

DATA MANAGEMENT SYSTEM FRAMEWORK DESIGN TECHNICAL MEMORANDUM

To: Yucaipa GSA
From: Matthew Palavido, Dudek
Subject: Yucaipa Basin GSP Data Management Plan
Date: October 29, 2019
cc: Steven Stuart, Dudek; Bob Tincher, SBVMWD
Attachment(s): Exhibit 1: High Level Entity Relationship Diagram
Exhibit 2: Entity Relationship Diagram
Exhibit 3: Geodatabase Object Specification Sheet
Exhibit 4: Data Flow Diagram

Dudek has developed the framework for the Data Management System (DMS) for the Yucaipa Basin Groundwater Sustainability Plan (GSP). This technical memorandum outlines the DMS structure and development methodologies. The DMS fulfills the requirements of the Sustainable Groundwater Management Act (SGMA) Chapter 6 Section 10727.2 and Section 10728 (2014) and California Code of Regulations Title 23 Article 3 § 352.4 and § 352.6.

The following paragraphs and attachments explain the database structure and detail the development process of the DMS. The workflow for the DMS consists of assessing compiled data, configuring the historical data sources for relevance and need within the DMS, inputting data into the DMS, and establishing methods for sharing data securely. The DMS is composed of historical data and allows for collection and input of future data with the ability to disseminate information in various formats. The data is stored in a Geographic Information System (GIS) relational geodatabase format. A geodatabase is a collection of spatial data, attributes or characteristics associated with the data, and any relationships that exist among them. The data is housed in a versioned ESRI Enterprise Geodatabase (GDB) and runs on the SQL Server platform (version 2016), allowing for rapid processing times, large data storage potential, web viewing capabilities, and multiple customization options for secure data dissemination.

Historical Data Input

The workflow begins with a determination of the key management wells within the Yucaipa Basin. As seen in the Data Flow Diagram (Exhibit 1), the Data Source Review Task is conducted as a step in which to sort the data by relevance for use within the DMS. Once the sorting is complete, code will be written for automated input of the historical data. Following automated input of data into the DMS, cases in which data does not follow a typical format or requires additional research or attention will be input manually as needed. A quality assurance/quality control (QA/QC) step follows the manual data input. This includes manually checking a random representative sample of the data as well as automated scripts to check for data consistency and anomalies.

Database Diagram and Architecture

The Database Diagram is representative of the DMS database architecture (Exhibit 2 and 3). The database architecture is the format in which the data is housed (e.g. groundwater levels stored as numbers). The boxes in the diagram represent specific tables within the database architecture; each box contains the table's name in the header, with a list of attribute columns below the header. This structure is further elaborated in the Specification (Spec) Sheet (Exhibit 4), which provides additional details regarding ESRI-specific conventions, data types, and configurations.

The Database Diagram also defines the relationships between tables. For example, a water well is stored as a GIS data point (i.e., consisting of a latitude and longitude coordinate). Other tables are related to this well point via relationships of One-to-One (1:1), One-to-Many (1:M), or Many-to-Many (M:M). An example 1:1 relationship is a relationship between one well and its associated construction information. An example 1:M relationship is a relationship between one well and many associated groundwater level measurements. An example M:M relationship is a relationship between wells and weather stations (i.e., a given well may be associated with any number of weather stations, and a given weather station may be associated with many wells depending on the criteria used to associate them).

As seen in the attached Database Diagram, the database tables store static well information such as well construction details, well reference point elevations, and aquifer designations. Additional data stored in database tables include data that are continuously collected, such as well production, groundwater levels, groundwater quality data, and weather station data. Weather station data are necessary to correct groundwater level data that are measured via a transducer that is configured to account for changes in the barometric pressure.

Future Data Collection

The DMS is configured for the collection of field data such as a well location or groundwater level measurement. Field data may be input during the field site visit as a GPS data point from a mobile device (i.e. iOS, Android, or Windows device), input by hand on a personal computer (e.g., transcribed from field notes), or automatically imported from specifically formatted tables via an automated procedure (e.g., from a laboratory electronic data deliverable). Future data from sources such as the Division of Drinking Water can be added to the DMS with pre-written import script(s) customized to validate and import each distinct data source.

Data Dissemination

The DMS will be viewable via Internet (any modern Web browser) and may be viewed geographically on a map viewer. The DMS is able to output data in GIS (file geodatabase) or Microsoft Excel format. Role-based access control will be used to ensure users can only see, or in some cases have the ability to edit, data they have specifically been given access to. This allows for multiple levels of access depending on the need and to whom data is made available. Future options include adding functionality to automatically output SGMA required reporting items, such as groundwater level contour maps with specific formatting.

Process for Future DMS Modifications

The Database Diagram included with this memo corresponds with the alpha version of the DMS (version 0.5.0). We understand that as applications and systems evolve, the underlying database structure and/or application design will likely need periodic updates.

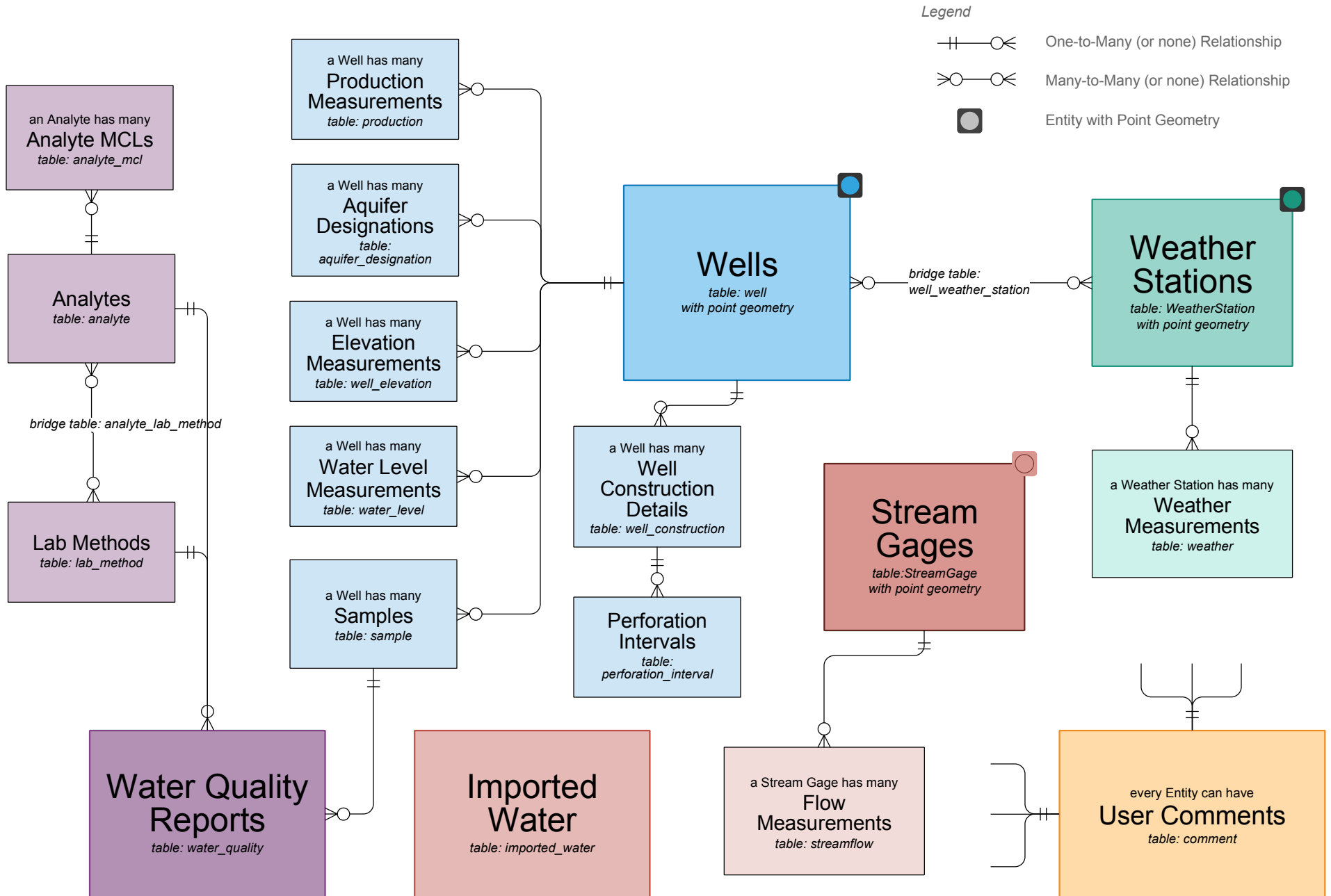
To track and organize these changes over time, each subsequent release of the DMS will be associated with a version number, following a process known as semantic versioning. Under semantic versioning, three numbers are separated by periods to indicate the major release number, the minor release number, and the patch number, respectively, and can be defined as follows:

- Major release numbers (e.g., version 1.0.0, version 2.0.0) correspond to changes to the application that are paradigm shifts in structure, design and/or function. For instance, upon deploying the DMS for production use we will advance to version 1.0.0 to denote the first “stable” DMS release. An example would be a major overhaul of the existing data structures and relationships among the data.
- Minor release numbers (e.g., version 1.1.0, version 1.2.0) indicate incremental additions of useful functionality and/or other changes that are not disruptive to the system as a whole. An example of an incremental addition would be the addition of a new table or dataset, or adding additional relationships among existing data without modifying existing relationships.
- Patch numbers (e.g., version 1.1.9, version 1.1.10) represent bug fixes and/or other small updates to address issues with current functionality, without adding new functionality to the system. An example of a patch would be the addition of new values to a list of valid values for a specific field in a table.

We will use semantic versioning to track each iterative modification to the DMS, so the system may remain consistent and a history of changes may be retained.

High-Level Entity Relationship Diagram

Yucaipa Basin GSP



Yucaipa Basin GSP

Draft Entity Relationship Diagram (v0.5.0, rev 2019-07-30)

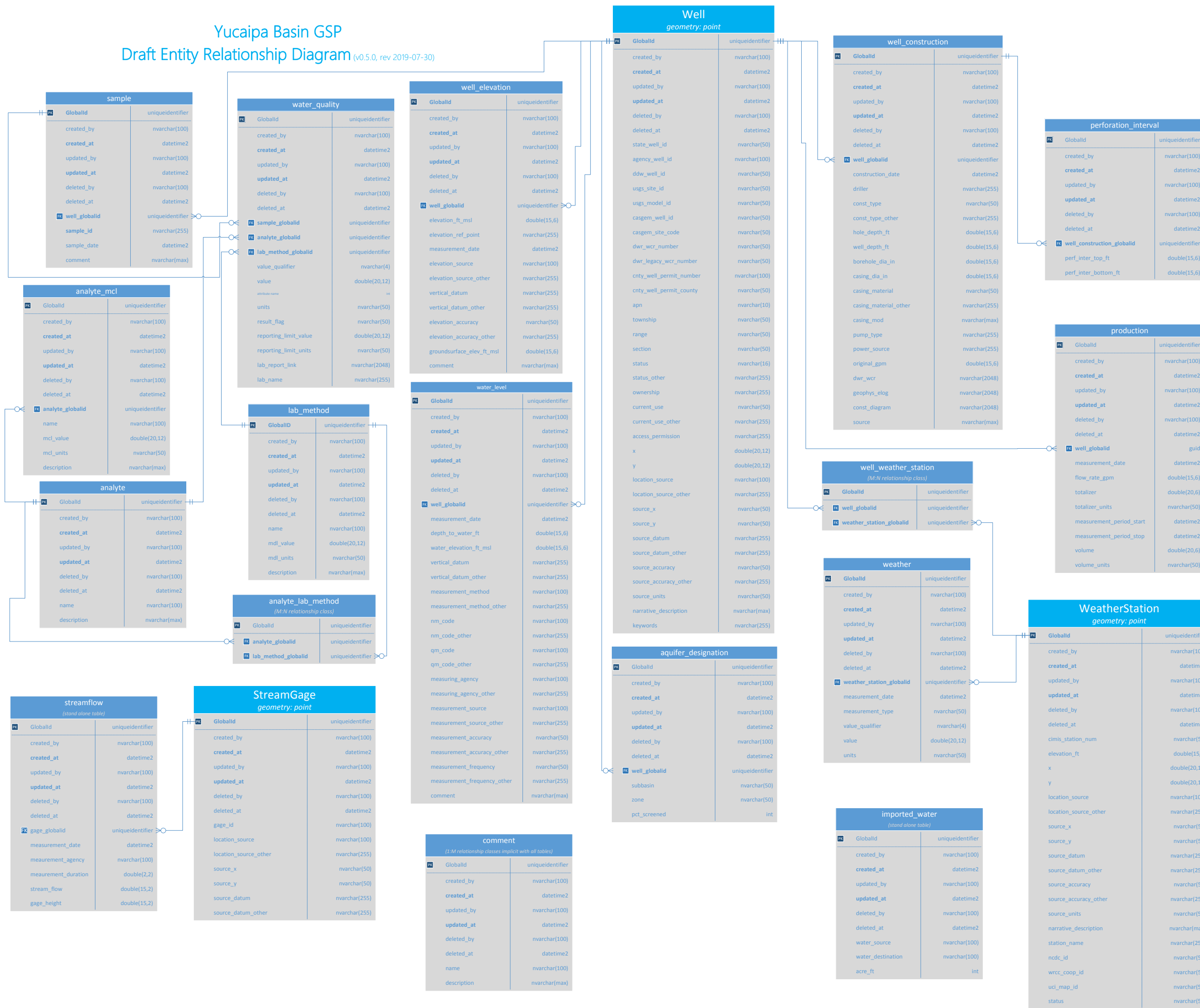


Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

This database architecture specification sheet (spec sheet) outlines the specific data fields (column headers, data types, constraints, indexes, etc.) used in the Data Management System (DMS). This spec sheet is intended to supplement the Entity Relationship Diagram (ERD), providing more commentary and ESRI-specific information regarding the database. Please consult the ERD as the primary source regarding database architecture.

Bolded and italicized text rows are requirements per the DWR Emergency Regulations. Bolded text rows represent information that the DWR Emergency Regulations ask be included if it is available.

Glossary of Terms

Term	Definition
Column	The SQL Server column name.
Alias	The column name as it appears in the ESRI attribute table.
SQL Server Data Type	The SQL Server data type of the column: <ul style="list-style-type: none">• uniqueidentifier = Global ID (for internal use, looks like this: {d468b22b-577c-485e-94bf-390cf491c764})• nvarchar(n max) = Text fields, where 'n' is the max character length allowed (note: nvarchar(max) ~ 1 billion characters); if a value is specified for 'n' the limit is 4096 characters.• integer = Whole number (positive or negative) – no decimals.• decimal(x, y) or double(x, y) = Number, where x is the total number of digits allowed in the number (both sides of decimal point), and y is the number of allowed digits to the right of the decimal point). Decimal handles precision at long decimal points slightly better than double, otherwise they are basically the same.• datetime2 = full date and time, e.g., 2019-07-30 07:30:11; we recommend using this for all dates and times. If no time, set to what DDW uses (i.e. midnight).
ESRI Data Type	The ESRI data type of the column: <ul style="list-style-type: none">• GlobalId or Guid = Global ID (for internal use, looks like this: {d468b22b-577c-485e-94bf-390cf491c764}). Translates to uniqueidentifier in SQL Server.• Text(n) = Text fields, where 'n' is the max character length allowed (4096 characters or less recommended for SQL Server 2012). Translates to nvarchar(n) in SQL Server.• Long = Whole number (positive or negative) – no decimals. Translates to integer in SQL Server.

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	<ul style="list-style-type: none"> • Double (x, y) = Number, where x is the total number of digits allowed in the number (both sides of decimal point), and y is the number of allowed digits to the right of the decimal point). Translates to double(x,y) in SQL Server. • Date = ESRI's catch-all date type for full date and time (e.g., 2019-07-30 07:30:11), simple date (e.g., 2019-07-30), or simple time (e.g., 07:30:11). Translates to datetime2 in SQL Server.
Nullable	Does the field allow NULL values? If the field is Nullable, a blank record will include the value of NULL (i.e., no value), if the field is non-nullable, a blank record will show as blank (i.e., empty string "") or a 0, depending on the data type. For data collection, non-nullable fields are required.
Default	The default value if none is specified upon collection.
Domain	Is this column domain-driven? If yes, the coded domain is provided inline or at the end of this spec sheet.
Validation Rule(s)	If applicable, the set of CHECK constraints and/or other validation rules to apply to the column for QA/QC purposes.
Comments	Much of this is database jargon for where we would index or add constraints, and there are also some questions in there we can address when the time is right. Some notes indicate that a Domain is being used. The Domain is a separate lookup table that is referenced by that datatype, for example well status could be active, inactive, etc.

Column Typeface Key

Bold and Italic: Required by regs.

Bold: Requested by regs if available.

Normal: Not required or requested by regs.

Additional Notes

- ESRI does not support many-to-many (M:N) relationship classes in Collector; as a result, the two M:N relationship classes used to bridge many-to-many relationships in this specification (analyte_lab_method and well_weather_station) would need to be approximated as standalone bridge tables with a combination of one-to-many (1:M) and one-to-one (1:1) relationship classes, managed in parallel to the M:N native relationship class.
- ESRI does not support unique indexes on tables in a versioned SDE environment; as a result, this specification makes parenthetical recommendations on where unique indexes would be valuable for data integrity, e.g., nonclustered (unique) index, but these unique constraints will not actually be implemented at the database tier. Where possible, enforce uniqueness at the application layer.

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- ESRI does not support adding domains to field of type GUID; for this reason, domains used as lookup lists of features (with the GlobalID as the code) cannot be explicitly tied to foreign keys for direct use within ESRI applications, though they will be maintained for convenience of use at the application layer. In these cases, the domains are listed in parentheses, e.g., (wells).

well

object type: feature class (with attachments)

geometry: point

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

Exhibit 3. Geodatabase Object Specification Sheet

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullabl e	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
state_well_id	nvarchar(50)	Text(50)	State Well ID	no	-	no	match regex: (\d{3})(S N)(\d{3})(E W) (\d{2}){1}([A-Z]{1})(\d{3})(S N) e.g., 000S000E00A000S	nonclustered (unique) index
agency_well_id	nvarchar(100)	Text(50)	Well Name	yes	NULL	no	na	nonclustered index
ddw_well_id	nvarchar(50)	Text(50)	Station Code	yes	NULL	no	na	nonclustered index
usgs_site_id	nvarchar(50)	Text(50)	USGS Site ID	yes	NULL	no	na	nonclustered index
usgs_model_id	nvarchar(50)	Text(50)	USGS Model ID	yes	NULL	no	na	nonclustered index
casgem_well_id	nvarchar(50)	Text(50)	CASGEM Well ID	yes	NULL	no	na	nonclustered index
casgem_site_code	nvarchar(50)	Text(50)	CASGEM Site Code	yes	NULL	no	na	nonclustered index
dwr_wcr_number	nvarchar(50)	Text(50)	DWR Well Completion Report Number	yes	NULL	no	na	nonclustered index
dwr_legacy_wcr_number	nvarchar(50)	Text(50)	DWR Legacy Well Completion Report Number	yes	NULL	no	na	nonclustered index
cnty_well_permit_number	nvarchar(100)	Text(50)	County Permit Number	yes	NULL	no	na	nonclustered index
cnty_well_permit_county	nvarchar(50)	Text(50)	County Name	yes	NULL	no	na	nonclustered index

Exhibit 3. Geodatabase Object Specification Sheet

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullabl e	Default	Domain	Validation Rule(s)	Comments
apn	nvarchar(10)	Text(10)	APN	yes	NULL	no	length == 10 AND match regex: (\d{10}) e.g., 1234567890	nonclustered index
township	nvarchar(50)	Text(50)	Township	yes	NULL	no	na	
range	nvarchar(50)	Text(50)	Range	yes	NULL	no	na	
section	nvarchar(50)	Text(50)	Section	yes	NULL	no	na	
status	nvarchar(16)	Text(16)	Status	yes	NULL	well_status	na	nonclustered index
status_other	nvarchar(255)	Text(255)	Other Status	yes	NULL	no	na	Only completed if 'Other' is chosen for status
ownership	nvarchar(255)	Text(255)	Ownership	yes	NULL	no	na	
current_use	nvarchar(50)	Text(50)	Current Use	yes	NULL	well_curre	na	nonclustered index
current_use_other	nvarchar(255)	Text(255)	Other Current Use	yes	NULL	no	na	Only completed if 'Other' is chosen for current_use
access_permission	nvarchar(255)	Text(255)	Access Permission	yes	NULL	no	na	
x	double(20,12)	Double(20,12)	Longitude	yes	NULL	no	na	
y	double(20,12)	Double(20,12)	Latitude	yes	NULL	no	na	
location_source	nvarchar(100)	Text(100)	Location Source	yes	NULL	well_sourc es	na	nonclustered index
location_source_ot her	nvarchar(255)	Text(255)	Other Location Source	yes	NULL	no	na	Only completed if 'Other' is chosen for location_source
source_x	nvarchar(50)	Text(50)	Source X	yes	NULL	no	na	
source_y	nvarchar(50)	Text(50)	Source Y	yes	NULL	no	na	
source_datum	nvarchar(255)	Text(255)	Source Datum	yes	NULL	datums	na	nonclustered index
source_datum_oth er	nvarchar(255)	Text(255)	Other Source Datum	yes	NULL	no	na	Only completed if 'Other' is chosen for source_datum
source_accuracy	nvarchar(50)	Text(50)	Source Accuracy	yes	NULL	well_sourc	na	nonclustered index
source_accuracy_o ther	nvarchar(255)	Text(255)	Other Source Accuracy	yes	NULL	no	na	Only completed if 'Other' is chosen for source_accuracy

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
source_units	nvarchar(50)	Text(50)	Units of Source Datum	yes	NULL	no	na	This column can be determined from the source_datum and is not strictly necessary
narrative_description	nvarchar(max)	Text(1073741822)	Well Site Location Narrative Description	no	-	no	na	
keywords	nvarchar(255)	Text(255)	Keywords	yes	NULL	no	na	For use in Queries/Filters in Web GIS apps; nonclustered index

multi-column indexes/constraints:

- none

well_elevation

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
elevation_ft_msl	double(15,6)	Double(15,6)	Reference Point Elevation (feet MSL)	yes	NULL	no	na	

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
<i>elevation_ref_point</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Elevation Reference Point Description</i>	yes	NULL	no	na	<i>Options include Well casing, ground surface, well pad, sounding port, USGS Elevation Marker. Not a domain; freeform text.</i>
measurement_date	datetime2	Date	Measurement Date	yes	NULL	no	na	nonclustered index
<i>elevation_source</i>	<i>nvarchar(100)</i>	<i>Text(100)</i>	<i>Elevation Source and Method</i>	yes	NULL	<i>well_elevation_sources</i>	na	
<i>elevation_source_other</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Other Elevation Source and Method</i>	yes	NULL	no	na	<i>Only completed if 'Other' is chosen for elevation_source</i>
<i>vertical_datum</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Vertical Datum</i>	yes	NULL	<i>vertical_datums</i>	na	
<i>vertical_datum_other</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Other Vertical Datum</i>	yes	NULL	no	na	<i>Only completed if 'Other' is chosen for vertical_datum</i>
<i>elevation_accuracy</i>	<i>nvarchar(50)</i>	<i>Text(50)</i>	<i>Elevation Accuracy</i>	Yes	NULL	<i>well_elevation_accuracies</i>	na	
<i>elevation_accuracy_other</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Other Elevation Accuracy</i>	Yes	NULL	no	na	<i>Only completed if 'Other' is chosen for elevation_accuracy</i>
<i>groundsurface_elev_ft_msl</i>	<i>double(15,6)</i>	<i>Double(15,6)</i>	<i>Ground Surface Elevation (feet MSL)</i>	yes	NULL	no	na	
comment	nvarchar(max)	Text(1073741822)	Comment	yes	NULL	no	na	

multi-column indexes/constraints:

- [well_globalid, measurement_date]->unique()

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

well_program

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

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Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
program	nvarchar(100)	Text(100)	Program	yes	NULL	well_programs	na	nonclustered index

multi-column indexes/constraints:

- none

well_construction

object type: table

geometry: none

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Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
construction_date	datetime2	Date	Construction Date	yes	NULL	no	na	nonclustered index
driller	nvarchar(255)	Text(255)	Driller	yes	NULL	no	na	nonclustered index

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Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
<i>const_type</i>	<i>nvarchar(50)</i>	<i>Text(50)</i>	<i>Construction Type</i>	<i>yes</i>	<i>NULL</i>	<i>const_types</i>	<i>na</i>	
<i>const_type_other</i>	<i>nvarchar(255)</i>	<i>Text(255)</i>	<i>Other Construction Type</i>	<i>yes</i>	<i>NULL</i>	<i>no</i>	<i>na</i>	<i>Only completed if 'Other' is chosen for const_type</i>
<i>hole_depth_ft</i>	<i>double(15,6)</i>	<i>Double(15,6)</i>	<i>Total Depth of Boring (feet)</i>	<i>yes</i>	<i>NULL</i>	<i>no</i>	<i>>0</i>	<i>nonclustered index</i>
<i>well_depth_ft</i>	<i>double(15,6)</i>	<i>Double(15,6)</i>	<i>Total Depth of Completed Well (feet)</i>	<i>yes</i>	<i>NULL</i>	<i>no</i>	<i>>0 AND <={hole_depth_ft}</i>	<i>nonclustered index</i>
borehole_dia_in	double(15,6)	Double(15,6)	Borehole Dia. (inches)	yes	NULL	no	>0	
casing_dia_in	double(15,6)	Double(15,6)	Casing Diameter (inches)	yes	NULL	no	>0 AND <={borehole_dia_in}	nonclustered index
casing_material	nvarchar(50)	Text(50)	Casing Material/Grade	yes	NULL	casing_materials	na	nonclustered index
casing_material_other	nvarchar(255)	Text(255)	Other Casing Material/Grade	yes	NULL	no	na	
casing_mod	nvarchar(max)	Text(1073741822)	Casing Modifications	yes	NULL	no	na	
pump_type	nvarchar(255)	Text(255)	Pump Type	yes	NULL	no	na	nonclustered index
power_source	nvarchar(255)	Text(255)	Power Source	yes	NULL	no	na	nonclustered index
original_gpm	double(15,6)	Double(15,6)	Original Production Rate (gpm)	yes	NULL	no	na	nonclustered index
dwr_wcr	nvarchar(2048)	Text(2048)	DWR Well Completion Report	yes	NULL	no	na	URL link
geophys_e_log	nvarchar(2048)	Text(2048)	Geophysical Log (e-log)	yes	NULL	no	na	URL link
const_diagram	nvarchar(2048)	Text(2048)	Well Construction Diagram	yes	NULL	no	na	URL link
source	nvarchar(max)	Text(1073741822)	Well Construction Data Source	yes	NULL	no	na	Source of well construction data

multi-column indexes/constraints:

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

- none

perforation_interval

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
well_construction_globalid	uniqueidentifier	guid	Well Construction GlobalId	no	-	no	na	nonclustered index; foreign key references (GlobalId) on (well_construction)
perf_inter_top_ft	double(15,6)	Double(15,6)	Top of Perforation Interval (feet bgs)	yes	NULL	no	>0	nonclustered index
perf_inter_bottom_ft	double(15,6)	Double(15,6)	Bottom of Perforation Interval (feet bgs)	yes	NULL	no	>0 AND > perf_inter_top_ft	nonclustered index

multi-column indexes/constraints:

- [well_construction_globalid ,perf_inter_top_ft, perf_inter_bottom_ft]->unique()

aquifer_designation

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
subbasin	nvarchar(50)	Text(50)	Subbasin	yes	NULL	subbasins	na	
zone	nvarchar(50)	Text(50)	Aquifer Zone	yes	NULL	aquifer_zones	na	nonclustered index
pct_screened	integer	Long	Percent Screened	yes	NULL	no	>=0 AND <=100	nonclustered index

multi-column indexes/constraints:

- [well_globalid, zone]->unique()

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

water_level

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
measurement_date	datetime2	Date	Measurement Date	yes	NULL	no	na	nonclustered index
depth_to_water_ft	double(15,6)	Double(15,6)	Depth to Water (feet)	yes	NULL	no	>0	
water_elevation_ft_msl	double(15,6)	Double(15,6)	Water Level Elevation (feet MSL)	yes	NULL	no	na	calculated value: (well_elevation.elevation_ft_msl – water_level.depth_to_water_ft)
vertical_datum	nvarchar(255)	Text(255)	Vertical Datum	yes	NULL	vertical_datums	na	
Vertical_datum_other	nvarchar(255)	Text(255)	Other Vertical Datum	yes	NULL	no	na	Only completed if 'Other' is chosen for vertical_datum
measurement_method	nvarchar(100)	Text(100)	Measurement Method	yes	NULL	measurement_methods	na	nonclustered index. Pick from CASGEM list
measurement_method_other	nvarchar(255)	Text(255)	Other Measurement Method	yes	NULL	no	na	Only completed if 'Other' is chosen for measurement_method
nm_code	nvarchar(100)	Text(100)	No Measurement Reason	yes	NULL	water_level_nm_codes	na	Only completed if no value is entered for depth_to_water_ft.
nm_code_other	nvarchar(255)	Text(255)	Other No Measurement Reason	yes	NULL	no	na	
qm_code	nvarchar(100)	Text(100)	Questionable Measurement Reason	yes	NULL	water_level_qm_codes	na	If applicable.
qm_code_other	nvarchar(255)	Text(255)	Other Questionable Measurement Reason	yes	NULL	no	na	

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
measuring_agency	nvarchar(100)	Text(100)	Water Level Measuring Agency	yes	NULL	water_level_measuring_agencies	na	
measuring_agency_other	nvarchar(255)	Text(255)	Other Water Level Measuring Agency	yes	NULL	no	na	
measurement_source	nvarchar(100)	Text(100)	Water Level Measurement Source	yes	NULL	water_level_measurement_sources	na	Primarily pertains to historical data. Use USGS "Source of measurement code"
measurement_source_other	nvarchar(255)	Text(255)	Other Water Level Measurement Source	yes	NULL	no	na	
measurement_accuracy	nvarchar(50)	Text(50)	Measurement Source Accuracy	yes	NULL	water_level_measurement_accuracies	na	
measurement_accuracy_other	nvarchar(255)	Text(255)	Other Measurement Source Accuracy	yes	NULL	no	na	
measurement_frequency	nvarchar(50)	Text(50)	Measurement Frequency	yes	NULL	no	na	DJD – No codes for this...chose between N/A, biannual, quarterly, monthly, transducer setting (eg 15 min) or custom.
measurement_frequency_other	nvarchar(255)	Text(255)	Other Measurement Frequency	yes	NULL	no	na	
comment	nvarchar(max)	Text(1073741822)	Comment	yes	NULL	no	na	

multi-column indexes/constraints:

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

- [well_globalid, measurement_date]
- [well_globalid, measurement_method]
- [well_globalid, measurement_date, measurement_method, depth_to_water_ft]->unique()

production

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
well_globalid	uniqueidentifier	Guid	Well GlobalId	yes	NULL	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
measurement_date	datetime2	Date	Date	yes	NULL	no	na	nonclustered index
flow_rate_gpm	double(15,6)	Double(15,6)	Flow Rate (gpm)	yes	NULL	no	>=0	nonclustered index
totalizer	double(20,6)	Double(20,6)	Totalizer	yes	NULL	no	>=0	nonclustered index
totalizer_units	nvarchar(50)	Text(50)	Totalizer Units	yes	NULL	no	na	nonclustered index
measurement_period_start	datetime2	Date	Measurement Period Start	yes	NULL	no	na	nonclustered index
measurement_period_stop	datetime2	Date	Measurement Period Stop	yes	NULL	no	na	nonclustered index
volume	double(20,6)	Double(20,6)	Volume This Period	yes	NULL	no	na	nonclustered index
volume_units	nvarchar(50)	Text(50)	Volume Units	yes	NULL	no	na	nonclustered index

multi-column indexes/constraints:

- [well_globalid, measurement_date]->unique()
- [measurement_period_start, measurement_period_stop]->index()
- [totalizer, totalizer_units]->index()
- [volume, volume_units]->index()

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

sample

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	(wells)	na	nonclustered index; foreign key references (GlobalId) on (well)
sample_id	nvarchar(255)	Text(255)	Sample ID	yes	NULL	no	na	nonclustered (unique) index; ID created by the person collecting the sample—not all samples will have a sample ID, in that case we will default to the state_well_id and the date.
sample_date	datetime2	Date	Sample Date	yes	NULL	no	na	nonclustered index
comment	nvarchar(max)	Text(1073741822)	Comment	yes	NULL	no	na	

multi-column indexes/constraints:

- none

water_quality

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
sample_globalid	uniqueidentifier	Guid	Sample GlobalID	no	-	(samples)	na	nonclustered index; foreign key references (GlobalId) on (sample)
analyte_globalid	uniqueidentifier	Guid	Analyte ID	no	-	(analytes)	na	nonclustered index; foreign key references (GlobalId) on (analyte)

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
lab_method_globalid	uniqueidentifier	Guid	Lab Method GlobalID	no	-	(lab_methods)	na	nonclustered index; foreign key references (GlobalId) on (lab_method)
value_qualifier	nvarchar(4)	Text(4)	Value Qualifier	no	"="	no	na	This will be a comparative operand qualifier, usually "=" or "<".
value	double(20,12)	Double(20,12)	Result Value	yes	NULL	no	na	Only NULL if lab could not run the analysis or report a value. If result is 'ND' then this column should default to the reporting limit and the value qualifier should be "<".
units	nvarchar(50)	Text(50)	Result Units	yes	NULL	no	na	
result_flag	nvarchar(50)	Text(50)	Laboratory Flag	yes	NULL	no	na	
reporting_limit_value	double(20,12)	Double(20,12)	Laboratory Reporting Limit or Practical Quantification Limit	yes	NULL	no	na	If NULL, reports should fall back to mdl_value for the associated lab_method. This field will retain a NULL to indicate there was no reporting limit provided with the results for this analyte.
reporting_limit_units	nvarchar(50)	Text(50)	Laboratory Reporting Limit or Practical Quantification Limit Units	yes	NULL	no	na	If reporting_limit_value is NULL, fall back to mdl_units for the associated lab_method. See comments above.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
lab_report_link	nvarchar(2048)	Text(2048)	Link to Lab Report	yes	NULL	no	na	URL Link
lab_name	nvarchar(255)	Text(255)	Lab Name	yes	NULL	no	na	

multi-column indexes/constraints:

- [sample_globalid, analyte_globalid]->unique()
- [sample_globalid, analyte_globalid, lab_method_globalid]

analyte

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
name	nvarchar(100)	Text(100)	Name	yes	NULL	no	na	nonclustered (unique) index
description	nvarchar(max)	Text(1073741822)	Description	yes	NULL	no	na	

multi-column indexes/constraints:

- none

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

analyte_mcl

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
analyte_globalid	uniqueidentifier	Guid	Analyte ID	no	-	(analytes)	na	nonclustered index; foreign key references (GlobalId) on (analyte)
name	nvarchar(100)	Text(100)	Name	yes	NULL	no	na	nonclustered index
mcl_value	double(20,12)	Double(20,12)	Maximum Contaminant Level (MCL)	yes	NULL	no	>=0	
mcl_units	nvarchar(50)	Text(50)	Maximum Contaminant Level (MCL) Units	yes	NULL	no	na	
description	nvarchar(max)	Text(1073741822)	Description	yes	NULL	no	na	

multi-column indexes/constraints:

- none

analyte_lab_method

object type: relationship class (cardinality: many-to-many)

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	guid	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
analyte_globalid	uniqueidentifier	Guid	Analyte GlobalID	no	-	no	na	nonclustered index; foreign key references (GlobalId) on (analyte)
lab_method_globalid	nvarchar(max)	Guid	Lab Method GlobalID	no	-	no	na	nonclustered index; foreign key references (GlobalId) on (lab_method)

multi-column indexes/constraints:

- [analyte_globalid, lab_method_globalid]->unique()

lab_method

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
name	nvarchar(100)	Text(100)		yes	NULL	no	na	nonclustered (unique) index
mdl_value	double(20,12)	Double(20,12)	Method Detection Limit (MDL)	yes	NULL	no	na	
mdl_units	nvharchar(50)	Text(50)	Method Detection Limit (MDL) Units	yes	NULL	no	na	
description	nvarchar(max)	Text(1073741822)	Description	yes	NULL	no	na	

multi-column indexes/constraints:

- none

weather

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullabl e	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullabl e	Default	Domain	Validation Rule(s)	Comments
weather_station_globalid	uniqueidentifier	Guid	Weather Station GlobalId	no	-	(weather_stations)	na	nonclustered index; foreign key references (GlobalId) on (weather_station)
measurement_date	datetime2	Date	Measurement Date	yes	NULL	no	na	nonclustered index
measurement_type	nvarchar(50)	nvarchar(50)	Measurement Type	yes	NULL	no		nonclustered index
value_qualifier	nvarchar(4)	Text(4)	Value Qualifier	no	"="	no	na	This will be a comparative operand qualifier, usually "=" or "<".
value	double(20,12)	Double(20,12)	Value	yes	NULL	no	na	Only NULL if instrument failed or measurement could not be taken for some other reason. If result is 'ND' or trace then this column should default to the instrument's reporting limit and the value qualifier should be "<". Zero is also an acceptable value (e.g., 0 precip).
units	nvarchar(50)	Text(50)	Units	yes	NULL	no	na	

multi-column indexes/constraints:

- [weather_station_globalid, measurement_date]->unique()
- [measurement_date, measurement_type]->index()

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

WeatherStation

object type: feature class (with attachments)

geometry: point

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
cimis_station_num	nvarchar(50)	Text(50)	CIMIS Station Number	yes	NULL	no		nonclustered index
elevation_ft	double (15,6)	Double(15,6)	Elevation (feet MSL)	yes	NULL	no	>0	
x	double(20,12)	Double(20,12)	Longitude	yes	NULL	no	na	
y	double(20,12)	Double(20,12)	Latitude	yes	NULL	no	na	
location_source	nvarchar(100)	Text(100)	Location Source	yes	NULL	weather_station_sources	na	nonclustered index
location_source_other	nvarchar(255)	Text(255)	Other Location Source	yes	NULL	no	na	Only completed if 'Other' is chosen for location_source
source_x	nvarchar(50)	Text(50)	Source X	yes	NULL	no	na	
source_y	nvarchar(50)	Text(50)	Source Y	yes	NULL	no	na	
source_datum	nvarchar(255)	Text(255)	Source Datum	yes	NULL	datums	na	nonclustered index
source_datum_other	nvarchar(255)	Text(255)	Other Source Datum	yes	NULL	no	na	Only completed if 'Other' is chosen for source_datum
source_accuracy	nvarchar(50)	Text(50)	Source Accuracy	yes	NULL	weather_station_source_accuracies	na	nonclustered index

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
source_accuracy_other	nvarchar(255)	Text(255)	Other Source Accuracy	yes	NULL	no	na	Only completed if 'Other' is chosen for source_accuracy
source_units	nvarchar(50)	Text(50)	Units of Source Datum	yes	NULL	no	na	This column can be determined from the source_datum and is not strictly necessary
narrative_description	nvarchar(max)	Text(1073741822)	Weather Station Location Narrative Description	yes	NULL	no	na	
station_name	nvarchar(100)	Text(100)	Station Name	yes	NULL	no	na	nonclustered index
ncdc_id	nvarchar(50)	Text(50)	NCDC ID	yes	NULL	no	na	nonclustered index
wrcc_coop_id	nvarchar(50)	Text(50)	WRDD COOP ID	yes	NULL	no	na	nonclustered index
uci_map_id	nvarchar(50)	Text(50)	UCI Map ID	yes	NULL	no	na	nonclustered index
status	nvarchar(50)	Text(50)	Status	yes	NULL	no	na	nonclustered index

multi-column indexes/constraints:

- none

well_weather_station

object type: relationship class (cardinality: many-to-many)

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
well_globalid	uniqueidentifier	Guid	Well GlobalId	no	-	no	na	nonclustered index; foreign key references (GlobalId) on (well)
weather_station_globalid	uniqueidentifier	Guid	Weather Station GlobalId	no	-	weather_station	na	nonclustered index; foreign key references (GlobalId) on (weather_station)

multi-column indexes/constraints:

- [well_globalid, weather_station_globalid]->unique()

imported_water

object type: table (with attachments)

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
water_source	nvarchar(100)	Text(50)	Source	no	NULL	no*	na	Source of the imported water. This can be modified to be a domain if values are identified. nonclustered index

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
water_destination	nvarchar(100)	Text(50)	Destination	yes	NULL	no*	na	Destination of the imported water. Possible examples would be recharge, treatment plant, etc. This can be modified be a domain if valid values are identified. nonclustered index
acre_ft	Integer	Long	Acre Ft	no	NULL	no	na	Acre feet of water imported

multi-column indexes/constraints:

- None

StreamGage

object type: feature class (with attachments)

geometry: point

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
gage_id	nvarchar(50)	Text(10)	Gage Name or Identifier	yes	NULL	no		nonclustered index
location_source	nvarchar(100)	Text(100)	Location Source	yes	NULL	weather_station_sources	na	nonclustered index

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
location_source_other	nvarchar(255)	Text(255)	Other Location Source	yes	NULL	no	na	Only completed if 'Other' is chosen for location_source
source_x	nvarchar(50)	Text(50)	Source X	yes	NULL	no	na	
source_y	nvarchar(50)	Text(50)	Source Y	yes	NULL	no	na	
source_datum	nvarchar(255)	Text(255)	Source Datum	yes	NULL	datums	na	nonclustered index
source_datum_other	nvarchar(255)	Text(255)	Other Source Datum	yes	NULL	no	na	Only completed if 'Other' is chosen for source_datum

multi-column indexes/constraints:

- none

streamflow

object type: table

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
gage_globalid	uniqueidentifier	Guid	Stream Gage GlobalId	no	-	(StreamGage)	na	nonclustered index; foreign key references (GlobalId) on (StreamGage))
measurement_date	datetime2	Date	Measurement Date	yes	NULL	no	na	nonclustered index
measurement_agency	nvarchar(100)	Text(100)	Measurement Agency	yes	NULL	no	na	nonclustered index
measurement_duration	double(2,2)	Double	Duration (hours)	yes	NULL	no	na	
stream_flow	double(15,2)	Double(15,2)	Stream Flow (ft ³ /s)	no	NULL	no	na	
gage_height	double(15,2)	Double(15,2)	Gage Height (ft)	yes	NULL	no	na	

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

multi-column indexes/constraints:

- none

comment

object type: table (with attachments)

geometry: none

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
GlobalId	uniqueidentifier	GlobalID	GlobalId	no	{GUIDv4}	no	na	primary key
created_by	nvarchar(100)	Text(100)	Created By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
created_at	datetime2	Date	Created At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates.
updated_by	nvarchar(100)	Text(100)	Updated By	yes	NULL	no	na	Metadata. Will be enabled for Editor Tracking.
updated_at	datetime2	Date	Updated At	no	GETUTCDATE()	no	na	Metadata. Will be enabled for Editor Tracking with UTC dates. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
deleted_by	nvarchar(100)	Text(100)	Deleted By	yes	NULL	no	na	Metadata.

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Column	SQL Server Data Type	ESRI Data Type	Alias	Nullable	Default	Domain	Validation Rule(s)	Comments
deleted_at	datetime2	Date	Deleted At	yes	NULL	no	na	Metadata. Enables soft-deleting records (i.e., if this field is not NULL then the record will be considered deleted, but will be retained for archival). Use UTC Date when populating. Not part of ESRI's built-in Editor Tracking – will be managed via application/script.
item_source_table	nvarchar(255)	Text(255)	Item Source Table	yes	NULL	no	na	nonclustered index
item_globalid	uniqueidentifier	Guid	Item Globalid	no	-	no	na	nonclustered index
comment_date	datetime2	Date	Comment Date	yes	NULL	no	na	nonclustered index
commentor	nvarchar(100)	Text(100)	Commentor	yes	NULL	no	na	nonclustered index
comment	nvarchar(max)	Text(1073741822)	Comment	yes	NULL	no	na	

multi-column indexes/constraints:

- [item_source_table, item_globalid]
- [item_source_table, item_globalid, comment_date]
- [item_source_table, item_globalid, commentor]
- [item_source_table, item_globalid, comment_date, commentor]
- [item_globalid, comment_date]
- [item_globalid, commentor]
- [item_globalid, comment_date, commentor]
- [comment_date, commentor]

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Domains

Domain Name	Items
wells	Populated via recurring job to mirror Well features: Key = Well.GlobalId Description = Well.local_well_id
well_statuses	Active Inactive Destroyed Unknown Other
well_current_uses	Observation Industrial Irrigation Public Supply Residential Stockwatering Unknown Other
well_sources	CASGEM DDW DWR USGS Dudek Unknown Other
well_source_accuracies	1 ft. 10 ft. 30 ft. 75 ft. 150 ft. Unknown Other

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Domain Name	Items
well_elevation_accuracies	0.1 ft. 2.5 ft. 5 ft. 10 ft. 20 ft. 50 ft. > 50 ft. Unknown Other
well_elevation_sources	USGS quad GPS GPS WAAS Surveyed to a benchmark Digital Elevation Model Google Earth Unknown Other
measurement_methods	Electric sounder measurement Steel tape Measurement Acoustic or sonic Sounder Airline measurement, pressure gage, or manometer Electric pressure transducer Observed Unknown Other
water_level_nm_codes	Measurement Discontinued Pumping Pump house locked Tape hung up Can't get tape in casing Unable to locate well Well has been destroyed Special/Other Casing leaking or wet Temporarily inaccessible Dry well Flowing artesian well Unknown

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Domain Name	Items
water_level_qm_codes	<ul style="list-style-type: none"> Caved or deepened Pumping Nearby pump operating Casing leaking or wet Pumped recently Air or pressure gauge measurement Recharge or surface water effects near well Oil or foreign substance in casing Acoustical sounder measurement Recently flowing Flowing artesian well Nearby flowing Nearby recently flowing Unknown Other
water_level_measurement_accuracies	<ul style="list-style-type: none"> 0.1 ft. 0.01 ft. 0.001 ft. 1 ft. Unknown Other
water_level_measuring_agencies	<ul style="list-style-type: none"> Montecito Water District County of Santa Barbara California Department of Water Resources U.S. Geological Survey Dudek Unknown Other
water_level_measurement_sources	<ul style="list-style-type: none"> Reported by another government agency From driller's log or report Reported by person other than the owner, driller, or another government agency Reported by owner of well Measured by personnel of reporting agency Unknown Other
water_level_measurement_frequencies	<ul style="list-style-type: none"> N/A Biannual Quarterly Monthly Transducer Setting (specify time in remarks, e.g., 15 minutes) Custom

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Domain Name	Items
weather_stations	Populated via recurring job to mirror WeatherStation features: Key = WeatherStation.GlobalId Description = (WeatherStation.cimis_station_num) WeatherStation.description
samples	Populated via recurring job to mirror sample records: Key = sample.GlobalId Description = sample.sample_id
analytes	Populated via recurring job to mirror analyte records: Key = analyte.GlobalId Description = analyte.name
lab_methods	Populated via recurring job to mirror lab_method records: Key = lab_method.GlobalId Description = lab_method.name
datums	... add list of datums Other Unknown Key = WKID Description = full datum name
vertical_datums	NAVD88 ... add list of vertical datums Other Unknown Key = WKID Description = full datum name
casing_materials	Concrete Steel ABS PVC Other
const_types	Single Clustered Nested Other
aquifer_zones	Upper Middle Lower
subbasins	... add list of subbasins if applicable

Exhibit 3. Geodatabase Object Specification Sheet

Yucaipa Basin (v0.5.0, rev 2019-07-30)

Domain Name	Items
weather_station_sources	NOAA Citizen Weather Observer Program (CWOP) Weather Underground University/Academic Private Unknown Other
weather_station_source_accuracies	1 ft. 10 ft. 30 ft. 75 ft. 150 ft. Unknown Other
well_programs	Groundwater Elevation Monitoring Groundwater Quality Monitoring Groundwater Modeling

Data Management System (DMS) Historical Data Collection and Review

