and review completed.
#     P  Provisional data subject to revision.
#     e  Value has been estimated.
#
agency_cd       site_no datetime        7588_00060_00003        7588_00060_00003_cd
5s      15s     20d     14n     10s
USGS    10337500        1895-07-01      1180    A
USGS    10337500        1895-07-02      1180    A
USGS    10337500        1895-07-03      1180    A
USGS    10337500        1895-07-04      1180    A
USGS    10337500        1895-07-05      1180    A
USGS    10337500        1895-07-06      1180    A
USGS    10337500        1895-07-07      1180    A
USGS    10337500        1895-07-08      1180    A
USGS    10337500        1895-07-09      1180    A
USGS    10337500        1895-07-10      1180    A
USGS    10337500        1895-07-11      1180    A
USGS    10337500        1895-07-12      1180    A
USGS    10337500        1895-07-13      1180    A
USGS    10337500        1895-07-14      1180    A
USGS    10337500        1895-07-15      1180    A
USGS    10337500        1895-07-16      1180    A
USGS    10337500        1895-07-17      1180    A
USGS    10337500        1895-07-18      1180    A
```

A2 | USGS

	A	B	C	D	E
1	agency	siteno	date	val	code
2	USGS	10337500	1895-07-01	1180	A
3	USGS	10337500	1895-07-02	1180	A
4	USGS	10337500	1895-07-03	1180	A
5	USGS	10337500	1895-07-04	1180	A
6	USGS	10337500	1895-07-05	1180	A
7	USGS	10337500	1895-07-06	1180	A
8	USGS	10337500	1895-07-07	1180	A
9	USGS	10337500	1895-07-08	1180	A
10	USGS	10337500	1895-07-09	1180	A
11	USGS	10337500	1895-07-10	1180	A
12	USGS	10337500	1895-07-11	1180	A
13	USGS	10337500	1895-07-12	1180	A
14	USGS	10337500	1895-07-13	1180	A
15	USGS	10337500	1895-07-14	1180	A
16	USGS	10337500	1895-07-15	1180	A
17	USGS	10337500	1895-07-16	1180	A
18	USGS	10337500	1895-07-17	1180	A
19	USGS	10337500	1895-07-18	1180	A
20	USGS	10337500	1895-07-19	1170	A
21	USGS	10337500	1895-07-20	1160	A
22	USGS	10337500	1895-07-21	266	A

USGSdownload

Figure 8. USGS Water Data output and flow data template

3.1.2 Downloading WDL Data

All Water Data Library (WDL) records for groundwater level (GWL) and flow may be accessed through the WDL homepage.

Groundwater Level Data

1) Navigate to the WDL homepage (http://www.water.ca.gov/waterdatalibrary/) and select "Groundwater Level Data" in the left side navigation menu (Figure 9).

2) Under the **Groundwater Level Data Reports** section, choose "Download compressed file of all groundwater levels." This will download groundwater levels for all of California.

3) Navigate to the Input\GWLinputs folder. Copy the existing files, rename by adding current date to the name and move the files to the Archive inputs folder.

4) Unzip the downloaded file and copy the file gst_file.csv, gwl_file.csv, and perf_file.csv to the following location: C:\DMS\Input\GWLinputs

5) These files are imported directly into the database. No additional formatting is necessary.

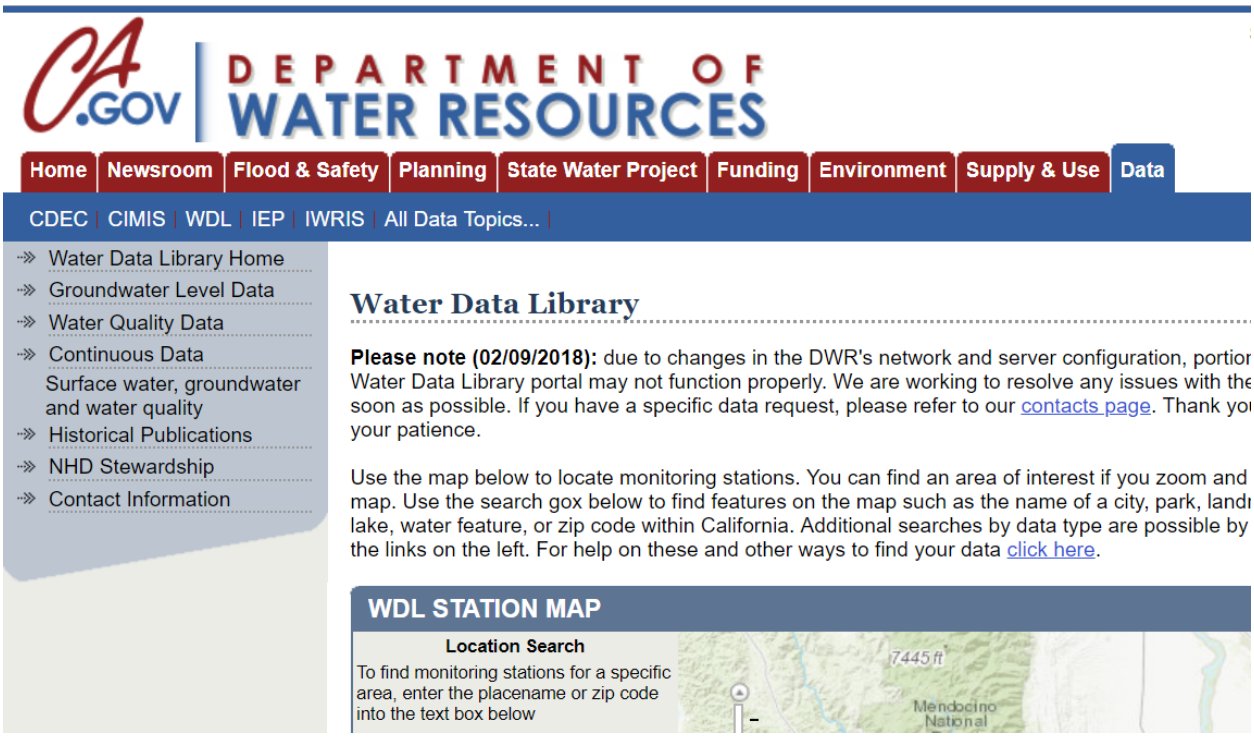


Figure 9. WDL Homepage: Groundwater Level and Flow Data Navigation

Surface Flow Data

1) Navigate to the WDL homepage (http://www.water.ca.gov/waterdatalibrary/) (Figure 9).

2) Use the WDL Station Map to find the station (s) for loading. Click on the station and then click on the View continuous data link (Figure 10).

3) Click on the Table/Data icon next to the Flow Daily Mean (cfs) parameter (Figure 11).

4) Put a copy of the original input file (WDL_inputs.xlsx) in the Archive Inputs folder. Rename the file with the current date. This preserves a copy of the data that has already been loaded into the database.

5) Copy the data from the table in step 3 and paste into the WDL_input.xlsx file in the Input folder. ***<u>Do not change the template name, column names, order of the workbook tabs or workbook tab names.</u>***

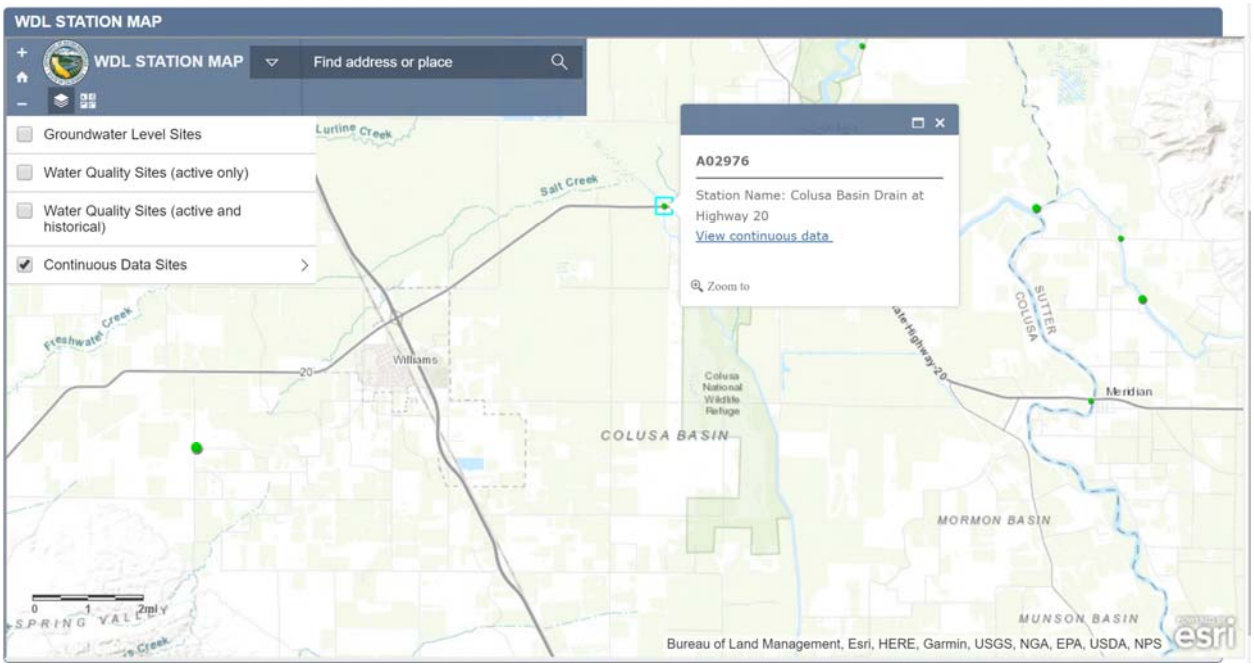


Figure 10. WDL Station Map

Site Information	
Site	Colusa Basin Drain at Highway 20
Station Number	A02976
Site Type	Surface Water

Site Specific Reports

	Report
Site Information	

Period of Record

Parameter	Plot	Table/Data	Report
Flow Daily Mean (cfs)			
Stage Daily Mean (ft)			

Note: the values displayed on the plots are not the same as the values in the table/data reports in the period of record reports. The values in tables/data reports are the mean daily values. The values displayed on plots are the mean values for a variable interval, which depends on the period the site has been monitored. The period and interval are displayed below the title and above the legend in the plot.

Figure 11. WDL Station Map and Continuous Data Download

3.1.3 Downloading CDEC Data

Surface Flow Data

1) Navigate to the CDEC query tools homepage (https://cdec.water.ca.gov/queryTools.html).
2) Under the **Current and Historical Data** section, select "Historical Data: CSV format" for a desired single station (Figure 12).
3) Under the **General Data Download** section, select the desired station record (Figure 13)
    a. CDEC Station ID (3 characters, may find at https://cdec.water.ca.gov/staMeta.html)
    b. Sensor Number (flow, mean daily (cfs): 41)
    c. Daily
    d. Start/End date (leave blank for full record)
4) Select **Download CSV Data Now** and save data file in an appropriate location on the computer.
5) Put a copy of the original input file (CDEC_inputs.xlsx) in the Archive Inputs folder. Rename the file with the current date. This preserves a copy of the data that has already been loaded into the database.
6) Import the CSV filed into the template ***CDEC_input.xlsx*** (Figure 14). ***Do not change the template name or column names.***
7) Save new data in the template and close. The template should now be ready to import.

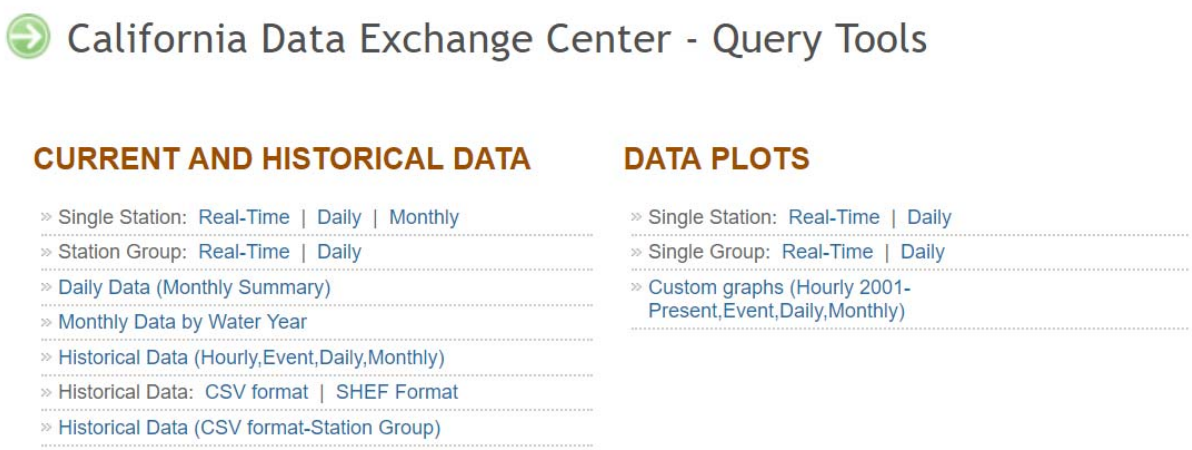


Figure 12. CDEC Query Tools: Historical Data

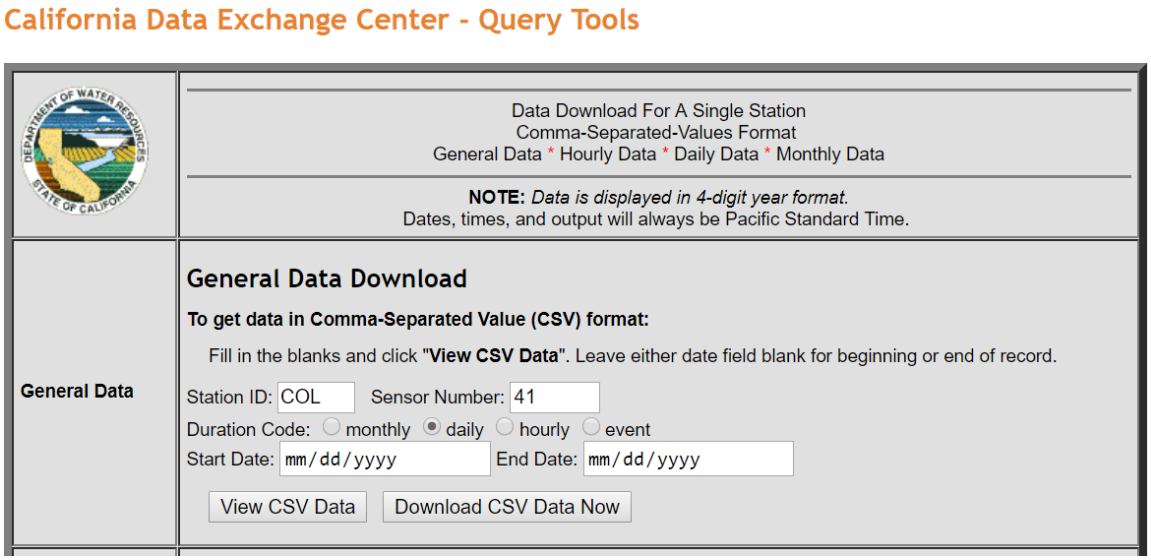
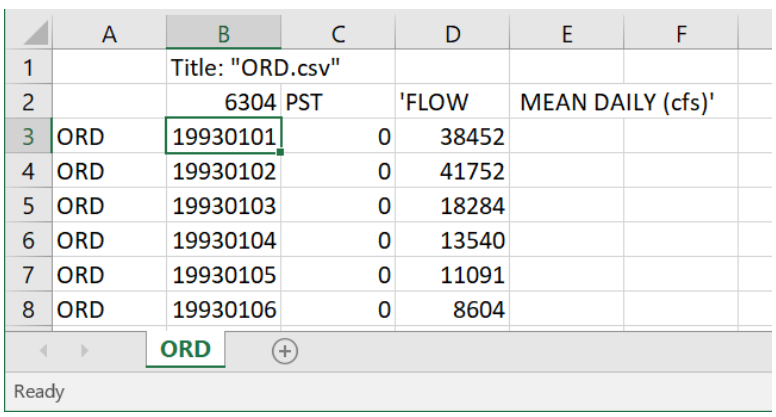


Figure 13. *CDEC Daily Flow Data Download*



	A	B	C	D	E	F
1		Title: "ORD.csv"				
2		6304	PST	'FLOW	MEAN DAILY (cfs)'	
3	ORD	19930101	0	38452		
4	ORD	19930102	0	41752		
5	ORD	19930103	0	18284		
6	ORD	19930104	0	13540		
7	ORD	19930105	0	11091		
8	ORD	19930106	0	8604		

ORD
Ready

Figure 14. CDEC Daily Flow Data Template

3.1.4 Downloading PRISM Data

Precipitation Data

All PRISM Climate Group precipitation data records can be accessed through the PRISM Data Explorer.

1) Navigate to the PRISM Climate Group Data Explorer: Download Time Series Values In Bulk webpage (http://prism.oregonstate.edu/explorer/bulk.php) (Figure 15).

2) Press the **Open Locations File** button.

3) In the file explorer window, navigate to the location of your DMS folder and locate the PRISM locations file (***…\DMS\SupportingFiles\PrismLocations.csv***) and open.

4) In the **Data Settings** section, select the following options (Figure *16*):

a. **Daily values**: choose the start and end date times for the desired data record.
Note: If the desired time range is greater than 6 months, then you must download multiple files covering your desired range.

b. **Units**: English

c. **Interpolate grid cell values**: check box

d. **Climate Variable**: precipitation

5) In the **Controls** section, select the **Prepare & Download Time Series** button.

6) In the file explorer window, navigate to the DMS input folder (***…\DMS\Input\PRISM_downloads***) and save.

7) If the desired time range is greater than 6 months, repeat steps 1 through 6 for each 6 month time period that is needed.

Merge all files into one spreadsheet and input into the template ***PRISM_input.xlsx*** (Figure 17*). As needed, reformat the data to match the template.* ***Do not change the template name or column names.***

8) Save new data in the template and close. The template should now be ready to import.

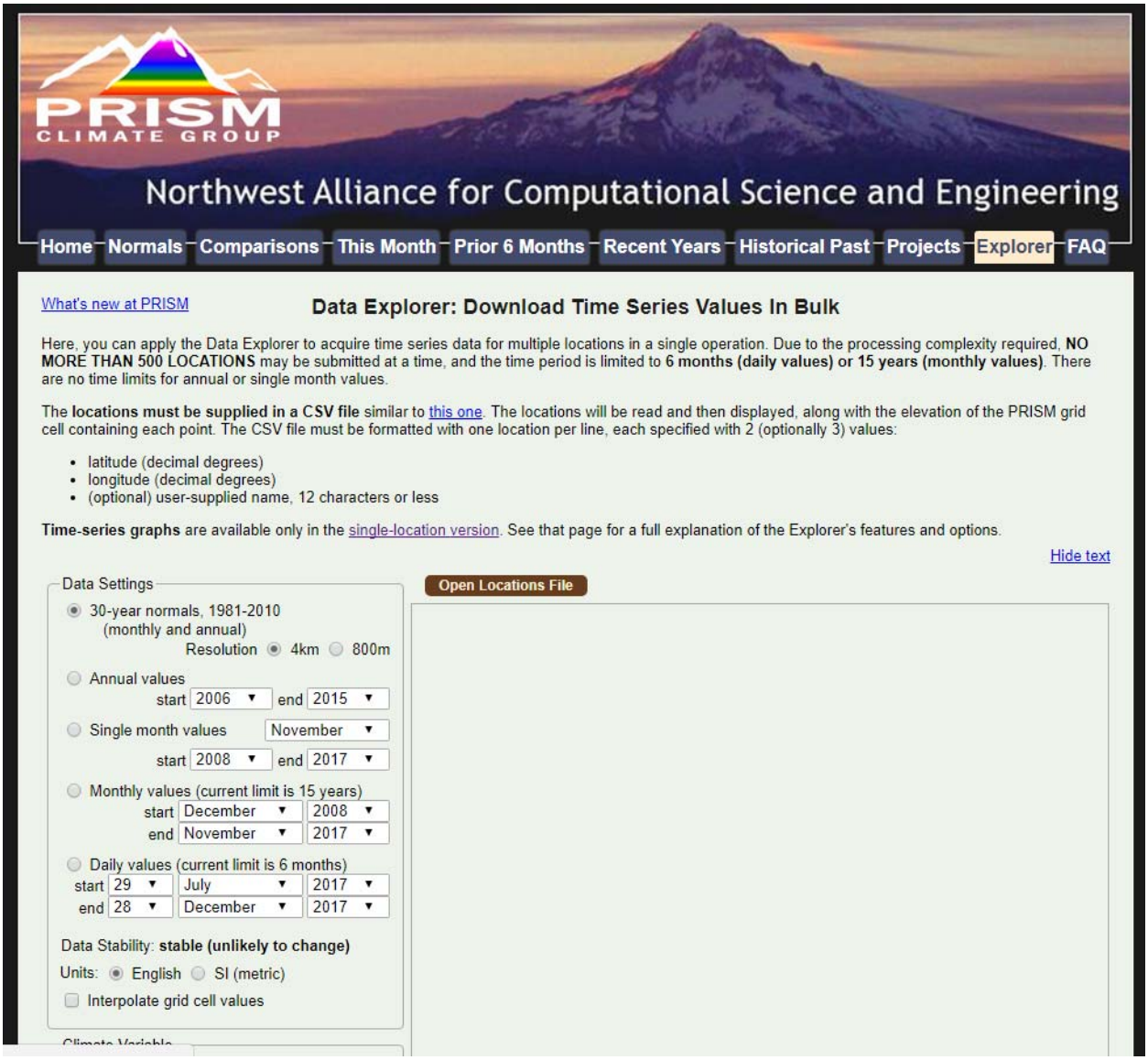


Figure 15. PRISM Data Explorer: Download Time Series Values in Bulk

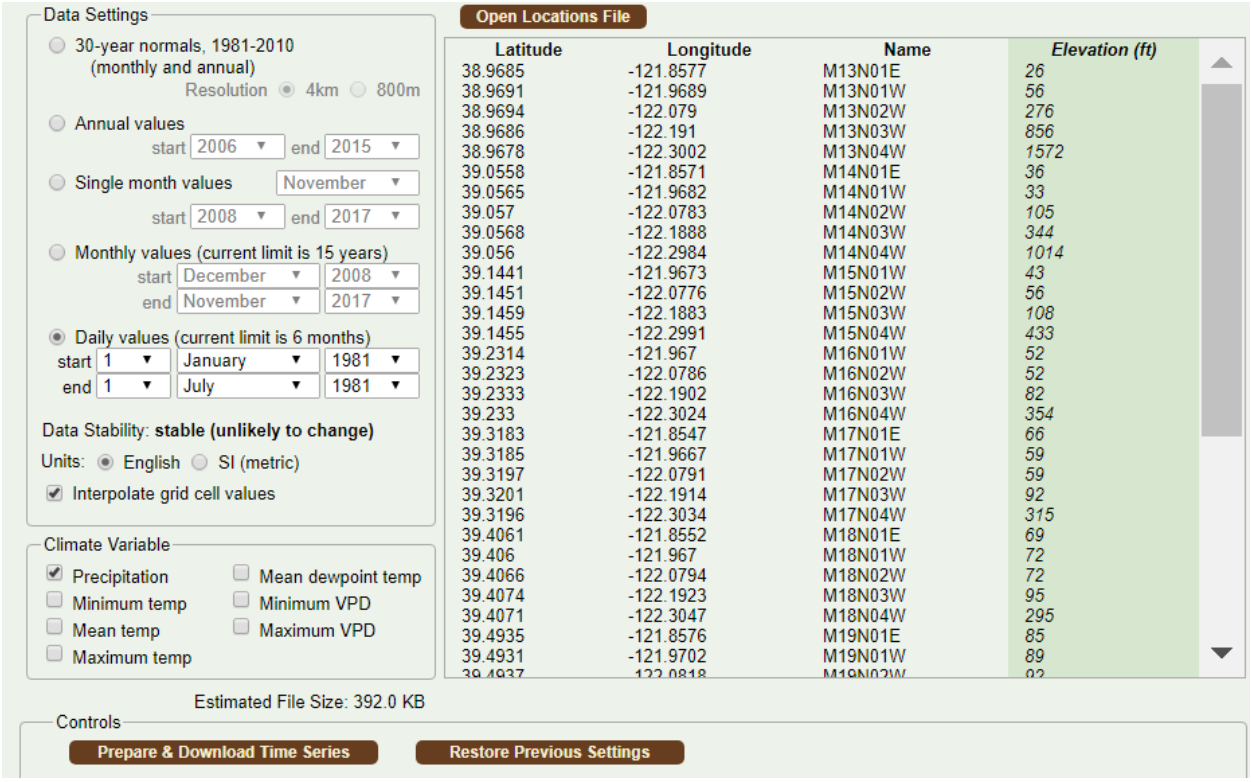
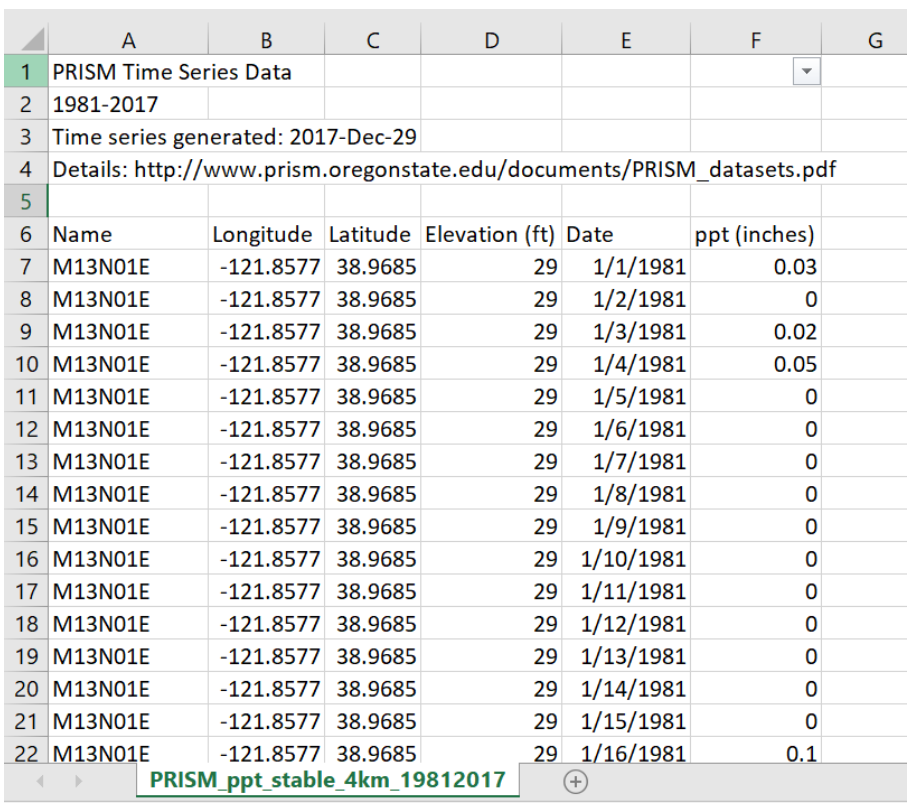


Figure 16. PRISM Data Explorer: Data Settings



	A	B	C	D	E	F	G
1	PRISM Time Series Data						
2	1981-2017						
3	Time series generated: 2017-Dec-29						
4	Details: http://www.prism.oregonstate.edu/documents/PRISM_datasets.pdf						
5							
6	Name	Longitude	Latitude	Elevation (ft)	Date	ppt (inches)	
7	M13N01E	-121.8577	38.9685	29	1/1/1981	0.03	
8	M13N01E	-121.8577	38.9685	29	1/2/1981	0	
9	M13N01E	-121.8577	38.9685	29	1/3/1981	0.02	
10	M13N01E	-121.8577	38.9685	29	1/4/1981	0.05	
11	M13N01E	-121.8577	38.9685	29	1/5/1981	0	
12	M13N01E	-121.8577	38.9685	29	1/6/1981	0	
13	M13N01E	-121.8577	38.9685	29	1/7/1981	0	
14	M13N01E	-121.8577	38.9685	29	1/8/1981	0	
15	M13N01E	-121.8577	38.9685	29	1/9/1981	0	
16	M13N01E	-121.8577	38.9685	29	1/10/1981	0	
17	M13N01E	-121.8577	38.9685	29	1/11/1981	0	
18	M13N01E	-121.8577	38.9685	29	1/12/1981	0	
19	M13N01E	-121.8577	38.9685	29	1/13/1981	0	
20	M13N01E	-121.8577	38.9685	29	1/14/1981	0	
21	M13N01E	-121.8577	38.9685	29	1/15/1981	0	
22	M13N01E	-121.8577	38.9685	29	1/16/1981	0.1	

PRISM_ppt_stable_4km_19812017

Figure 17. PRISM Precipitation Data Input File

3.1.5 Downloading NCEI Data

Precipitation Data

All National Centers for Environmental Information (NCEI) precipitation data records can be accessed through the NCEI Climate Data Online Data Tools. Precipitation data may be retrieved from specific stations across multiple datasets by specifying a location or a specific station. The steps below will detail the process for downloading data by location.

1) Navigate to the **NCEI Data Tools: Select a Location** webpage (https://www.ncdc.noaa.gov/cdo-web/datatools/selectlocation) (Figure 18).

2) In the **Select a Dataset** scroll menu, select **Daily Summaries**.

3) In the **Select a Location Type** scroll menu, select **County** or **Zip Code** and enter appropriate details to refine your search.

4) Select the **Add Location to Cart** button to select data for all sites within the region or select the **Add to Cart** button next to any individual station.

5) Navigate to **Cart (Free Data)** to download the selected data by the button in the upper right corner of the webpage.

6) Under **Select Cart Options**, select **Custom GHCN-Daily CSV** and the data record time period you wish to download (Figure 19, left).

7) Press the **Continue** button to proceed.

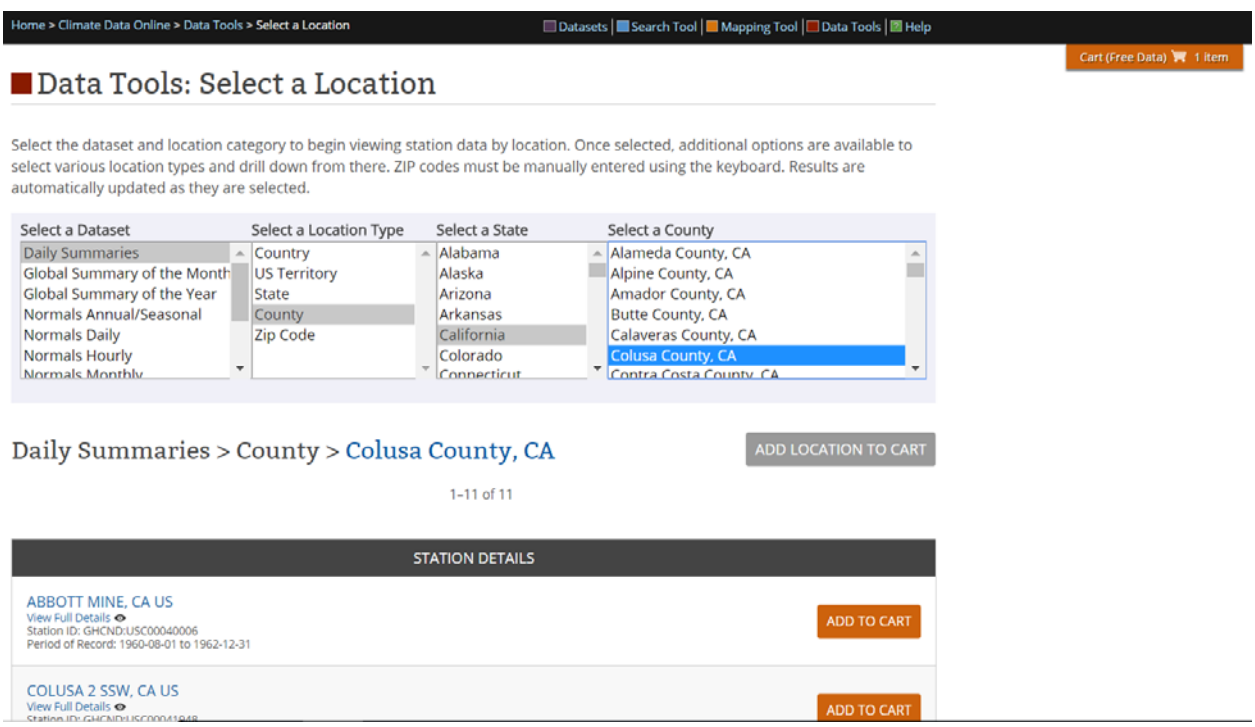


Figure 18. NCEI Precipitation Data Selection by Location

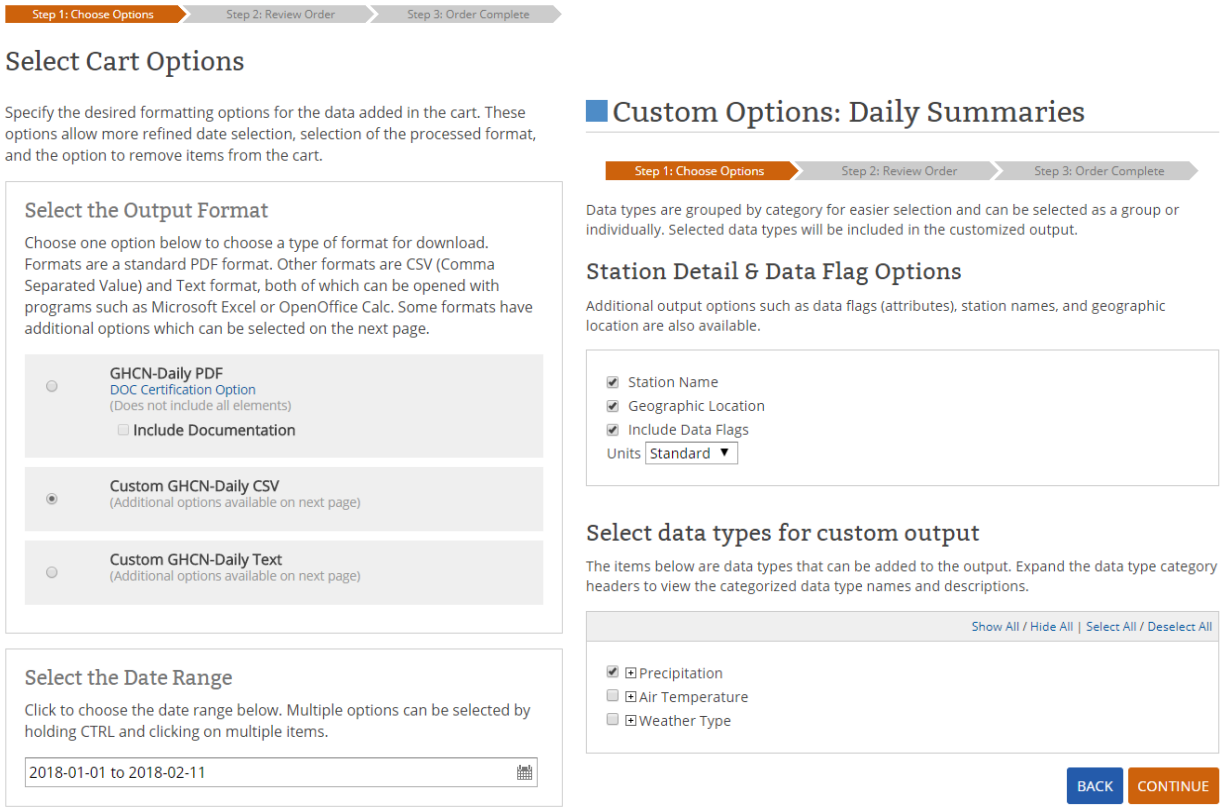


Figure 19. NCEI Precipitation Data Selection Criteria

8) Under the **Station Detail and Data Flag Options** section, choose the following options (Figure 19, right):

    a. **Station Name**: check

    b. **Geographic Location**: check

    c. **Include Data Flags**: check

    d. **Units**: Standard

9) Under the **Select Data Types for Custom Output** section, select **Precipitation**

10) Press the **Continue** button to continue.

11) On the **Review Order** form, enter an email address for the data to be sent to (Figure 20).

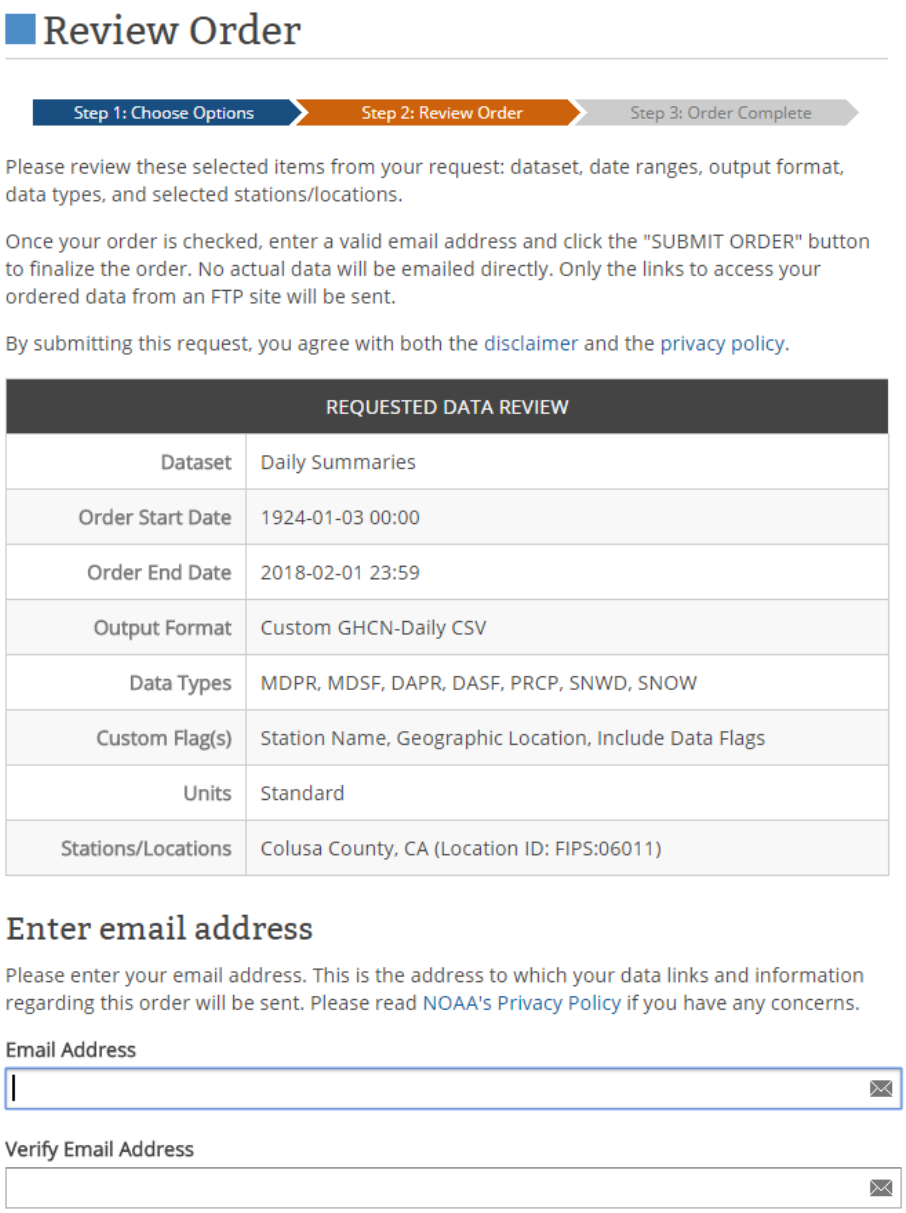
12) Press the **Submit Order** button to submit your data request.

13) An email will be sent to the address you entered providing details regarding your data request, and a later email will include a link to the requested data. This process may only take a few minutes.

14) Navigate to the requested data following the File Download link in the email (Figure).

15) Copy the precipitation data from the CSV file received (Figure) and input into the template ***NCEI_input.xlsx***. As needed, reformat the data to match the template. ***Do not change the template name or column names.***

16) Save new data in the template and close. The template should now be ready to import.



Review Order

Step 1: Choose Options | Step 2: Review Order | Step 3: Order Complete

Please review these selected items from your request: dataset, date ranges, output format, data types, and selected stations/locations.

Once your order is checked, enter a valid email address and click the "SUBMIT ORDER" button to finalize the order. No actual data will be emailed directly. Only the links to access your ordered data from an FTP site will be sent.

By submitting this request, you agree with both the disclaimer and the privacy policy.

REQUESTED DATA REVIEW	
Dataset	Daily Summaries
Order Start Date	1924-01-03 00:00
Order End Date	2018-02-01 23:59
Output Format	Custom GHCN-Daily CSV
Data Types	MDPR, MDSF, DAPR, DASF, PRCP, SNWD, SNOW
Custom Flag(s)	Station Name, Geographic Location, Include Data Flags
Units	Standard
Stations/Locations	Colusa County, CA (Location ID: FIPS:06011)

Enter email address

Please enter your email address. This is the address to which your data links and information regarding this order will be sent. Please read NOAA's Privacy Policy if you have any concerns.

Email Address

Verify Email Address

Figure 20. NCEI Precipitation Data Request

Your order has been processed and is ready for download. Use the links below to download the individual orders.

If any part of your order has certifiable data, a link will be supplied that will help you with the certification process.

Documentation for each dataset is linked from within the order for your convenience.

Order Details

Order #1219371 (Custom GHCN-Daily CSV)

File	Download (Available until 2018-Feb-22)
Order ID	1219371
Date Submitted	2018-02-15 06:28
Order Summary	View Summary
Documentation	View Documentation

Want to manage your previous orders online?

If you want to check or resubmit an older order, please visit our order status page.

	A	B	C	D	E	F	G	
1	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	DATE	DAPR	DAF
2	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/11/1925		
3	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/16/1927		
4	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/18/1927		
5	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/2/1928		
6	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/3/1928		
7	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/4/1928		
8	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	12/15/1929		
9	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/22/1930		
10	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	3/5/1930		
11	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	3/15/1930		
12	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	1/17/1938		
13	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	2/9/1938		
14	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	3/12/1938		
15	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/1/1938		
16	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/2/1938		
17	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/3/1938		
18	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/4/1938		
19	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/5/1938		
20	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/6/1938		
21	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/7/1938		
22	USC00048580	STONYFORD, CA US	39.3752	-122.5461	356.6	10/8/1938		

1219371

Figure 21. NCEI Precipitation Data Output

3.1.6 Preparing USBR Deliveries

All USBR deliveries data can be accessed from the USBR Central Valley Operations Delivery Reports webpage. Additional QC is not performed on the USBR reported deliveries at this time. Data downloaded from the USBR website are reformatted and loaded in the QC_MonVol table.

1) Navigate to the USBR Delivery Reports webpage (https://www.usbr.gov/mp/cvo/deliv.html).

2) For the new record year you wish to add, download the report tables for districts corresponding to the region of interest under the **Report of Operations Monthly Delivery Tables** section (Figure). These tables may include:

    a. **Central Valley Project Diversions** (USBR Table 21)

    b. **Tehama-Colusa Canal Deliveries** (USBR Table 27)

    c. **Sacramento River Deliveries (Long-term contracts)** (USBR Table 28)

    d. **Sacramento-San Joaquin Valley – Streamflow Data** (USBR Table 29)

3) From these pdf files, enter monthly diversions information for final water users within your region of interest in the ***USBR_input.xlsx*** template (Figure). A list of potential final water users is provided in Table 2. NOTE: not all of the deliveries listed in Table 2 will likely be ultimately required to support GSP development and implementation; this will depend on the outcome of water budget development, monitoring network refinement, and establishment of sustainable management criteria. Ensure that the site name is consistent between record years. ***Do not change the template name or column names.***

4) Save new data in the template and close. The template should now be ready to import.

Figure 22. USBR Delivery Reports

	A	B	C	D	E	F	G
1	MonthlyDeliveryTable	OriginalWaterUserName	FinalWaterUserName	Month	Year	Volum	Notes
2	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	1	1997	0	
3	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	2	1997	0	
4	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	3	1997	240	
5	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	4	1997	21060	
6	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	5	1997	47450	
7	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	6	1997	43790	
8	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	7	1997	52590	
9	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	8	1997	42380	
10	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	9	1997	32390	
11	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	10	1997	10580	
12	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	11	1997	0	
13	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	12	1997	0	
14	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	1	1998	0	
15	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	2	1998	0	
16	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	3	1998	0	
17	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	4	1998	0	
18	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	5	1998	22690	
19	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	6	1998	29330	
20	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	7	1998	58580	
21	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	8	1998	58470	
22	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	9	1998	41870	
23	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	10	1998	13560	
24	Central Valley Project Div	A Canal - Upper Kla	A Canal - Upper Kla	11	1998	0	

Figure 23. USBR Central Delivery Reports Input Template

Table 2. USBR Diversions: List of Potential Final Water Users

District	Site (Final Water User)
Central Valley Project. These represent primarily diversions to canals in the region. The North Canal and South Canal refer to the Orland Unit Water Users Association.	Corning
	North Canal
	South Canal
	Stony Creek
	Tehama-Colusa
Sacramento River. These represent settlement contractor diversions from the Sacramento River, most of which do not divert into the study area, but may need to be considered as part of evaluating streamflows or other aspects of GSP development in subsequent phases.	A&F Boeger Corp & Thunder Farm
	Andreotti, Arnold, et al
	Andreotti, Arthur, et al
	Baber, Jack, et al
	Bartizon Farms (Odyesseus)
	Boeger
	Burroughs et al (Clauss)
	Cannel, Fred
	Carter Mutual Water Company
	Carter, Jane
	Carter, Robert
	Chaplin, May B.
	Clauss, John Jr.
	Colusa IC (King & Dommer)
	Colusa Prop. Inc
	Cranmore Farms (Reynen)
	Davis Ranches
	Deseret Farms of Calif
	Dommer, Elizabeth
	Eastside Mutual Water Company
	Fargo & Haggerty
	Forry, Laurie
	Glenn-Colusa ID
	Glenn-Colusa Irrigation District
	Green Valley Corporation
	Griffin & Prater Tenancy-in-Common
	Hanks, G.A. & Sons
	Hollins, Mariette B
	Howald Farms
	Howald Farms, Inc.
	Hulbert, & Tarke
	Hunter, Robert
	Janice OBrien
	King & Dommer
	King, Barbara
	Latter Day Saints
	Lewis, Joan

District	Site (Final Water User)
	Lomo Cold Storage
	Lovvorn, Wilson
	M & T, Inc.
	Maxwell Irrigation District
	Mehrhof & Montgomery
	MEM Properties
	Meridian Farms Water Company
	Merle, John R.
	Newhall Land & Farming
	O'Brien, Janice
	Odyesseus Farms
	Oji Brothers Farm, Inc.
	Otterson, Mike
	Pelger Mutual Water Company
	Pelger Road 1700 LLC (Cranmore Farms)
	Pleasant Grove-Verona MWC
	Premier Partners III
	Princeton-Codora-Glenn Irrigation District
	Provident Irrigation District
	RCM Properties
	Reclamation District #1004
	Reclamation District #108
	Regents of Univ. Of CA
	Reynen, John, et al
	Rnaggs, layton
	Robert's Ditch Irrigation Company
	Sartain Mutual WC
	Spence, Ruth Ann
	Sutter Mutual Water Company
	Swinford Tract Irrigation Co
	Sycamore Family Trust
	Tarke, Stephen
	Te Velde Family Trust
	Tisdale Irrigation and Drainage Company
	Title Insur. & Trust Co.
	Tomlinson, Fred
	Van Ruiten Bros.
	Wallace Construction, Inc.
	Wallace, Jack, Trust
	Wallace, Jeanne
	Wells, Joyce M
	Wilbur, Roger C.
	Zumwalt Orchards
Sacramento-San Joaquin Valley. These represent streamflow	At Bend Bridge
	At Colusa

District	Site (Final Water User)
volumes along the Sacramento River.	At Keswick Dam
	At Ord Ferry
	At Sacramento "I" St
	At Verona
	At Vina Bridge
	Below Wilkins Slough
	Shasta Inflow (Computed)
Tehama-Colusa Canal. These represent deliveries to Tehama-Colusa Canal contractors.	4H Water District
	4-M Water District
	Colusa County WD
	Cortina WD
	Davis WD
	Elder Creek W.D.
	Fish Facilities
	Glenn Valley WD
	Glenn-Colusa ID
	Glenn-Colusa Irrigation District
	Glide WD
	Holthouse WD
	Kanawha WD
	Kirkwood WD
	La Grande WD
	LaGrange WD
	Myers-Marsh MWC
	Orland-Artois WD
	Ranch Saucos W.D.
	Richfield
	Rolthouse W.D.
	Tehama Ranch M.W.C.
	Tehama W.D.
	Westside WD

3.1.7 Preparing Well Completion Reports

To import WCR records in the DMS, prepare site information from the county's primary Well Completion Report database and input this into the template ***WellCompletion_input.xlsx*** (Figure 24). ***Do not change the template name or column names.*** Save new data in the template and close. The template should now be ready to import.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Link	File_N	Drill_Date	Year	Received	Permit_Num	APN	File_Date	Log_Numb	County	MTRS_old	FID	MTRS_new	MTRS	State_Well_No	POINT_X	POINT_Y	Lat
2	23640.pdf	23640	1/17/1970	1970		0	023-240-049	1/1/1984	48229	GLENN		2513		M21N02W29		576096.0733	4388776.281	
3	23091.pdf	23091	1/1/1970	1970		0	032-270-012	1/1/1983	41877	GLENN		2512		M22N01W28		586695.425	4397847.881	
4	23641.pdf	23641	2/17/1970	1970		0	000-000-000	1/1/1986	48232	GLENN		2511		M22N02W09		576759.5121	4403246.449	
5	23134.pdf	23134	2/14/1970	1970		0	015-180-014	1/1/1979	42158	GLENN		2510		M19N01W22		589116.7523	4370807.076	
6	23643.pdf	23643	2/25/1970	1970		No	044-260-020	1/1/1981	48235	GLENN		348		M22N03W12		572055.4982	4402641.386	
7	23642.pdf	23642	2/20/1970	1970		No	046-210-008	1/1/1985	48233	GLENN		347		M22N02W19		574515.0852	4399974.787	
8	23136.pdf	23136	3/2/1970	1970		0	000-000-000	1/1/1979	42160	GLENN		2509		M19N01W22		588825.9708	4371231.611	
9	23135.pdf	23135	3/13/1970	1970		0	000-000-000	1/1/1981	42159	GLENN		2508		M18N01W28		588204.8579	4359870.618	
10	23092.pdf	23092	3/19/1970	1970		0	000-000-000	1/1/1982	41881	GLENN		2507		M19N02W01		583564.4673	4376437.235	
11	24225.pdf	24225	3/1/1970	1970		No	000-000-000	1/1/1983	93598	GLENN		496				552471.9915	4358810.076	
12	23644.pdf	23644	3/5/1970	1970		No	047-240-051	1/1/1985	48236	GLENN		349		M22N03W33		567976.0043	4396086.749	
13	23614.pdf	23614	5/1/1970	1970		No	024-190-017	1/1/1983	46896	GLENN		346		M21N03W31		564658.8097	4387250.955	
14	23645.pdf	23645	5/20/1970	1970		No	046-210-045	1/1/1983	48240	GLENN		350		M22N02W19		574797.9165	4399976.411	
15	23646.pdf	23646	6/1/1970	1970		No	037-032-001	1/1/1983	48241	GLENN		351		M22N02W03		578350.5947	4405562.247	
16	23647.pdf	23647	6/13/1970	1970		No	047-090-003	1/1/1984	48242	GLENN		352		M22N03W25		572612.9407	4398188.936	
17	23650.pdf	23650	7/28/1970	1970		0	046-320-001	1/1/1981	48247	GLENN		2506		M22N02W29		575946.5718	4399189.133	
18	23648.pdf	23648	7/8/1970	1970		No	047-130-004	1/1/1983	48245	GLENN		353		M22N03W31		564516.773	4396896.733	
19	23649.pdf	23649	7/10/1970	1970		No	047-190-004	1/1/1982	48246	GLENN		354		M22N02W31		574254.2222	4397001.545	
20	22176.pdf	22176	8/28/1970	1970		No	000-000-000	1/1/1985	3835	GLENN		3496		M21N02W11		581070.1427	4393505.735	
21	23744.pdf	23744	8/15/1970	1970		0	000-000-000	1/1/1981	54170	GLENN		2505		M21N01W28		586307.2665	4387965.11	
22	23651.pdf	23651	8/4/1970	1970		No	000-000-000	1/1/1983	48248	GLENN		355		M19N03W02		567782.0503	4376221.611	
23	24451.pdf	24451	8/1/1970	1970		No	000-000-000	1/1/1983	113860	GLENN		498		M22N03W04		567925.1641	4404858.708	
24	23139.pdf	23139	8/28/1970	1970		No	020-060-004	1/1/1983	42165	GLENN		334		M20N03W25		572646.6237	4378996.938	
25	23140.pdf	23140	10/15/1970	1970		0	013-270-010	1/1/1981	42166	GLENN		2504		M18N02W06		574925.5963	4366284.663	

Figure 24. WCR Input Template

3.2 Import Data Function

Once data records have been downloaded and formatted from their original sources (see User Guide section 3.1 Data retrieval from sources), the input templates can be imported into the DMS through the **Import Data** Form.

From the Overview form, navigate to the **Import Data** Form following the button of the same name (Figure 25). All steps for importing data records using this form are outlined by parameter below.

3.2.1 Importing Daily Flow and Precipitation Data, USBR Deliveries, and Well Completion Reports

1) In the **Daily Flow Import Buttons** or **Other** sections, select the button associated with the data source type you wish to import (e.g. USGS, WDL) (Figure 25). An **Import Complete** message will appear when finished.

2) Press the **Close** button to return to the **Overview** form when finished importing data.

3.2.2 Importing WDL Groundwater Level Data

1) In the **Import WDL Groundwater Level Data by Basin** section, select the **Get Basin List** button (Figure 26). An **Import Complete** message will appear when finished.

2) Under the **Select Basin** drop-down menu, select the basin associated with the desired groundwater level data.

3) Select the **3. Get GWL Data** button to import the groundwater level data of that basin. An **Import Complete** message will appear when finished.

4) Press the **Close** button to return to the **Overview** form when finished importing data.

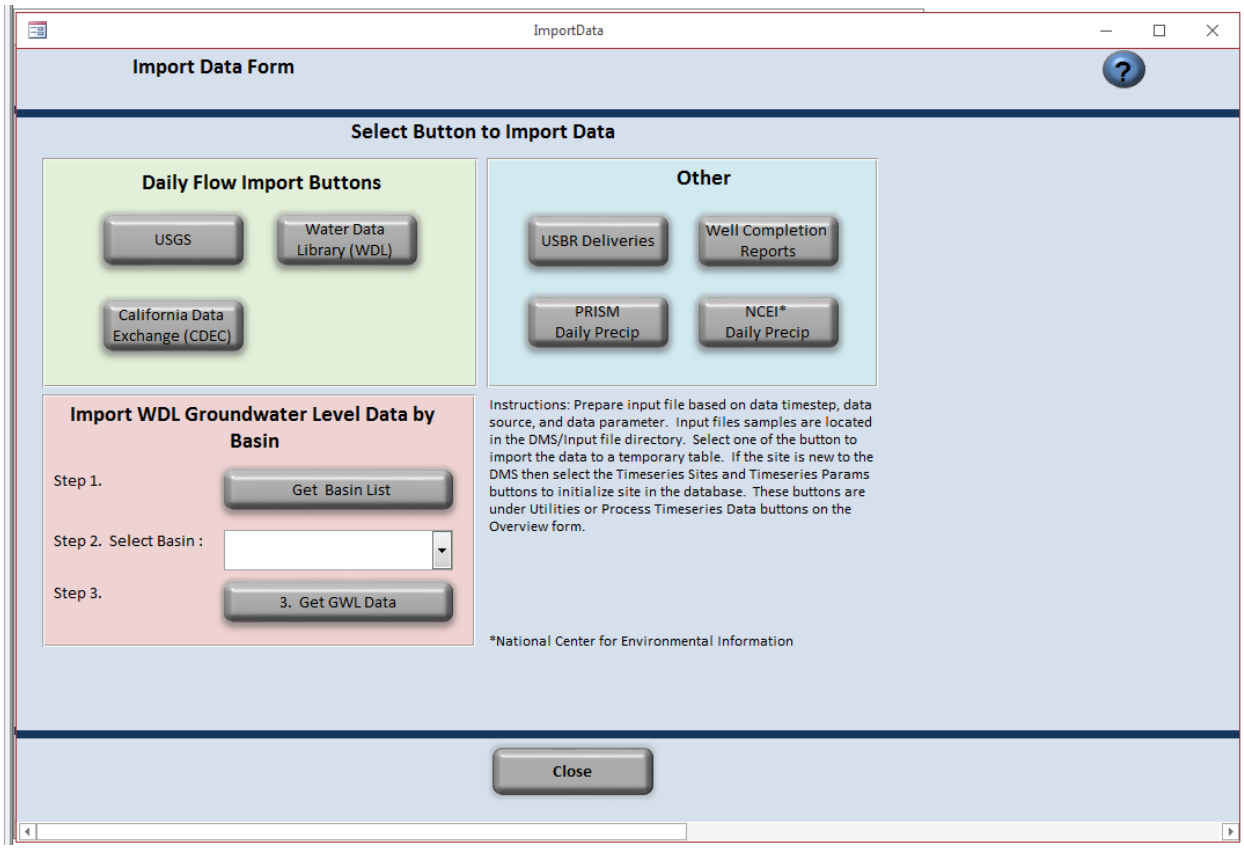


Figure 25. Import Data Form

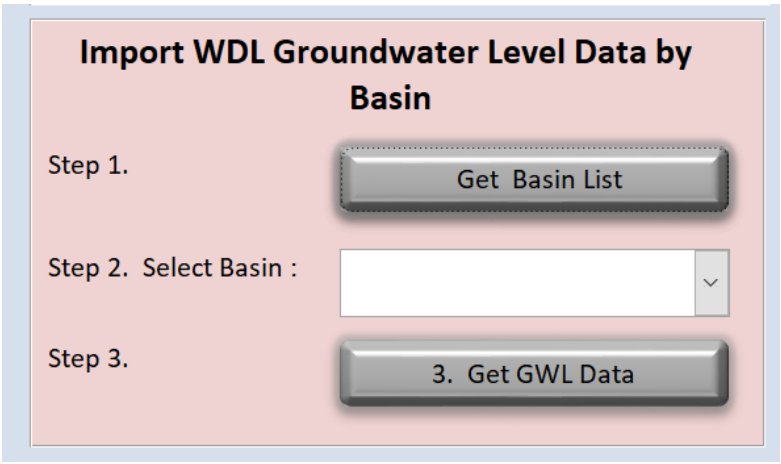


Figure 26. Import WDL Groundwater Level Data

4. Process Timeseries Data

Quality control checks of all newly imported daily data can be conducted through the **Process Timeseries Data** menu (Figure 27). Within this menu, the user may:

1) Initialize new sites in the database (**Timeseries Sites**)
2) Initialize new data parameters associated with sites in the database (**Timeseries Parameters**)
3) Set up and Run Quality Control Process (**Run QC Checks**)
4) Generate or define estimates for missing or inaccurate data points (**Estimate Missing**)
5) Manually review results from qc process (**Manual Review**)

After these QC checks are conducted and edits are made to missing or inaccurate data, the DMS allows the user to manually review and save a revised data set for each site. As this process is completed for each site, the DMS manages both the raw data (as imported) and the QC data (edited and confirmed during QC checks). At any time, the user may view or reset either data set as needed.

This section will lead the user through the steps of initializing a new site with new parameters and running full QC checks of this data.

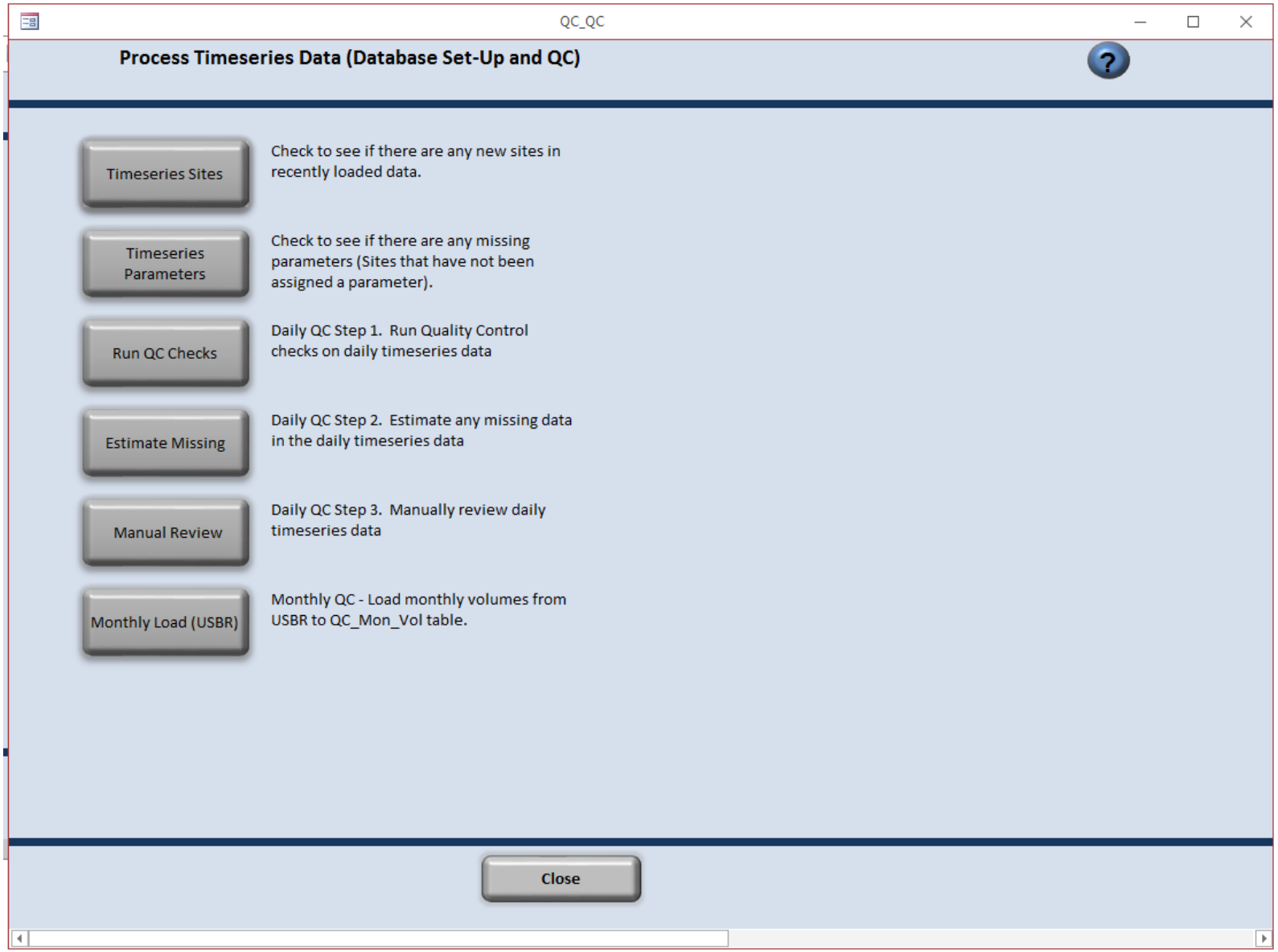


Figure 27. Process Timeseries Data Menu

4.1 Initializing a New Site in the DMS: Timeseries Sites

As raw data is imported into the database, data records are linked to sites by their associated site ID numbers (see section 3. Importing Data). When raw data for new sites are imported into the database, these unrecognized sites must first be initialized in the DMS. During this process, the user defines basic information about the site (e.g. name, location) that is then associated with all data imported for that site in the future. This process is initiated through the **Timeseries Sites** button.

The **Timeseries Sites** form provides a list of these new, unrecognized sites that automatically updates as data records are imported. These sites may be initialized in the DMS through the following steps.

1) Select the **Timeseries Sites** button from the **Process Timeseries Data (Database Set-up and QC)** form.

2) On the **Timeseries Sites** form, select the site number of the new, unassociated site from the **Sites Missing from QC_Sites Table** drop-down menu (Figure 28). Choosing a site will automatically populate the data source type (e.g. USGS, WDL) of the data associated with that new site.

3) Enter all relevant information for this site:

    a. **Site Name**: name of the newly added site which will determine the nomenclature throughout the database; may use full site name or a descriptive site nickname

    b. **County**: where site is located

    c. **Latitude**: in decimal degrees

    d. **Longitude**: in decimal degrees; (-) indicates degrees west longitude

    e. Elevation: of site, in feet

    f. **Note**: other relevant information about the site

    g. **User ID**: identifies the user entering this information

4) *Optional:* If adding a PRISM file, you may select the **Use Name, Lat, Long, and Elev from PRISM Load File** button to automatically edit the site information based on the ***PRISM_inputs.xlsx*** template.

5) Press the **Add New Site** button to enter this site information. Accept these changes when ready. This establishes the site information for that particular site.

6) Press the **Close** button to return to the **Timeseries Sites** form.

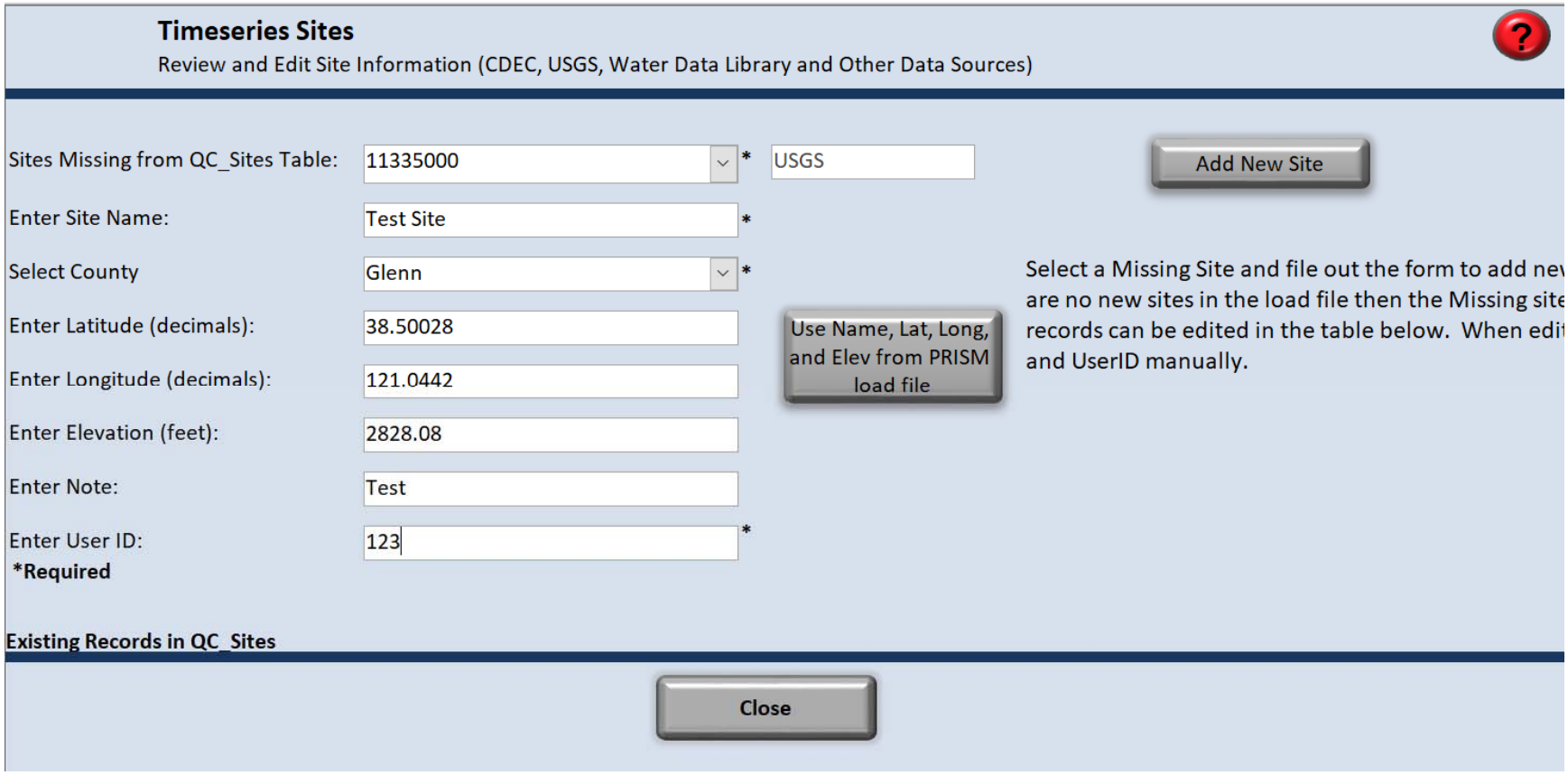


Figure 28. Timeseries Sites: Initializing a New Site

4.2 Initializing New Data Parameters in the DMS: Timeseries Parameters

As new sites are initialized in the database, each site must also be formally associated with a parameter to indicate which types of raw data can be imported for that site. This process is initiated through the **Timeseries Parameters** button.

The **Timeseries Parameters** form provides two options: initializing a parameter for a site with no associated parameters, or associating a parameter with an existing site. In each case, the user defines the parameter associated with the site and the time period when the record for that parameter is valid. The second case is used when two parameters are imported for the site. For instance, flow and level are both of interest to the user.

Both processes are outlined in the following steps.

4.2.1 Initializing Timeseries Parameter for Site with No Associated Parameters

1) Select the **Timeseries Parameters** button from the **Process Timeseries Data (Database Set-up and QC)** form.

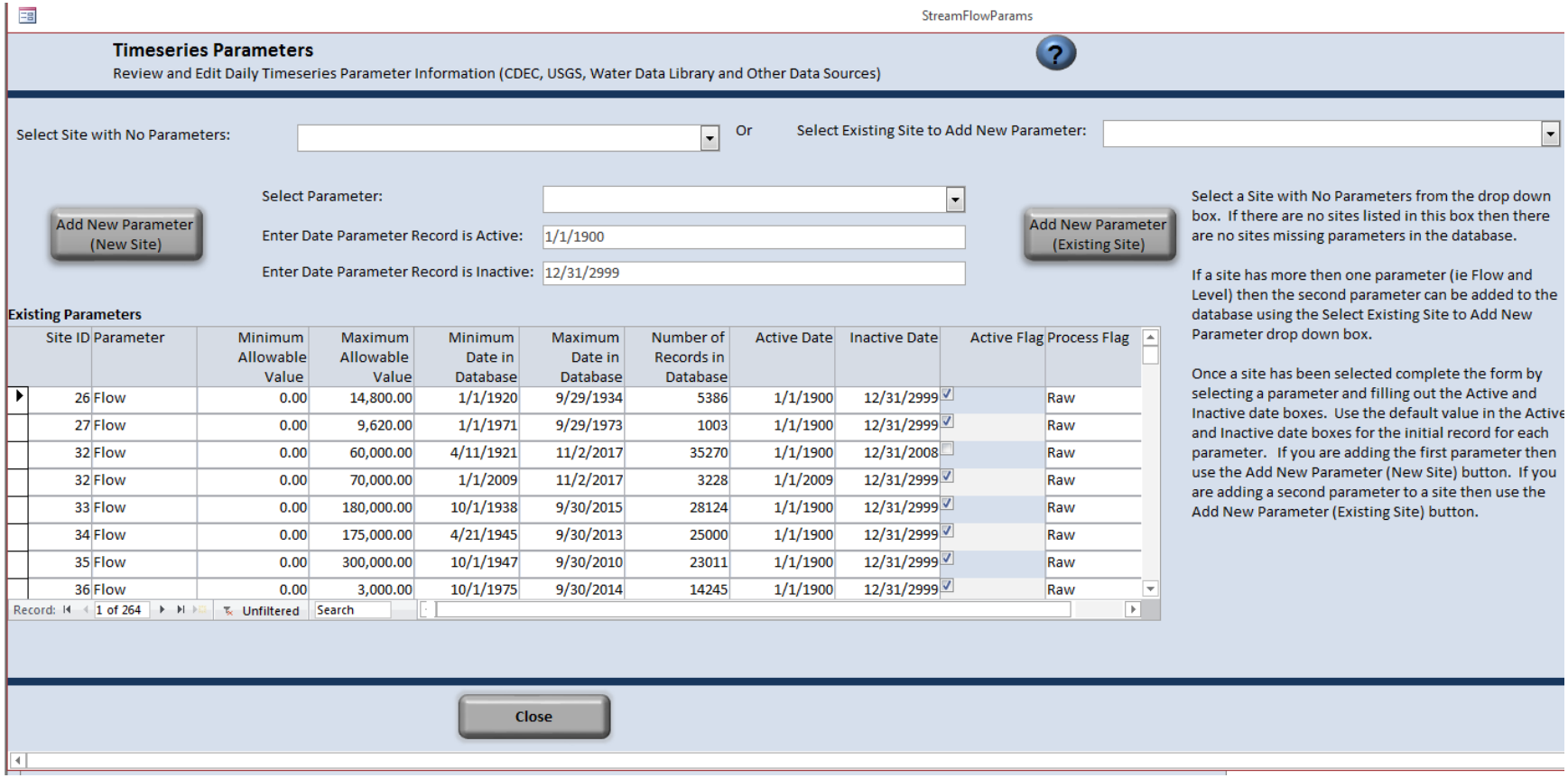
2) On the **Timeseries Parameters** form, select the name of the new, unassociated site from the **Select Site with No Parameters** drop-down menu. As the site has no associated parameters, no values will appear in the **Existing Parameters** table below (Figure 29).

3) In the **Select Parameter** drop-down menu, choose the imported data parameter which you would like to associate with this site.

4) Enter the beginning date (**Date Parameter Record is Active**) and the ending date (**Date Parameter Record is Inactive**) of the data record you would like to add. The Active and Inactive dates should most likely be set to the default values of 1/1/1900 and 12/31/2999.

5) Press the **Add New Parameter (New Site)** button to the left to initialize the parameter for the chosen site. Accept these changes when ready. This action links this data under this specific parameter type to this specific site.

6) Press the **Close** button when finished to return to the **Timeseries Parameters** form.



Site ID	Parameter	Minimum Allowable Value	Maximum Allowable Value	Minimum Date in Database	Maximum Date in Database	Number of Records in Database	Active Date	Inactive Date	Active Flag	Process Flag
26	Flow	0.00	14,800.00	1/1/1920	9/29/1934	5386	1/1/1900	12/31/2999	☑	Raw
27	Flow	0.00	9,620.00	1/1/1971	9/29/1973	1003	1/1/1900	12/31/2999	☑	Raw
32	Flow	0.00	60,000.00	4/11/1921	11/2/2017	35270	1/1/1900	12/31/2008	☐	Raw
32	Flow	0.00	70,000.00	1/1/2009	11/2/2017	3228	1/1/2009	12/31/2999	☑	Raw
33	Flow	0.00	180,000.00	10/1/1938	9/30/2015	28124	1/1/1900	12/31/2999	☑	Raw
34	Flow	0.00	175,000.00	4/21/1945	9/30/2013	25000	1/1/1900	12/31/2999	☑	Raw
35	Flow	0.00	300,000.00	10/1/1947	9/30/2010	23011	1/1/1900	12/31/2999	☑	Raw
36	Flow	0.00	3,000.00	10/1/1975	9/30/2014	14245	1/1/1900	12/31/2999	☑	Raw

Figure 29. Initializing Timeseries Parameters for New Sites with No Associated Parameters and Existing Sites with Associated Parameters

4.2.2 Initializing Timeseries Parameter for Existing Site with Associated Parameters

1) Select the **Timeseries Parameters** button from the **Process Timeseries Data (Database Set-up and QC)** form.

2) On the **Timeseries Parameters** form, select the name of the existing site from the **Select Existing Site to Add New Parameter** drop-down menu. Any parameters already associated with this site will appear in the **Existing Parameters**.

3) In the **Select Parameter** drop-down menu, choose the imported data parameter which you would like to associate with this site.

7) Enter the beginning date (**Date Parameter Record is Active**) and the ending date (**Date Parameter Record is Inactive**) of the data record you would like to add. The Active and Inactive dates should most likely be set to the default values of 1/1/1900 and 12/31/2999.

4) Press the **Add New Parameter (New Site)** button to initialize the parameter for the chosen site. Accept these changes when ready. This action links this specific parameter type to this specific site.

5) Press the **Close** button when finished to return to the **Process Timeseries Data (Database Set-up and QC)** form.

4.3 Run QC Checks on Imported Data

After importing raw data records and linking these to initialized sites and their associated parameters, quality control (QC) checks must be conducted to ascertain that the imported data does not contain errors or missing values.

The initial QC check is conducted by the DMS in three steps: 1) the raw data source is selected and loaded into the QC application, 2) boundary limits are set for each dataset to define the likely maximum and minimum tolerable values in each data record, and finally 3) missing data records or data records that fall outside these limits are flagged for evaluation.

QC checks of all data records are conducted through the **Run QC Checks** form (Figure 30). This menu provides a sequence of steps to perform these checks, which are outlined in detail below.

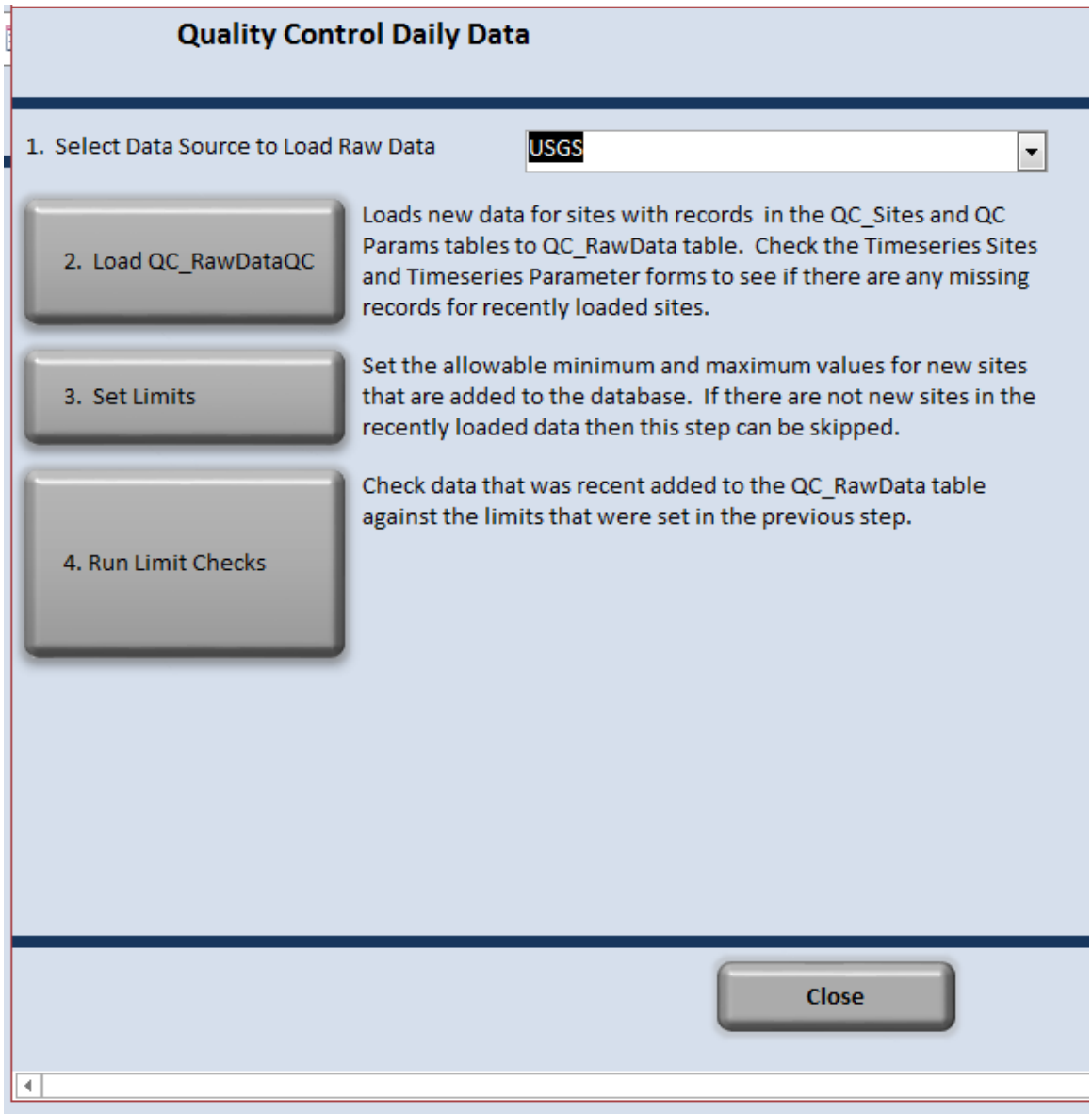


Figure 30. Run QC Checks Form

4.3.1 Selecting and Loading Data for QC Checks

1) On the **Process Timeseries Data (Database Set-up and QC)** form, press the **Run QC Checks** button to navigate to the **Run QC Checks** form (Figure 30).

2) Under the **1. Select Data Source to Load Raw Data** drop-down menu, select the data source type which you would like to load into the DMS. To run QC checks on the newly imported data, this data source type should be the same as that of the newly imported data (see section 3.2 Import Data Function).

3) Select button **2. Load QC_RawDataQC** to add this data's associations with initialized sites (**QC_sites** table) and initialized parameters (**QC_params** table) to the **QC_RawData** table. A pop-up window will indicate when this data transfer is complete.

4.3.2 Setting Data Boundary Limits

1) Select button **3. Set Limits** to navigate to the **Add/Modify Stream Flow Quality Control Limits** form.

2) Under the **Create Raw Data Graphs** section, select the data which you would like to graphically evaluate and set boundary limits for (Figure 31).

    a. **Select First Site Name**: name of the site

    This will populate the **Existing Parameter Records for Selected Sites** table below, which summarizes the available data records and existing data value range for that site. This information may be useful for informing how the data limits are set.

    b. **Site Second Site Name:** name of a secondary site for graphical comparison

    c. **Select Parameter**: parameter of data record

    d. **Enter Date Range**: beginning to end of time period for which you would like to set boundary limits; a 1 year time period is automatically selected after a beginning date is entered, but may be revised

3) Press the **Graph** button to generate a graph of the parameter value for the chosen data record over time (Figure 32). This may be useful for identifying possible data errors (e.g. missing values, unexplained spikes, static values).

4) Close the graph to return to the **Add/Modify Quality Control Limits** form.

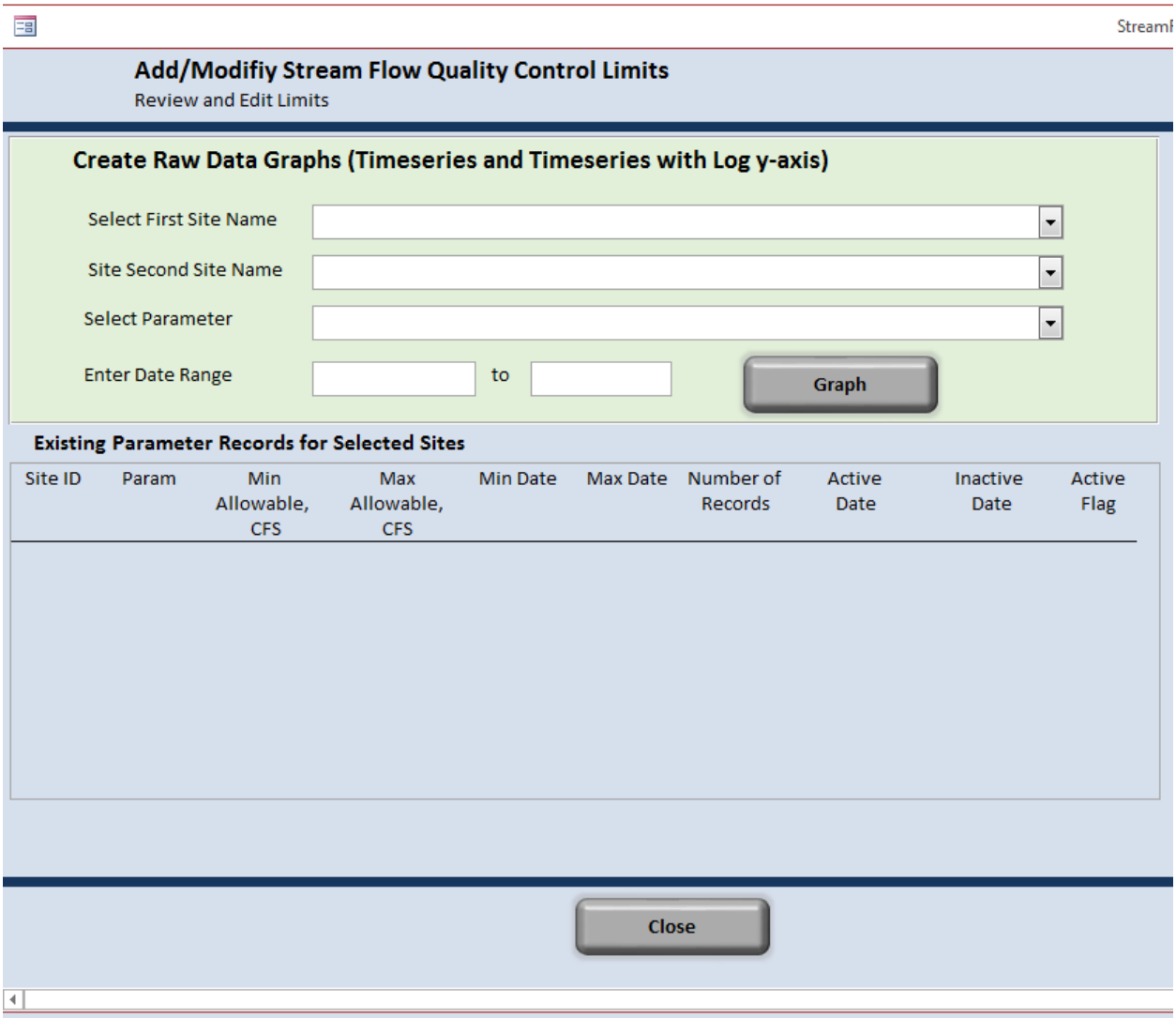


Figure 31. Set Limits Form: Create Raw Data Graphs

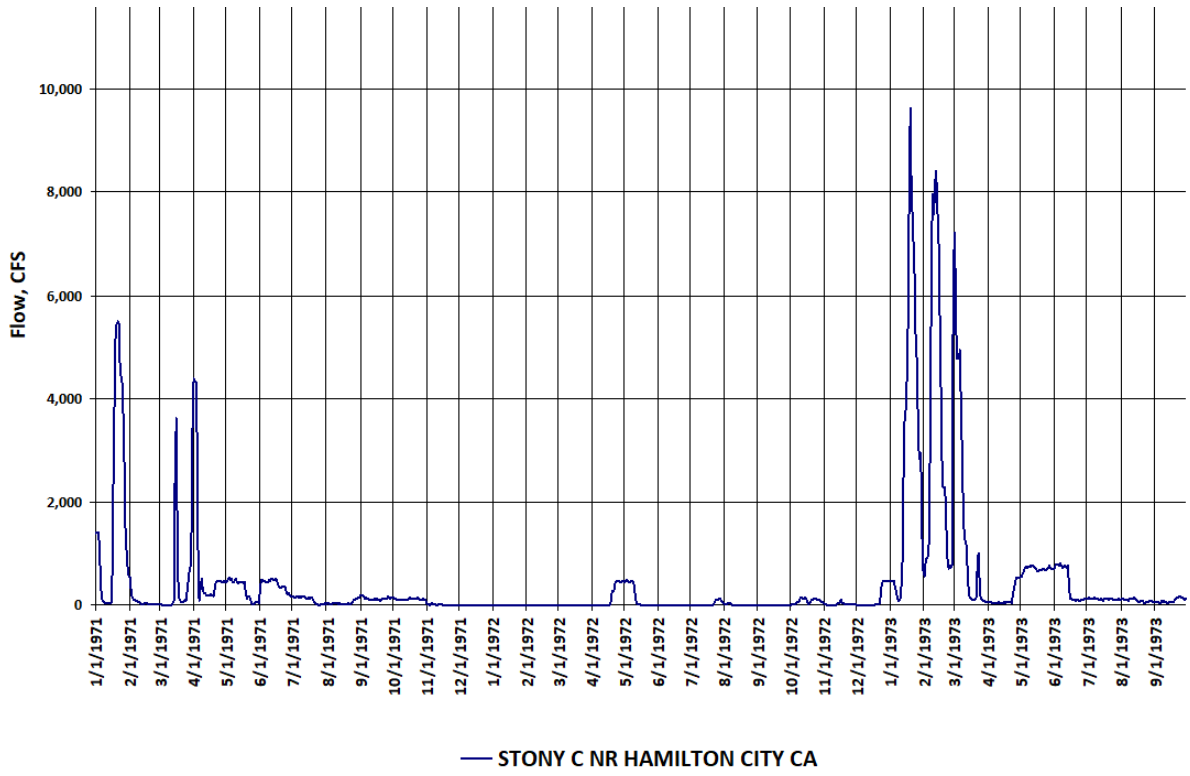


Figure 32. Graph for Evaluating Raw Data Limits

5) Under the **Set Limits** section, initial values are automatically generated for all entries (Figure 33). Change these entries to match your desired boundary limits, if applicable. Generic recommended values are provided for each entry below, but limits should be set to identify high or low value errors.

    a. **Minimum Allowable Value**: automatically set to 0.00 (0.00 recommended)

    b. **Maximum Allowable Value**: automatically set to maximum value in the data record (10% above maximum recorded value recommended)

    c. **Active Date**: automatically set to beginning of active record (set to beginning of period you wish to provide limits for)

    d. **Date of Maximum Value**: automatically reads date of maximum parameter value

6) Press the **Set Limits** button to establish your chosen limits. A pop-up window will confirm when a new record has successful been added.

    Note: The **Sites with Limits to Review** section lists all sites with initialized parameters that have not undergone the **Set Limits** process (Figure 33, bottom). If data has been entered for parameters in these sites, you may use this list as a guide for identifying which data requires QC checks.

7) Press the **Close** button to return to the **QC Daily Data** form.

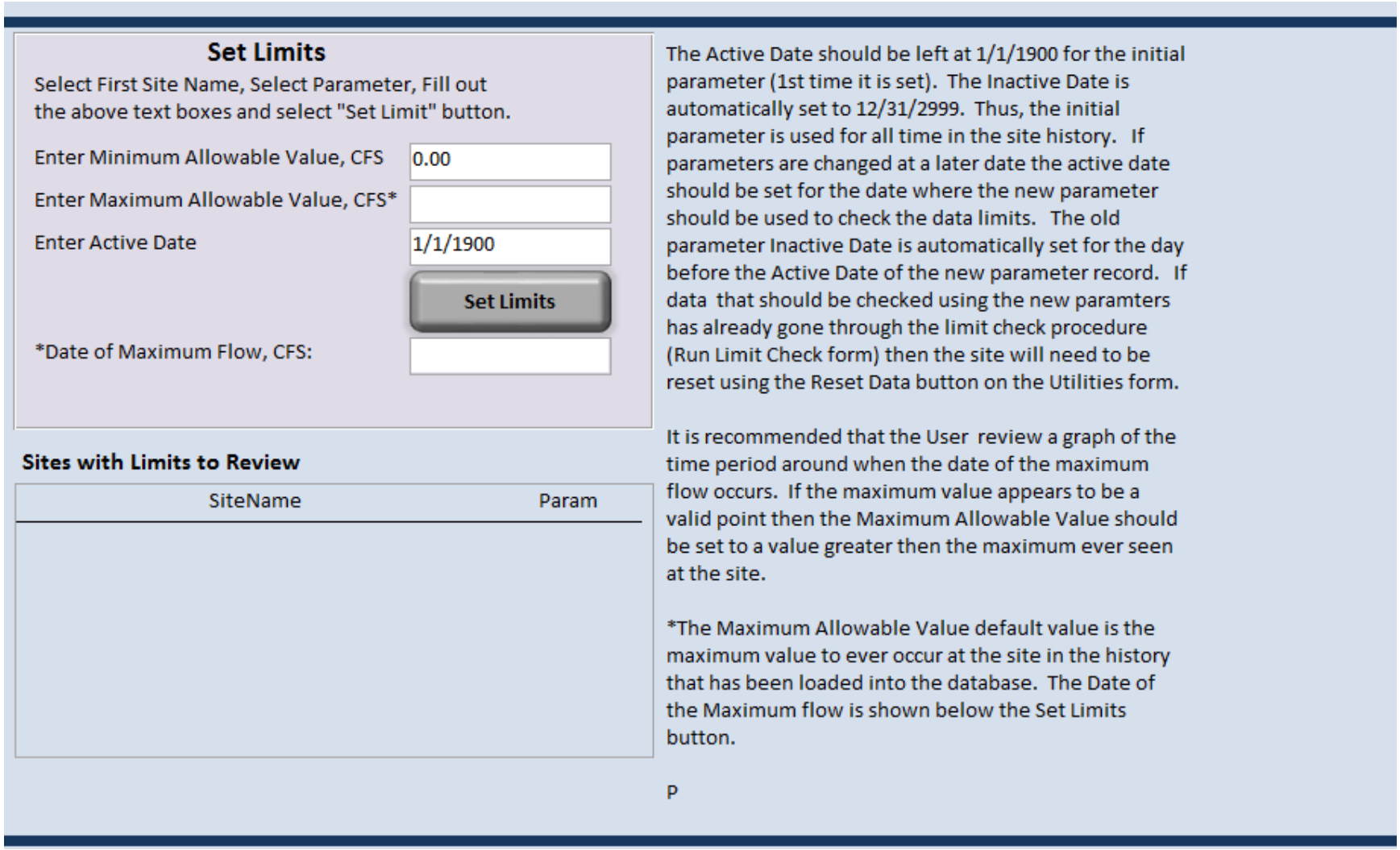


Figure 33. Set Limits Options and Overview of Sites with Limits to Review

4.3.3 Run Limit Checks

1) Press the button **4. Run Limit Checks** to navigate to the **Run Limit Checks** form.

2) Press the **Run Limit Checks** button to initiate checks of all limits set previously (Figure 34). The **Raw Data Records for Limit Checks** section provides a list of all data records with set limits that will be checked.

   Note: This step may take up to several hours. It is recommended that the Run Limit Checks function be allowed to run overnight when used with large data records.

   Each record is automatically flagged by the DMS with a code indicating its QC limit check result (QFlag). A list of these flags and their meanings is provided in Table 3.

3) After the **Run Limit Checks** function has completed, a summary of these data records is automatically generated in the **Limit Check Results Summary** section with the following information:

   a. **Site ID**: site associated with data record

   b. **Param**: parameter associated with data record

   c. **Good Record (No Flag)**: number of data points in the record which meet the limit check criteria (within limits, not missing)

   d. **Below Minimum Allowable Value**: number of data points in the record which fall below the minimum value limit (each record flagged during the Limit Check)

   e. **Above Maximum Allowable Value**: number of data points in the record which exceed the maximum value limit (each record flagged during the Limit Check)

   f. **Missing Record**: number of data points in the record which have no assigned value (each record flagged during the Limit Check)

4) Press the **Close** button to return to the **QC Daily Data** form.

5) Press the **Close** button to return to the **Process Timeseries Data (Database Set-up and QC)** form.

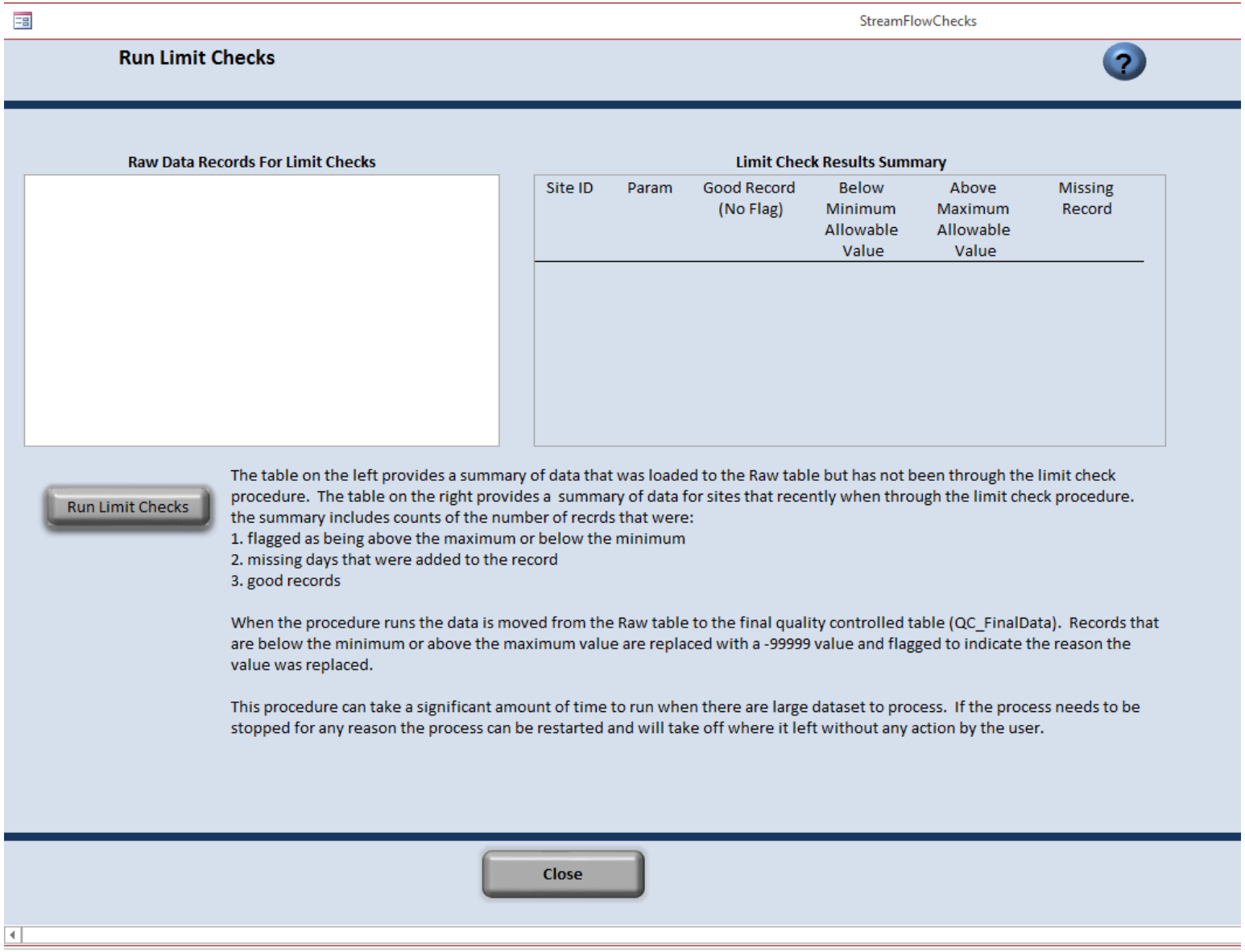


Figure 34. Run Limit Checks Form

Table 3. List of Quality Control Limit Check Codes (QFlags)

Code (QFlag)	Meaning
L00	Passed limit check
L01	Below allowable minimum value
L02	Above allowable minimum value
L03	Missing value

4.4 Estimating Missing or Inaccurate Values

After missing or inaccurate data records are flagged in the QC limit check, the DMS assists users in generating estimates or replacing erroneous values.

Estimation processes are handled through the **Estimate Missing and/or "Bad" Data** form (Figure 35). This menu provides several methods for estimating flow from adjacent historical records and for estimating precipitation data from geographically adjacent sites. The choice of procedure used in estimation varies based on conditions including the site location, the number of consecutive missing or bad[2] values, and the reason a record was flagged (the QFlag).

As estimates are generated, these new values are also flagged in the DMS with codes corresponding to the type of estimation used to replace the missing or inaccurate data (EFlags). Additionally, users have the option to provide their own alternative estimates and provide codes that correspond to those methods (e.g. alternative sensor measurement available, with code explaining source). A list of these flags and their meanings is provided in Table 4.

If there are still missing data points after completing this form they can be manually specified by the user with the **Manual Review** form as described in the next section.

The procedures for estimating flow and groundwater data or precipitation data are outlined separately in the steps below.

[2] "Bad" data refers to data for a given site outside of specified QC ranges.

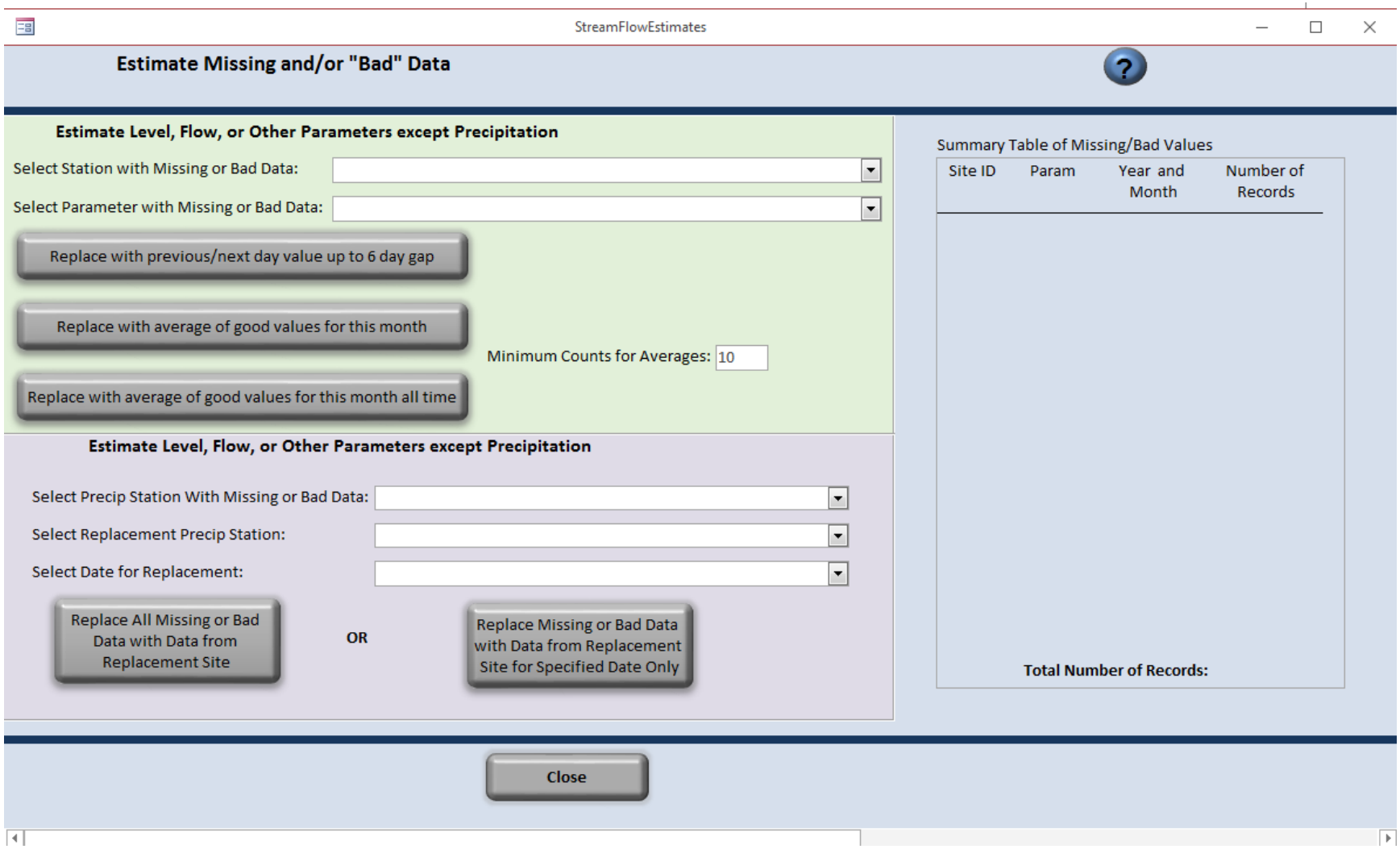


Figure 35. Estimate Missing and/or "Bad" Data Form

Table 4. List of Estimation Codes (EFlags)

Code (EFlag)	Meaning
E00	No estimate
E01	Replaced with previous day's value
E02	Replaced with next day's value
E03	Replaced with average this month
E04	Replaced with average all months
E05	Interpolated between "good" records
E06	Set to 5000
E07	Replace with nearby station data (include site id of replacement station after E07)

4.4.1 Estimating Flow and Groundwater Level Data

NOTE: It is anticipated that this functionality, although enabled for both flow and groundwater level data, will be used exclusively for flow data, except in cases where continuous groundwater level data is available and small data gaps need to be filled.

1) On the **Process Timeseries Data (Database Set-up and QC)** form, press the **Estimate Missing** button to navigate to the **Estimate Missing and/or "Bad" Data** form (Figure 35).

2) Under the **Select Station with Missing or Bad Data** drop-down menu, select the site associated with flow or groundwater level data that you wish to view.

   The DMS will automatically generate a **Summary Table of Missing/Bad Values** with the following information related to this site:

   a) **Site ID**: the site with a data record containing missing values

   b) **Param**: the parameter with missing values

   c) **Year and Month**: the year and month (YYYYMM) when the missing or bad values were found.

   d) **Number of Records**: the number of missing of bad values found during that time

3) Under the **Select Parameter with Missing or Bad Data** drop-down menu, select the parameter with missing or bad data which you wish to estimate.

4) Select one of the three replacement methods listed below. These are listed in order of preferred use:

   a. **Replace with previous/next day value up to 6 day gap**: replaces missing value with nearest adjacent QC approved value, up to 6 days difference

   b. **Replace with average of good values for this month**: replaces missing value with the average value of the same month that year

   c. **Replace with average of good values for this month all time**: replaces missing value with the average of the same month across all years in the data record

5) For average value replacement options, select the minimum number of values used to generate the average (standard: 10).

6) Press the **Close** button to return to the **Process Timeseries Data (Database Set-up and QC)** form.

4.4.2 Estimating Precipitation Data

1) On the **Process Timeseries Data (Database Set-up and QC)** form, press the **Estimate Missing** button to navigate to the **Estimate Missing and/or "Bad" Data** form (Figure *36*).

2) Under the **Select Precip Station with Missing or Bad Data** drop-down menu, select the precipitation site you wish to view.

   The DMS will automatically generate a **Summary Table of Missing/Bad Values** with the same information as listed above for flow and groundwater level data

3) Under the **Select Replacement Precip Station** drop-down menu, select a nearby or representative precipitation site you wish to replace your missing precipitation data with.

4) Under **Date for Replacement,** enter the date of the missing record you wish to replace (if you do not wish to replace all dates identically).

5) Select one of the two replacement methods listed for precipitation stations below:

   a. **Replace All Missing or Bad Data with Data from Replacement Site**: replaces all missing values with those of the chosen replacement site

   b. **Replace Missing or Bad Data with Data from Replacement Site for Specified Date Only**: replaces only the selected date's value with that of the chosen replacement site

6) Press the **Close** button to return to the **Process Timeseries Data (Database Set-up and QC)** form.

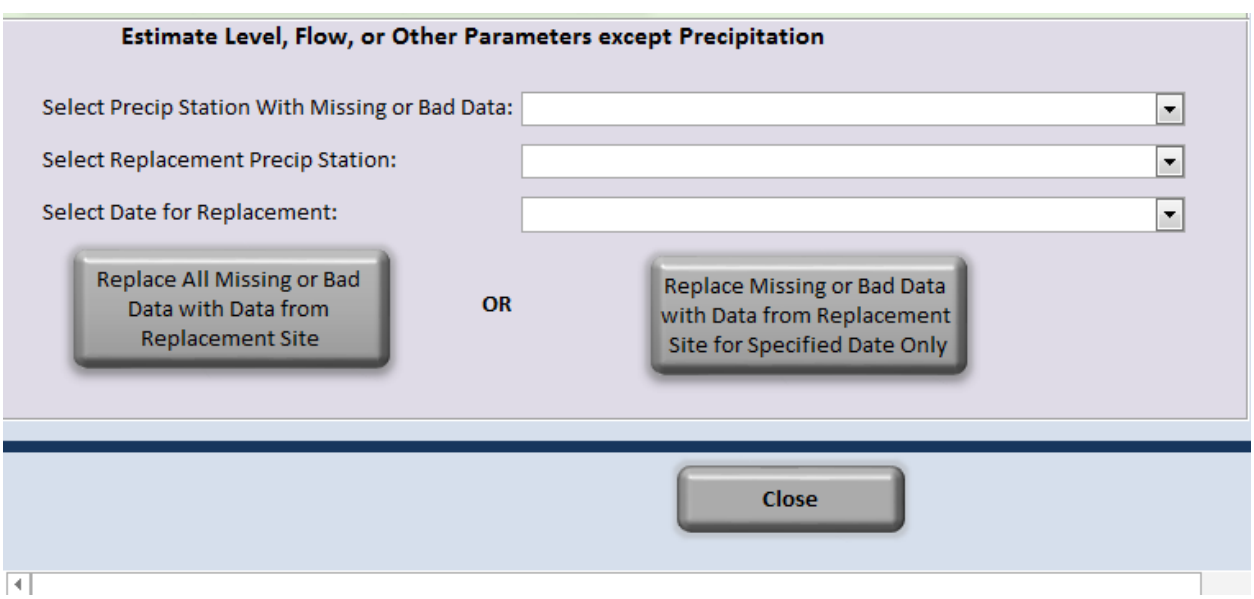


Figure 36. Estimating Missing or Bad Precipitation Data

4.5 Manual Data Review

After estimations have been made for missing and inaccurate values in the data record, a final manual inspection is conducted before these changes are saved in the DMS. Alternatively, the user has the option of bypassing the automated QC procedures for missing and inaccurate values described in the previous section and estimating all QC values manually.

This process is managed through the **Manual Review of Final Data** form (Figure 37). In this, the user is directed first to create graphs of the raw/final data to view how automated or prior manual estimations have changed the data record. The user can also use the Export Daily Data for Graphing to the output spreadsheet for review of the data. Graphs in the Excel output spreadsheet are easier to view and change scales. Next, the user can make changes to any remaining errors in the data following the previously described estimation procedures. These two steps may be repeated as needed to replace all remaining errors in the data record.

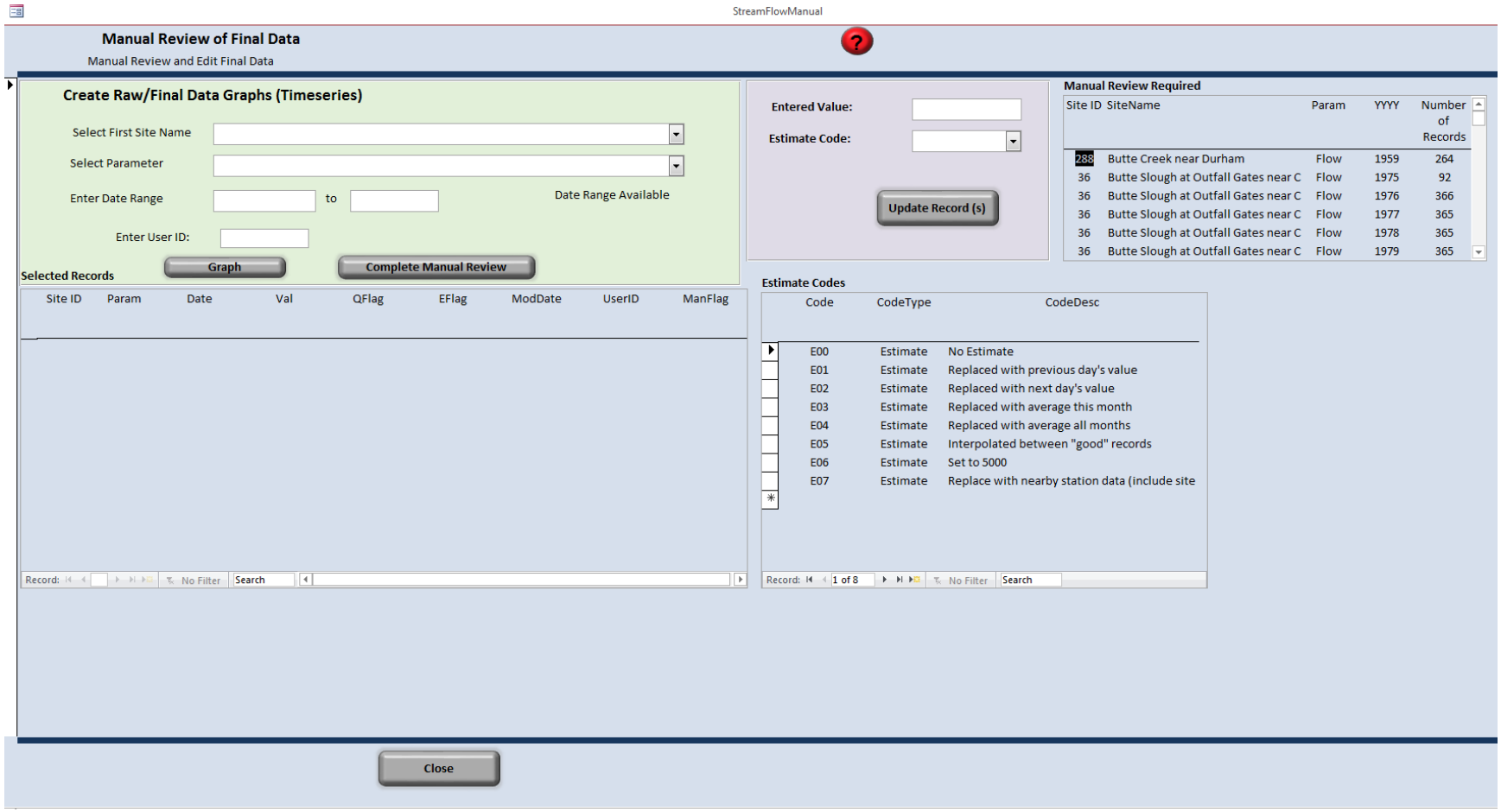


Figure 37. Manual Review of Final Data form

1) On the **Process Timeseries Data (Database Set-up and QC)** form, press the **Manual Review** button to navigate to the **Manual Review of Final Data** form (Figure 37).

2) In the **Create Raw/Final Data Graphs** section, enter all information on the data record you wish to manually inspect. (Figure 38).

    a. **Select First Site Name**: the site associated with the data record

    This will populate the **Selected Records** table below, which summarizes all estimated values for that site.

    i. **Site ID**

    ii. **Param**: the parameter of the missing record

    iii. **Data**: the date of the missing record

    iv. **Val**: the estimated value

    v. **QFlag**: code signifying the reason the record was missing or inaccurate (Table 3)

    vi. **EFlag**: code signifying the estimation method used (Table 4)

    vii. **ModDate**: the date the estimation was made

    viii. **UserID**: the ID of the user who made the estimation

    ix. **ManFlag**: check box indicating the record has been manually inspected

    b. **Select Parameter**: the parameter with estimated values

    c. **Enter Date Range**: the graph time period

    d. **Enter User ID**: the ID of the user who is conducting the manual review

3) Press the **Graph** button to view this data record (with estimates).

4) For any remaining missing or inaccurate records or records with inappropriate estimates:

    a. Select the data range in the **Create Raw/Final Data Graphs** section (Figure 38)

    b. Manually enter your estimate in the **Entered Value** box (Figure 39)

    c. Indicate the estimate type using the **Estimate Code** dropdown menu

    d. Press the **Update Record(s)** button to make these changes

5) When finished updating these records, press the **Complete Manual Review** button to make these changes in the record and indicate that manual review has been completed for this dataset.

6) Repeat steps 2-5 for all records still requiring manual review (Figure 39, right).

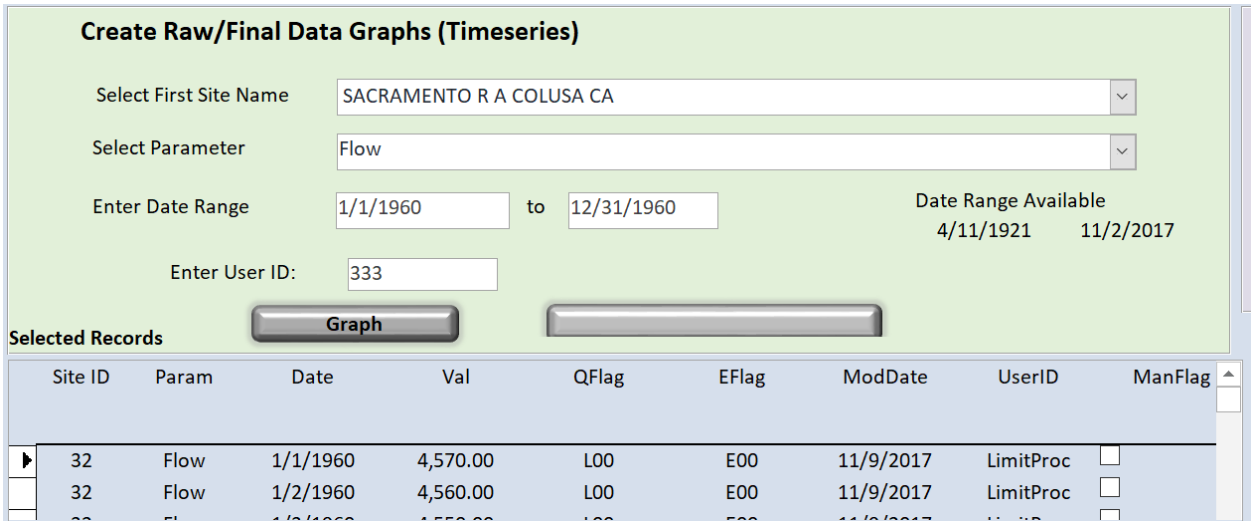


Figure 38. Create Raw/Final Data Graphs (Timeseries)

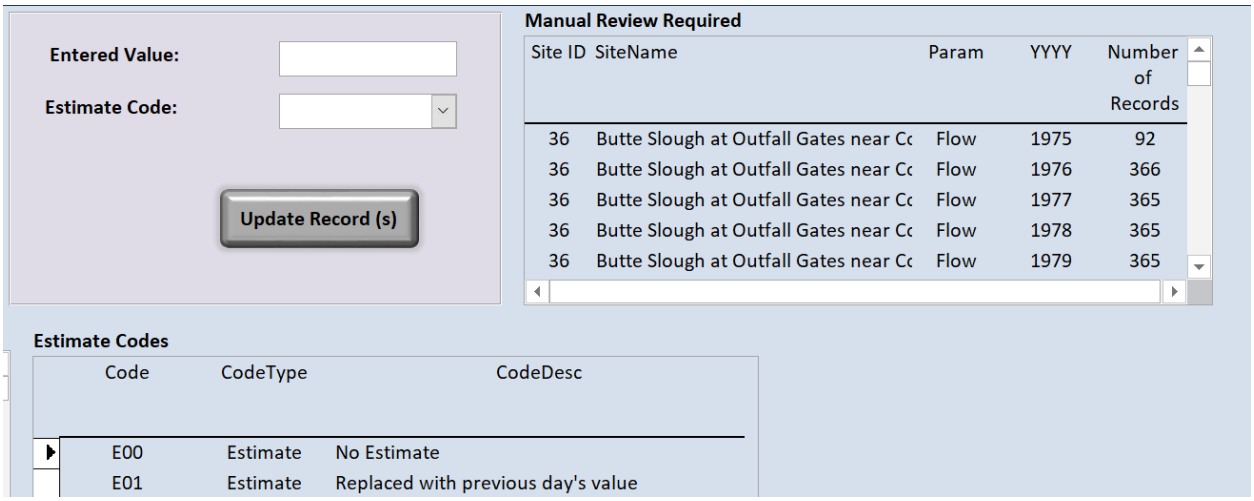


Figure 39. Manual Estimation Entry and Overview of Remaining Manual Inspections Required

5. Outputs

The DMS allows you to develop an output file for reporting and graphing groundwater level data.

After raw data records have been imported (3. Importing Data) into the DMS and have undergone the described QC check procedures (4. Process Timeseries), the DMS assists the user in compiling output files. These include output tables for groundwater level contours as well as graphs and spreadsheets summarizing historical groundwater levels, surface flows, and precipitation.

Individual sites may be used to generate both data tables and graphs relating groundwater level, flow, or precipitation over any chosen time period. Multiple sites may be selected to generate combined data tables for providing regional information over a desired time period.

These output tables and graphs may be used directly toward data reporting, or the DMS may be used to filter and compile data into exported tables that can be used in other applications. Each of these procedures is conducted through the **Output File Development** form, which is accessed by the **Output** button on the **Overview** form (Figure40).

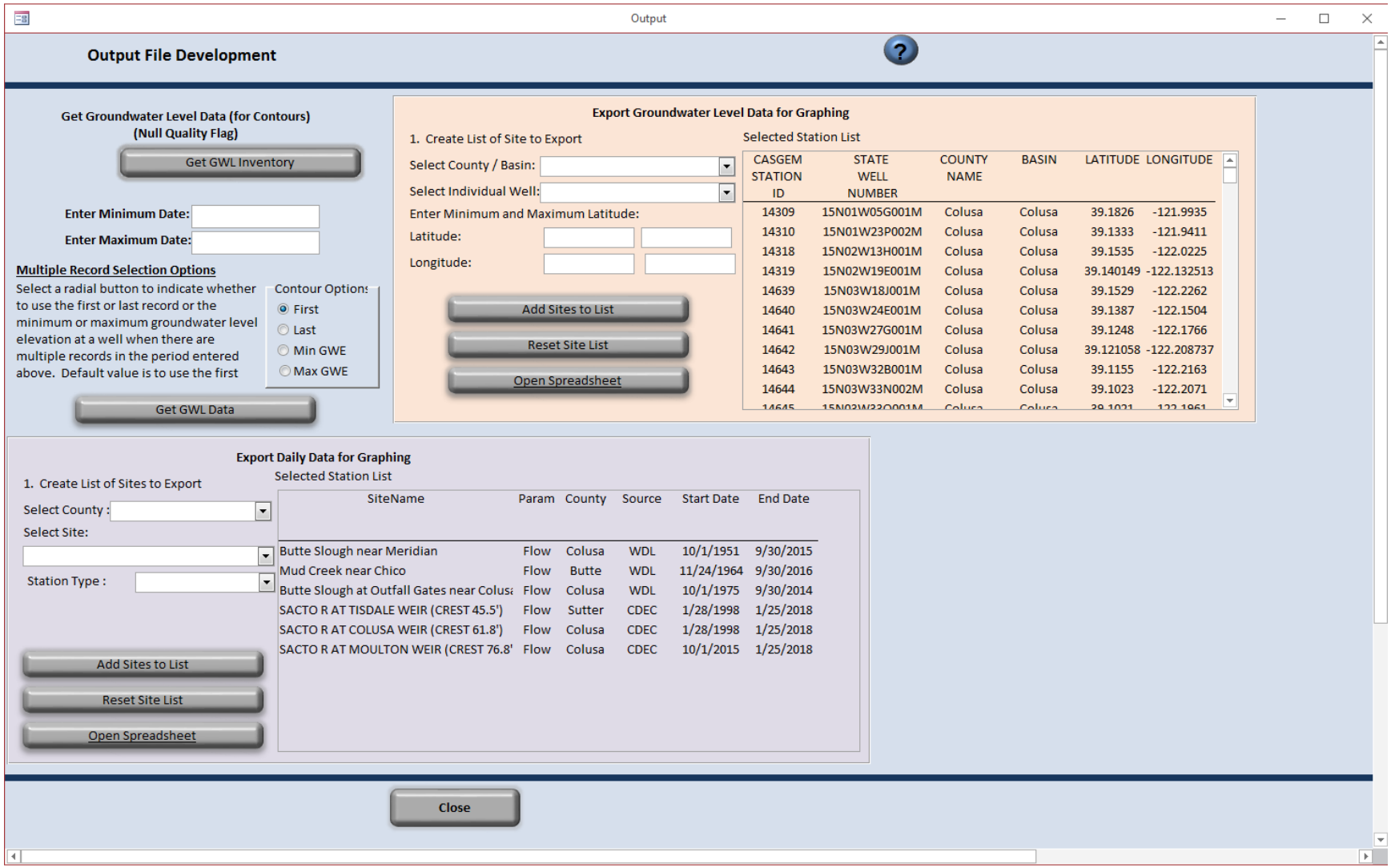


Figure 40. Output File Development Form

5.1 Retrieving Groundwater Level Data for Contours

1) In the **Get Groundwater Level Data (for Contours) (Null Quality Flag)** section, push the **Get GWL Inventory** button to open the **Groundwater Level Inventory** table containing information on the well stations and data records (Figure 3941):

    a. **CASGEM_STATION_ID**: the ID of the available stations

    b. **LATITUDE**

    c. **LONGITUDE**

    d. **COUNTY_NAME**

    e. **NumberOfPerf**

    f. **startdate**: start date of data record

    g. **enddate**: end date of data record

    h. **totNoRec**: total number of data records available for this station

    i. **NoGoodRec**: number of good data records available for this station

2) Select the date range you wish to create a new output table from the **Groundwater Level Inventory** using the **Enter Minimum Date** and **Enter Maximum Date** boxes.

3) For sites that contain more than one record, select which record you wish to use among the options in the **Contour Options** table:

    a. **First**: first record available (by date)

    b. **Last**: last record available (by date)

    c. **Min GWE**: record with minimum recorded groundwater elevation

    d. **Max GWE**: record with maximum recorded groundwater elevation

4) Press the **Get GWL Data** button to generate a groundwater level inventory table that is screened by the selection criteria above (Figure 42). Copy this file to a spreadsheet and use in developing groundwater level contours as needed.

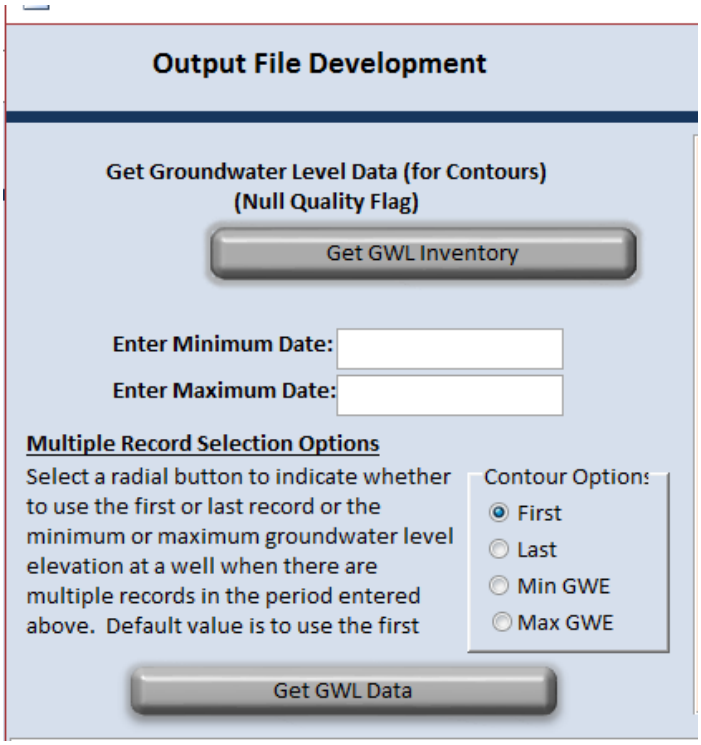


Figure 41. Get Groundwater Level Data for Contours

CASGEM_ST	BAS	COU	STATE_WELL_N	SITE_CODE	LATITUI	LONGITU	N	mi	Ma	TO	MEASUREI	RP_ELEVATIC	GS_ELEVATIC	\	RP_READING	CASGEM_READ
8692	Yolo	Yolo	08N02E04E001M	385699N1217655W001	38.5699	-121.7655	1	75	228	228	10/15/1990	53.55	51.55	0	42.8	N
9072	Yolo	Yolo	08N03E04R001M	385619N1216436W001	38.5619	-121.6436	1	124	132	132	1/22/1990	20.04	18.54	0	14.7	N
11791	Yolo	Yolo	10N02E29A001M	386914N1217662W001	38.6914	-121.7662	1	39	79	120	4/9/1990	59.01	57.51	0	28.7	N
12527	Yolo	Yolo	08N03E32L001M	384938N1216714W001	38.4938	-121.6714	3	164	420	628	4/9/1990	28.53	27.53	0	31.9	N
13932	Sutter	Sutter	15N03E26M001M	391173N1216125W001	39.1173	-121.6125	1	100	250	250	3/15/1990	54.28	53.48	0	24.1	N
14309	Colusa	Colusa	15N01W05G001M	391826N1219935W001	39.1826	-121.9935	1	75	140	140	3/8/1990	48.42	47.42	0	7.1	N
14319	Colusa	Colusa	15N02W19E001M	391401N1221325W001	########	#########	5	162	334	334	3/8/1990	88.46	87.46	0	11.3	N
14321	Sutter	Sutter	15N03E05D002M	391851N1216691W001	39.1851	-121.6691	1	38	200	200	11/5/1990	62.09	61.89	0	22.2	N
14645	Colusa	Colusa	15N03W33Q001M	391021N1221961W001	39.1021	-122.1961	3	99	257	305	3/12/1990	150.51	149.51	0	34.9	N
16127	West B	Butte	20N01E10C002M	396097N1218487W001	########	#########	1	20	120	210	3/7/1990	128.35	127.35	0	17.4	N
16140	West B	Butte	20N01W26H002M	395611N1219329W001	39.5611	-121.9329	1	0	76	76	3/6/1990	108.67	107.97	0	10.7	N
16141	West B	Butte	20N02E06P003M	396109N1217946W001	39.6109	-121.7946	1	120	327	327	11/1/1990	133.34	132.34	0	22.2	N
16142	West B	Butte	20N02E06Q001M	396127N1217883W001	39.6127	-121.7883	1	10	44	383	3/4/1990	138.13	137.63	0	21.5	N
16300	Colusa	Colusa	16N03W14H002M	392439N1221540W001	########	-122.1543	1	150	160	160	3/8/1990	66.45	65.45	0	5	N
16308	Colusa	Colusa	16N04W02P001M	392629N1222754W001	39.2629	-122.2754	1	112	203	203	3/9/1990	163.03	162.53	0	21.4	N
16356	Colusa	Colusa	13N01W16N003M	389716N1219836W001	38.9716	-121.9836	1	180	200	200	3/6/1990	59.66	58.46	0	21	N
16357	Colusa	Colusa	13N01W22P002M	389553N1219631W001	38.9553	-121.9631	1	22	236	236	3/6/1990	61.16	60.46	0	26.2	N
16361	Colusa	Colusa	13N01W35L002M	389317N1219463W001	38.9317	-121.9463	1	197	237	237	3/8/1990	67.96	67.46	0	38.2	N
16366	Colusa	Colusa	13N02W04G001M	390088N1220877W001	39.0088	-122.0877	1	350	470	505	1/19/1990	189.01	188.81	0	77.8	N
16379	West B	Colusa	18N01W32L002M	393672N1219985W001	39.3672	-121.9985	1	52	120	120	3/8/1990	78.4	77.4	0	14	N
16494	Colusa	Colusa	13N02W04G004M	390088N1220878W001	39.0088	-122.0878	1	1	193	193	1/19/1990	188.81	188.81	0	54.9	N
16494	Colusa	Colusa	13N02W04G004M	390088N1220878W001	39.0088	-122.0878	1	1	193	193	1/19/1990	188.81	188.81	0	54.9	N
16498	Colusa	Colusa	13N02W13C001M	389827N1220355W001	38.9827	-122.0355	1	204	220	224	3/12/1990	138.49	137.49	0	93	N
16500	Colusa	Colusa	13N02W20H001M	389640N1220999W001	38.964	-122.0999	1	70	290	320	3/12/1990	341.08	340.58	0	132.6	N

Figure 42. Groundwater Level Inventory Table for Generating Contours

5.2 Exporting Groundwater Level Data for Graphing

1) In the **Export Groundwater Level Data for Graphing** section, first press the **Reset Site List** button to clear old export list criteria (Figure 43).

2) Begin creating a list of sites to export by entering your desired location information into one of the three entry options below.

    a. **Select County/Basin**: allows you to select all sites in a chosen county/basin

    b. **Select Individual Well**: allows you to select an individual well

    c. **Enter Minimum and Maximum Latitude and Longitude**: enter minimum (left column boxes) and maximum (right column boxes) to select all wells within those boundaries.

3) Press the **Add Sites to List** button to add the sites selected above to your site list.

    Information on all selected sites will be added to the **Selected Station List** summary table on the right.

4) Repeat steps 2 and 3 as needed to create composite lists of sites from multiple regions in one output spreadsheet.

5) Press the **Open Spreadsheet** button to generate an output Excel file titled ***GWL_Output_Summary.xlsx***. This workbook contains three spreadsheets which generate graphs and provide compiled data for the desired sites:

    a. **GraphAll**: provides graphs for all chosen stations (Figure 44)

        i. Press **Refresh All Data** button to update spreadsheet with new site output criteria. Sometimes this will need to be selected twice to completely update the spreadsheet data.

        ii. Use the **Select Station Below for Graphing** scroll menu to select an individual station's data. Selecting a station will automatically update the following sections:

            1. **Data Tables** (left): contains Wind Speed (WS) Depth and WS Elevation data for the selected site, separated by good data (Measurement_issue_id is null) and questionable data (Measurement_issue_id is not null)

            2. **Graphing** (center): contains figure with data for the selected site.

        iii. Press the **Rescale Graph** button to rescale the graph properly to that station's data. This should correct improperly depicted graphs.

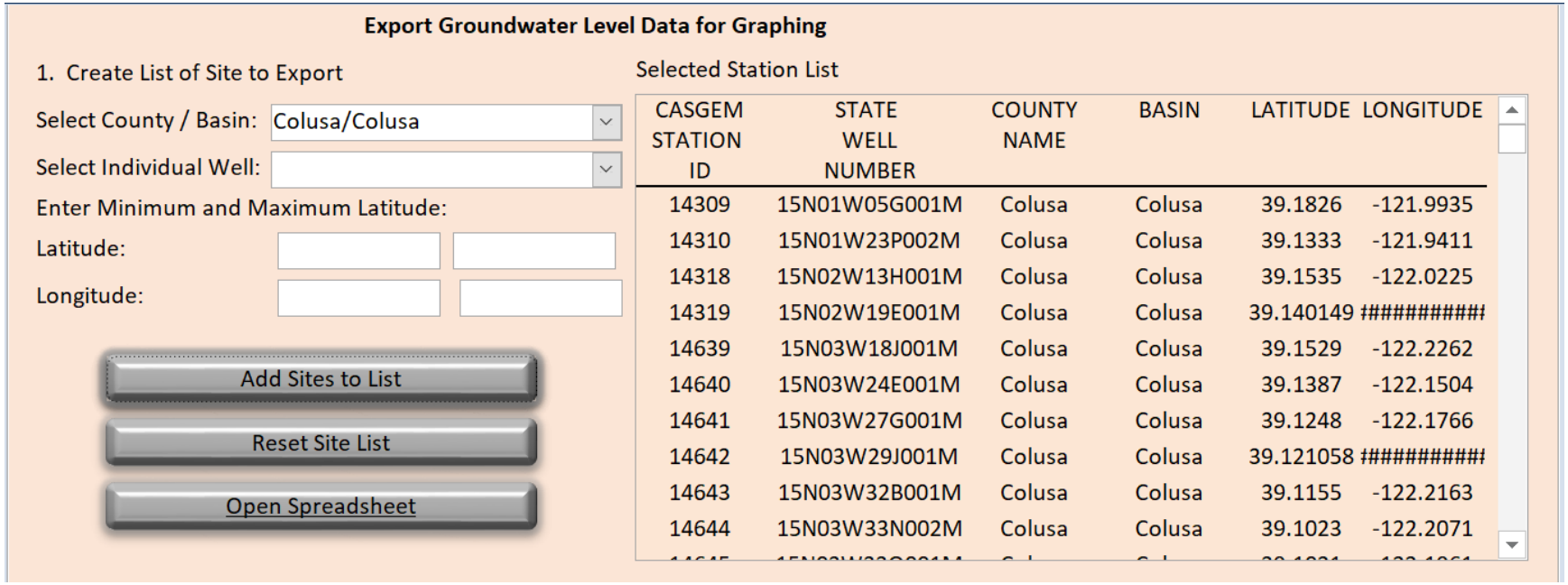
    b. **data_stationlist**: Contains all information about the chosen stations including ID number, latitude/longitude, basin, county, total well depth, and station use (e.g. residential, irrigation, stockwatering, etc.) (Figure 45).

    Information may be sorted and copied as needed from this spreadsheet for use in other user applications.

c. **data_all:** Contains all data records for each of the stations described in data_stationlist, including measurement date, water surface elevation, depth to water surface, etc. (Figure 46).

   Data may be sorted and copied as needed from this spreadsheet for use in other user applications.

6) On the **GraphAll** spreadsheet, press the **Return to DMS** button to return to the DMS.



CASGEM STATION ID	STATE WELL NUMBER	COUNTY NAME	BASIN	LATITUDE	LONGITUDE
14309	15N01W05G001M	Colusa	Colusa	39.1826	-121.9935
14310	15N01W23P002M	Colusa	Colusa	39.1333	-121.9411
14318	15N02W13H001M	Colusa	Colusa	39.1535	-122.0225
14319	15N02W19E001M	Colusa	Colusa	39.140149	##########
14639	15N03W18J001M	Colusa	Colusa	39.1529	-122.2262
14640	15N03W24E001M	Colusa	Colusa	39.1387	-122.1504
14641	15N03W27G001M	Colusa	Colusa	39.1248	-122.1766
14642	15N03W29J001M	Colusa	Colusa	39.121058	##########
14643	15N03W32B001M	Colusa	Colusa	39.1155	-122.2163
14644	15N03W33N002M	Colusa	Colusa	39.1023	-122.2071

Figure 43. Export Groundwater Level Data for Graphing

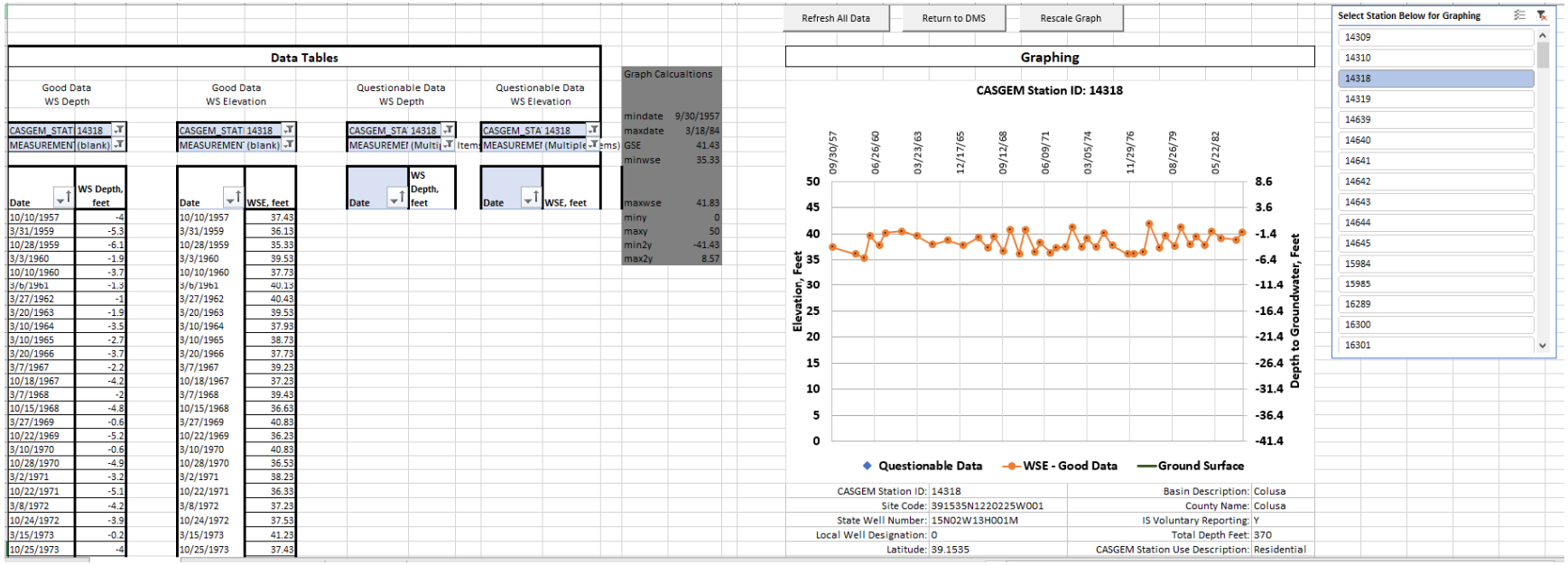


Figure 44. Groundwater Level Data Output Spreadsheet: GraphAll

CASGEM_STATION_ID	SITE_CODE	STATE_WELL_NUMBER	LOCAL_WELL_DESIGNATION	LATITUDE	LONGITUDE	LOC_METHOD	LOC_ACCURACY	BASIN_CD	BASIN_DES
14318	391535N1220225W001	15N02W13H001M		39.1535	-122.0225	Unknown	Unknown	5-021.52	Colusa
14639	391529N1222262W001	15N03W18J001M		39.1529	-122.2262	Unknown	Unknown	5-021.52	Colusa
14640	391387N1221504W001	15N03W24E001M		39.1387	-122.1504	Unknown	Unknown	5-021.52	Colusa
14641	391248N1221766W001	15N03W27G001M		39.1248	-122.1766	Unknown	Unknown	5-021.52	Colusa
14643	391155N1222163W001	15N03W32B001M		39.1155	-122.2163	Unknown	Unknown	5-021.52	Colusa
14644	391023N1222071W001	15N03W33N002M		39.1023	-122.2071	Unknown	Unknown	5-021.52	Colusa
15984	390134N1220792W001	14N02W34N001M		39.0134	-122.0792	Unknown	Unknown	5-021.52	Colusa
15985	390134N1220396W001	14N02W36N001M		39.0134	-122.0396	Unknown	Unknown	5-021.52	Colusa
16289	392525N1220252W001	16N02W12J001M		39.2525	-122.0252	Unknown	Unknown	5-021.52	Colusa
16301	391914N1221719W001	16N03W35N002M	16N03W35N002M	39.1914	-122.1719	USGS quad	5 ft.	5-021.52	Colusa
16309	392606N1222565W001	16N04W12C001M		39.2606	-122.2565	Unknown	Unknown	5-021.52	Colusa
16358	389479N1219881W001	13N01W28E002M		38.9479	-121.9881	Unknown	Unknown	5-021.52	Colusa
16359	389266N1220148W001	13N01W31Q001M		38.9266	-122.0148	Unknown	Unknown	5-021.52	Colusa
16360	389263N1219606W001	13N01W34P001M		38.9263	-121.9606	Unknown	Unknown	5-021.52	Colusa
16362	389261N1219321W001	13N01W36N001M		38.9261	-121.9321	Unknown	Unknown	5-021.52	Colusa
16363	389260N1219213W001	13N01W36Q001M		38.926	-121.9213	Unknown	Unknown	5-021.52	Colusa
16387	394074N1220760W001	18N02W15N001M		39.4074	-122.076	Unknown	Unknown	5-021.52	Colusa
16495	390062N1221163W001	13N02W05E001M		39.0062	-122.1163	Unknown	Unknown	5-021.52	Colusa
16496	390092N1221017W002	13N02W05H003M		39.0092	-122.1017	Unknown	Unknown	5-021.52	Colusa
16497	389889N1220605W001	13N02W11M001M		38.9889	-122.0605	Unknown	Unknown	5-021.52	Colusa
16499	389726N1220267W001	13N02W13R001M		38.9726	-122.0267	Unknown	Unknown	5-021.52	Colusa

Figure 45. Groundwater Level Data Output Spreadsheet: data_stationlist

CASGEM_STATION_ID	STATE_WELL_NUMBER	MEASUREMENT_DATE	RP_ELEVATION	GS_ELEVATION	RPWS	WSE	MEASUREMENT_ISSUE_ID	MEASUREMENT_METHOD_ID	MEASUR
14309	15N01W05G001M	10/21/1975	48.42	47.42	12.3	36.12		7	
14309	15N01W05G001M	3/9/1976	48.42	47.42	9.8	38.62		7	
14309	15N01W05G001M	10/12/1976	48.42	47.42	13.2	35.22		7	
14309	15N01W05G001M	3/9/1977	48.42	47.42	12	36.42		7	
14309	15N01W05G001M	10/26/1977	48.42	47.42	15.5	32.92		7	
14309	15N01W05G001M	3/15/1978	48.42	47.42	4	44.42		7	
14309	15N01W05G001M	11/3/1978	48.42	47.42	12.5	35.92		7	
14309	15N01W05G001M	3/13/1979	48.42	47.42	7	41.42		7	
14309	15N01W05G001M	10/24/1979	48.42	47.42	12.6	35.82		7	
14309	15N01W05G001M	3/19/1980	48.42	47.42	2.2	46.22		7	
14309	15N01W05G001M	10/16/1980	48.42	47.42	12.1	36.32		7	
14309	15N01W05G001M	3/18/1981	48.42	47.42	6.9	41.52		7	
14309	15N01W05G001M	10/8/1981	48.42	47.42	15.5	32.92		7	
14309	15N01W05G001M	3/11/1982	48.42	47.42	2.5	45.92		7	
14309	15N01W05G001M	10/14/1982	48.42	47.42	11.2	37.22		7	
14309	15N01W05G001M	3/24/1983	48.42	47.42	4.8	43.62		7	
14309	15N01W05G001M	10/6/1983	48.42	47.42	9.8	38.62		7	
14309	15N01W05G001M	3/8/1984	48.42	47.42	2	46.42		7	
14309	15N01W05G001M	10/5/1984	48.42	47.42	10.6	37.82		7	
14309	15N01W05G001M	3/7/1985	48.42	47.42	7	41.42		7	
14309	15N01W05G001M	10/2/1985	48.42	47.42	11.7	36.72		7	

Figure 46. Groundwater Level Data Output Spreadsheet: data_all

5.3 Exporting Daily Data for Graphing

1) In the **Export Daily Data for Graphing** section, first press the **Reset Site List** button to clear old export list criteria (Figure 47).

2) Begin creating a list of sites to export by entering your desired location information into one of the three entry options below.

    a. **Select County**: allows you to select all sites in a chosen county

    b. **Select Site**: allows you to select an individual site

    c. **Station Type**: allows you to select all stations of a chosen type.

3) Press the **Add Sites to List** button to add the sites selected above to your site list.

    Information on all selected sites will be added to the **Selected Station List** summary table on the right.

4) Repeat steps 2 and 3 as needed to create composite lists of sites from multiple regions in one output spreadsheet.

5) Press the **Open Spreadsheet** button to generate an output Excel file titled ***DailyData_Output_Summary.xlsx***. This workbook contains four spreadsheets which generate graphs and provide compiled data for the desired sites:

    a. **DailyGraphing**: provides graphs for all chosen stations (Figure 48)

        i. Press **Refresh All Data** button to update spreadsheet with new site output criteria

        ii. Use the **Select a Site Name to Graph** scroll menu to select an individual site's data. Selecting a station will automatically update the following sections:

            1. **Daily Data Table** (left): contains parameter values for the selected site for each day of the data record.

            2. **Graph** (center): figure with parameter data for the selected site.

        iii. In the **Edit the Axis Scales** section, use one of the two options to rescale the graph properly to the site's data.

            1. **Manually Set X-Axis and Y-Axis**: Select minimum and maximum values in the indicated cells and press the button above.

            2. **Set to Data Value Max and Min**: Press the button to automatically rescale the graph properly to the station's full time record and associated parameter values.

    b. **Summaries**: provides summary tables and graphs for the site selected in the **GraphAll** spreadsheet (Figure 49).

        i. **Annual Summary Table**: summary of the annual sum parameter values for each year in the chosen site's data record

ii. **Monthly Summary Table**: summary of the monthly sum parameter values for each month and year in the chosen site's data record

iii. **Annual Summary Graph**: summary of the annual sum parameter values for each year in the site's data record. Use one of the two options provided to properly scale the graph.

1. **Manually Set X-Axis and Y-Axis**: Select minimum and maximum values in the indicated cells and press the button above.

2. **Set to Data Value Max and Min**: Press the button to automatically rescale the graph properly to the station's full time record and associated parameter values.

c. **StationList**: Contains all information about the chosen data sites including ID number, name, associated parameter, county, data source type, and time period of record (Figure 50).

Information may be sorted and copied as needed from this spreadsheet for use in other user applications.

d. **DailyData**: Contains all QC checked data records for each of the sites described in **StationList**, including measurement date, parameter value, QC and estimation codes, etc. (Figure 51).

Data may be sorted and copied as needed from this spreadsheet for use in other user applications.

6) On the **DailyGraphing** spreadsheet, press the **Return to DMS** button to return to the DMS.

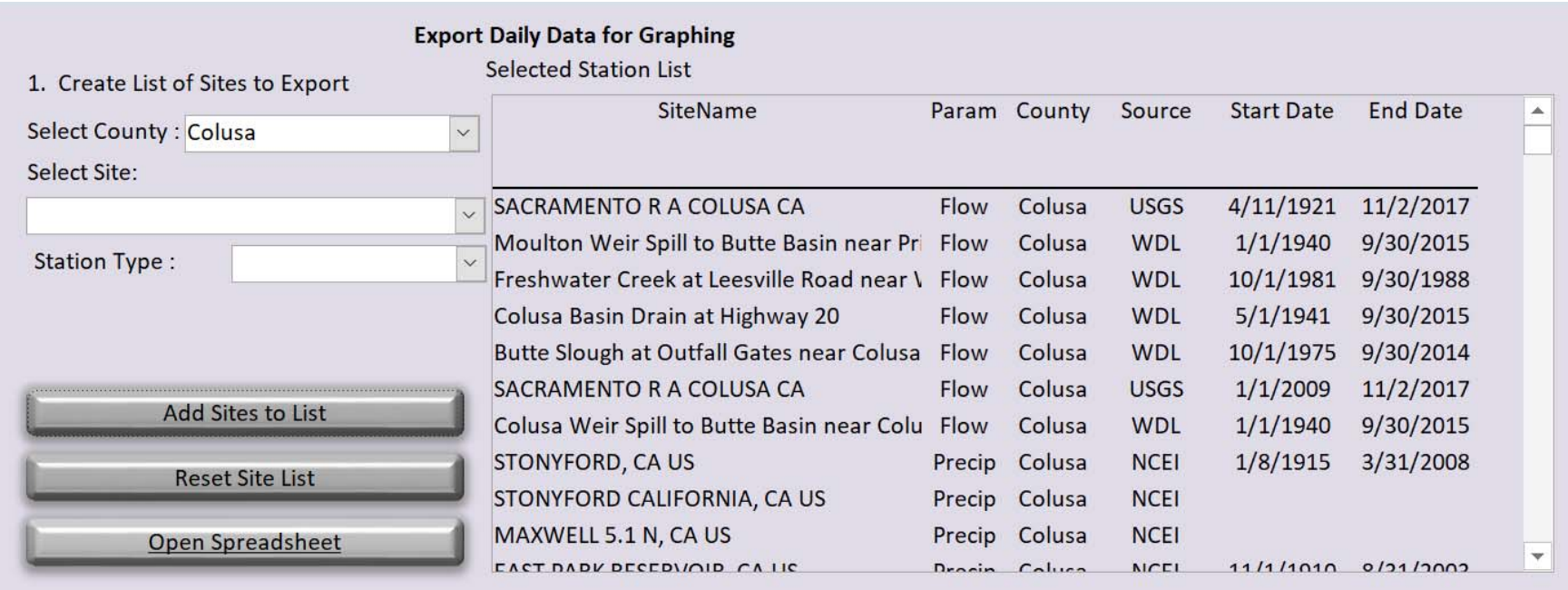


Figure 47. Export Daily Data for Graphing

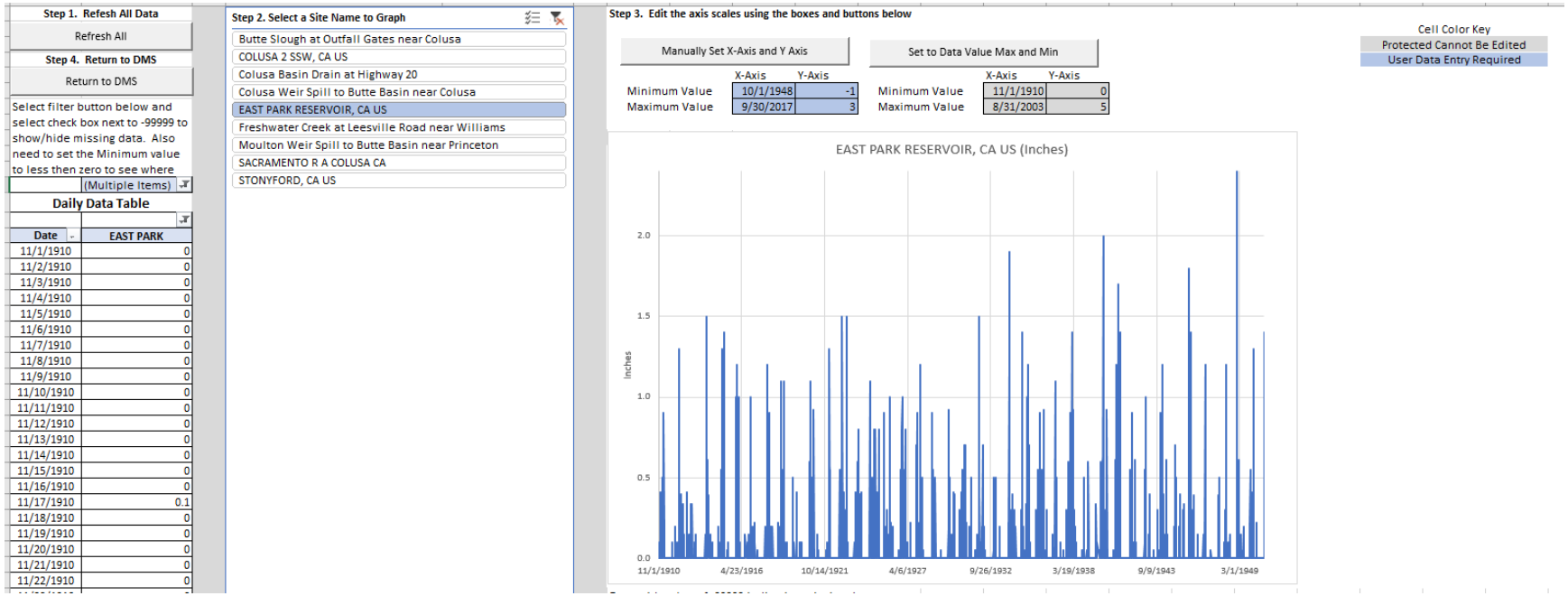


Figure 48. Daily Data Output Spreadsheet: DailyGraphing

Annual Summary Table

Year	AF
1975	23,175.2
1976	119,365.0
1977	18,438.6
1978	178,800.6
1979	272,693.6
1980	158,291.2
1981	206,311.8
1982	150,097.4
1983	0.0
1985	37,367.2
1986	147,296.7
1987	161,062.2
1988	101,963.6
1989	143,035.3
1990	133,142.4
1991	103,594.4
1992	104,185.9
1993	141,751.1
1994	147,357.8
1995	80,194.5
1996	89,659.3
1997	110,004.9
1998	58,224.1
1999	92,645.7
2000	162,923.1
2001	396,630.7
2002	170,675.6
2003	92,259.9
2004	54,064.5

Monthly Summary Table

Year	Month	AF
1975	10	10,461.0
1975	11	5,454.6
1975	12	7,259.6
1976	1	24,637.1
1976	2	2,259.2
1976	3	10,564.1
1976	4	5,988.2
1976	5	16,197.3
1976	6	4,992.5
1976	7	993.7
1976	8	25,660.5
1976	9	23,399.3
1976	10	4,673.1
1976	11	0.0
1976	12	0.0
1977	1	4,831.8
1977	2	31.7
1977	3	0.0
1977	4	0.0
1977	5	708.1
1977	6	0.0
1977	7	0.0
1977	8	0.0
1977	9	0.0
1977	10	0.0
1977	11	202.3
1977	12	12,664.6
1978	1	13,404.5
1978	2	12,646.8
1978	3	5,093.6
1978	4	2,653.9
1978	5	7,904.2
1978	6	11,853.4
1978	7	4,976.6
1978	8	18,416.8
1978	9	50,259.9
1978	10	14,049.1
1978	11	17,692.8

Butte Slough at Outfall Gates near Colusa

Edit the axis scales using the boxes and buttons below

Manually Set X-Axis and Y-Axis

	X-Axis	Y-Axis
Minimum Value	1948	0
Maximum Value	2017	40

Auto Set X-Axis and Y-Axis

	X-Axis	Y-Axis
Minimum Value	1975	FALSE
Maximum Value	2004	396,631

Cell Color Key
Protected Cannot Be Edited
User Data Entry Required

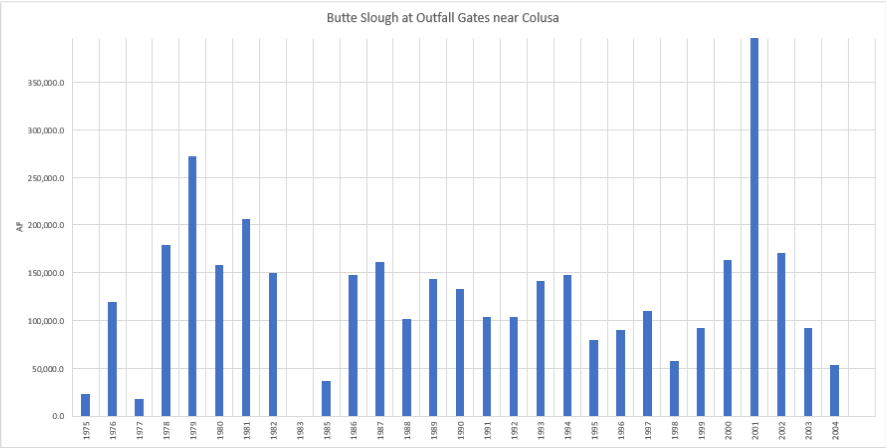


Figure 49. Daily Data Output Spreadsheet: Summaries

	A	B	C	D	E	F	G	H
1	SiteID	Param	SiteName	County	Source	MinDate	MaxDate	ParamUnit
2	40	Flow	Moulton Weir Spill to Butte Basin near Princeto	Colusa	WDL	1/1/1940	9/30/2015	CFS
3	39	Flow	Freshwater Creek at Leesville Road near William	Colusa	WDL	10/1/1981	9/30/1988	CFS
4	38	Flow	Colusa Weir Spill to Butte Basin near Colusa	Colusa	WDL	1/1/1940	9/30/2015	CFS
5	37	Flow	Colusa Basin Drain at Highway 20	Colusa	WDL	5/1/1941	9/30/2015	CFS
6	32	Flow	SACRAMENTO R A COLUSA CA	Colusa	USGS	1/1/2009	11/2/2017	CFS
7	32	Flow	SACRAMENTO R A COLUSA CA	Colusa	USGS	4/11/1921	11/2/2017	CFS
8	36	Flow	Butte Slough at Outfall Gates near Colusa	Colusa	WDL	10/1/1975	9/30/2014	CFS
9	62	Precip	MAXWELL 5.1 N, CA US	Colusa	NCEI			Inches
10	63	Precip	STONYFORD CALIFORNIA, CA US	Colusa	NCEI			Inches
11	61	Precip	EAST PARK RESERVOIR, CA US	Colusa	NCEI	11/1/1910	8/31/2003	Inches
12	60	Precip	COLUSA 2 SSW, CA US	Colusa	NCEI	10/1/1948	9/30/2017	Inches
13	64	Precip	STONYFORD, CA US	Colusa	NCEI	1/8/1915	3/31/2008	Inches
14								

Figure 50. Daily Data Output Spreadsheet: StationList

	SiteID	Param	Date	Val	QFlag	EFlag	ModDate	UserID	ManFlag	SiteName	SourceSiteCode	AF	Year	Month
2	32	Flow	4/11/1921	14900	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	29554.15	1921	4
3	32	Flow	4/12/1921	14800	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	29355.8	1921	4
4	32	Flow	4/13/1921	14800	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	29355.8	1921	4
5	32	Flow	4/14/1921	14900	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	29554.15	1921	4
6	32	Flow	4/15/1921	14800	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	29355.8	1921	4
7	32	Flow	4/16/1921	14400	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	28562.4	1921	4
8	32	Flow	4/17/1921	14000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	27769	1921	4
9	32	Flow	4/18/1921	13700	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	27173.95	1921	4
10	32	Flow	4/19/1921	13600	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	26975.6	1921	4
11	32	Flow	4/20/1921	13300	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	26380.55	1921	4
12	32	Flow	4/21/1921	13100	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25983.85	1921	4
13	32	Flow	4/22/1921	13000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25785.5	1921	4
14	32	Flow	4/23/1921	13100	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25983.85	1921	4
15	32	Flow	4/24/1921	13000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25785.5	1921	4
16	32	Flow	4/25/1921	13000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25785.5	1921	4
17	32	Flow	4/26/1921	12700	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25190.45	1921	4
18	32	Flow	4/27/1921	12400	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	24595.4	1921	4
19	32	Flow	4/28/1921	12000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	23802	1921	4
20	32	Flow	4/29/1921	12000	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	23802	1921	4
21	32	Flow	4/30/1921	12400	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	24595.4	1921	4
22	32	Flow	5/1/1921	12700	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	25190.45	1921	5
23	32	Flow	5/2/1921	12600	L00	E00	11/9/2017	LimitProc	FALSE	SACRAMENTO R A COLUSA CA	11389500	24992.1	1921	5

Figure 51. Daily Data Output Spreadsheet: DailyData

6. Utilities

In addition to the central utilities involved in importing data, conducting QC checks, and outputting data results files, the DMS also provides additional utilities for viewing and managing data stored within the database. The **Utilities for Database Management** form may be accessed using the **Utilities** button on the main **Overview** menu (Figure 52).

6.1 Groundwater Level Inventory

Selecting the **GWL Inventory** button will direct you to the full groundwater level record library. This is structured the same as the **Groundwater Level Data for Contours** table accessed through the output utilities, but contains all data (Figure *53*). This inventory lists the following information for all well station records:

a. **CASGEM_STATION_ID**: the ID of the available stations

b. **LATITUDE**

c. **LONGITUDE**

d. **COUNTY_NAME**

e. **NumberOfPerf**

f. **startdate**: start date of data record

g. **enddate**: end date of data record

h. **totNoRec**: total number of data records available for this station

i. **NoGoodRec**: number of good data records available for this station (Measurement_issue_is is null)

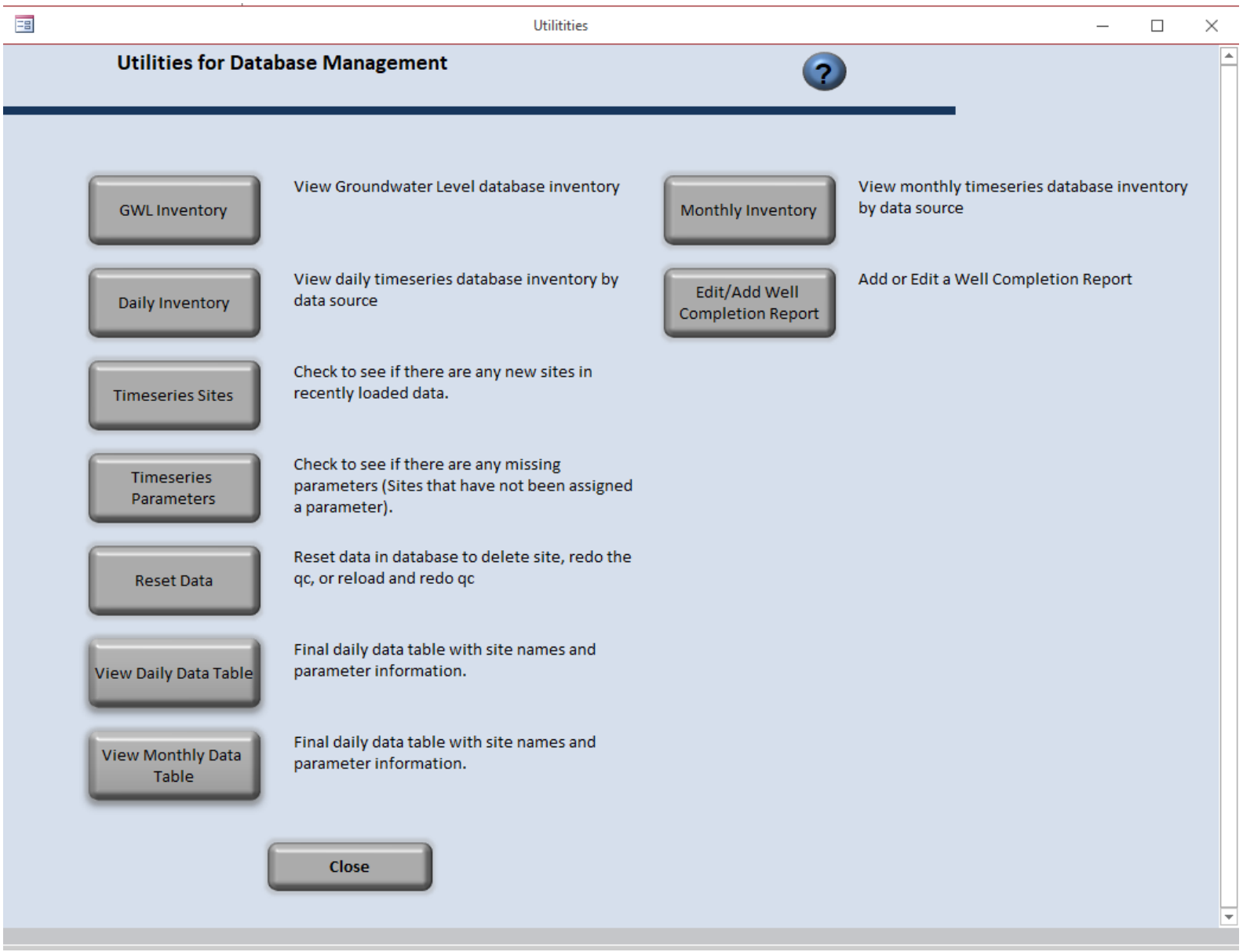


Figure 52. Utilities for Database Management Form

CASGEM_STATION_ID	LATITUDE	LONGITUDE	COUNTY_NAME	NumberOfPerf	startdate	enddate	totNoRec	NoGoodRec
24706	39.0458	-121.6114	Sutter	1	10/20/2005	8/22/2017 11:17:00 AM	77	73
24705	39.0458	-121.6114	Sutter	1	10/20/2005	8/22/2017 11:02:00 AM	77	73
24704	39.0458	-121.6114	Sutter	1	10/20/2005	8/22/2017 11:00:00 AM	77	73
24707	39.0458	-121.6114	Sutter	1	10/20/2005	8/22/2017 10:44:00 AM	77	73
47782	39.008641	-121.67187	Sutter	1	3/9/2011	8/22/2017 10:04:00 AM	44	44
47781	39.008641	-121.67187	Sutter	1	3/9/2011	8/22/2017 10:03:00 AM	44	44
47780	39.008641	-121.67187	Sutter	1	4/5/2012 2:47:00 PM	8/22/2017 9:59:00 AM	40	40
48396	39.02141	-121.662478	Sutter	0	12/1/2011 10:00:00 AM	8/18/2017 10:33:00 AM	21	20
48395	38.973607	-121.623281	Sutter	0	12/1/2011 10:00:00 AM	8/18/2017 10:00:00 AM	21	21
48394	38.982025	-121.592293	Sutter	0	12/1/2011 10:00:00 AM	8/18/2017 9:25:00 AM	21	20
48393	38.985983	-121.592775	Sutter	0	12/1/2011 10:00:00 AM	8/18/2017 9:00:00 AM	21	20
24334	39.8543	-122.1535	Tehama	1	5/22/2007	8/14/2017	55	55
24335	39.8543	-122.1535	Tehama	1	5/22/2007	8/14/2017	57	57
24336	39.8543	-122.1535	Tehama	1	5/22/2007	8/14/2017	58	58
24337	39.8543	-122.1535	Tehama	2	5/22/2007	8/14/2017	57	57
25967	39.903046	-122.224557	Tehama	5	6/23/2004	8/14/2017	88	88
25968	39.903046	-122.224557	Tehama	2	6/23/2004	8/14/2017	87	87
25969	39.899615	-122.122745	Tehama	3	6/23/2004	8/14/2017	87	87
37717	39.903046	-122.224557	Tehama	2	6/23/2004	8/14/2017	86	86
37718	39.8996	-122.1227	Tehama	3	6/23/2004	8/14/2017	88	88
37920	39.8543	-122.1535	Tehama	2	5/22/2007	8/14/2017	57	57
48708	39.811667	-122.102	Tehama	2	10/21/2011	8/14/2017	30	30
48709	39.81925	-122.159	Tehama	1	10/20/2011	8/14/2017	30	30
48854	39.8117	-122.102	Tehama	1	10/21/2011	8/14/2017	30	30

Figure 53. Groundwater Level Inventory Complete Data Table

6.3 Daily Inventory

The **Daily Inventory** utility allows the user to view the full inventory of daily data records for each daily data source type (e.g. USGS, PRISM). The **View Inventory** form is accessed by the **Daily Inventory** button (Figure 54).

Under the Select a Source to View Inventory drop-down menu, select a daily data source type. The DMS will automatically generate the Source Inventory list with the following information for all raw data records of that type:

a) **SiteID**
b) **SiteName**
c) **Param**: the parameter associated with the daily data record
d) **Start Date**: the beginning of the active daily data record
e) **End Date**: the end of the active daily data record
f) **Number of Records**: the number of data points (days) in the active record period at that site

View Inventory

Review and Edit Charges and Allocations or Add a New Year

Select a Source to View Inventory PRISM

Source Inventory List

SiteID	SiteName	Param	Start Date	End Date	Number of Records
72	M13N01E	Precip	1/1/1981	12/28/2017	13,511
73	M13N01W	Precip	1/1/1981	12/28/2017	13,511
74	M13N02W	Precip	1/1/1981	12/28/2017	13,511
75	M13N03W	Precip	1/1/1981	12/28/2017	13,511
76	M13N04W	Precip	1/1/1981	12/28/2017	13,511
77	M14N01E	Precip	1/1/1981	12/28/2017	13,511
78	M14N01W	Precip	1/1/1981	12/28/2017	13,511
79	M14N02W	Precip	1/1/1981	12/28/2017	13,511
80	M14N03W	Precip	1/1/1981	12/28/2017	13,511
81	M14N04W	Precip	1/1/1981	12/28/2017	13,511

Close

Figure 54. Daily Inventory for Each Daily Data Source Type

6.3 Timeseries Sites

The **Timeseries Sites** form is used to initialize new sites by loading their information in the DMS. Buttons linking to this same form are provided in both the **Process Timeseries Data (Database Set-up and QC)** and **Other Utilities** menus. For a full explanation of the **Timeseries Sites** form, please see User Guide section 4.1 Initializing a New Site in the DMS: Timeseries Sites.

6.4 Timeseries Parameters

The **Timeseries Parameters** form is used to initialize new parameters to link data records with sites in the DMS. Buttons linking to this same form are provided in both the **Process Timeseries Data (Database Set-up and QC)** and **Other Utilities** menus. For a full explanation of the **Timeseries Parameters** form, please see User Guide section 4.2 Initializing New Data Parameters in the DMS: Timeseries Parameters.

6.5 Reset Data

The **Reset Data** utility allows the user to clear selected data records from the DMS. The steps for removing different sets and types of records are detailed below.

1) Select **Reset Data** button on the **Utilities for Database Management** form. This opens the **Reset Data Form** (Figure 55).

2) Under the **Select Site** drop-down menu, choose the site you with to reset data for by its name, source, and site ID number.

   The DMS will automatically generate a Site Inventory summary in the table below, with information on the type and number of records available for the selected site.

3) Select a time period for the data reset using the **Enter Reset Start Date** and **Enter Reset End Date** boxes.

4) Under the **Select Parameter** drop-down menu, select the parameter associated with the data record that you wish to reset.

5) Choose which data record you wish to reset by pressing the appropriate button:

   a. **Reset Data for Site (QC'd)**: deletes the associated site record from only the QC table. The raw data associated with this site record is retained in the DMS. The user must reload the raw data into the QC table via the Run QC Checks process (User Guide section 4.3.3 Run Limit Checks).

   b. **Reset Data for Site (Raw and QC'd)**: deletes the associated site record from both the QC table and the Raw data table. The user must reload source data into the raw data table and then load this into QC table before repeating the QC check process (User Guide section 4.3.1 Selecting and Loading Data for QC Checks).

   A pop-up message will appear when the data has been successfully reset.

6) Press the Close button to return to the **Utilities for Database Management** form.

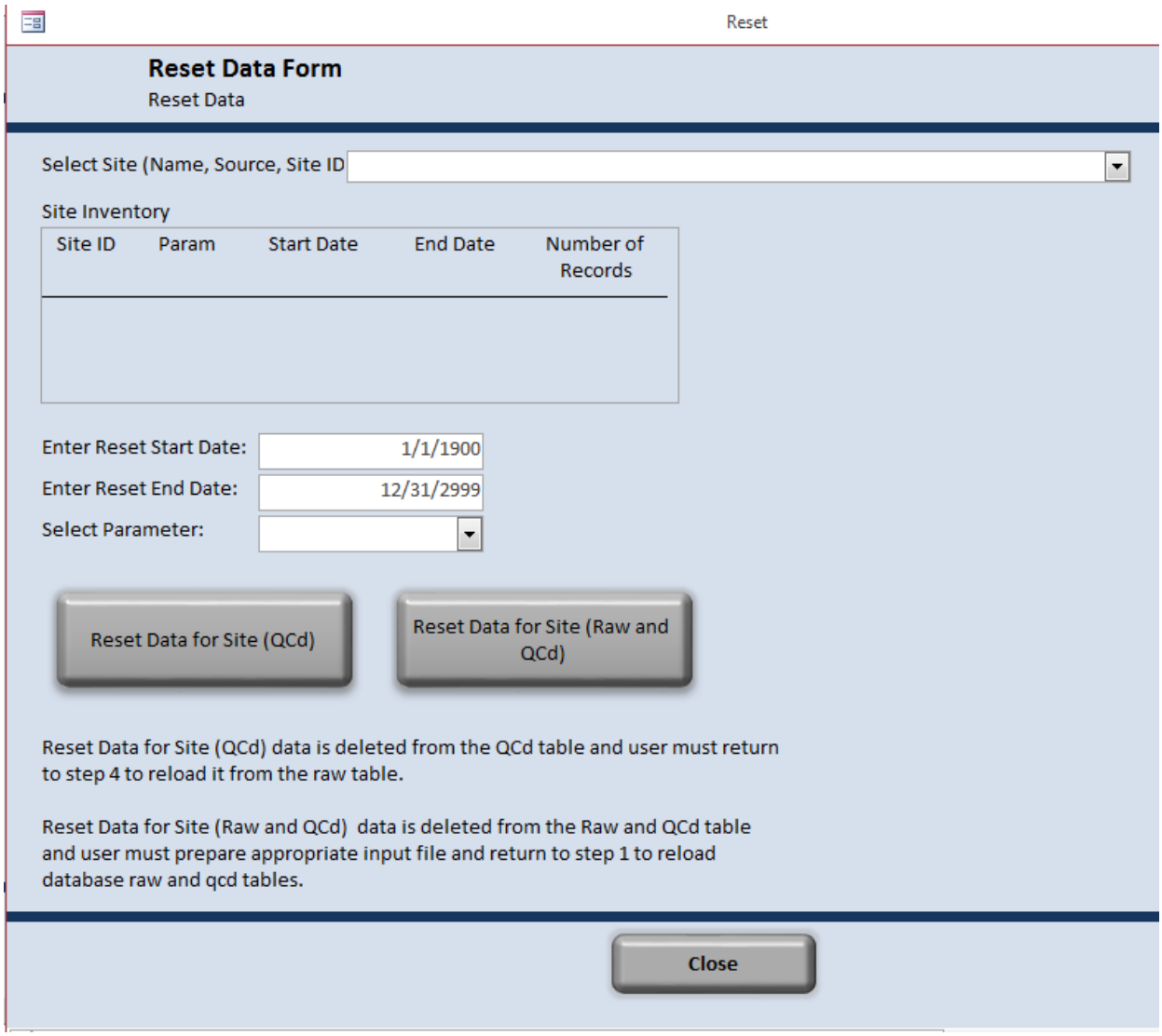


Figure 55. Reset Data form

6.6 View Daily Data Table

Selecting the **View Daily Data Table** button directs the user to a compiled table (Figure 56) of the full library of QC checked daily data (flow and precipitation data). This final data table lists the following information for all daily data records:

a. **SiteName**

b. **ParamUnit**: the parameter units associated with the data record

c. **ID**

d. **SiteID**

e. **Param**: the parameter associated with the daily data record

f. **Date**: the day the data record was taken

g. **Val**: the data record value

h. **QFlag**: the QC check results code (Table 3)

i. **EFlag**: the estimation code (Table 4)

j. **ModDate**: the date the estimation was made

k. **UserID**: the ID associated with the user who made these changes to the data

l. **ManFlag**: a check box indicating whether the data has been manually checked

SiteName	ParamUnit	ID	SiteID	Param	Date	Val	QFlag	EFlag	ModDate	UserID	ManFlag
STONY C NR ORLAND CA	CFS	52432	26	Flow	1/1/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52433	26	Flow	1/2/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52434	26	Flow	1/3/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52435	26	Flow	1/4/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52436	26	Flow	1/5/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52437	26	Flow	1/6/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52438	26	Flow	1/7/1920	30	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52439	26	Flow	1/8/1920	30	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52440	26	Flow	1/9/1920	29	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52441	26	Flow	1/10/1920	28	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52442	26	Flow	1/11/1920	28	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52443	26	Flow	1/12/1920	27	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52444	26	Flow	1/13/1920	26	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52445	26	Flow	1/14/1920	26	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52446	26	Flow	1/15/1920	25	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52447	26	Flow	1/16/1920	25	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52448	26	Flow	1/17/1920	25	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52449	26	Flow	1/18/1920	26	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52450	26	Flow	1/19/1920	27	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52451	26	Flow	1/20/1920	28	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52452	26	Flow	1/21/1920	30	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52453	26	Flow	1/22/1920	33	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52454	26	Flow	1/23/1920	32	L00	E00	11/9/20	LimitProc	
STONY C NR ORLAND CA	CFS	52455	26	Flow	1/24/1920	32	L00	E00	11/9/20	LimitProc	

Figure 56. Final Daily Data Table

6.7 View Monthly Data Table

Selecting the **View Monthly Data Table** button directs the user to a compiled table (Figure 57) of the Monthly USBR data. This final data table lists the following information for all monthly data records:

a. **SiteName**

b. **SiteID**

c. **Param**: the parameter associated with the daily data record

d. **Yr**: the year the data record was taken

e. **Mon**: the month the data record was taken

f. **Vol_af**: the data record value

g. **ModDate**: the date the estimation was made

h. **UserID**: the ID associated with the user who made these changes to the data

SiteName	SiteID	Param	Yr	Mon	Vol_af	ModDate	UserID
4-M Water District	120	Vol	1989	1	0	2/20/2018	USBR003
4-M Water District	120	Vol	1989	2	0	2/20/2018	USBR003
4-M Water District	120	Vol	1989	3	0	2/20/2018	USBR003
4-M Water District	120	Vol	1989	4	334	2/20/2018	USBR003
4-M Water District	120	Vol	1989	5	402	2/20/2018	USBR003
4-M Water District	120	Vol	1989	6	402	2/20/2018	USBR003
4-M Water District	120	Vol	1989	7	487	2/20/2018	USBR003
4-M Water District	120	Vol	1989	8	627	2/20/2018	USBR003
4-M Water District	120	Vol	1989	9	287	2/20/2018	USBR003
4-M Water District	120	Vol	1989	10	57	2/20/2018	USBR003
4-M Water District	120	Vol	1989	11	13	2/20/2018	USBR003
4-M Water District	120	Vol	1989	12	0	2/20/2018	USBR003
4-M Water District	120	Vol	1990	1	0	2/20/2018	USBR003
4-M Water District	120	Vol	1990	2	0	2/20/2018	USBR003
4-M Water District	120	Vol	1990	3	80	2/20/2018	USBR003
4-M Water District	120	Vol	1990	4	454	2/20/2018	USBR003
4-M Water District	120	Vol	1990	5	330	2/20/2018	USBR003
4-M Water District	120	Vol	1990	6	410	2/20/2018	USBR003
4-M Water District	120	Vol	1990	7	501	2/20/2018	USBR003
4-M Water District	120	Vol	1990	8	383	2/20/2018	USBR003
4-M Water District	120	Vol	1990	9	298	2/20/2018	USBR003
4-M Water District	120	Vol	1990	10	149	2/20/2018	USBR003
4-M Water District	120	Vol	1990	11	0	2/20/2018	USBR003
4-M Water District	120	Vol	1990	12	0	2/20/2018	USBR003
4-M Water District	120	Vol	1991	1	0	2/20/2018	USBR003
4-M Water District	120	Vol	1991	2	0	2/20/2018	USBR003
4-M Water District	120	Vol	1991	3	0	2/20/2018	USBR003

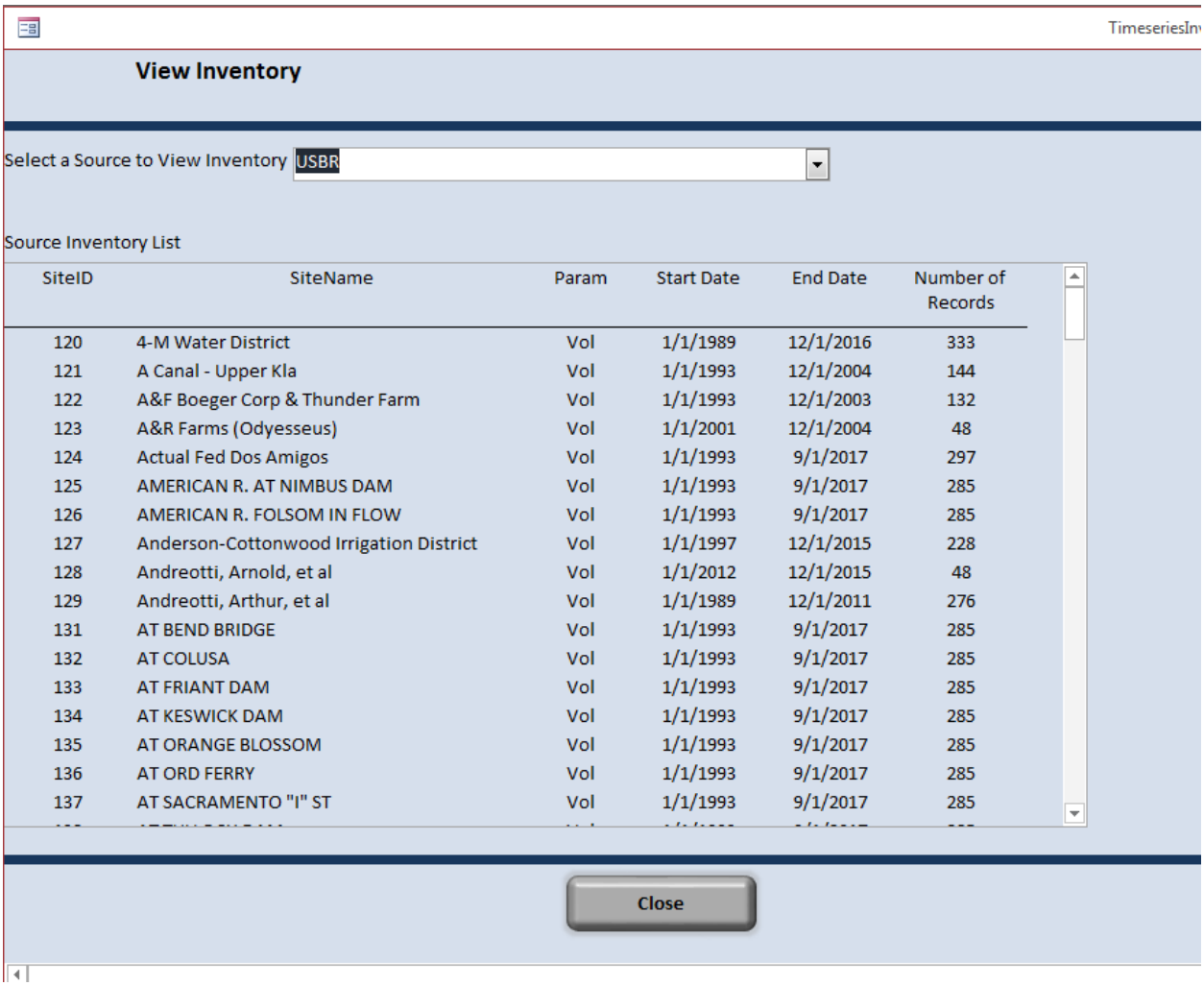
Figure 57. Final Monthly Data Table

6.8 Monthly Inventory

The **Monthly Inventory** utility allows the user to view the full inventory of monthly data records for each data source type (USBR). The **View Inventory** form is accessed by the **Monthly Inventory** button (Figure 54).

Under the Select a Source to View Inventory drop-down menu, select a daily data source type. The DMS will automatically generate the Source Inventory list with the following information for all raw data records of that type:

a) **SiteID**
b) **SiteName**
c) **Param**: the parameter associated with the daily data record
d) **Start Date**: the beginning of the active daily data record
e) **End Date**: the end of the active daily data record
f) **Number of Records**: the number of data points (days) in the active record period at that site



SiteID	SiteName	Param	Start Date	End Date	Number of Records
120	4-M Water District	Vol	1/1/1989	12/1/2016	333
121	A Canal - Upper Kla	Vol	1/1/1993	12/1/2004	144
122	A&F Boeger Corp & Thunder Farm	Vol	1/1/1993	12/1/2003	132
123	A&R Farms (Odyesseus)	Vol	1/1/2001	12/1/2004	48
124	Actual Fed Dos Amigos	Vol	1/1/1993	9/1/2017	297
125	AMERICAN R. AT NIMBUS DAM	Vol	1/1/1993	9/1/2017	285
126	AMERICAN R. FOLSOM IN FLOW	Vol	1/1/1993	9/1/2017	285
127	Anderson-Cottonwood Irrigation District	Vol	1/1/1997	12/1/2015	228
128	Andreotti, Arnold, et al	Vol	1/1/2012	12/1/2015	48
129	Andreotti, Arthur, et al	Vol	1/1/1989	12/1/2011	276
131	AT BEND BRIDGE	Vol	1/1/1993	9/1/2017	285
132	AT COLUSA	Vol	1/1/1993	9/1/2017	285
133	AT FRIANT DAM	Vol	1/1/1993	9/1/2017	285
134	AT KESWICK DAM	Vol	1/1/1993	9/1/2017	285
135	AT ORANGE BLOSSOM	Vol	1/1/1993	9/1/2017	285
136	AT ORD FERRY	Vol	1/1/1993	9/1/2017	285
137	AT SACRAMENTO "I" ST	Vol	1/1/1993	9/1/2017	285

Figure 58. Monthly Inventory for Each Data Source Type

6.9 Add/Edit Well Completion Reports

This form allows users to edit or add records to the well completion report table (QC_WellCompletionData) in the database rather than using the bulk import process (Figure 59). These tasks are described below.

To Add New Record (pink section): Select the Add New Record button and fill in the text boxes on the left in the Data Entry Section of the form (green section). The Add New Record button adds a blank record to the table that is displayed in the data entry section of the form; however, it will only add one blank record. The user must change either the MTRS, APN, State Well No or FID in the data entry section. If none of these fields are available for the WCR record set the MTRS to NA.

Edit Existing Records (purple section): Search for a record by entering all or any part of the fields APN, State Well No., MTRS, or FID to search for record(s). Edit the record in the text boxes on the left. Modifications are automatically saved. Run a backup of the well completion data table before making significant changes to the dataset (see Backing up the Data Section of the form). If a mistake is made you can select the Open Backup Table button for instructions to correct the error.

Backing up the Data: Select the Create Backup button to create a copy of the existing Well Completion Data table. This process overwrites the exiting backup. To keep a copy of an older back up, change the table name (right click on the table name and select rename) using the navigation pane on the left from tempBackupWellCompletionData to tempBackupWellCompletionData_mmddyyyy where mmddyyyy are the date the backup was made.

Add/Edit Well Completion Reports

Data Entry Section

Link		Section1	0	Checked	
File_N		Use		Checked_By	
Drill_Date		Book	0	Hyperlink	
Year	0	Page	0	Basin	
Received		Parcel	0	Network_Status	
Permit_Num		Diameter		Dest_Permit	
APN	000-000-000	Top_Perf	0	Dest_Date	
File_Date		Tops			
Log_Number	0	Bottom_perf	0		
County		Bottoms			
MTRS_old		Intervals			
MTRS_new		Depth	0		
MTRS	-99999	BH Depth	0		
FID	-99999	Perf_length	0		
State_Well_No	-99999	Percent_perf	0.00%		
POINT_X	0	GPM			
POINT_Y	0	Static_DTW			
Lat	0	Drawdown			
Long	0	Duration			
Loc_Source		Spec_cap			
Loc_Accuracy		Drill_Method			
Well_Owner		Verification			
Meridian		Driller			
Activity		Old_Number			
Township		Status			
Range		Status_code			

Top_1	0	Bottom_1	0
Top_2	0	Bottom_2	0
Top_3	0	Bottom_3	0
Top_4	0	Bottom_4	0
Top_5	0	Bottom_5	0
Top_6	0	Bottom_6	0
Top_7	0	Bottom_7	0
Top_8	0	Bottom_8	0
Top_9	0	Bottom_9	0
Top_10	0	Bottom_10	0
Top_11	0	Bottom_11	0
Top_12	0	Bottom_12	0
Top_13	0	Bottom_13	0
Top_14	0	Bottom_14	0
Top_15	0	Bottom_15	0

Record: 1 of 1 No Filter Search

Use the Arrow Keys above to navigate records.

Add New Record: Select the Add New Record button below and edit the text boxes on the left. The MTRS field should be changed to NA if no MTRS is available for the well.

Add New Record

Edit Existing Records: Search for record by entering all or any part of the fields below to search for record (s). Edit the record in the text boxes on the left. Modifications are automatically saved. Run a backup of the well completion data table before making significant changes to the dataset (see Backing up the Data Section of the form) . If a mistake is made you can select the Open Backup Table button to see how to correct the error.

APN:	000-000-000
State Well No.:	-99999
MTRS:	-99999
FID:	-99999

Clear Record Search

Backing up the Data: Select the Create Backup button to create a copy of the existing Well Completion Data table. This process overwrite the exiting backup. To keep a copy of an older back up change the table name using the navigation pane on the left from tempBackupWellCompletionData to tempBackupWellCompletionData_mmddyyyy where mmddyyyy are the date the backup was made.

Create Backup

Close | Open Data Table | Open Backup

Note: This table does not have a primary key (unique identifier) for each record. It is recommended that key be considered for the data set as part of future phases of DMS implementation.

Figure 59. Add/Edit Well Completion Reports

List of Acronyms Used

Acronym	Meaning
AF	Acre feet
APN	Assessor's Parcel Number
CDEC	California Data Exchange Center
cfs	Cubic feet per second
DMS	Data Management System
DWR	Department of Water Resources
FID	Field Identification Number
ft	Feet
GSP	Groundwater Sustainability Plan
GUI	graphical user interface
GWL	groundwater level
in	Inches
MTRS	Meridian Township Range Section
NCEI	National Centers for Environmental Information
QC	Quality Control
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
WCR	Well Completion Reports
WDL	Water Data Library
WS	Wind Speed or Water Surface (depending upon context)

Data Management System (DMS) Programmer's Guide

1. DMS Tables

There are thirteen main tables in the database. Descriptions of each table are listed in Table 1. In addition, procedures throughout the application create temporary processing tables that contain intermediate calculations. All of the temporary tables begin with "temp". These are not described in the tables below. Columns associated with each of the tables (except the "temp" tables) are listed in table 2.

Table 1. List of DMS Tables and Descriptions

Table Name	Description
Days	List of dates with weekends and water year columns. Used for date summaries and identification of missing days.
GST	Water Data Library Groundwater Level Table: Station (well) header data
GWL	Water Data Library Groundwater Level Table: Groundwater level data
ParamDesc	List of parameter and units that are stored in the database
Perf	Water Data Library Groundwater Level Table: Well perforation details
QC_Codes	List of all codes used in the QC process
QC_FinalData	Final daily data table (quality controlled records)
QC_MonVol	Final monthly data table (USBR data)
QC_Params	Parameters attributes by site including min and max allowable values
QC_RawData	Raw daily data table (raw records from data source)
QC_Sites	Site attributes including location, site type, and name
QC_WellCompletionData	Well Completion data table
UserCodes	List of user codes (to be used in later development)

Table 2. List of DMS Columns, Data Types and Descriptions

Table Name	Table Column Name	Data Type	Table Description
Days	r_date	Date/Time	Date (1/1/1900 – 12/31/2040)
Days	season	Short Text	Season (Winter, Spring, Summer, Fall)
Days	weekend	Short Text	Weekend (Y/N)
Days	holiday	Short Text	Holiday (Y/N)
Days	water_yr	Number	Water year
Days	j_date	Number	Day of year (1 – 366)
GST	CASGEM_STATION_ID	Number	Station Identifier (database key)
GST	SITE_CODE	Short Text	Unique station identifier
GST	STATE_WELL_NUMBER	Short Text	State well number
GST	LOCAL_WELL_DESIGNATION	Short Text	Identifier used by local agency
GST	LATITUDE	Number	Station latitude, dec. degrees
GST	LONGITUDE	Number	Station longitude, dec. degrees
GST	LOC_METHOD	Short Text	Method by which well was located
GST	LOC_ACCURACY	Short Text	Accuracy of well location
GST	BASIN_CD	Short Text	Groundwater basin code of well
GST	BASIN_DESC	Short Text	Groundwater basin name of well

Table Name	Table Column Name	Data Type	Table Description
GST	COUNTY_NAME	Short Text	County of well location
GST	IS_VOLUNTARY_REPORTING	Short Text	Code (Y/N) indicating report status
GST	TOTAL_DEPTH_FT	Number	Total depth of well (if public)
GST	CASGEM_STATION_USE_DESC	Short Text	Description of well water usage (Irrigation, Residential, Industrial, etc.)
GST	COMPLETION_RPT_NBR	Short Text	Well completion report number
GST	NumberOfPerf	Number	Number of perforations
GST	maxperfbott	Number	Maximum depth of bottom perforation
GST	minperftop	Number	Minimum depth of top perforation
GST	monitoring_well	Yes/No	Monitoring well flag
GWT	CASGEM_STATION_ID	Number	Station Identifier (database key)
GWT	SITE_CODE	Short Text	Unique station identifier
GWT	ELEVATION_ID	Number	Record identifier
GWT	MEASUREMENT_DATE	Date/Time	Measurement date/time
GWT	RP_ELEVATION	Number	Reference point elevation
GWT	GS_ELEVATION	Number	Ground surface elevation
GWT	WS_READING	Number	Water surface reading
GWT	MEASUREMENT_ISSUE_ID	Number	Measurement problem code
GWT	MEASUREMENT_METHOD_ID	Number	Measurement method code
GWT	MEASUREMENT_ACCURACY_ID	Number	Measurement accuracy code
GWT	CASGEM_READING	Short Text	Reading is a CASGEM submittal
GWT	ORG_ID	Number	Monitoring entity agency code
GWT	ORG_NAME	Short Text	Monitoring entity agency code
GWT	COMMENTS	Short Text	Measurement remarks
GWT	COOP_AGENCY_ORG_ID	Number	Cooperating agency code
GWT	COOP_ORG_NAME	Short Text	Cooperating agency name
ParamDesc	ID	AutoNumber	Identity number for record
ParamDesc	Param	Short Text	Reported flow
ParamDesc	ParamDesc	Short Text	Reported flow, discharge in cubic feet per second
ParamDesc	ParamUnit	Short Text	Unit of measurement
ParamDesc	ParamMissingFlag	Yes/No	Flag to indicate whether missing day should be added to record
Perf	CASGEM_STATION_ID	Number	Station identifier (database key)
Perf	SITE_CODE	Short Text	Unique station identifier
Perf	CASGEM_STATE_WELL_NBR	Short Text	State well number
Perf	LOCAL_WELL_DESIGNATION	Short Text	Identifier used by local agency
Perf	PERFORATION_TOP_MSRMNT	Number	Top of perforation depth for this interval
Perf	PERFORATION_BOTTOM_MSRMNT	Number	Bottom of perforation depth for this interval
QC_Code	Code	Short Text	Code used in database
QC_Code	CodeType	Short Text	Type of code based on procedure
QC_Code	CodeDesc	Short Text	Description of code
QC_FinalDate	ID	AutoNumber	Identity number for record
QC_FinalDate	SiteID	Number	Site Identifier from QC_Sites Table
QC_FinalDate	Param	Short Text	Measured parameter (See table ParamDesc)
QC_FinalDate	Date	Date/Time	Date (mm/dd/yyyy)

Table Name	Table Column Name	Data Type	Table Description
QC_FinalDate	Val	Number	Measured value
QC_FinalDate	Qflag	Short Text	Quality flag for limit check an manual QC
QC_FinalDate	Eflag	Short Text	Estimate flag for estimating missing or bad quality data
QC_FinalDate	ModDate	Date/Time	Date data was last modified
QC_FinalDate	UserID	Short Text	Processed by user (UserCodes)
QC_FinalDate	ManFlag	Yes/No	Flag indication whether the data has been manually quality controlled or not
QC_Params	ParamID	AutoNumber	Parameter identifier
QC_Params	SiteID	Number	Site identifier (see QC_Sites Table)
QC_Params	ParamID	Short Text	Parameter measured (See ParamDesc table)
QC_Params	MinVal	Number	Minimum allowable value
QC_Params	MaxVal	Number	Maximum allowable value
QC_Params	MinDate	Date/Time	Minimum date in database
QC_Params	MaxDate	Date/Time	Maximum date in database
QC_Params	NoRec	Number	Number of records in database
QC_Params	ActiveDate	Date/Time	Active date
QC_Params	InactiveDate	Date/Time	Inactive date
QC_Params	ActiveFlag	Yes/No	Active Fflag (Yes/No)
QC_Params	ProcessFlag	Short Text	Raw, Quality Controlled
QC_Params	LimitsSet	Yes/No	Indicated whether the limits have been set or default values are used
QC_RawData	SiteID	Number	Site identifier (See QC_Sites Table)
QC_RawData	Param	Short Text	Measured parameter (See table ParamDesc)
QC_RawData	Date	Date/Time	Date (mm/dd/yyyy)
QC_RawData	Val	Number	Measured value
QC_RawData	Code1	Short Text	First code from agency
QC_RawData	Code2	Short Text	Second code from agency
QC_RawData	ModDate	Date/Time	Date data was last modified
QC_RawData	UserID	Short Text	Processed by user (UsersCodes)
QC_RawData	QCFlag	Yes/No	Flag indicating whether the date has been quality controlled or not
QC_Sites	SiteID	AutoNumber	Identity column in table
QC_Sites	SRCode	Short Text	Subregion code (to be developed; linkage attribute for water balance)
QC_Sites	LUCode	Short Text	Land use code (to be developed; linkage attribute for water balance)
QC_Sites	QPathID	Short Text	Water balance flow path identity (to be developed; linkage attribute for water balance)
QC_Sites	SiteName	Short Text	Site name
QC_Sites	County	Short Text	County of site location
QC_Sites	Source	Short Text	Source of site data
QC_Sites	TimeStep	Short Text	Timestep of source data
QC_Sites	StationType	Short Text	General data type of station (Surface

Table Name	Table Column Name	Data Type	Table Description
			Water, Weather)
QC_Sites	Latitude	Number	Latitude of station location
QC_Sites	Longitude	Number	Longitude of station location
QC_Sites	Elevation	Short Text	Elevation of station location
QC_Sites	SourseSiteCode	Short Text	Code for site that is used by the data source.
QC_Sites	QCd	Yes/No	Indicates weather site has been quality controlled
QC_Sites	Note	Short Text	General note related to site
QC_Sites	Userid	Short Text	User id of person who last changed the record
QC_Sites	ModDate	Date/Time	Date when record was last modified.

2. DMS Queries

There are 106 queries used in the application. Table 3 below lists all the queries and describes where and how the query is used in the application.

Table 3. List of DMS Queries, Uses and Descriptions

Query Name	Used By	Query Description
000FinalDataView	View Daily Data Table	Query used to show final data table to users
000RawInventoryMake	2. Load QC_RawDataQC button	Make temporary inventory table
001RawMissingDays	2. Load QC_RawDataQC button	Identify missing days at site
002RawSkeletonMake	2. Load QC_RawDataQC button	Make skeleton when days are missing for a site
003RawSkeletonAppend	2. Load QC_RawDataQC button	Append missing days to raw table
CDEC000_MissingSitesReset	CDEC Import Button	Resets missing sites temporary processing table
CDEC001_MissingSitesAppend	CDEC Import Button	Append any sites that are missing from the sites table for records that were recently imported
CDEC002_deleterows	2. Load QC_RawDataQC button	Delete extra null rows from temporary import table
CDEC003_nullto99999	2. Load QC_RawDataQC button	Update null values in temporary import table to -99999 for missing data
CDEC004_RawDataAppend	2. Load QC_RawDataQC button	Append data from the temporary import table into the QC_RawData table
Estimate001_Summary	Estimate Form	Summary Table of Missing/Bad Values
Estimate002_tempEstMissing	Replace with previous/next day value up to 6 day gap	Creates temporary table of missing values for selected site
Estimate003_prevday	Replace with previous/next day value up to 6 day gap	Update values in the temporary table with value from previous day

Query Name	Used By	Query Description
Estimate004_updtFinal	Replace with previous/next day value up to 6 day gap	Updates QC_FinalData table with previous or next day value from the temporary table
Estimate005_nextday	Replace with previous/next day value up to 6-day gap	Update values in the temporary table with values from next day
Estimate006_tempavgthismonth	Replace with average of good values for this month	Create temporary table with average value for each month/year at selected site
Estimate007_avgthismonth	Replace with average of good values for this month	Update missing record in the QC_FinalData table with average monthly value for good records in the given month/year for the selected site
Estimate008_tempavgallmonth	Replace with average of good values for this month all time	Create temporary table with average value for each month (all years) at selected site
Estimate009_avgallmonth	Replace with average of good values for this month all time	Update missing record in the QC_FinalData table with average monthly value for good records in the given month (all years) for the selected site
Estimate010_missingdates	Not Used	List of missing dates for selected site
Estimate011_PrecipReplacement	Replace All Missing or Bad Data with Data from Replacement Site	Create temporary table with all days that are missing for selected precipitation station
Estimate012_PrecipReplacement	Replace All Missing or Bad Data with Data from Replacement Site	Updates QC_FinalData missing precipitation value with value from selected replacement station for all days
Estimate013_PrecipReplacementday	Replace Missing or Bad Data with Data from Replacement Site for Specified Date Only	Updates QC_FinalData missing precipitation value with value from selected replacement station for selected date
GWL_Extract	Get GWL Data (for Contours)	Intermediate query used to create the GWL_Extract_Final query
GWL_Extract_Final	Get GWL Data (for Contours)	Final query used to create contours based on selected option and dates
GWL_Extract_getdates	Get GWL Data (for Contours)	Intermediate query used to create the GWL_Extract_Final query
GWL_Extract_minmaxdates	Get GWL Data (for Contours)	Intermediate query used to create the GWL_Extract_Final query
GWL_Extract_minmaxGWE	Get GWL Data (for Contours)	Intermediate query used to create the GWL_Extract_Final query
GWL_Extract_minmaxRP	Get GWL Data (for Contours)	Intermediate query used to create the GWL_Extract_Final query
GWL001_GSTAppend	3. Get GWL Data button	Appends data that was recently imported into temporary table to the GST table in the database
GWL002_PerfAppend	3. Get GWL Data button	Appends data that was recently imported into temporary table to the Perf table in the database
GWL003_GWLAppend	3. Get GWL Data	Appends data that was recently imported

Query Name	Used By	Query Description
	button	into temporary table to the GWL table in the database
GWL004_tempPerfCount_mk	3. Get GWL Data button	Create temporary table of the number of perforation per well
GWL005_updtNoOfPerf	3. Get GWL Data button	Update the number of perforations column in the GWL table
GWL006_norecs	GWL Inventory	Count the number of records per well
GWL007_inventory	GWL Inventory	Well inventory
GWL008_maxbottomperf	3. Get GWL Data button	Create temporary table of the maximum bottom perforation and minimum top perforation
GWL009_maxperbott_up	3. Get GWL Data button	Update the maximum bottom perforation and minimum top perforation in the GWL table
GWL010_getdata	GWL Output file	GWL data that are exported to excel for graphing
GWL012_getstationattributes	GWL Output file	GWT data that are exported to excel for graphing
GWL013_stationstoadd	GWL Output file	List of all wells with data in the database
GWL014_addstations	Groundwater Level Add to Site List	Add sites to the temporary output table for GWL
GWL015_resetstationlist	Groundwater Level Reset Site List (Output form)	Deletes all records from the temporary output table for GWL sites
GWL016_stationlist	Output form	Selected station list for GWL sites
Limits001_RawDataRS	Not used	
Limits002_ResultsSummary	Run Limit Checks: Limit Check Results Summary	Summary of results for sites that completed the run limit check procedure for the current day.
Manual001_daterangegraph	Manual Review: Graphs	Date range for graphing
Manual002_ParamList	Manual Review form: Select Parameter	List of parameters at the selected site
Manual003_updtFinal	Manual Review form: Complete Manual Review	Updates the ManFlag column in the QC_FinalData table indicating that manual review is complete
Manual004_ManualEstimate	Manual Review form: Update Record (s)	Updates records with specified value and code for date range entered at selected site
Manual006_SiteManSummary	Manual Review form: Manual Review Required	List of sites/years that have not been manually review
Manual007_selectedsitedates	Manual Review form: Date Range Available	Range of dates available in the database for the selected site and parameter
NCEI000_MissingSitesReset	NCEI Daily Precip import button	Resets missing sites temporary processing table
NCEI001_MissingSitesAppend	NCEI Daily Precip import button	Append any sites that are missing from the sites table for records that were recently imported
NCEI002_deleterows	2. Load QC_RawDataQC button	Delete extra null rows from temporary import table

Query Name	Used By	Query Description
NCEI003_nullto99999	2. Load QC_RawDataQC button	Update null values in temporary import table to -99999 for missing data
NCEI004_RawDataAppend	2. Load QC_RawDataQC button	Append data from the temporary import table into the QC_RawData table
Output_DailyCountyAppend	Output form: Add Sites to List (Daily Data)	Appends selected station to the temporary daily output table.
Output_DailyReset	Output form: Add Sites to List (Daily Data)	Reset stations in the temporary daily output table
Output_DailyStationList	Output form: Add Sites to List (Daily Data)	Data query used to export data to excel output file for daily data
Output_ExtractDailyData	Output form: Add Sites to List (Daily Data)	Data query used to export data to excel output file for daily data
PRISM000_MissingSitesReset	Prism import button	Reset missing sites temporary processing table
PRISM001_MissingSitesAppend	Prism Import button	Append any sites that are missing from the sites table for records that were recently imported
PRISM002_deleterows	2. Load QC_RawDataQC button	Delete extra null rows from temporary import table
PRISM003_nullto99999	2. Load QC_RawDataQC button	Update null values in temporary import table to -99999 for missing data
PRISM004_RawDataAppend	2. Load QC_RawDataQC button	Append data from the temporary import table into the QC_RawData table
USBR000_MissingSitesReset	USBR Deliveries Import button	Resets missing sites temporary processing table
USBR001_MissingSitesAppend	USBR Deliveries Import button	Append any sites that are missing from the sites table for records that were recently imported
USBR003_appendqcmonvol	Monthly Load (USBR)	Append data from temporary table into the QC_MonVol table
USBR004_tempmonvol_mk	Monthly Load (USBR)	Creates a temporary summary table of QC_MonVol table
USBR005_qcparams_inventory	Monthly Load (USBR)	Updates QC_Params with min and max dates for USBR deliveries
USGS000_MissingSitesMake	USGS Import button	Resets missing sites temporary processing table
USGS000_MissingSitesReset	USGS Import button	Append any sites that are missing from the sites table for records that were recently imported
USGS001_MissingSiteAppend	Timeseries Sites: Add New Site button	Add record to sites table based on data entered into form
USGS002_RemovefromMissing	Timeseries Sites: Add New Site button	Remove the recently added site from the missing site list temporary table
USGS003_MissingParamsMake	Timeseries Parameter button	Creates a list of sites that do not have parameters
USGS004_AddNewParam	Timeseries Parameters form: Add New Parameter (New Site)	Add new parameter record to the QC_Param table
USGS005_AddNewParam	Timeseries Parameters form: Add New	Add new parameter record to the QC_Param table

Query Name	Used By	Query Description
	Parameter (Existing Site)	
USGS006_RemovefromMissing	Timeseries Parameters form: Add New Parameter (New Site)	Remove newly added parameter from the temporary table of missing parameters
USGS007_ParamList	Set Limits Form: Select Parameter List	Creates list of parameters for selected site
USGS008_daterangegraph	Set Limits Form: Graph Button	Create temporary table of data for selected date range, site, and parameters
USGS008b_daterangegraph_log	Set Limits Form: Graph Button	Log of date ranges for graphing
USGS009_deleterows	2. Load QC_RawDataQC button	Delete extra null rows from temporary import table
USGS010_nullto99999	2. Load QC_RawDataQC button	Update null values in temporary import table to -99999 for missing data
USGS011_RawDataAppend	2. Load QC_RawDataQC button	Append data from the temporary import table into the QC_RawData table
USGS012_RawInventoryMake	2. Load QC_RawDataQC button	make inventory table to update QC_Params min and max dates
USGS013_QCRawData_date_updt	2. Load QC_RawDataQC button	update min and max dates in QC_Params table
USGS014_updtparamlimit	Set Limits Form: Set Limits button	Update the limits for new parameter records where limits have not been set for selected site, parameter
USGS015_tempnewparam	Set Limits Form: Set Limits button	Create a temporary table with new parameter record where the limits are going to be modified.
USGS016_setInActive	Set Limits Form: Set Limits button	Set current parameter records to inactive
USGS017_AddNewRecord	Set Limits Form: Set Limits button	Append new parameter record to the qc_params table
USGS018_deleteErrorRecords	Set Limits Form: Set Limits button	Clean up qc_params table for error records
USGS019_StationSummary	Run Limit Checks: Raw Data Records for Limit Checks	Summary of records that need to be run through the run limit check procedure
UTI000_getperiodrecord	Reset Data Form: Site Inventory	Create summary of sites for Site Inventory table
UTI000_getperiodrecord2	Daily Inventory: Source Inventory List	Create summary of sites for Source Inventory List table
UTI000_getperiodrecord3	Monthly Inventory: Source Inventory List	Create summary of sites for Source Inventory List table
UTI001_deleteQCd	Reset Data for Site (QCd) Button and Reset Data for Site (Raw and QCd)	Delete data from QC_FinalData for selected station and time period
UTI002_deleteRAW	Reset Data for Site (Raw and QCd)	Delete data from the QC_RawData table for selected station and time period
UTI002_resetRAW	Reset Data for Site (QCd) Button	Reset the QCFlag column in QC_Raw_Data table so data for site can be re-quality

Query Name	Used By	Query Description
		controlled for selected station and time period
WDL000_MissingSitesReset	Water Data Library (WDL) Import button	Resets missing sites temporary processing table
WDL001_MissingSitesAppend	Water Data Library (WDL) Import button	Append any sites that are missing from the sites table for records that were recently imported
WDL002_deleterows	2. Load QC_RawDataQC button	Delete extra null rows from temporary import table
WDL003_nullto99999	2. Load QC_RawDataQC button	Update null values in temporary import table to -99999 for missing data
WDL004_RawDataAppend	2. Load QC_RawDataQC button	Append data from the temporary import table into the QC_RawData table
WDL005_LimitstoSet	Not Used	
WellComp000_deletetemp	Well Completion Import Button	Reset temporary table before import of data

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Detailed Tabular DMS Inventory

Table D-1. Streamflow Inventory

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
BIG CHICO CREEK NEAR CHICO	Butte	CDEC	BIC	01-Oct-12	24-Jan-18	1,942
BLACK BUTTE GENERATOR	Tehama	CDEC	BBG	08-Feb-10	25-Jan-18	2,909
BUTTE CREEK NR DURHAM	Butte	CDEC	BCD	01-Oct-13	23-Jan-18	1,576
BUTTE CREEK NR WESTERN CANAL	Butte	CDEC	BWC	01-Oct-11	12-Mar-12	164
BUTTE SLOUGH NR MERIDIAN	Sutter	CDEC	BSL	01-Oct-15	24-Jan-18	847
GRINDSTONE CK NR GRINDSTONE RANCHERIA	Glenn	CDEC	GRI	20-Jan-15	24-Jan-18	1,101
LINDO CHANNEL NEAR CHICO	Butte	CDEC	LCH	25-Jan-07	24-Jan-18	4,018
MUD CREEK NEAR CHICO	Butte	CDEC	MUC	01-Oct-16	24-Jan-18	481
PARROT DIV FROM BUTTE CREEK	Butte	CDEC	BPD	01-Oct-13	23-Jan-18	1,576
RAINBOW DIVERSION DAM	Colusa	CDEC	RBW	29-Jan-08	24-Jan-18	3,649
SACRAMENTO R AT HAMILTON CITY-MAIN CH	Glenn	CDEC	HMC	01-Jan-01	24-Jan-18	6,233
SACRAMENTO R AT ORD FERRY-MAIN CHANNEL	Glenn	CDEC	ORD	01-Jan-93	25-Jan-18	9,156
SACRAMENTO RIVER AT BUTTE CITY	Glenn	CDEC	BTC	28-Jan-98	25-Jan-18	7,303
SACRAMENTO RIVER AT COLUSA	Colusa	CDEC	COL	01-Jan-92	24-Jan-18	9,521
SACRAMENTO RIVER BELOW WILKINS SLOUGH	Sutter	CDEC	WLK	01-Jan-93	24-Jan-18	9,155
SACTO R AT COLUSA WEIR (CREST 61.8')	Colusa	CDEC	CLW	28-Jan-98	25-Jan-18	7,303
SACTO R AT MOULTON WEIR (CREST 76.8')	Colusa	CDEC	MLW	01-Oct-15	25-Jan-18	848
SACTO R AT TISDALE WEIR (CREST 45.5')	Sutter	CDEC	TIS	28-Jan-98	25-Jan-18	7,303
STONY CK NR GRIZZLY FLAT (CO RD 200A)	Glenn	CDEC	SCG	09-Dec-14	25-Jan-18	1,144
STONY CREEK NR SUWANNA RANCH (CO RD 410)	Glenn	CDEC	SUW	25-Nov-14	24-Jan-18	1,157

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
YOLO BYPASS NEAR WOODLAND	Yolo	CDEC	YBY	17-Mar-97	24-Jan-18	7,619
SACRAMENTO R A COLUSA CA	Colusa	USGS	11389500	11-Apr-21	02-Nov-17	35,270
SACRAMENTO R A COLUSA CA	Colusa	USGS	11389500	01-Jan-09	02-Nov-17	3,228
STONY C NR HAMILTON CITY CA	Glenn	USGS	11388500	01-Jan-71	29-Sep-73	1,003
STONY C NR ORLAND CA	Glenn	USGS	11387500	01-Jan-20	29-Sep-34	5,386
Big Chico Creek near Chico	Butte	WDL	A42105	01-Oct-96	30-Sep-12	5,844
Butte Creek below Western Canal near Nelson	Butte	WDL	A04158	01-Oct-91	30-Sep-11	7,305
Butte Creek near Durham	Butte	WDL	A04265	10-Jan-59	30-Sep-13	19,988
Butte Slough at Outfall Gates near Colusa	Colusa	WDL	A02967	01-Oct-75	30-Sep-14	14,245
Butte Slough near Meridian	Colusa	WDL	A02972	01-Oct-51	30-Sep-15	23,376
Colusa Basin Drain at Highway 20	Colusa	WDL	A02976	01-May-41	30-Sep-15	27,181
Colusa Weir Spill to Butte Basin near Colusa	Colusa	WDL	A02981	01-Jan-40	30-Sep-15	27,667
Freshwater Creek at Leesville Road near Williams	Colusa	WDL	A00647	01-Oct-81	30-Sep-88	2,557
Lindo Channel near Chico	Butte	WDL	A00615	01-Oct-75	30-Sep-11	13,149
Moulton Weir Spill to Butte Basin near Princeton	Colusa	WDL	A02986	01-Jan-40	30-Sep-15	27,667
Mud Creek near Chico	Butte	WDL	A04242	24-Nov-64	30-Sep-16	18,939
Parrot Butte Creek Diversion near Chico	Butte	WDL	A41105	11-Apr-97	30-Sep-13	6,017
Sacramento River at Butte City	Glenn	WDL	A02500	01-Oct-38	30-Sep-15	28,124
Sacramento River at Butte slough Outfall Gates	Colusa	WDL	A02400	01-Oct-92	30-Sep-04	4,383
Sacramento River at Hamilton City (main channel only)	Glenn	WDL	A02630	21-Apr-45	30-Sep-13	25,000
Sacramento River at Ord Ferry (main channel only)	Glenn	WDL	A02570	01-Oct-47	30-Sep-10	23,011

Table D-2. Precipitation Inventory

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
COLUSA 2 SSW, CA US	Colusa	NCEI	USC00041948	01-Oct-48	30-Sep-17	25,202
DUNNIGAN, CA US	Yolo	NCEI	USC00042568	01-Mar-06	31-Dec-78	26,604
EAST PARK RESERVOIR, CA US	Colusa	NCEI	USC00042640	01-Nov-10	31-Aug-03	33,907
ORLAND, CA US	Glenn	NCEI	USC00046506	01-Jan-04	10-Nov-17	41,588
RUMSEY 1 NW, CA US	Yolo	NCEI	USC00047598	11-Aug-86	31-Jan-88	539
STONY GORGE RESERVOIR, CA US	Glenn	NCEI	USC00048587	01-Nov-26	10-Nov-17	33,248
STONYFORD, CA US	Colusa	NCEI	USC00048580	08-Jan-15	31-Mar-08	34,052
WILLOWS 6 W, CA US	Glenn	NCEI	USC00049699	30-Oct-06	07-Nov-17	40,552
M13N01E	Glenn	PRISM	M13N01E	01-Jan-81	28-Dec-17	13,511
M13N01W	Glenn	PRISM	M13N01W	01-Jan-81	28-Dec-17	13,511
M13N02W	Glenn	PRISM	M13N02W	01-Jan-81	28-Dec-17	13,511
M13N03W	Glenn	PRISM	M13N03W	01-Jan-81	28-Dec-17	13,511
M13N04W	Glenn	PRISM	M13N04W	01-Jan-81	28-Dec-17	13,511
M14N01E	Glenn	PRISM	M14N01E	01-Jan-81	28-Dec-17	13,511
M14N01W	Glenn	PRISM	M14N01W	01-Jan-81	28-Dec-17	13,511
M14N02W	Glenn	PRISM	M14N02W	01-Jan-81	28-Dec-17	13,511
M14N03W	Glenn	PRISM	M14N03W	01-Jan-81	28-Dec-17	13,511
M14N04W	Glenn	PRISM	M14N04W	01-Jan-81	28-Dec-17	13,511
M15N01W	Glenn	PRISM	M15N01W	01-Jan-81	28-Dec-17	13,511
M15N02W	Glenn	PRISM	M15N02W	01-Jan-81	28-Dec-17	13,511
M15N03W	Glenn	PRISM	M15N03W	01-Jan-81	28-Dec-17	13,511
M15N04W	Glenn	PRISM	M15N04W	01-Jan-81	28-Dec-17	13,511

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
M16N01W	Glenn	PRISM	M16N01W	01-Jan-81	28-Dec-17	13,511
M16N02W	Glenn	PRISM	M16N02W	01-Jan-81	28-Dec-17	13,511
M16N03W	Glenn	PRISM	M16N03W	01-Jan-81	28-Dec-17	13,511
M16N04W	Glenn	PRISM	M16N04W	01-Jan-81	28-Dec-17	13,511
M17N01E	Glenn	PRISM	M17N01E	01-Jan-81	28-Dec-17	13,511
M17N01W	Glenn	PRISM	M17N01W	01-Jan-81	28-Dec-17	13,511
M17N02W	Glenn	PRISM	M17N02W	01-Jan-81	28-Dec-17	13,511
M17N03W	Glenn	PRISM	M17N03W	01-Jan-81	28-Dec-17	13,511
M17N04W	Glenn	PRISM	M17N04W	01-Jan-81	28-Dec-17	13,511
M18N01E	Glenn	PRISM	M18N01E	01-Jan-81	28-Dec-17	13,511
M18N01W	Glenn	PRISM	M18N01W	01-Jan-81	28-Dec-17	13,511
M18N02W	Glenn	PRISM	M18N02W	01-Jan-81	28-Dec-17	13,511
M18N03W	Glenn	PRISM	M18N03W	01-Jan-81	28-Dec-17	13,511
M18N04W	Glenn	PRISM	M18N04W	01-Jan-81	28-Dec-17	13,511
M19N01E	Glenn	PRISM	M19N01E	01-Jan-81	28-Dec-17	13,511
M19N01W	Glenn	PRISM	M19N01W	01-Jan-81	28-Dec-17	13,511
M19N02W	Glenn	PRISM	M19N02W	01-Jan-81	28-Dec-17	13,511
M19N03W	Glenn	PRISM	M19N03W	01-Jan-81	28-Dec-17	13,511
M19N04W	Glenn	PRISM	M19N04W	01-Jan-81	28-Dec-17	13,511
M20N01W	Glenn	PRISM	M20N01W	01-Jan-81	28-Dec-17	13,511
M20N02W	Glenn	PRISM	M20N02W	01-Jan-81	28-Dec-17	13,511
M20N03W	Glenn	PRISM	M20N03W	01-Jan-81	28-Dec-17	13,511
M20N04W	Glenn	PRISM	M20N04W	01-Jan-81	28-Dec-17	13,511

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
M20N05W	Glenn	PRISM	M20N05W	01-Jan-81	28-Dec-17	13,511
M21N01W	Glenn	PRISM	M21N01W	01-Jan-81	28-Dec-17	13,511
M21N02W	Glenn	PRISM	M21N02W	01-Jan-81	28-Dec-17	13,511
M21N03W	Glenn	PRISM	M21N03W	01-Jan-81	28-Dec-17	13,511
M21N04W	Glenn	PRISM	M21N04W	01-Jan-81	28-Dec-17	13,511
M21N05W	Glenn	PRISM	M21N05W	01-Jan-81	28-Dec-17	13,511
M22N01W	Glenn	PRISM	M22N01W	01-Jan-81	28-Dec-17	13,511
M22N02W	Glenn	PRISM	M22N02W	01-Jan-81	28-Dec-17	13,511
M22N03W	Glenn	PRISM	M22N03W	01-Jan-81	28-Dec-17	13,511
M22N04W	Glenn	PRISM	M22N04W	01-Jan-81	28-Dec-17	13,511
M22N05W	Glenn	PRISM	M22N05W	01-Jan-81	28-Dec-17	13,511

Table D-3. Diversion Inventory

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
4-M Water District	Unknown	USBR	4-M Water District	01-Jan-89	1-Dec-16	333
A Canal - Upper Kla	Unknown	USBR	A Canal - Upper Kla	01-Jan-93	1-Dec-04	144
A&F Boeger Corp & Thunder Farm	Unknown	USBR	A&F Boeger Corp & Thunder Farm	01-Jan-93	1-Dec-03	132
A&R Farms (Odyesseus)	Unknown	USBR	A&R Farms (Odyesseus)	01-Jan-01	1-Dec-04	48
Actual Fed Dos Amigos	Unknown	USBR	Actual Fed Dos Amigos	01-Jan-93	1-Sep-17	297
AMERICAN R. AT NIMBUS DAM	Unknown	USBR	AMERICAN R. AT NIMBUS DAM	01-Jan-93	1-Sep-17	285
AMERICAN R. FOLSOM IN FLOW	Unknown	USBR	AMERICAN R. FOLSOM IN FLOW	01-Jan-93	1-Sep-17	285

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Anderson-Cottonwood Irrigation District	Unknown	USBR	Anderson-Cottonwood Irrigation District	01-Jan-97	1-Dec-15	228
Andreotti, Arnold, et al	Unknown	USBR	Andreotti, Arnold, et al	01-Jan-12	1-Dec-15	48
Andreotti, Arthur, et al	Unknown	USBR	Andreotti, Arthur, et al	01-Jan-89	1-Dec-11	276
ANDREOTTI, O.	Unknown	USBR	ANDREOTTI, O.			0
AT BEND BRIDGE	Unknown	USBR	AT BEND BRIDGE	01-Jan-93	1-Sep-17	285
AT COLUSA	Unknown	USBR	AT COLUSA	01-Jan-93	1-Sep-17	285
AT FRIANT DAM	Unknown	USBR	AT FRIANT DAM	01-Jan-93	1-Sep-17	285
AT KESWICK DAM	Unknown	USBR	AT KESWICK DAM	01-Jan-93	1-Sep-17	285
AT ORANGE BLOSSOM	Unknown	USBR	AT ORANGE BLOSSOM	01-Jan-93	1-Sep-17	285
AT ORD FERRY	Unknown	USBR	AT ORD FERRY	01-Jan-93	1-Sep-17	285
AT SACRAMENTO "I" ST	Unknown	USBR	AT SACRAMENTO "I" ST	01-Jan-93	1-Sep-17	285
AT TULLOCH DAM	Unknown	USBR	AT TULLOCH DAM	01-Jan-93	1-Sep-17	285
AT VERONA	Unknown	USBR	AT VERONA	01-Jan-93	1-Sep-17	285
At Vina Bridge	Unknown	USBR	At Vina Bridge	01-Jan-00	1-Sep-17	201
Baber, Jack, et al	Unknown	USBR	Baber, Jack, et al	01-Jan-93	1-Dec-15	276
Bartizon Farms (Odyesseus)	Unknown	USBR	Bartizon Farms (Odyesseus)	01-Jan-98	1-Dec-00	36
BELOW WILKINS SLOUGH	Unknown	USBR	BELOW WILKINS SLOUGH	01-Jan-93	1-Sep-17	285
Berryessa Computed Inflow	Unknown	USBR	Berryessa Computed Inflow	01-Jan-93	1-Sep-17	285
Burroughs et al (Clauss)	Unknown	USBR	Burroughs et al (Clauss)	01-Jan-89	1-Dec-99	132

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Cannel, Fred	Unknown	USBR	Cannel, Fred	01-Jan-89	1-Dec-03	180
Carter Mutual Water Company	Unknown	USBR	Carter Mutual Water Company	01-Jan-04	1-Dec-15	144
Carter, Jane	Unknown	USBR	Carter, Jane	01-Jan-97	1-Dec-04	96
CARTER, ROBERT	Unknown	USBR	CARTER, ROBERT	01-Jan-89	1-Dec-96	96
CHAPLIN, MAY B.	Unknown	USBR	CHAPLIN, MAY B.	01-Jan-89	1-Dec-93	60
CITY OF WEST SACRAMENTO	Unknown	USBR	CITY OF WEST SACRAMENTO	01-Jan-89	1-Dec-95	84
Clear Lake Reservoir	Unknown	USBR	Clear Lake Reservoir	01-Jan-93	1-Dec-04	144
Colusa County WD	Unknown	USBR	Colusa County WD	01-Jan-89	1-Dec-16	333
COLUSA IRRIGATION CO.	Unknown	USBR	COLUSA IRRIGATION CO.	01-Jan-89	1-Dec-95	84
Colusa Prop. Inc	Unknown	USBR	Colusa Prop. Inc	01-Jan-89	1-Dec-04	192
Conaway Preservation Group, LLC	Unknown	USBR	Conaway Preservation Group, LLC	01-Jan-92	1-Dec-15	288
Contra Costa	Unknown	USBR	Contra Costa	01-Jan-93	1-Sep-17	297
Corning	Unknown	USBR	Corning	01-Jan-93	1-Sep-17	297
Cortina WD	Unknown	USBR	Cortina WD	01-Jan-89	1-Dec-16	333
Cranmore Farms (Reynen, John, et al)	Unknown	USBR	Cranmore Farms (Reynen, John, et al)	01-Jan-94	1-Dec-15	264
Davis Ranches	Unknown	USBR	Davis Ranches	01-Jan-89	1-Dec-04	192
Davis WD	Unknown	USBR	Davis WD	01-Jan-89	1-Dec-16	333
Davis, Olive P, et al	Unknown	USBR	Davis, Olive P, et al			0
Delta-Mendota	Unknown	USBR	Delta-Mendota	01-Jan-93	1-Sep-17	297

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Deseret Farms of Calif	Unknown	USBR	Deseret Farms of Calif	01-Jan-89	1-Dec-03	180
Dommer, Elizabeth	Unknown	USBR	Dommer, Elizabeth	01-Jan-96	1-Dec-03	84
Dunnigan WD	Unknown	USBR	Dunnigan WD	01-Jan-89	1-Dec-16	333
Eastside Mutual Water Company	Unknown	USBR	Eastside Mutual Water Company	01-Jan-04	1-Dec-15	144
ELDER CREEK W.D.	Unknown	USBR	ELDER CREEK W.D.	01-Jan-89	1-Dec-94	72
Fargo & Haggerty	Unknown	USBR	Fargo & Haggerty	01-Jan-89	1-Dec-00	144
FEATHER RIVER W.D. (15.2)	Unknown	USBR	FEATHER RIVER W.D. (15.2)	01-Jan-89	1-Dec-95	72
FEATHER RIVER W.D. (20.4)	Unknown	USBR	FEATHER RIVER W.D. (20.4)	01-Jan-89	1-Dec-95	72
FED DOS AMIGOS PUMP.	Unknown	USBR	FED DOS AMIGOS PUMP.	01-Jan-95	1-Dec-95	12
FISH FACILITIES	Unknown	USBR	FISH FACILITIES	01-Jan-89	1-Dec-94	72
Folsom-South	Unknown	USBR	Folsom-South	01-Jan-93	1-Sep-17	297
Forry, Laurie	Unknown	USBR	Forry, Laurie	01-Jan-89	1-Dec-15	324
Forster, Rosemary	Unknown	USBR	Forster, Rosemary	01-Jan-02	1-Dec-04	36
Friant-Kern	Unknown	USBR	Friant-Kern	01-Jan-93	1-Sep-17	297
Furlan Joint Venture (Area 1)	Unknown	USBR	Furlan Joint Venture (Area 1)	01-Jan-89	1-Dec-15	324
Furlan Joint Venture (Area 2)	Unknown	USBR	Furlan Joint Venture (Area 2)	01-Jan-89	1-Dec-15	324
Gerber Reservoir	Unknown	USBR	Gerber Reservoir	01-Jan-93	1-Dec-04	144
Glenn Valley WD	Unknown	USBR	Glenn Valley WD	01-Jan-89	1-Dec-16	321
Glenn-Colusa ID	Unknown	USBR	Glenn-Colusa ID	01-Jan-89	1-Dec-15	324

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Glenn-Colusa ID (TC)	Glenn	USBR	Glenn-Colusa ID (TC)	01-Jan-89	1-Dec-16	273
Glide WD	Unknown	USBR	Glide WD	01-Jan-89	1-Dec-16	333
Green Valley Corporation	Unknown	USBR	Green Valley Corporation	01-Jan-04	1-Dec-15	144
Griffin & Prater Tenancy-in-Common	Unknown	USBR	Griffin & Prater Tenancy-in-Common	01-Jan-89	1-Dec-15	324
HANKS, G.A. & SONS	Unknown	USBR	HANKS, G.A. & SONS	01-Jan-89	1-Dec-91	36
Henle Family Limited Partnership	Unknown	USBR	Henle Family Limited Partnership	01-Jan-92	1-Dec-15	288
Hershey Land Co	Unknown	USBR	Hershey Land Co	01-Jan-89	1-Dec-04	192
Hiatt Family Trust	Unknown	USBR	Hiatt Family Trust	01-Jan-89	1-Dec-14	312
Hiatt Family Trust/Illerich Family Trust	Unknown	USBR	Hiatt Family Trust/Illerich Family Trust	01-Jan-05	1-Dec-15	132
Hollins, Mariette B	Unknown	USBR	Hollins, Mariette B	01-Jan-92	1-Dec-04	156
Holthouse WD	Unknown	USBR	Holthouse WD	01-Jan-89	1-Dec-16	333
Howald Farms, Inc	Unknown	USBR	Howald Farms, Inc	01-Jan-89	1-Dec-15	324
HULBERT, & TARKE	Unknown	USBR	HULBERT, & TARKE	01-Jan-92	1-Dec-95	48
HUNTER, ROBERT	Unknown	USBR	HUNTER, ROBERT	01-Jan-89	1-Dec-91	36
Kanawha WD	Unknown	USBR	Kanawha WD	01-Jan-89	1-Dec-16	333
King & Dommer (Colusa IC)	Unknown	USBR	King & Dommer (Colusa IC)	01-Jan-00	1-Dec-04	24
King, Barbara	Unknown	USBR	King, Barbara	01-Jan-96	1-Dec-03	84
KINGS R. AT PINE FLAT DAM	Unknown	USBR	KINGS R. AT PINE FLAT DAM	01-Jan-93	1-Sep-17	285

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Kirkwood WD	Unknown	USBR	Kirkwood WD	01-Jan-89	1-Dec-16	333
Klamath Drainage Dist	Unknown	USBR	Klamath Drainage Dist	01-Jan-93	1-Dec-04	144
Klamath River to Lost	Unknown	USBR	Klamath River to Lost	01-Jan-93	1-Dec-04	144
Knaggs Walnut Ranches Company, L.P.	Unknown	USBR	Knaggs Walnut Ranches Company, L.P.	01-Jan-92	1-Dec-12	252
Knights Landing Investors, LLC	Unknown	USBR	Knights Landing Investors, LLC	01-Jan-07	1-Dec-15	108
La Grande WD	Unknown	USBR	La Grande WD	01-Jan-89	1-Dec-16	333
LATTER DAY SAINTS	Unknown	USBR	LATTER DAY SAINTS	01-Jan-89	1-Dec-91	36
LEWIS, JOAN	Unknown	USBR	LEWIS, JOAN	01-Jan-89	1-Dec-92	48
Lockett, WilliamP.	Unknown	USBR	Lockett, William P.	01-Jan-92	1-Dec-04	156
Lomo Cold Storage	Unknown	USBR	Lomo Cold Storage	01-Jan-01	1-Dec-15	180
M & T INC.	Unknown	USBR	M & T INC.	01-Jan-89	1-Dec-15	324
Madera	Unknown	USBR	Madera	01-Jan-93	1-Sep-17	297
Maxwell Irrigation District	Unknown	USBR	Maxwell Irrigation District	01-Jan-89	1-Dec-15	324
MCM Properties, Inc.	Unknown	USBR	MCM Properties, Inc.	01-Jan-89	1-Dec-15	324
Mehrhof & Montgomery	Unknown	USBR	Mehrhof & Montgomery	01-Jan-04	1-Dec-04	12
Meridian Farms Water Company	Unknown	USBR	Meridian Farms Water Company	01-Jan-89	1-Dec-15	324
MERLE, JOHN R.	Unknown	USBR	MERLE, JOHN R.	01-Jan-89	1-Dec-91	36
Myers-Marsh MWC	Unknown	USBR	Myers-Marsh MWC	01-Jan-89	1-Dec-16	333

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Natomas Central Mutual Water Company	Unknown	USBR	Natomas Central Mutual Water Company	01-Jan-89	1-Dec-15	324
NEAR VERNALIS	Unknown	USBR	NEAR VERNALIS	01-Jan-93	1-Sep-17	285
NEW MELONES INFLOW	Unknown	USBR	NEW MELONES INFLOW	01-Jan-93	1-Sep-17	285
NEWHALL LAND & FARMING	Unknown	USBR	NEWHALL LAND & FARMING	01-Jan-89	1-Dec-93	60
North Canal	Unknown	USBR	North Canal	01-Jan-93	1-Sep-17	297
O'Brien, Janice	Unknown	USBR	O'Brien, Janice	01-Jan-92	1-Dec-15	288
Odysseus Farms	Unknown	USBR	Odysseus Farms	01-Jan-92	1-Dec-01	84
Oji Brothers Farm, Inc.	Unknown	USBR	Oji Brothers Farm, Inc.	01-Jan-89	1-Dec-15	324
Oji, Mitsue, Family Partnership	Unknown	USBR	Oji, Mitsue, Family Partnership	01-Jan-89	1-Dec-15	324
Orland-Artois WD	Unknown	USBR	Orland-Artois WD	01-Jan-89	1-Dec-16	333
Otterson, Mike	Unknown	USBR	Otterson, Mike	01-Jan-07	1-Dec-15	108
Pelger Mutual Water Company	Unknown	USBR	Pelger Mutual Water Company	01-Jan-89	1-Dec-15	324
Pleasant Grove-Verona MWC	Unknown	USBR	Pleasant Grove-Verona MWC	01-Jan-89	1-Dec-15	324
Premier Partners III	Unknown	USBR	Premier Partners III	01-Jan-94	1-Dec-00	84
Princeton-Codora-Glenn Irrigation District	Unknown	USBR	Princeton-Codora-Glenn Irrigation District	01-Jan-89	1-Dec-15	324
Provident Irrigation District	Unknown	USBR	Provident Irrigation District	01-Jan-89	1-Dec-15	324
PUTAH CREEK-LAKE SOLANO	Unknown	USBR	PUTAH CREEK-LAKE SOLANO	01-Jan-93	1-Sep-17	285
Putah South Canal	Unknown	USBR	Putah South Canal	01-Jan-93	1-Sep-17	297

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
RANCH SAUCOS W.D.	Unknown	USBR	RANCH SAUCOS W.D.	01-Jan-89	1-Dec-94	72
Rauf, Abdul & Tahmina	Unknown	USBR	Rauf, Abdul & Tahmina	01-Jan-05	1-Dec-15	132
Reclamation District #1004	Unknown	USBR	Reclamation District #1004	01-Jan-89	1-Dec-15	312
Reclamation District #108	Unknown	USBR	Reclamation District #108	01-Jan-89	1-Dec-15	312
REGENTS OF UNIV. OF CA	Unknown	USBR	REGENTS OF UNIV. OF CA	01-Jan-89	1-Dec-97	96
RICHFIELD	Unknown	USBR	RICHFIELD	01-Jan-89	1-Dec-94	72
Richter Brothers, et al	Unknown	USBR	Richter Brothers, et al	01-Jan-90	1-Dec-15	168
River Garden Farms	Unknown	USBR	River Garden Farms	01-Jan-89	1-Dec-15	312
Robert's Ditch Irrigation Company	Unknown	USBR	Robert's Ditch Irrigation Company	01-Jan-89	1-Dec-15	312
Sacramento River Ranch, LLC	Unknown	USBR	Sacramento River Ranch, LLC	01-Jan-04	1-Dec-14	132
Sartain Mutual WC	Unknown	USBR	Sartain Mutual WC	01-Jan-89	1-Dec-03	168
SHASTA INFLOW (COMPUTED)	Unknown	USBR	SHASTA INFLOW (COMPUTED)	01-Jan-93	1-Sep-17	285
Siddiqui, J&A & Siddiqui Family	Unknown	USBR	Siddiqui, J&A & Siddiqui Family	01-Jan-97	1-Dec-05	108
SJ RIVER AND MENOTA POOL	Unknown	USBR	SJ RIVER AND MENOTA POOL	01-Jan-94	1-Dec-98	60
SL DOS AMIGOS PP	Unknown	USBR	SL DOS AMIGOS PP	01-Jan-94	1-Dec-94	12
Sly Park - Camino Con	Unknown	USBR	Sly Park - Camino Con	01-Jan-93	1-Dec-03	132
South Canal	Unknown	USBR	South Canal	01-Jan-93	1-Sep-17	297
Spence, Ruth Ann	Unknown	USBR	Spence, Ruth Ann	01-Jan-92	1-Dec-04	156
Stony Creek	Unknown	USBR	Stony Creek	01-Jan-93	1-Sep-17	297

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
Sutter Mutual Water Company	Unknown	USBR	Sutter Mutual Water Company	01-Jan-89	1-Dec-15	312
Swinford Tract Irrigation Co	Unknown	USBR	Swinford Tract Irrigation Co	01-Jan-89	1-Dec-03	168
Sycamore Family Trust	Unknown	USBR	Sycamore Family Trust	01-Jan-05	1-Dec-15	132
Tarke, James	Unknown	USBR	Tarke, James	01-Jan-96	1-Dec-04	108
Tarke, Stephen	Unknown	USBR	Tarke, Stephen	01-Jan-05	1-Dec-15	132
Te Velde Family Trust	Unknown	USBR	Te Velde Family Trust	01-Jan-15	1-Dec-15	12
Tecolete Tunnel	Unknown	USBR	Tecolete Tunnel	01-Jan-93	1-Sep-17	297
TEHAMA RANCH M.W.C.	Unknown	USBR	TEHAMA RANCH M.W.C.	01-Jan-89	1-Dec-94	72
TEHAMA W.D.	Unknown	USBR	TEHAMA W.D.	01-Jan-89	1-Dec-94	72
Tehama-Colusa	Unknown	USBR	Tehama-Colusa	01-Jan-93	1-Sep-17	297
Tisdale Irrigation and Drainage Company	Unknown	USBR	Tisdale Irrigation and Drainage Company	01-Jan-89	1-Dec-15	312
TITLE INSUR. & TRUST CO.	Unknown	USBR	TITLE INSUR. & TRUST CO.	01-Jan-89	1-Dec-90	24
TOMLINSON, FRED	Unknown	USBR	TOMLINSON, FRED	01-Jan-89	1-Dec-90	24
Van Ruiten Bros.	Unknown	USBR	Van Ruiten Bros.	01-Jan-15	1-Dec-15	12
Wallace Construction, Inc.	Unknown	USBR	Wallace Construction, Inc.	01-Jan-89	1-Dec-04	180
Wallace, Jack, Trust	Unknown	USBR	Wallace, Jack, Trust	01-Jan-05	1-Dec-06	24
WALLACE, JEANNE	Unknown	USBR	WALLACE, JEANNE	01-Jan-92	1-Dec-92	12
Wells, Joyce	Unknown	USBR	Wells, Joyce	01-Jan-89	1-Dec-06	204
Westside WD	Unknown	USBR	Westside WD	01-Jan-89	1-Dec-16	333

Site Name	County	Source	Source Site Code	Min Date	Max Date	Number of Records
WILBUR, ROGER C.	Unknown	USBR	WILBUR, ROGER C.	01-Jan-89	1-Dec-90	24
Wilson Ranch Partnership	Unknown	USBR	Wilson Ranch Partnership	01-Jan-89	1-Dec-15	324
Windswept Land & Livestock Co.	Unknown	USBR	Windswept Land & Livestock Co.	01-Jan-01	1-Dec-15	180
WOODLAND FARMS	Unknown	USBR	WOODLAND FARMS	01-Jan-89	1-Dec-90	24
Woodland-Davis Clean Water Agency	Unknown	USBR	Woodland-Davis Clean Water Agency	01-Jan-15	1-Dec-15	12
Yolo Land Trust	Unknown	USBR	Yolo Land Trust	01-Jan-13	1-Dec-15	36
ZUMWALT ORCHARDS	Unknown	USBR	ZUMWALT ORCHARDS	01-Jan-89	1-Dec-90	24