EASTERN TULE GSA

TRI-COUNTY WATER AUTHORITY GSA

PIXLEY IRRIGATION DISTRICT GSA

LOWER TULE RIVER IRRIGATION DISTRICT GSA

DELANO-EARLIMART IRRIGATION DISTRICT GSA

ALPAUGH GSA

TULARE COUNTY GSA

TULE SUBBASIN COORDINATION AGREEMENT

1/6/2020

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LIST OF ACRONYMS AND DEFINITIONS

"GSA"- Groundwater Sustainability Agency

"GSP" - Groundwater Sustainability Plan

"Coordination Agreement"

"DWR" - California Department of Water Resources

"Tule Subbasin" or "Tule Basin" - Bulletin 118 Groundwater Basin Number 5-22.13

"Tule Subbasin TAC" - Tule Subbasin Technical Advisory Committee

ACOE - United States Army Corps of Engineers

Alpaugh GSA – Alpaugh Irrigation District Groundwater Sustainability Agency

AWWA – American Water Works Association

BMP – Best Management Practices

CASGEM – California Statewide Groundwater Elevation Monitoring

DCTRA – Deer Creek Tule River Authority

DEID GSA – Delano-Earlimart Irrigation District Groundwater Sustainability Agency

ET - Evapotranspiration

ETGSA – Eastern Tule Groundwater Sustainability Agency

GIS – Geographic Information System

LTGSA – Lower Tule River Irrigation District Groundwater Sustainability Agency

LTRID – Lower Tule River Irrigation District

PIXID GSA – Pixley Irrigation District Groundwater Sustainability Agency

RWQCB – Regional Water Quality Control Board

QA/QC – Quality Assurance/Quality Control

SGMA – Sustainable Groundwater Management Act

TCWA GSA – Tri-County Water Authority Groundwater Sustainability Agency

TRA – Tule River Association

USBR – United State Bureau of Reclamation

USGS – United States Geological Survey

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I. INTRODUCTION

1.1 General (§357.4(a))

Pursuant to 23 Cal. Code Regs. §357.4(a), the GSAs hereby enter into this Coordination Agreement. The Tule Subbasin identified by DWR as No. 5-22-13 of the Tulare Lake Hydrologic Region, **Figure 1-1**, is currently composed of seven GSAs. Each GSA within the Tule Subbasin has previously submitted notice to the Department of its intent to implement and develop its own GSP pursuant to 23 CCR §353.6. As a result, a Coordination Agreement is necessary as multiple GSAs within the Tule Subbasin are developing and implementing independent GSPs. The purpose of this Coordination Agreement is to fulfill all statutory and regulatory requirements related to Intra-basin coordination agreements pursuant to the Sustainable Groundwater Management Act ("SGMA").

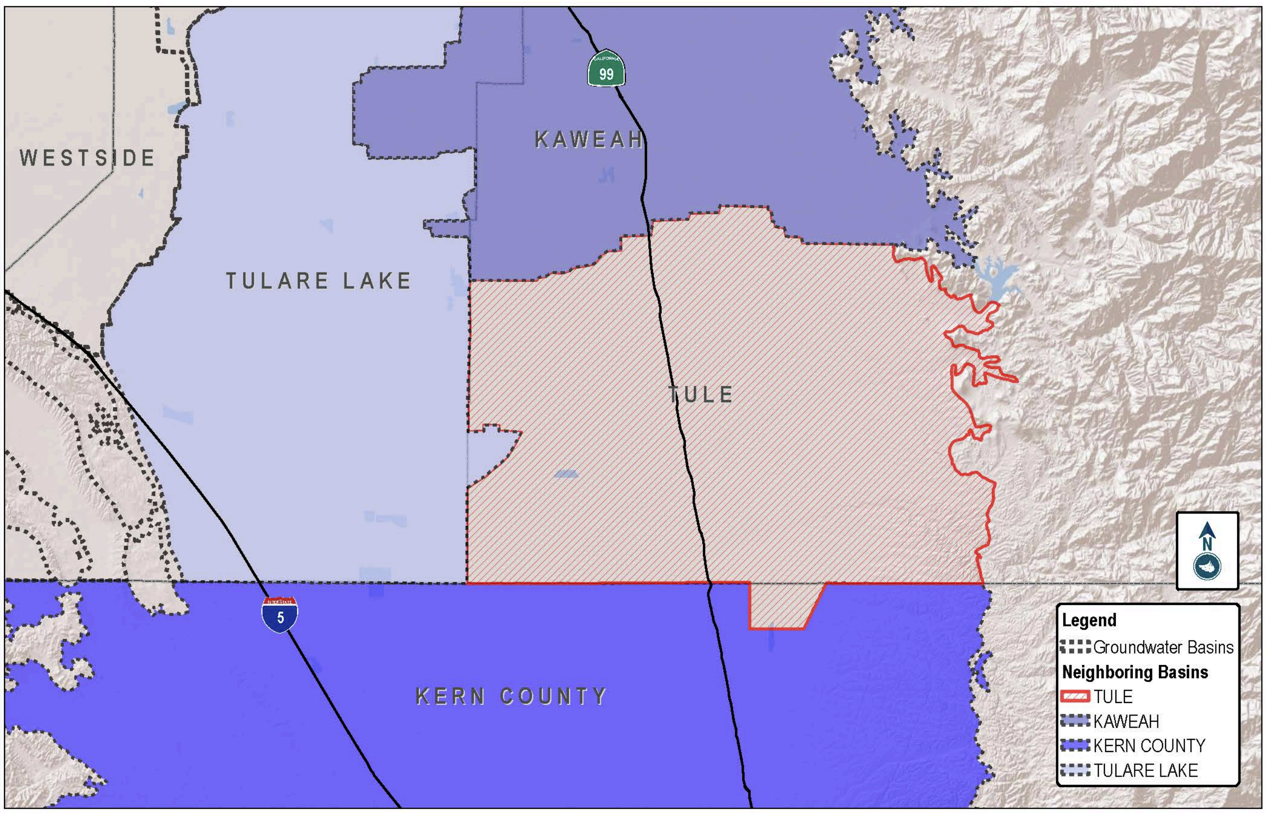

FIGURE 1-1: TULE SUBBASIN

1.2 Parties

The Parties to this Coordination Agreement are the seven (7) exclusive GSAs within the Tule Subbasin identified as follows:

1. Eastern Tule Groundwater Sustainability Agency ("ETGSA"),
2. Tri-County Water Authority Groundwater Sustainability Agency ("TCWA GSA"),
3. Pixley Irrigation District Groundwater Sustainability Agency ("PIXID GSA"),

4. Lower Tule River Irrigation District Groundwater Sustainability Agency ("LTGSA"),
5. Delano-Earlimart Irrigation District Groundwater Sustainability Agency ("DEID GSA"), and
6. Alpaugh Groundwater Sustainability Agency ("Alpaugh GSA")
7. Tulare County Groundwater Sustainability Agency ("Tulare County GSA")

It should be noted the Tulare County GSA has entered into MOUs concerning coverage of territories under adjacent GSPs and although there are seven GSAs there will be six GSPs covering the Tule Subbasin. Hereinafter the foregoing is collectively referred to as "Parties" or "Tule Subbasin GSAs" or individually as "Party", **Figure 1-2**. Collectively, the Parties' jurisdictional areas cover the Tulare Lake Hydrologic Region San Joaquin Valley Groundwater Basin, Tule Subbasin, a groundwater subbasin recognized by DWR as described in Groundwater Bulletin 118 and also identified as Groundwater Basin Number 5-22.13.

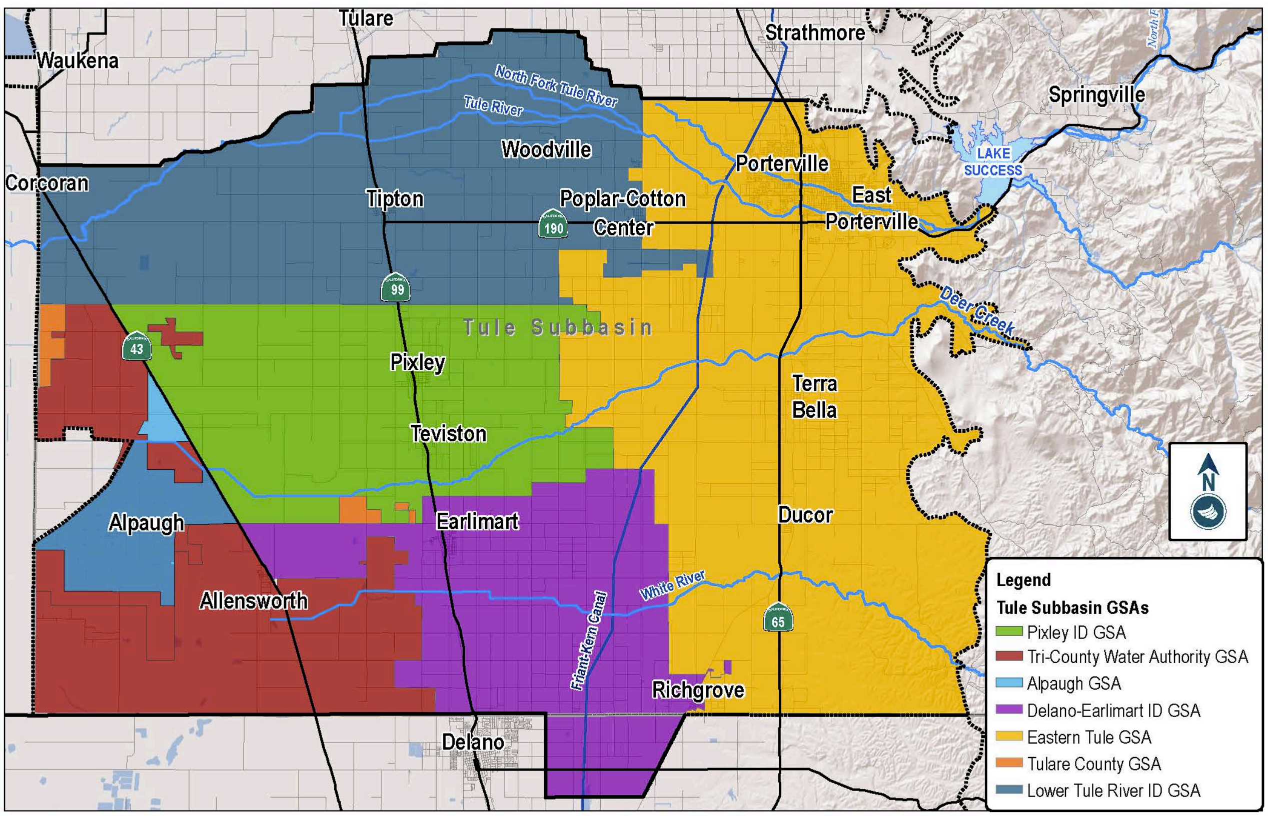

FIGURE 1-2: TULE SUBBASIN GROUNDWATER SUSTAINABILITY AGENCIES

1.3 Plan Manager (§§357.4(b)(1), 351(z))

Pursuant to 23 Cal. Code Regs. §357.4(b) and §351(z), the Plan Manager or point of contact with DWR, who is responsible for reviewing this Agreement and the GSPs prepared by each respective GSA and delegated the authority under this Agreement to submit information on behalf of the GSAs within the Tule Subbasin to DWR, shall be the selected chairperson of the Tule

Subbasin Technical Advisory Committee (TAC), which consists of representatives from each Party. Currently, the Chairperson of the Tule Subbasin TAC is:

David De Groot, Principal Engineer
324 S. Sante Fe, Suite A
Visalia, CA 93292
559-802-3052
davidd@4-creeks.com

The Parties agree that no GSP shall be submitted by the Plan Manager without the prior authority to do so being granted by the respective GSA that prepared that GSP.

1.4 <u>Process for submitting all Plans, Plan amendments, supporting information, monitoring data, annual reports and periodic evaluations.</u> <u>(§357.4(d).)</u>

Pursuant to 23 Cal. Code Regs. §357.4(d), this section describes the process for submitting GSPs, plan amendments, supporting information, monitoring data, and other pertinent information, along with annual reports and periodic evaluations to DWR. Each GSA shall provide to the Chairperson of the Tule Subbasin TAC the approved GSP, any subsequent GSP amendments and supporting information for submittal to the DWR. All GSAs within the Tule Subbasin shall endeavor to complete all GSP requirements in a timely manner.

The Plan Manager shall be responsible for submitting all required information to DWR in compliance with SGMA and 23 Cal. Code Regs. §353.4. No information shall be submitted by the Plan Manager without the prior written authorization of each responsible GSA.

1.4.1 <u>Groundwater Sustainability Plans, Plan Amendments, and Supporting Information (§355.2, §355.10)</u>

The Parties agree that each GSA shall prepare and submit its respective GSP and supporting information to the Tule Subbasin TAC so each GSP can be reviewed by the other GSAs in the Subbasin prior to the GSPs being submitted to the DWR. The Parties shall notify the other GSAs of future amendments and updates to their respective GSPs. The Parties agree that they endeavor to provide each other with as much notice of such amendments and updates as practically possible, but that the baseline, minimum noticing requirements will be what the SGMA Regulations require for public notice. Any plan amendments shall also be circulated to the other GSAs for review and submitted to the Plan Manager for submittal to DWR.

1.4.2 <u>Monitoring Data (§354.40)</u>

Basin-wide monitoring data will be collected in accordance with the Tule Subbasin Monitoring Plan, provided in this Coordination Agreement as **Attachment 1**, and reported to the Tule Subbasin TAC as part of the annual reports described below in compliance with 23 Cal. Code Regs. § 354.40.

If an individual GSA has identified monitoring features for use in collecting data specific to its GSA, and the features are not included in the Subbasin Monitoring Plan of this Coordination

Agreement, then the GSA can incorporate the features and data into its GSP upon confirmation that the monitoring features meet the minimum criteria specified in the Monitoring Plan.

1.4.3 Annual Reports (§356.2)

Pursuant to 23 Cal. Code Regs. § 356.2, annual reports are required to be submitted to DWR by April 1 of each year following the adoption by the GSA of the GSP. Each GSA shall submit annually to the Plan Manager a report to meet these requirements, who will in turn submit the reports to DWR on behalf of the Tule Subbasin. The Tule Subbasin TAC may develop a standardized template for these reports and use by each respective GSA. The annual report shall be separated between a subbasin-wide section and individual GSA specific sections that will be prepared by each respective GSA, but reviewed by the Tule Subbasin TAC prior to submission to DWR for review. The report shall contain the information described below.

- General information summarizing the contents of the report and a map depicting the subbasin.
- Groundwater elevation data from monitoring wells
    - Groundwater elevation contour maps
    - Hydrographs of groundwater elevations and water year type
- Groundwater extraction from preceding water year
- Surface water supply used or available for use for groundwater recharge or in-lieu use
- Total water use
- Changes in groundwater storage
    - Change in groundwater storage maps
    - Graph depicting water year type, groundwater use, annual change in groundwater storage, and cumulative change in groundwater in storage for the basin

In addition, each GSA shall provide a description of the progress towards implementing its respective GSP. The description shall include progress with respect to interim milestones, implementation of projects, and any management actions implemented since the prior annual report.

1.4.4 Periodic Evaluations (§356.4)

Pursuant to 23 Cal. Code Regs. §356.4, periodic evaluations by each GSA are required at least every five years and whenever a GSP is amended. These evaluations shall be provided to DWR.

Each individual GSA shall prepare the required periodic evaluation, in consultation with the Tule Subbasin TAC where subbasin-wide information is required. The evaluations shall be delivered to the Plan Manager for submission to DWR and subject to review by the other subbasin GSAs.

The periodic evaluations shall include all the requirements found in Section 356.4 of SGMA Regulations, including but not limited to the following:

- Groundwater conditions relative to measurable objectives, interim milestones, and minimum thresholds
- Description of project or management action implementations
- GSP elements that are being requested for reconsideration or proposed revision, if any
- Evaluation of the basin setting in light of new information or changes in water use
- Description of the monitoring network as described in **Attachment 1** including:
    - Assessment of monitoring network function
    - Identification of data gaps and program resolving such gaps
    - Plans to install new data collection facilities
    - Adjustments to Monitoring Network
- Description of significant information that has been made available since GSP adoption, amendment, or prior periodic evaluation and if changes to GSP elements are needed
- Description of actions taken by GSA related to GSP
- Enforcement activities, if any, by the GSA
- GSP amendments that have been completed or proposed
- Summary of coordination between GSAs
- Other relevant information

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II. BASIN SETTING (§§354.12-354.20)

Pursuant to 23 Cal. Code Regs. §354.12-354.20, the basin setting components are attached hereto and incorporated by reference as **Attachment 2** and summarized below.

2.1 Physical Setting

The Tule Subbasin is located in the southern portion of the San Joaquin Valley Groundwater Basin in the Central Valley of California. The lateral boundaries of the Tule Subbasin include both natural and political boundaries. The eastern boundary of the Tule Subbasin is defined by the surface contact between crystalline rocks of the Sierra Nevada and surficial alluvial sediments that make up the groundwater basin. The northern boundary is defined by the Lower Tule River Irrigation District (LTRID) and Porterville Irrigation District boundaries. The western boundary is defined by the Tulare County/Kings County boundary, except for a portion of the Tulare Lake Basin Water Storage District that extends east across the county boundary and is excluded from the subbasin. The southern boundary is defined by the Tulare County/Kern County boundary except for the portion of the Delano-Earlimart Irrigation District (DEID) that extends south of the county boundary and is included in the subbasin.

The area of the Tule Subbasin is defined by the latest version of DWR Bulletin 118 and is approximately 744 square miles (475,895 acres). The subbasin has been divided into seven individual GSAs: ETGSA, LTGSA, PIXID GSA, DEID GSA, Alpaugh GSA, TCWA GSA, and the Tulare County GSA. Communities within the subbasin include Allensworth, Alpaugh, Porterville, Tipton, Pixley, Earlimart, Richgrove, Ducor and Terra Bella. Neighboring DWR Bulletin 118 subbasins include the Kern County Subbasin to the south, the Tulare Lake Subbasin to the west, and the Kaweah Subbasin to the north.

2.2 Hydrogeologic Conceptual Model §354.14

The hydrogeologic conceptual model of the Tule Subbasin, as described in **Attachment 2**, has been developed in accordance with the requirements of California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 2 (§354.14) and in consideration of DWR Best Management Practices (BMPs) for the preparation of hydrogeologic conceptual models. The hydrogeologic conceptual model forms the basis for the numerical groundwater flow model of the subbasin.

2.3 Groundwater Conditions §354.16.

Two primary aquifers have been identified within the Tule Subbasin: an upper unconfined to semi-confined aquifer and a lower semi-confined to confined aquifer. The upper and lower aquifers are separated by the Corcoran Clay confining unit in the western portion of the subbasin. Groundwater within the southeastern portion of the subbasin is also produced from the Santa Margarita Formation, which is located stratigraphically below the lower aquifer.

In general, groundwater in the Tule Subbasin flows from areas of natural recharge along major streams at the base of the Sierra Nevada Mountains on the eastern boundary towards a groundwater pumping depression in the western-central portion of the subbasin. Groundwater level changes observed in wells completed in the upper aquifer show a persistent downward trend between approximately 1987 and 2017, despite a relatively wet hydrologic period between 1991 and 1999 and other intervening wet years (2005 and 2011). Groundwater level trends in wells perforated exclusively in the lower aquifer vary depending on location in the subbasin. In the northwestern part of the subbasin, lower aquifer groundwater levels have shown a persistent downward trend from 1987 to 2017. In the southern part of the subbasin, groundwater levels were relatively stable between 1987 and 2007, but began declining after 2007.

Changes in groundwater storage within the Tule Subbasin have been estimated through analysis of the water budget. Comparison of the groundwater inflow elements of the water budget with the outflow elements shows a cumulative change in groundwater storage over the 31-year period between 1986/87 and 2016/17 of approximately -4,948,000 acre-ft. The average annual change in storage resulting from the groundwater budget is approximately -160,000 acre-ft/yr.

Seawater intrusion cannot occur in the Tule Subbasin due to its location with respect to the Pacific Ocean.

Groundwater quality in the Tule Subbasin is generally very good and does not prevent the beneficial use of the water in most places. The primary exception is perched and upper aquifer groundwater in the southwest portion of the subbasin, where the beneficial use designation has been removed by the State Water Resources Control Board. The primary groundwater quality issues that could affect the beneficial uses of groundwater in the future are nitrate and pesticides. Point sources of contamination have been identified in some parts of the subbasin, but they are highly localized problems.

Land surface subsidence resulting from lowering the groundwater level from groundwater production has been well documented in the Tule Subbasin. Since 1987, the highest rates of land subsidence have occurred in the northwestern portion of the subbasin and in the vicinity of the Friant-Kern Canal near Terra Bella.

Groundwater dependent ecosystems require shallow groundwater or groundwater that discharges at the land surface. Throughout the Tule Subbasin, the depth to groundwater is well below the level required to support riparian vegetation (vegetation that draws water directly from groundwater) or near surface ecosystems, except some areas along the Tule River, east of Porterville.

2.4 <u>Water Budget §354.18.</u>

A detailed surface water and groundwater budget has been developed for the Tule Subbasin for the 31-year period from 1986/87 to 2016/17. The surface water budget includes the following inflow and outflow terms:

<u>Surface Water Inflow</u>

- Precipitation
- Stream inflow
- Imported water

- Discharge to the land surface from wells

Surface Water Outflow

- Infiltration of precipitation
- Evapotranspiration of precipitation from native vegetation and crops
- Stream infiltration
- Canal losses
- Recharge in basins
- Deep percolation of applied water
- Crop consumptive use

The groundwater budget describes the sources and estimates the volumes of groundwater inflow and outflow within the Tule Subbasin. The groundwater budget includes the following inflow and outflow terms:

Groundwater Inflow

- Areal recharge from precipitation
- Recharge in stream/river channels
- Managed recharge in basins
- Canal losses
- Deep percolation of applied water
- Release of water from compression of aquitards
- Subsurface inflow

Groundwater Outflow

- Groundwater pumping
- Evapotranspiration
- Subsurface outflow

A fundamental premise of the groundwater budget is the following relationship:

Inflow – Outflow = +/- ΔS

The difference between the sum of groundwater inflow terms and the sum of groundwater outflow terms is the change in groundwater storage (ΔS). The cumulative change in groundwater storage over the 31-year period between 1986/87 and 2016/17 in the Tule Subbasin was approximately -4,948,000 acre-ft. The average annual change in storage resulting from the groundwater budget is approximately -160,000 acre-ft/yr.

In the Tule Subbasin, sources of groundwater recharge (i.e. inflow) that are associated with pre-existing surface water rights and imported water deliveries are not used to estimate the Sustainable Yield of the subbasin.

III. COORDINATED DATA AND METHODOLOGIES (§357.4(b)(3).)

3.1 General

This section of the Coordination Agreement describes the types of data to be collected and the data collection and analysis methodologies to be utilized to satisfy requirements for the preparation of GSPs and annual reports.

Pursuant to Water Code Section 10727.6, GSAs intending to develop and implement multiple GSPs are required to coordinate with other agencies preparing a GSP within the basin to ensure that the various GSPs utilize the same data and methodologies for the following assumptions in developing the GSP:

a) Groundwater elevation data;
b) Groundwater extraction data;
c) Surface water supply;
d) Total water use;
e) Change in groundwater storage;
f) Water budget; and
g) Sustainable yield.

3.2 Groundwater Elevation (§357.4(b)(3)(A))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(A), the following describes how the GSAs have used the same data and methodologies for groundwater elevation, which is supported by the quality, frequency and spatial data in the monitoring network and monitoring objectives. Groundwater elevation data to be relied on for the purpose of determining minimum thresholds, estimating change in groundwater storage as required for annual reports, and measuring progress towards achieving sustainability will be collected from the minimum monitoring well network identified in the Tule Subbasin Monitoring Plan (see **Attachment 1**).

The Tule Subbasin shall use the following data and methods to measure or estimate groundwater elevations:

3.2.1 Data and Monitoring Protocols

Groundwater elevation data to be relied on for the purpose of determining minimum thresholds, estimating change in groundwater storage as required for annual reports, and measuring progress towards achieving sustainability will be collected from the minimum monitoring well network. Groundwater elevation monitoring protocols and measurement frequencies are described in detail in the Tule Subbasin Monitoring Plan (**Attachment 1**).

The monitoring well network for collection of groundwater elevation data may consist of a combination of existing wells and new dedicated monitoring wells. In order to be included in the well network for collecting groundwater elevation data, each monitoring well must meet the following minimum criteria:

3.2.1.1 *<u>Existing Wells</u>*

Preference will be given where feasible to existing wells that are not actively pumped as they provide the most representative static groundwater level data. Monitoring of groundwater levels in existing wells that are actively pumped must be conducted in accordance with the monitoring procedures specified in the Tule Subbasin Monitoring Plan (**Attachment 1**).

The location (i.e. X-Y Coordinates) of existing wells to be included in the monitoring well network must be surveyed to the nearest 1 foot (NAD83) by a California licensed land surveyor. The elevation of the reference point (i.e. the Z Coordinate) shall be surveyed to an accuracy of 0.1 foot relative to mean sea level (NAVD88) by a California licensed land surveyor.

The construction of each existing well must be documented and confirmed to the satisfaction of the Tule Subbasin TAC's technical consultant. Construction information shall include:

- The total well depth,
- The perforation interval(s),
- The casing diameter,
- Depth intervals of all seals,
- Pump setting (if applicable).

If these data are not known or cannot be confirmed, the well must be investigated in the field to be considered for inclusion in the monitoring well network. Any field investigation must be conducted with the consent of the landowner and/or well owner. All field verification of the wells will be collected utilizing professional staff that are trained and experienced in the use of the equipment used to measure well depth and inspect wells, and who meet the minimum qualifications and training requirements required by the Tule Subbasin TAC technical consultant. Field verification of the wells identified in the Tule Subbasin Monitoring Plan will be conducted by a technical consultant of the Tule Subbasin TAC. A GSA may hire and use its own technical consultant, who meets minimum qualifications and training requirements required by the Tule Subbasin TAC consultant, to collect data from wells within its GSA's boundaries, that a GSA may choose to monitor in addition to the wells identified in the Tule Subbasin Monitoring Plan. Each GSA shall be provided notice of when the Tule Subbasin TAC consultant will be conducting field verification or measurements and a GSA may have its consultant quality control check the Tule Subbasin TAC's consultant's work. Furthermore, nothing in this Agreement prevents multiple GSAs from using the same consultant to conduct field verification.

Field verification will consist of obtaining a downhole video log of the full length of blank and perforated well casing. If the well is equipped with a pump, the pump shall be removed prior to obtaining the downhole video log. The video camera equipment shall be equipped with side-scan capability in order to view the condition and depth of well perforations. Existing wells for which adequate documentation is not available, as determined by the Tule Subbasin TAC's technical consultant, will not be included in the groundwater level monitoring network. Further, wells for which the owner does not provide access, does not voluntarily remove the pump for investigating the well, or does not otherwise provide consent to investigate the well will not be included in the groundwater level monitoring network.

An established and acceptable sounding access tube or port shall be available for the purpose of measuring groundwater levels. Sounding tubes that are separate and outside the main well casing (i.e. enter the well casing from the outside at depth) will be preferred. Sounding tubes located within the main well casing are acceptable if they extend past the pump intake depth. The sounding tube shall be free and clear and allow for collection of representative groundwater level measurements without the risk of damaging the sounder.

Only wells perforated exclusively in either the upper aquifer (as defined in **Attachment 1**) or lower aquifer (as defined in **Attachment 1**) will be included in the monitoring well network. Wells constructed with perforations across multiple aquifers in a single casing string (i.e. "composite wells") will not be included in the monitoring network for measuring groundwater elevations unless authorized by the Tule Subbasin TAC.

Groundwater elevation data has historically been obtained via monitoring programs conducted under other local State and Federal programs such as the Regional Water Quality Control Board (RWQCB) General Order for Dairies, California Statewide Groundwater Elevation Monitoring (CASGEM) program, Bureau of Reclamation, and others. Existing wells that have been monitored as part of these programs will be considered for the Tule Subbasin monitoring network as long as they meet the criteria specified in this section.

3.2.1.2 *New Wells*

New monitoring wells will either be constructed in the upper aquifer, lower aquifer, or Santa Margarita Formation aquifer (as defined in **Attachment 1**). New wells shall not be constructed as composite wells. The exact depth and perforation intervals of these wells will be determined from site-specific data collected during the drilling of the boreholes for the wells.

New monitoring wells will be constructed with minimum 4-inch diameter casing in order to allow for collection of groundwater samples.

Each new monitoring well will be constructed with a steel above-ground riser equipped with a protective locking cap for keeping the wellhead secure. The above-ground riser will be surrounded by cement-filled steel bollards for further protection.

A dedicated reference point shall be established and marked on the top of the monitoring well casing. All groundwater level measurements shall be obtained relative to the reference point. The elevation of the reference point shall be surveyed to an accuracy of 0.1 foot relative to mean sea level (NAVD88) by a California licensed land surveyor.

3.2.2 Quality Assurance/Quality Control

All groundwater elevation data will be collected utilizing professional staff that are trained and experienced in the use of the monitoring equipment and who meet the minimum qualifications and training requirements required by the Tule Subbasin TAC technical consultant. All data collection required for the Tule Subbasin Monitoring Plan ("Baseline Monitoring") will be performed either by the Tule Subbasin TAC technical consultant or a consultant hired direct by the GSA. If the GSA utilizes the Tule Subbasin TAC technical consultant, each GSA shall be notified in advance of when such data collection will occur within that respective GSA's boundaries and each GSA may hire its own consultant for quality control and peer review the work of the Tule Subbasin TAC technical consultant. If the GSA hires and uses its own consultant, who meets the same minimum qualifications and training requirements required by the Tule Subbasin TAC consultant, to collect data for monitoring features within its GSA's boundaries, all data shall be submitted per the data management requirements and schedule. Furthermore, nothing in this Agreement prevents multiple GSAs from using the same consultant to collect such data. General and basin-wide data will be collected by and/or provided to the Tule Subbasin TAC's consultant in accordance with the protocols specified in the Tule Subbasin Monitoring Plan (**Attachment 1**). The goal of the GSAs is to maintain the integrity of the data by following the above described procedures for collection of Baseline Monitoring data and additional data within each GSA that will provide additional information for the benefit of the Subbasin.

By December 1 following a water year, all groundwater elevation data produced by the GSAs shall be submitted to the Tule Subbasin TAC's technical consultant for input into the Tule Subbasin Water Management Database (**Attachment 1**). All groundwater elevation data shall be subject to Quality Assurance/Quality Control (QA/QC) checks by the Tule Subbasin TAC's technical consultant. QA/QC may include (but not necessarily be limited to):

- Verification of reference point survey data
- Verification of groundwater level measurement methodology
- Review of calculations to convert groundwater depth to groundwater elevation
- Comparison of data with previous measurements to identify outliers

Data from wells that have not been included in the Tule Subbasin Monitoring Plan or do not follow the above-described procedures, shall not be relied on for making basin management decisions and shall not be used in the analyses necessary for completion of GSPs or annual reports. No wells will be added or removed from the groundwater elevation network without the prior approval of the Tule Subbasin TAC. All monitoring wells to be added to the monitoring network shall meet the criteria specified in this section. Upon such time as wells are added or removed from the monitoring network, the Tule Subbasin Monitoring Plan (**Attachment 1**) will be revised to reflect the changes.

Individual GSAs may include additional monitoring features, not specifically identified in the Tule Subbasin Monitoring Plan, for collecting data to include in their respective GSPs and annual reports. Tule Subbasin GSAs may collect more GSA-specific data utilizing the same methodologies and may supply applicable information to the Tule Subbasin TAC's technical consultant for the benefit of basin-wide information. The technical consultant will compile the groundwater elevation data into a relational database to be maintained by the consultant in accordance with **Attachment 1**.

3.3 Groundwater Extraction (§357.4(b)(3)(B))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(B), this section outlines the approved methodologies for measuring or estimating groundwater extraction in the Tule Subbasin. The

GSAs shall use either satellite remote sensing technology or metered wells to estimate groundwater extraction as described below:

3.3.1 Data and Monitoring Protocols

3.3.1.1 *Groundwater Extraction Estimated from Satellite Data*

In this method, groundwater extraction is estimated as a function of the total agricultural water demand, surface water deliveries, and precipitation. This method is specific to agricultural groundwater extraction (as opposed to municipal groundwater extraction). The total agricultural water demand (i.e. applied water demand) is estimated as follows:

$$W_d = \frac{A_i \; x \; ET}{I_{eff}}$$

Where:

W_d = Total Agricultural Water Demand (acre-ft)
A_i = Irrigated Area (acres)
ET = Evapotranspiration (acre-ft/acre)
I_{eff} = Irrigation Efficiency (unitless)

Crop evapotranspiration (ET) is estimated using remote sensing data from LandSAT satellites. The satellite data is entered into a model, which is used to estimate the ET rate and ET spatial distribution of an area in any given time period. When appropriately calibrated to land-based ET and/or climate stations and validated with crop surveys, the satellite-based model provides an estimate of crop ET (i.e. consumptive use). The satellite-based model is representative, verifiable, and can be accomplished uniformly across the Tule Subbasin by an independent third party. The Tule Subbasin TAC will provide this data for all GSAs.

Irrigation efficiency (I_{eff}) is estimated for any given area based on the irrigation method for that area (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.). Irrigation methods are tied to crop types based on either DWR land use maps or field surveys. The following irrigation efficiencies will be applied to the different irrigation methods based on California Energy Commission (2006):

- Border Strip Irrigation – 77.5 percent
- Micro Sprinkler – 87.5 percent
- Surface Drip Irrigation – 87.5 percent
- Furrow Irrigation – 67.5 percent

Agricultural groundwater extraction is estimated as the total applied water demand (W_d) minus surface water deliveries and effective precipitation. Effective precipitation is the portion of precipitation that becomes evapotranspiration.

3.3.1.2 *Groundwater Extraction Measured Using Flow Meters*

For this method, groundwater extraction is measured using a totalizing flowmeter. The GSAs agree that for metering to be effective, any well in a GSA that chooses this method and pumps over 70 gallons per minute, or an annual total of two (2) acre-ft per year, shall be metered. The GSAs also agree that as a Subbasin-wide standard, meters installed shall be calibrated, certified, and periodically tested following the guidance of American Water Works Association (AWWA) Standard M6 – Water Meters, Selection, Installation, Testing and Maintenance (AWWA, 2012) and the AWWA standards referenced therein for the types of inline meters employed (AWWA C700 series standards). Copies of all meter calibration and testing reports shall be submitted to the Tule Subbasin TAC's technical consultant for review and documentation.

3.3.2 Quality Assurance/Quality Control

By January 1 following a water year, all groundwater extraction data produced by the GSAs shall be submitted to the Tule Subbasin TAC's technical consultant for input into Tule Subbasin Water Management Database (see Section 4.3).

All groundwater extraction data will be subject to QA/QC checks and verification by the Tule Subbasin TAC's technical consultant. QA/QC could include (but not necessarily be limited to):

- Field inspection and verification of inline flow meters.
- Review of flow meter calibration and testing reports.
- Review of groundwater extraction estimates using satellite data.

3.4 Surface Water Supply (§357.4(3)(b)(B))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(B), the GSAs agree the total surface water supply to the Tule Subbasin will be the sum of supplies from stream inflow, imported water, and delivered recycled water. Surface water supplies will be compiled annually by the Tule Subbasin TAC consultant from the following sources:

- Tule River inflow to the Subbasin – Tule River Association (TRA) Annual Reports
- Tule River flow from ETGSA to LTGSA – TRA Annual Reports
- Deer Creek inflow to the Subbasin – United States Geological Survey (USGS) Stream Gage at Fountain Springs
- Deer Creek flow from ETGSA to PID GSA – Trenton Weir as provided by Pixley Irrigation District
- Deer Creek flow to downstream license holders in the Tule Subbasin – measured by TCWA GSA
- White River inflow to the Subbasin – Estimated by the Tule Subbasin TAC consultant based on flows measured in Deer Creek
- White River flow from ETGSA to DEID GSA – Estimated by the Tule Subbasin TAC consultant based on an analysis of infiltration or data from White River at Road 208 (from DEID or California Data Exchange Center), as available.

The Tule Subbasin shall use the following data and methods to measure or estimate surface water supply:

3.4.1 Data and Monitoring Protocols

3.4.1.1 *Stream Inflow*

3.4.1.1.1 *Tule River*

Streamflow in the Tule River is recorded as releases from the Lake Success Reservoir and reported in the TRA annual reports. Diversions from the Tule River between Lake Success and Oettle Bridge are documented in TRA annual reports and described in Section 2.6.1.1 of the Monitoring Plan.

Native Tule River water flow in the Tule River channel from the ETGSA to the LTGSA will be recorded as the flow at Rockford Station minus assumed channel losses between the Rockford Station stream gage and Oettle Bridge, as reported in TRA annual reports.

Tule River gaged flow into the LTGSA is assumed to be the sum of gaged surface water measured Below Oettle Bridge, Woods Central Ditch Diversion, Poplar Irrigation Company flow reaching LTGSA, and Porter Slough at 192, as reported in TRA annual reports. Diversions of native Tule River water in the LTGSA will be recorded using the following ratio:

$$\frac{TR_{Gaged}}{TR_{Gaged} + FK_{LTRID}} \; x \; LTRID \; deliveries = TR_{delivered}$$

Where:

TR_{Gaged}	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK_{LTRID}	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
LTRID deliveries	=	Total water deliveries to farmers in the LTRID (acre-ft).
$TR_{delivered}$	=	Assumed portion of LTRID delivered water that is native Tule River water (acre-ft).

Any residual stream flows left in the Tule River after diversions and channel loss are measured at the Turnbull Weir, located at the west end of the LTGSA and the Tule Subbasin. This stream outflow from the Subbasin will be the same as reported in TRA annual reports. Exports of Tule River water to the Friant-Kern Canal will be the same as reported in TRA annual reports.

3.4.1.1.2 *Deer Creek*

Streamflow in Deer Creek is measured by the USGS at their gaging station at Fountain Springs. Stream inflow from Deer Creek into the Tule Subbasin is recorded as the flow at the USGS Fountain Springs stream gage. It is noted that although the Fountain Springs gage is located approximately five miles upstream of the Tule Subbasin boundary, the creek flows over granitic bedrock between the gage and the alluvial basin boundary and losses along this reach are assumed to be limited to evapotranspiration. Evapotranspiration losses between the Fountain Springs gage and the Trenton Weir are assumed to be 30 acre-ft/month when the gaged flow at Fountain Springs is greater than 30 acre-ft/month. When the gaged flow at Fountain Springs is less than 30 acre-ft/month the evapotranspiration is assumed to be equal to the gaged flow.

Deer Creek stream flow from the ETGSA to the PID GSA will be recorded as the flow at Trenton Weir as reported in the Pixley Irrigation District annual water use summaries. J.G. Boswell Company and Angiola Water District hold licenses on Deer Creek and those flows will be reported by TCWA GSA.

3.4.1.1.3 *White River*

Stream inflow into the Tule Subbasin (and ETGSA) from the White River has historically been measured at the USGS stream gage near Ducor. The measured data from this station is only available from 1971 to 2005. For years with no stream flow data, it is assumed that the magnitude of flow in the White River is proportional to the magnitude of flow in Deer Creek. A linear regression analysis of monthly White River streamflow plotted against monthly Deer Creek streamflow for the period 1971 to 2005 results in a correlation coefficient of 0.91. Accordingly, monthly stream flow in the White River will be reported using the following equation from the linear regression:

$$SF_{WR} = 0.3523(SF_{DC}) - 1.1215$$

Where:

SF_{WR} = Stream flow in the White River (Acre-ft).
SF_{DC} = Stream flow in Deer Creek (Acre-ft).

This method will be used to record stream inflow from the White River until a stream gage is established in the river near the eastern subbasin boundary.

White River stream flow from the ETGSA to the DEID GSA will be estimated as the White River inflow into the Subbasin minus evapotranspiration loss and minus an assumed infiltration rate between the eastern subbasin boundary and the DEID GSA boundary. Evapotranspiration losses between the Subbasin boundary and the DEID GSA are estimated to be 14 acre-ft/month when the flow at the boundary is greater than 14 acre-ft/month and equal to the flow in the river when the flow is less than 14 acre-ft/month. Channel loss within the ETGSA is estimated as the total flow minus ET up to 1,190 acre-ft/month. If flows exceed 1,190 acre-ft/month, the balance, up to 9,000 acre-ft/month, is assumed to infiltrate within the DEID GSA. If measured flow at the USGS stream gage near Ducor or interpolated flows, based on the linear regression described above, exceed 9,000 acre-ft in any given month, the volume over 9,000 acre-ft is assumed to infiltrate within the TCWA GSA.

3.4.1.2 *Imported Water*

Imported water delivered to the various agencies within the seven GSAs of the Tule Subbasin will be reported on an annual basis by the agencies receiving deliveries.

3.4.1.3 *Recycled Water*

Recycled water consists of treated wastewater generated at the City of Porterville's Wastewater Treatment Facility and other treatment facilities within the Subbasin. Most of the water from subbasin facilities is delivered to crops in the area. In the case of the City of Porterville, the balance is allowed to infiltrate into the subsurface in recharge ponds located in the old Deer Creek channel. The volume of recycled water delivered to crops shall be measured using an in-line calibrated flow meter. Monthly water deliveries will be provided on an annual basis by the City of Porterville, community services districts, and public utility districts within the Subbasin.

3.4.2 Quality Assurance/Quality Control

The Tule Subbasin GSAs assume that the QA/QC procedures in place by the various entities acting as sources of data, including the TRA, USGS, United States Bureau of Reclamation (USBR), United States Army Corps of Engineers (ACOE), Angiola Water District, City of Porterville, and any other entity upon which the GSAs rely for monitoring surface water flowing in and out of the Subbasin, are satisfactory and will not cause any undue compromise of the data relied upon to calculate total surface water supply.

Surface water supply data will be obtained from the various sources of data by the Tule Subbasin TAC's technical consultant and entered into the Tule Subbasin Water Management Database (see Section 4.3). Surface water supply data will be made available to each GSA by February 1 following the end of a water year.

3.5 Total Water Use (§357.4(b)(3)(B))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(B), the GSAs agree the total water use, as defined herein, is based on 23 Cal. Code Regs. §356.2(b)(4), which provides: "Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements." Total water use is the total water demand, including consumptive use.

The Tule Subbasin shall use the following data and methods outlined in **Attachment 1** to measure or estimate total water use, briefly described below:

3.5.1 <u>Data and Monitoring Protocols</u>

3.5.1.1 *Agricultural Water Use*

3.5.1.1.1 *Agricultural Water Demand*

Agricultural water demand will be the sum of groundwater extractions (see Section 3.3) and surface water deliveries from stream sources, imported water, and recycled water (Sections 3.4.1.1, 3.4.1.2 and 3.4.1.3).

3.5.1.1.2 *Agricultural Consumptive Use*

Crop consumptive use will be estimated using the method described in Section 3.3.1.1.

3.5.1.2 *Municipal and Industrial Water Use*

3.5.1.2.1 *M&I Water Demand*

Municipal water demand will be the sum of metered groundwater production from the following communities:

ETGSA
1. City of Porterville
2. Community of East Porterville
3. Terra Bella Irrigation District
4. Ducor Community Services District

LTGSA
1. Tipton Public Utility District
2. Woodville Community Services District
3. Poplar Community Services District

PIXID GSA
1. Pixley Public Utility District
2. Teviston Community Services District

DEID GSA
1. Earlimart Public Utility District
2. Richgrove Community Services District

Alpaugh GSA
1. Alpaugh Community Services District

TCWA GSA
1. Allensworth Community Services District

Tulare County GSA
(None)

3.5.1.2.2 *M&I Consumptive Use*

Consumptive use of landscaping associated with applied municipal groundwater pumping will be estimated based on an assumed percentage of delivered water that is applied to landscaping and an assumed deep percolation factor. It is assumed 47 percent of municipal water use is applied to landscaping. It is assumed that 75 percent of applied water to landscaping is consumptively used by the plants.

The total municipal consumptive use for any one of the communities in the Subbasin is the sum of landscape consumptive use and evaporation of surface water in that community's wastewater treatment facility discharge basins.

3.5.2 Quality Assurance/ Quality Control

By January 1 following a water year, the total water use from each GSA shall be submitted to the Tule Subbasin TAC's technical consultant for review and input into the Tule Subbasin Water Management Database (see Section 4.3).

Total water use will be calculated by individuals from each GSA who meet the minimum qualifications and training requirements. Total water use will be checked by the Tule Subbasin TAC's technical consultant to ensure consistency with the methods described in this Coordination Agreement and to verify that the consumptive use estimates are consistent with satellite data.

3.6 Change in Groundwater Storage (§357.4(b)(3)(B))

The Tule Subbasin shall use the following data and methods to measure or estimate change in annual groundwater storage:

3.6.1 Data and Monitoring Protocols

3.6.1.1 *GIS-Based Method for Estimating Storage Change*

For any given GSA, the change in groundwater storage can be estimated using the following equation:

$V_w = S_y A \, \Delta h$

Where:

V_w	=	the volume of groundwater storage change (acre-ft).
S_y	=	specific yield of aquifer sediments (unitless).
A	=	the surface area of the aquifer within the Tule Subbasin/GSA (acres).
Δh	=	the change in hydraulic head (i.e. groundwater level) (feet).

The change in storage estimate is specific to the shallow aquifer as the groundwater level in the deep aquifer will not likely drop below the top of the aquifer. The calculations will be made using a Geographic Information System (GIS) map of the Tule Subbasin/GSA that will be discretized into 300-foot by 300-foot grids to allow for spatial representation of aquifer specific yield and groundwater level change.

The areal and vertical distribution of specific yield for the shallow aquifer will be based on the values obtained from the calibrated groundwater flow model of the Tule Subbasin.

For the areal distribution of change in hydraulic head within the Tule Subbasin/GSA, groundwater contours for the spring of the previous year will be digitized and overlain on the grid map of the Tule Subbasin/GSA in GIS. Groundwater levels will then be assigned to each grid. A contour map with groundwater elevation contours from spring of the next year will also be digitized and overlain on the grid map. Change in hydraulic head (groundwater level) at each grid will be calculated as the difference in groundwater level between the two years.

The complete GIS files of specific yield and groundwater levels will be exported into a spreadsheet program for the final analysis of groundwater storage change. The change in groundwater storage will be calculated for each grid cell by multiplying the change in groundwater level by the specific yield and then by the area of the cell.

The data from the analysis can be used to develop change in storage maps for incorporation into the annual reports.

3.6.1.2 *Groundwater Flow Model Method for Estimating Storage Change*

The calibrated groundwater flow model of the Tule Subbasin, which was originally prepared for the Tule Subbasin TAC in 2018, can be used to estimate the change in groundwater storage across the subbasin and within each GSA boundary. The calibrated groundwater surface from one year can be exported and subtracted from the exported calibrated groundwater surface from a subsequent year. The difference in groundwater levels is multiplied by the specific yield distribution of the shallow aquifer in the model to obtain an estimate of the change in groundwater storage across the subbasin.

In order to develop updated change in storage values for the annual reports, the model will be updated on a regular basis. The update will include incorporation of the previous year’s groundwater extractions, recharge values, and groundwater levels. The model calibration will be validated with the measured data and adjusted as needed. Once the updated model is validated, it can be used to estimate changes in groundwater storage both across the Subbasin and within each GSA. The GSAs acknowledge that the more measured data that is available for incorporation into the model, the better the model results will be. The GSAs further acknowledge that they have used the best available information up to this point, but that they will continue to evaluate and gather additional information through the Monitoring Plan.

The model output will be used to develop maps showing the changes in groundwater storage, for incorporation into annual reports.

3.6.2 Quality Control and Assurance

All change in groundwater storage estimates will be conducted by professionals trained and experienced in the use of the groundwater flow model and hydrological calculations. All work shall be conducted under the direct supervision of a California registered Professional Civil Engineer, Professional Geologist, or Certified Hydrogeologist.

3.7 Water Budget (§357.4(b)(3)(B))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(B), the GSAs agree to use the following data and methods to measure or estimate a water budget, for both the Subbasin and individual GSAs:

3.7.1 Data and Monitoring Protocols

The water budget methodologies described herein have been developed based on the best available data and procedures at the time of publication. The methodologies shall be reviewed and updated periodically as new monitoring features, data, and technical advances are available.

3.7.2 Surface Water Budget

Surface water budgets describe all of the sources and volumes of surface water inflow and outflow to/from the subbasin. Inflow terms for the surface water budget of the Tule Subbasin will include:

1. Precipitation.
2. Stream inflow.
3. Imported water.
4. Discharge to the land surface from wells.

Surface water outflow terms will include:

1. Infiltration of precipitation.
2. Evapotranspiration of precipitation from native vegetation and crops.
3. Stream infiltration.
4. Infiltration in canals.
5. Recharge in basins.
6. Deep percolation.
7. Consumptive use.
8. Stream outflow.

3.7.2.1 *Surface Water Inflow*

3.7.2.1.1 *Precipitation*

The annual volume of water entering the Tule Subbasin as precipitation will be estimated based on the long-term average annual isohyetal map as included in **Attachment 2** and annual precipitation data reported for the Porterville precipitation station. As annual precipitation values are not available throughout the entire Tule Subbasin, it will be assumed that the relative precipitation distribution for each year is the same as that shown on the isohyetal map. The magnitude of annual precipitation within each isohyetal zone will be varied from year to year based on the ratio of annual precipitation at the Porterville Station to annual average precipitation at the Porterville isohyetal zone multiplied by the isohyetal zone average annual precipitation.

$$\frac{Precip_{Porterville}}{Precip_{Ave\ Porterville}}\ x\ Isohyet_{Ave\ Precip} = Precip_{Isohyet}$$

Where:

$Precip_{Porterville}$	=	Precipitation at the Porterville Station in any given year (ft/yr).
$Precip_{Ave\ Porterville}$	=	Long-Term Average Precipitation at the Porterville Station (ft/yr).
$Isohyet_{Ave\ Precip}$	=	Average precipitation within the Isohyet zone overlying the Subbasin/GSA (ft/yr).
$Precip_{Isohyet}$	=	Adjusted annual precipitation within the isohyet zone overlying the Subbasin/GSA (ft/yr).

The adjusted annual precipitation for the year of interest will be multiplied by the area of the isohyet zone to estimate the precipitation falling on the area (in acre-ft).

3.7.2.1.2 *Stream Inflow*

Surface water inflow to the Tule Subbasin occurs primarily via three native streams: the Tule River, Deer Creek, and the White River. As the ETGSA borders the eastern Tule Subbasin boundary, stream inflow into the Tule Subbasin is equal to the stream inflow into the ETGSA.

Tule River

Streamflow in the Tule River is documented in TRA annual reports. Stream inflow to the Tule Subbasin (and ETGSA) is recorded as releases from the Richard L. Schafer Dam (formerly Lake Success Dam) and will be the same as reported in the TRA annual reports. Accounting of diversions from the Tule River is described in Section 3.4.1.1.1 of this Coordination Agreement.

Deer Creek

Accounting of streamflow in Deer Creek is described in Section 3.4.1.1.2 of this Coordination Agreement.

White River

Accounting of streamflow in the White River is described in Section 3.4.1.1.3 of this Coordination Agreement.

3.7.2.1.3 *Imported Water*

Imported water delivered to the various agencies within the six GSAs of the Tule Subbasin will be provided on an annual basis by the agencies receiving deliveries.

3.7.2.1.4 *Discharge to Crops from Wells*

Water applied to crops from wells is assumed to be the total applied water minus surface water deliveries from imported water and diverted stream flow. Total crop demand will be estimated based on the methodologies identified in Section 3.3.1. Diverted streamflow and imported water deliveries are described in Sections 3.4.1.1 and 3.4.1.2, respectively.

3.7.2.1.5 *Municipal Deliveries from Wells*

Accounting of groundwater pumping for municipal supply will be provided on a monthly basis by the various cities/communities in the Tule Subbasin. These cities/communities include:

1. City of Porterville
2. Tipton Public Utility District
3. Pixley Public Utility District
4. Teviston Community Services District
5. Earlimart Community Services District
6. Terra Bella Irrigation District
7. Richgrove Community Services District
8. Poplar Community Services District
9. Woodville Community Services District
10. Allensworth Community Services District
11. Alpaugh Community Services District
12. Ducor Community Services District

It is assumed that municipal pumping will be metered. In the event that metered pumping data is not available, municipal supply will be estimated based on the population of the community served and an assumption of per capita water demand from the most recent Urban Water Master Plan applicable to the area.

It is noted that there are some households in the rural portions of the Tule Subbasin that rely on private wells to meet their domestic water supply needs. However, given the low population density of these areas, the volume of pumping from private domestic wells is considered negligible compared to the other pumping sources.

3.7.2.2 Surface Water Outflow

3.7.2.2.1 *Areal Recharge from Precipitation*

Historical estimates of areal recharge from precipitation falling on the valley floor in the Tule Subbasin, as used in TH&Co (2017a)[1] were based on Williamson et al., (1989).[2] The equation for estimating areal recharge, using the Williamson Method, is:

$$PPT_{rech} = (0.64)PPT - 6.2$$

Where:

PPT_{rech}	=	Groundwater Recharge from Precipitation (ft/yr)
PPT	=	Annual Precipitation (ft/yr)

Total precipitation in any given GSA (i.e. PPT) will be estimated on an annual basis using the portion of the isohyetal map overlapping the GSA (see **Attachment 2**; Figure 2-27) and adjusted based on the recorded annual precipitation at the Porterville station, as described in Section 3.7.1.1.1.1. Precipitation recharge for each GSA will then be recorded on an annual basis using the above equation.

3.7.2.2.2 *Streambed Infiltration (Channel Loss)*

Tule River

Total channel loss (i.e. streambed infiltration plus evapotranspiration) in the Tule River between Lake Success and Oettle Bridge will be the same as reported in TRA annual reports and shall be allocated pursuant to the allocation method in the TRA Water Rights Schedule. Tule River infiltration for the water budget will be estimated as follows:

$TR_{CL} – ET = TR_{NatInf}$

Where:

TR_{CL}	=	Tule River channel losses between Lake Success and Oettle Bridge as reported in TRA annual reports (acre-ft).
ET	=	Evapotranspiration (acre-ft).
TR_{NatInf}	=	Infiltration losses between Lake Success and Oettle Bridge attributed to native Tule River water (acre-ft).

[1] TH&Co, 2017a; Hydrogeological Conceptual Model and Water Budget of the Tule Subbasin. Dated August 1, 2017.

[2] Williamson, A.K., Prudic, D.E., and Swain, L.A., 1989. Ground-Water Flow in the Central Valley, California. USGS Professional Paper 1401-D.

Evapotranspiration between Lake Success and Oettle Bridge will be equal to 35 acre-ft/month when the flow in the channel is greater than 35 acre-ft/month and equal to the flow when less than 35 acre-ft/month.

Reporting of total streambed infiltration of surface water flow in the Tule River channel between Oettle Bridge and Turnbull Weir will be obtained from LTRID annual water use summaries and adjusted to account for ET in the stream channel. Evapotranspiration in the Tule River channel between Oettle Bridge and Turnbull Weir is assumed to be equal to 55 acre-ft/month if the flow in the channel is greater than 55 acre-ft/month and equal to the flow when less than 55 acre-ft/month.

Given the fact that LTRID periodically releases imported water from the Friant-Kern Canal to the Tule River upstream of Oettle Bridge, it will be necessary to account for the portion of channel infiltration attributed to native Tule River flow versus the channel infiltration attributed to imported water as the native river flow infiltration is part of the Sustainable Yield of the subbasin but the imported water recharge is not. Imported water deliveries to the Tule River channel are reported in the TRA annual reports. The estimated native Tule River water infiltration in the channel between Oettle Bridge and Turnbull Weir will be computed as follows:

$$\frac{FK}{TR_{BOB} + FK}\, x\, TR_{Tot\ Inf} - ET = TR_{Native\ Inf\ Loss}$$

Where:

FK	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
TR_{BOB}	=	Gaged flow Below Oettle Bridge from TRA annual reports (acre-ft).
$TR_{Tot\ Inf}$	=	Infiltration losses from both native Tule River water and imported water (acre-ft).
ET	=	Evapotranspiration (acre-ft).
$TR_{Native\ Inf\ Loss}$	=	Infiltration losses between Oettle Bridge and Turnbull Weir attributed to native Tule River water (acre-ft).

Deer Creek

Deer Creek is a losing stream such that infiltration of surface water within the stream channel recharges the groundwater system beneath it. Streambed infiltration (channel loss) is estimated for the stream reaches between the Fountain Springs gaging station and Trenton Weir and between Trenton Weir and Homeland Canal. The difference in streamflow between Fountain Springs station and Trenton Weir is assumed to be total channel loss along this section. Combined streambed infiltration in the Deer Creek channel between Trenton Weir and Homeland Canal and canal losses within the rest of the Pixley Irrigation District were estimated based on Pixley Irrigation District monthly water use summaries. Measured channel loss includes infiltration as well as evapotranspiration. Therefore, infiltration is equal to channel loss minus evapotranspiration.

It is noted that there are two sources of water in the Deer Creek channel: 1) native flow and 2) imported water from the Friant-Kern Canal. It is further noted that imported water is introduced into the Deer Creek channel upstream of Trenton Weir. Thus, until a stream gage is established upstream of the Friant-Kern Canal/Deer Creek intersection, the separate accounting of losses associated with imported water and native Deer Creek surface flow will be approximated. Imported water discharged to the Deer Creek channel from the Friant-Kern Canal is monitored by the USBR and reported in the Pixley Irrigation District monthly water use summaries.

Deer Creek channel loss (i.e. streambed infiltration and evapotranspiration) from Fountain Springs to Trenton Weir was estimated based on the difference in measured flows between the two stations. The surface flow between these two stations is assumed to be, for this water budget, native Deer Creek water. Deer Creek channel infiltration will be estimated as follows:

$$DC_{FS} - DC_{TW} - ET = DC_{Inf\ Loss}$$

Where:

$\underline{DK_{FS}}$	=	Gaged flow at Fountain Springs (acre-ft).
$\underline{DK_{TW}}$	=	Gaged flow at Trenton Weir (acre-ft).
ET	=	Evapotranspiration (acre-ft).
$DC_{Inf\ Loss}$	=	Infiltration losses attributed to native Deer Creek water (acre-ft).

Flow in the Deer Creek channel from Trenton Weir to Homeland Canal is a combination of native Tule River water and imported water purchased by the Pixley Irrigation District for distribution in their service area. For this water balance, it is assumed that all of the water that flows through Trenton Weir is either delivered to farmers or becomes channel or canal loss (i.e. there are no data available to document surface flow from the Deer Creek channel to Homeland Canal although it is known that this occurs during periods of above normal precipitation). The infiltration of native Deer Creek water in the Deer Creek channel downstream of Trenton Weir is estimated for each month based on Pixley Irrigation District annual water use summaries in the following way:

1. Subtract the imported water deliveries to Deer Creek from the total flow measured at Trenton Weir to estimate the volume entering Pixley Irrigation District that is attributed to native Deer Creek flow.
2. Pixley Irrigation District sales and deliveries to basins are subtracted from the total flow through Trenton Weir to determine the volume of water presumably lost as infiltration in the Deer Creek channel and canals.
3. The total loss in No. 2 is multiplied by the ratio of Deer Creek channel length to the total channel/canal length within the Pixley irrigation District (0.21) to estimate losses in the channel and multiplied by the ratio of canal length to the total channel/canal length to estimate losses in the canals (0.79).
4. The total loss attributed to the Deer Creek channel, as estimated from No. 3, is multiplied by the ratio of native Deer Creek flow at Trenton Weir to the total water available to estimate the volume of native Deer Creek water infiltration estimated to occur in the Deer Creek channel.

5. The total loss attributed to canals, as estimated from No. 3, is multiplied by the ratio of native Deer Creek flow at Trenton Weir to the total water available to estimate the volume of native Deer Creek water loss estimated to occur in the canals.

Infiltration losses in the Deer Creek channel are included in the Sustainable Yield of the overall Tule Subbasin.

White River

All of the surface water flow measured or interpolated at the White River stream gage, after accounting for ET losses, is assumed to become streambed infiltration, as described in Section 3.4.1.1.3.

3.7.2.2.3 *Canal Losses*

Canal Losses from Tule River Diversions

Canal losses from Tule River diversions occur within the numerous unlined canals connected to the Tule River within the City of Porterville, Vandalia Water District, Porterville Irrigation District and LTRID. With the exception of LTRID, canal losses are accounted for in the portion of the water budget that addresses deep percolation of applied water (see Section 3.7.1.1.2.5).

Canal losses associated with deliveries of native Tule River water in the LTRID GSA are estimated based on LTRID annual water use summaries. Canal losses will be reported as total LTRID GSA losses minus channel losses attributed to native Tule River water ($TR_{Native\ Inf\ Loss}$). The equation is as follows:

$$\frac{TR_{Gaged}}{TR_{Gaged} + FK}\ x\ LTRID_{Total\ Losses} - TR_{Native\ Inf\ Loss} = TR_{Native\ Can\ Loss}$$

Where:

TR_{Gaged}	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK	=	Imported water delivered to the LTRID from the Friant Kern Canal.
$LTRID_{Total\ Losses}$	=	Total losses reported in LTRID annual water use summaries.
$TR_{Native\ Inf\ Loss}$	=	Native Tule River channel infiltration losses.
$TR_{Native\ Can\ Loss}$	=	Canal losses attributed to native Tule River water.

Canal losses from diverted native Tule River water are not included in the Sustainable Yield of the overall Tule Subbasin.

Canal Losses from Deer Creek Diversions

It is assumed that canal losses from delivery of native Deer Creek water to riparian landowners and farmers occur only within the PID GSA. The methodology to estimate canal losses within the PID GSA is described above.

Canal losses from diverted Deer Creek water are not included in the Sustainable Yield of the overall Tule Subbasin.

Canal Losses from Imported Water Deliveries

With the exception of canal losses within the Angiola Water District and Porterville Irrigation District, it is assumed that imported water that infiltrates into the subsurface in the Tule River channel, Deer Creek channel and unlined canals is grouped together. Within the Angiola Water District and Porterville Irrigation District, canal losses are accounted for in the portion of the water budget that addresses deep percolation of applied water (see Section 3.7.1.1.2.5). For the Tule River, canal losses are estimated as follows:

$$LTRID_{Total\ Losses} - TR_{Native\ Inf\ Loss} = LTRID_{Imp\ Can\ Loss}$$

Where:

$LTRID_{Total\ Losses}$	=	Total losses reported in LTRID annual water use summaries (acre-ft).
$TR_{Native\ Inf\ Loss}$	=	Native Tule River channel infiltration losses (acre-ft).
$LTRID_{Imp\ Can\ Loss}$	=	Canal losses attributed to imported water in the LTRID (acre-ft).

For Deer Creek, canal losses are estimated as follows:

$$Pixley_{Total\ Losses} - DC_{Native\ Inf\ Loss} = Pixley_{Imp\ Can\ Loss}$$

Where:

$Pixley_{Total\ Losses}$	=	Total losses reported in Pixley Irrigation District annual water use summaries (acre-ft).
$DC_{Native\ Inf\ Loss}$	=	Native Deer Creek channel infiltration losses (acre-ft).
$Pixley_{Imp\ Can\ Loss}$	=	Canal losses attributed to imported water in the Pixley Irrigation District (acre-ft).

Canal losses resulting from delivery of imported water are not included in the Sustainable Yield of the overall Tule Subbasin.

3.7.2.2.4 *Managed Recharge in Basins*

Managed Recharge of Tule River Diversions

Native Tule River water is diverted to basins for recharge by Pioneer Water Company, Campbell and Moreland Ditch Company, Vandalia Water District, Porterville Irrigation District, and LTRID.

All of the water diverted by Campbell and Moreland Ditch Company and Vandalia Water District (ETGSA) is native Tule River flow and is assumed to be delivered to basins. The native Tule River water diverted by these agencies is reported in TRA annual reports. Native Tule River water diverted to basins by Pioneer Water Company and Porterville Irrigation District will be provided by those agencies.

Monthly total water deliveries to basins in the LTGSA are reported in LTRID annual water use summary reports. The total deliveries include both native Tule River water and imported water from the Friant-Kern Canal. The basin recharge attributable to native Tule River water downstream of Oettle Bridge will be reported as follows:

$$\frac{TR_{Gaged}}{TR_{Gaged} + FK} \, x \, LTRID_{Total\ Basin\ Rech} = TR_{Basin\ Rech}$$

Where:

TR_{Gaged}	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
$LTRID_{Total\ Basin\ Rech}$	=	Total LTRID basin recharge from annual water use summaries (acre-ft).
$TR_{Basin\ Rech}$	=	Basin recharge in LTRID attributed to native Tule River water (acre-ft).

Managed recharge of diverted native Tule River water is not included in the Sustainable Yield of the overall Tule Subbasin.

Managed Recharge of Deer Creek Diversions

Artificial recharge (i.e. recharge in basins) of diverted Deer Creek streamflow is accomplished via multiple recharge facilities. Native Deer Creek water is diverted to basins for recharge by Pixley Irrigation District and DCTRA. It is acknowledged that the Pixley Irrigation District diversions are limited to the rights of the riparians within the District. The amount of the water right is subject to discussion. Basin recharge attributed to native Deer Creek water is estimated using the following equation:

$$\frac{DC_{Gaged}}{DC_{Gaged} + FK} \; x \; Pixley_{Total\ Basin\ Rech} = DC_{Basin\ Rech}$$

Where:

DC_{Gaged}	=	Gaged flow through Trenton Weir (acre-ft).
FK	=	Imported water delivered to the Pixley Irrigation District from the Friant-Kern Canal (acre-ft).
$Pixley_{Total\ Basin\ Rech}$	=	Total Pixley Irrigation District basin recharge from annual water use summaries (acre-ft).
$DC_{Basin\ Rech}$	=	Basin recharge in Pixley Irrigation District attributed to native Deer Creek water (acre-ft).

Managed recharge of diverted Deer Creek water is not included in the Sustainable Yield of the overall Tule Subbasin.

Managed Recharge of Imported Water

Managed recharge of imported water is accomplished via multiple recharge facilities within the Porterville Irrigation District, LTRID, Pixley Irrigation District, Tea Pot Dome Water District and DEID. Managed recharge attributed to imported water in the LTRID is estimated as follows:

$$\frac{FK}{TR_{Gaged} + FK} \; x \; LTRID_{Total\ Basin\ Rech} = LTRID_{Imp\ Basin\ Rech}$$

Where:

TR_{Gaged}	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
$LTRID_{Total\ Basin\ Rech}$	=	Total LTRID basin recharge from annual water use summaries (acre-ft).
$LTRID_{Imp\ Basin\ Rech}$	=	Basin recharge in LTRID attributed to imported water (acre-ft).

Managed recharge of imported water in the Pixley Irrigation District is estimated as follows:

$$\frac{FK}{DC_{Gaged} + FK} \; x \; Pixley_{Total\ Basin\ Rech} = Pixley_{Imp\ Basin\ Rech}$$

Where:

DC_{Gaged}	=	Gaged flow through Trenton Weir (acre-ft).
FK	=	Imported water delivered to the Pixley Irrigation District from the Friant Kern Canal (acre-ft).
$Pixley_{Total\ Basin\ Rech}$	=	Total Pixley Irrigation District basin recharge from annual water use summaries (acre-ft).
$Pixley_{Imp\ Basin\ Rech}$	=	Basin recharge in Pixley Irrigation District attributed to imported water (acre-ft).

Imported water delivered to recharge in basins for DEID, Porterville Irrigation District and Tea Pot Dome Water District will be provided by each district.

Managed recharge of imported water is not included in the Sustainable Yield of the overall Tule Subbasin.

Recharge of Recycled Water in Basins

Most of the recycled water generated by the City of Porterville is used for agricultural irrigation. From time to time, some of the recycled water is delivered to basins in the Old Deer Creek Channel where it infiltrates into the subsurface to become groundwater recharge. Basin recharge of recycled water will be based on data provided by the City of Porterville. Managed recharge of recycled water in basins is not included in the Sustainable Yield of the overall Tule Subbasin.

3.7.2.2.5 *Deep Percolation of Applied Water*

Deep Percolation of Applied Tule River Diversions

Deep percolation of applied Tule River water for irrigating agriculture will be applied to the various land uses in the Tule Subbasin according to the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in DWR on-line land use maps. Irrigation efficiencies will be applied to the different irrigation methods based on tables reported in California Energy Commission (2006)[3].

Tule River water is diverted for agricultural irrigation by the Pioneer Water Company, Porter Slough Headgate, Porter Slough Ditch Company, Campbell and Moreland Ditch Company, Vandalia Water District, Hubbs and Miner Ditch Company, Poplar Irrigation Co., Woods Central Ditch Company, Porter Slough Below 192, and Below Oettle Bridge. Application of the appropriate deep percolation rate will depend on the crop types receiving native Tule River water and the associated irrigation methods. In the LTGSA, estimation of the volume of applied water attributed to native Tule River water is based on the following:

[3] California Energy Commission, 2006. PIER Project Report: Estimating Irrigation Water Use for California Agriculture: 1950s to Present. May 2006.

$$\frac{TR_{Gaged}}{TR_{Gaged} + FK}\ x\ LTRID_{Total\ Deliveries} = TR_{App\ Water}$$

Where:

TR_{Gaged}	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
$LTRID_{Total\ Deliveries}$	=	Total LTRID deliveries (i.e. "Sales") from annual water use summaries (acre-ft).
$TR_{App\ Water}$	=	Volume of applied native Tule River water in the LTRID (acre-ft).

Deep percolation is calculated as the applied water ($TR_{App\ Water}$) multiplied by the appropriate percent deep percolation depending on the crop type receiving the water and the associated irrigation method.

Deep percolation of applied native Tule River water is not included in the Sustainable Yield of the overall Tule Subbasin.

<u>Deep Percolation of Applied Deer Creek Diversions</u>

The portion of native Deer Creek water delivered for agricultural use within the PIXID GSA is estimated using the following equation:

$$\frac{DC_{Gaged}}{DC_{Gaged} + FK}\ x\ Pixley_{Total\ Deliveries} = DC_{App\ Water}$$

Where:

DC_{Gaged}	=	Gaged flow through Trenton Weir (acre-ft).
FK	=	Imported water delivered to the Pixley Irrigation District from the Friant Kern Canal (acre-ft).
$Pixley_{Total\ Deliveries}$	=	Total Pixley Irrigation District deliveries (i.e. "Sales") from annual water use summaries (acre-ft).
$DC_{App\ Water}$	=	Applied water in Pixley Irrigation District from native Deer Creek River water (acre-ft).

Deep percolation is estimated as the applied water ($DC_{App\ Water}$) multiplied by the appropriate percent deep percolation depending on the crop type receiving the water.

Deep percolation of applied native Deer Creek water is not included in the Sustainable Yield of the overall Tule Subbasin.

<u>Deep Percolation of Applied Imported Water</u>

Deep percolation of imported water delivered and applied to crops within the LTGSA is based on the following equation:

$$\frac{FK}{TR_{Gaged} + FK}\ x\ LTRID_{Total\ Deliveries} x\ DP_{Factor} = DP_{LTRID\ FK}$$

Where:

<u>TR_{Gaged}</u>	=	Sum of gaged flow at Below Oettle Bridge, Woods Central Diversion, Poplar Irrigation Company flow reaching LTRID, and Porter Slough at 192 (acre-ft).
FK	=	Imported water delivered to the LTRID from the Friant Kern Canal (acre-ft).
$LTRID_{Total\ Deliveries}$	=	Total LTRID deliveries (i.e. "Sales") from annual water use summaries (acre-ft).
DP_{Factor}	=	Deep percolation factor that varies from 0.06 to 0.33 depending on the type of crop receiving the imported water (see Section 3.7.1.1.2.3.4) (unitless).
$DP_{LTRID\ FK}$	=	Deep percolation of imported water applied to crops in the LTRID (acre-ft).

Deep percolation of imported water delivered and applied to crops within the PIXID GSA is based on the following equation:

$$\frac{FK}{DC_{Gaged} + FK}\ x\ Pixley\ ID_{Total\ Deliveries} x\ DP_{Factor} = DP_{Pixley\ ID\ FK}$$

Where:

<u>DC_{Gaged}</u>	=	Deer Creek at Trenton Weir (acre-ft).
FK	=	Imported water delivered to the Pixley ID from the Friant Kern Canal (acre-ft).
Pixley $ID_{Total\ Deliveries}$	=	Total Pixley ID deliveries (i.e. "Sales") from annual water use summaries (acre-ft).
DP_{Factor}	=	Deep percolation factor that varies from 0.06 to 0.33 depending on the type of crop receiving the imported water (see Section 3.7.1.1.2.3.4) (unitless).
$DP_{Pixley\ ID\ FK}$	=	Deep percolation of imported water applied to crops in Pixley Irrigation District (acre-ft).

Deep percolation of imported water delivered and applied to crops in DEID, Porterville Irrigation District, Saucelito Irrigation District, Tea Pot Dome Water District, Alpaugh Irrigation District, Angiola Water District, and Atwell Island Water District shall be estimated as the delivered water, minus water delivered to basins, multiplied by the appropriate percent deep percolation factor.

Deep percolation of applied imported water is not included in the Sustainable Yield of the overall Tule Subbasin.

Deep Percolation of Applied Recycled Water

Deep percolation of recycled water applied to crops will be estimated using the deep percolation factors described earlier in this section. Deep percolation of applied recycled water is not included in the Sustainable Yield of the overall Tule Subbasin.

Deep Percolation of Applied Native Groundwater for Agricultural Irrigation

The balance of agricultural irrigation demand not met by imported water or stream diversions is assumed to be met by groundwater pumping. Groundwater extraction will be calculated based on the methods described in Section 3.3. Deep percolation of applied water from groundwater pumping will be based on the types of crops on which the water is applied and will be calculated using the deep percolation factors discussed earlier in this section. Deep percolation of applied water from agricultural groundwater pumping is included in the Sustainable Yield of the overall Tule Subbasin.

Deep Percolation of Applied Native Groundwater for Municipal Irrigation

Deep percolation of applied water for landscape irrigation was estimated for the urbanized portions of the Tule Subbasin. All municipal water demand is met from groundwater pumping. For the City of Porterville, landscape irrigation was estimated to be 47 percent of the total water delivered to each home based on an analysis of the total groundwater production and influent flows to the wastewater treatment plant (City of Porterville draft Urban Water Management Plan 2010 Update, 2014). Of the water used for irrigation, 25 percent is assumed to become deep percolation and groundwater recharge. Deep percolation of applied water from municipal groundwater pumping is included in the Sustainable Yield of the overall Tule Subbasin.

For the other smaller communities in the Tule Subbasin, wastewater discharge is assumed to be through individual septic systems. For water discharged to septic systems, it is assumed that 100 percent of the discharge becomes deep percolation and groundwater recharge. As with the City of Porterville, 47 percent of total water use was assumed to be for landscape irrigation and 25 percent of the landscape irrigation is assumed to become deep percolation.

3.7.2.2.6 *Evapotranspiration*

Evapotranspiration of Precipitation from Crops and Native Vegetation

Evapotranspiration (ET) is the loss of water to the atmosphere from free-water evaporation, soil-moisture evaporation, and transpiration by plants. Evapotranspiration of precipitation is assumed to be the difference between total precipitation (Section 3.7.1.1.1.1) and areal recharge from precipitation (Section 3.7.1.1.2.1). This value includes evapotranspiration of precipitation from crops as well as native vegetation.

Evapotranspiration of Surface Water Within the Tule River Channel

Evapotranspiration of surface water within the Tule River channel is a function of the ET rate and wetted channel surface area. The ET rate was based on published data for riparian vegetation in an intermittent stream and applied to channel segments with similar average width based on aerial photographs (Google Earth). The ET rate was applied to the surface area of each reach to obtain an estimate of ET. The sum of reach by reach ET estimates between Lake Success and the western Tule Subbasin boundary represents the total Tule River ET.

Evapotranspiration of Surface Water Within the Deer Creek Channel

Evapotranspiration within the Deer Creek channel was estimated using the same methodology as described for the Tule River Channel.

Evapotranspiration of Surface Water Within the White River Channel

Evapotranspiration in the White River channel was estimated using the same methodology as described for the Tule River Channel.

Evapotranspiration of Recycled Water in Basins

Evapotranspiration of recycled water delivered to basins will be provided by the City of Porterville.

Agricultural Consumptive Use

Crop consumptive use may be estimated using one of the methods described in Section 3.3.1.

Municipal Consumptive Use

Consumptive use of landscaping associated with applied municipal groundwater pumping will be estimated based on the methods described in Section 3.5.1.2.2.

3.7.2.2.7 *Surface Water Flow Out of the Subbasin*

Tule River

Any residual stream flow in the Tule River that reaches the Turnbull Weir, located at the west (downstream) end of the Tule Subbasin, is assumed to flow out of the subbasin. Outflow through the Turnbull Weir is documented in the TRA annual reports. Exports of Tule River water to the Friant-Kern Canal will be the same as reported in TRA annual reports.

Deer Creek

During periods of above-normal precipitation, residual stream flow left in the Deer Creek after diversions has historically flowed into Homeland Canal, located at the west end of the Tule Subbasin. The data for this outflow is currently unavailable. As this data becomes available, it will be incorporated into the surface water budget.

3.7.3 Groundwater Budget

The groundwater budget describes the sources and estimates the volumes of groundwater inflow and outflow within the Tule Subbasin. The difference between the sum of inflow terms and the sum of outflow terms is the change in groundwater storage (ΔS). A fundamental premise of the groundwater budget is the following relationship:

Inflow – Outflow = +/- ΔS

Sources of recharge (inflow terms) in the groundwater budget include:

1. Areal recharge from precipitation.
2. Recharge within stream and river channels.
3. Managed recharge in basins.
4. Canal infiltration.
5. Deep percolation of applied municipal and agricultural irrigation.
6. Release of water from compression of aquitards.
7. Subsurface inflow.
8. Mountain-Front Recharge.

It is noted that many of the groundwater inflow terms are surface water outflow terms. The groundwater budget includes the following sources of discharge (outflow terms):

1. Municipal groundwater pumping.
2. Agricultural groundwater pumping.
3. Groundwater pumping for export out of the subbasin.
4. Evapotranspiration.
5. Subsurface outflow.

3.7.3.1 *Sources of Recharge*

3.7.3.1.1 *Areal Recharge*

Groundwater recharge from precipitation falling on the valley floor in the Tule Subbasin will be estimated for each GSA as described in Section 3.7.1.1.2.1. Areal recharge of the groundwater system from precipitation is included in the Sustainable Yield of the overall Tule Subbasin.

3.7.3.1.2 *Tule River*

Groundwater recharge of native Tule River water occurs as streambed infiltration, infiltration of water in unlined canals, recharge in basins, and deep percolation of applied water.

The methods for estimating the volumes of Tule River water that become groundwater recharge are described in Section 3.7.1.1.2.

3.7.3.1.3 *Deer Creek*

Groundwater recharge of native Deer Creek water occurs as streambed infiltration, canal loss, recharge in basins, and deep percolation of applied water. The methods for estimating the volumes of Deer Creek water that become groundwater recharge are described in Section 3.7.1.1.2.

3.7.3.1.4 *White River*

Groundwater recharge of White River water occurs as streambed infiltration as described in Section 3.7.1.1.2.

3.7.3.1.5 *Imported Water Deliveries*

Groundwater recharge of imported water occurs as canal loss, recharge in basins, and deep percolation of applied water as described in Section 3.7.1.1.2.

3.7.3.1.6 *Recycled Water*

Groundwater recharge of recycled water occurs as artificial recharge and deep percolation of applied water as described in Section 3.7.1.1.2.

3.7.3.1.7 *Deep Percolation of Applied Water from Groundwater Pumping*

A portion of irrigated agriculture and municipal applied water from groundwater pumping becomes deep percolation and groundwater recharge as described in Sections 3.7.1.1.2.8.1 and 3.7.1.1.2.8.2.

3.7.3.1.8 *Release of Water from Compression of Aquitards*

As land subsidence due to groundwater withdrawal is considered an undesirable result, the ultimate goal of the Tule Subbasin TAC is to reduce it to de minimis levels. In the meantime, in order to produce a representative water balance, the volume of water released to the aquifer as a result of subsidence can be estimated using the methods described in Section 3.8.

3.7.3.1.9 *Subsurface Inflow*

The subsurface inflow and outflow along the southern, western and northern boundaries of the Tule Subbasin as well as the internal boundaries between each GSA will be evaluated as needed using either of the following methodologies:

Flow Net Analysis

A flow net analysis is applied to groundwater elevation contours developed for both the shallow and deep aquifers. The groundwater elevation contours will be based on measured groundwater levels at designated monitoring wells with perforations specific to each aquifer. After developing the groundwater contours, flow lines that are perpendicular to the groundwater elevation contours will be equally spaced along the boundary of the Subbasin or GSA.

For the shallow aquifer, which is conceptualized as being unconfined, subsurface inflow/outflow will be estimated using the Dupuit Equation, which is expressed as:

$$Q = 0.5K\left(\frac{(h_1 - h_2)^2}{L}\right)$$

Where:

Q	=	Subsurface flow, (acre-ft)
K	=	Hydraulic Conductivity, (ft/day)
h_1	=	Initial Hydraulic head, (ft amsl)
h_2	=	Ending Hydraulic head, (ft amsl)
L	=	Flow Length (ft)

For the deep aquifer, which is conceptualized as being semi-confined/confined, subsurface inflow/outflow will be estimated using the Darcy Equation, which is expressed as:

$$Q = KA\left(\frac{dh}{dl}\right)$$

Where:

Q	=	Subsurface flow, (acre-ft)
K	=	Hydraulic Conductivity, (ft/day)
A	=	Aquifer Cross-Sectional Area, (ft^2)
$\frac{dh}{dl}$	=	Hydraulic gradient

As the groundwater flow lines into and out of the subbasin/GSA may not occur at right angles to the subbasin/GSA boundary, it will be necessary to correct the subsurface flow by the angle (degrees) of the flow line relative to the basin boundary. This will be conducted by multiplying the subsurface inflow value by the sine of the angle of flow relative to the boundary.

Groundwater Flow Model

TH&Co has prepared a calibrated groundwater flow model of the Tule Subbasin. The model is capable of calculating the subsurface inflow and outflow to/from the subbasin boundaries and/or each GSA boundary. In order to develop updated subsurface inflow/outflow values for the water budget, the model will be updated annually with groundwater extractions, recharge values, and groundwater levels. The model calibration will be validated with the measured data and adjusted periodically. Once the updated model is validated, it can be used to estimate the subsurface inflow/outflow at each subbasin boundary and each GSA boundary.

3.7.3.1.10 *Mountain-Front Recharge*

Mountain-front recharge represents the infiltration of precipitation into the fractures in the bedrock east of the Tule Subbasin, which eventually flows into the alluvial aquifer system in the subsurface where the fractured rock aquifer system is in hydrologic communication with the alluvial aquifer system. Estimates of mountain-block recharge will be developed using the calibrated groundwater flow model.

3.7.3.2 *Sources of Discharge*

3.7.3.2.1 *Municipal Groundwater Pumping*

Groundwater pumping data for municipal supply is metered and will be provided by the individual cities within the Tule Subbasin, as described in Section 3.7.1.1.1.5

3.7.3.2.2 *Agricultural Groundwater Pumping*

Agricultural groundwater production will be estimated as described in Section 3.3.

3.7.3.2.3 *Groundwater Pumping for Export Out of the Tule Subbasin*

The volume of groundwater that is pumped and exported out of the subbasin on a quarterly basis will be provided by Angiola Water District and the Boswell/Creighton Ranch.

3.7.3.2.4 *Subsurface Outflow*

The subsurface outflow at the Tule Subbasin boundaries and/or GSA boundaries will be estimated using one of the methods described in Section 3.7.1.2.1.9.

3.7.4 Quality Assurance and Control

The water budget will be completed and updated by each GSA using professionals working under the direct supervision of a California Registered Professional Civil Engineer, Professional Geologist, or Certified Hydrogeologist. All GSA water budgets will be subject to review by the Tule Subbasin TAC's technical consultant.

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IV. Sustainable Management Criteria (§357.4(b)(3)(C))

Pursuant to 23 Cal. Code Regs. §357.4(b)(3)(C), the coordination agreement shall describe how the GSAs have used the same data and methodologies for estimating sustainable yield for the basin. The description shall be supported by a description of undesirable results for the basin, and an explanation of how the minimum thresholds and measurable objectives defined by each Plan relate to those undesirable results, based on information described in the basin setting.

4.1 Introduction (Reg. § 354.22)

Pursuant to 23 Cal. Code Regs. §354.22, this Chapter describes criteria that constitute sustainable groundwater criteria for the Tule Subbasin, including its sustainability goal and the characterization and definition of undesirable results for each applicable sustainability indicator.

4.2 Sustainability Goal (§ 354.24)

Pursuant to 23 Cal. Code Regs. §357.24, the Sustainability Goal of the Tule Subbasin is defined as the absence of undesirable results, accomplished by 2040 and achieved through a collaborative, Subbasin-wide program of sustainable groundwater management by the various Tule Subbasin GSAs.

Achievement of this goal will be accomplished through the coordinated effort of the Tule Subbasin GSAs in cooperation with their many stakeholders. It is further the goal of the Tule Subbasin GSAs that coordinated implementation of their respective GSPs will achieve sustainability in a manner that facilitates the highest degree of collective economic, societal, environmental, cultural, and communal welfare and provides all beneficial uses and users the ability to manage the groundwater resource at least cost. Moreover, this coordinated implementation is anticipated to ensure that the sustainability goal, once achieved, is also maintained through the remainder of the 50-year planning and implementation horizon, and well thereafter.

In achieving the Sustainability Goal, these GSPs are intended to balance average annual inflows and outflows of water by 2040 so that negative change in storage does not occur after 2040, with the ultimate goal being avoidance of undesirable results caused by groundwater conditions throughout the Subbasin. The stabilization of change in storage should also drive stable groundwater elevations, which, in turn, works to inhibit water quality degradation and arrest land subsidence.

4.2.1 Sustainable Yield

Chapter 2.3.2.6 of the *Tule Subbasin Setting* estimates the projected Sustainable Yield for the Tule Subbasin to be approximately 130,000 acre-ft/yr (see ***Table 2-4,*** *Tule Subbasin Setting*).

The term "Sustainable Yield" for the purposes of SGMA and GSPs developed under SGMA is defined by Water Code §107219(w) as: "*the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any* *temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result.*"

Within the Tule Subbasin, the Sustainable Yield includes the natural channel losses in the natural streams, precipitation, subsurface inflow and subsurface outflow, mountain front subsurface inflow, and return flow of applied water not subject to recapture (by virtue of a Water Right). The components not included in the estimate of the Tule Subbasin's Sustainable Yield is described below from the Tule Subbasin Setting:

"It is noted that sources of groundwater recharge in the subbasin that are associated with pre-existing water rights and/or imported water deliveries are not included in the Sustainable Yield estimate. These recharge sources include:

Diverted Tule River water canal losses, recharge in basins, and deep percolation of applied water, Diverted Deer Creek water canal losses, recharge in basins, and deep percolation of applied water, Imported water canal losses, recharge in basins, and deep percolation of applied water, and Recycled water deep percolation of applied water and recharge in basins." (Tule Subbasin Setting)

The sources of groundwater recharge that are not included in the Subbasin Sustainable Yield calculations are intended to be accounted for by each GSA.

As noted above, for purposes of establishing the water budget pursuant to 23 Cal. Code Regs. §354.18, the GSAs in the Tule Subbasin have agreed that the Sustainable Yield for the Subbasin shall be divided amongst the GSAs for purposes of development of their GSPs as described in the attached water budget (**Attachment 2**). The basin-wide portion of the Sustainable Yield identified in the water budget was divided amongst each GSA by multiplying that GSA's proportionate areal coverage of the Tule Subbasin times the total Subbasin Sustainable Yield.

The water budget, as divided amongst the GSAs, is not an allocation or final determination of any water rights (including without limitation any claimed appropriative or prescriptive rights). This understanding is consistent with § 10720.5(b) of SGMA, which provides that nothing in SGMA or in a plan adopted under SGMA determines or alters surface or groundwater rights under common law or any provision of law that determines or grants water rights. Rather, for practical reasons and in keeping with SGMA limitations with respect to determining water rights and the statutory deadlines for GSP submittal, the use of the proportional acreage basis for dividing up the water budget among the Tule Subbasin GSAs, was used because it represents the most readily-available and implementable manner of accounting for the water budget for GSA-specific GSP preparation purposes at this time.

The GSAs will be collecting additional data during the GSP implementation period and will consider refining or changing the method of dividing Sustainable Yield for water budget purposes in future GSP updates. The division of Sustainable Yield among the GSAs under this Coordination Agreement does not constitute any determination that groundwater extractions within a GSA in excess of a budgeted amount would necessarily cause an undesirable result or that extractions less than a budgeted amount would necessarily not cause an undesirable result. The water budget division also does not require any GSA to implement particular projects or management actions.

4.3 Undesirable Results (Reg. § 354.26)

Pursuant to 23 Cal. Code Regs. §357.26, the GSAs agree on the following processes and criteria to define undesirable results applicable to the Subbasin. Undesirable Results are caused by groundwater conditions occurring throughout the basin that, for any sustainability indicator, are considered significant and unreasonable. These conditions, or sustainability indicators, include:

- Chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon;
- Reduction of groundwater storage;
- Seawater intrusion;
- Degraded water quality, including the migration of contaminant plumes that impair water supplies;
- Land subsidence that substantially interferes with surface land uses; and
- Depletions of interconnected surface water that have adverse impacts on beneficial uses.

The Tule Subbasin GSAs have evaluated the potential for each of these groundwater conditions and have established common criteria wherein, if any such significant and unreasonable conditions were to become present, they would constitute an undesirable result within the GSA.

There are four groundwater conditions with sustainability indicators that may have potential to cause significant and unreasonable effects within the Tule Subbasin. These conditions are:

- Chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon;
- Reduction of groundwater storage;
- Degraded water quality, including the migration of contaminant plumes that impair groundwater supplies; and
- Land subsidence that substantially impacts critical infrastructure.

The undesirable results and measurement methodology for each sustainability indicator are defined below.

4.3.1 Chronic Lowering of Groundwater Levels

4.3.1.1 Causes of Groundwater Conditions That Could Lead to Undesirable Results (§354.26(b)(1))

Pursuant to 23 Cal. Code Regs. §354.26(b)(1), chronic lowering of groundwater levels occurs when groundwater pumping exceeds the available recharge of the basin over a prolonged period. The GSAs within the Subbasin have defined the Undesirable Result for groundwater levels to be significant and unreasonable if there is basin-wide loss of well pumping capacity, which cannot be remedied.

Projects and management actions will be implemented by each GSA in order to decelerate and arrest chronic lowering of local groundwater levels within the Tule Subbasin by 2040.

4.3.1.2 *Criteria to Define Undesirable Results (§354.26(b)(2))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(2), the criteria for an undesirable result for the chronic lowering of groundwater levels is defined as the unreasonable lowering of the groundwater elevation below the minimum threshold for two consecutive years at greater than 50% of GSA Management Area RMS Sites, which results in significant impacts to groundwater supply.

Measurement Methodology: Utilize Groundwater Elevations, as determined by measuring depth to groundwater at representative monitoring sites according to the monitoring schedule outlined in **Attachment 1**.

4.3.1.3 *Potential Effects on Beneficial Uses and Users (§354.26(b)(3))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(3), generally, the avoidance of an undesirable result for the chronic lowering of groundwater levels is to protect unreasonable lowering of groundwater levels may effect groundwater users by causing well failures, additional operational costs for groundwater extraction from deeper pumping levels, and additional costs to lower pumps, deepen wells, or drill new wells.

Localized lowering of groundwater levels to the extent that an undesirable result is experienced may also affect other nearby monitoring areas, management areas, or GSAs to maintain groundwater levels above their minimum thresholds and/or prevent them from achieving their measurable objectives.

4.3.2 Reduction of Groundwater Storage

4.3.2.1 *Causes of Groundwater Conditions That Could Lead to Undesirable Results (§354.26(b)(1))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(1), chronic reduction of groundwater storage occurs when pumping exceeds the available recharge and subsurface inflows of the basin over a prolonged period. The Groundwater Level Minimum Threshold elevations across the GSA and subbasin were used to calculate the amount of groundwater in storage below the Minimum Thresholds to the base of the aquifer. An undesirable result would occur if the total amount of water in storage was less than the calculated amount of groundwater in storage below the Minimum Threshold.

Projects and management actions will be implemented by each GSA in order to decelerate and arrest chronic negative change in groundwater storage within the Tule Subbasin by 2040.

4.3.2.2 *Criteria to Define Undesirable Results (§354.26(b)(2))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(2), the criteria for an undesirable result for the reduction of groundwater storage is defined as the unreasonable reduction of Groundwater Storage below the minimum threshold for two consecutive years at greater than 50% of GSA Management Area RMS Sites, which results in significant reductions to groundwater storage.

Measurement Methodology: Utilize groundwater elevations, as determined by measuring depth to groundwater at representative monitoring sites, used to calculate the gross groundwater storage volume. The net groundwater storage volume will be calculated subtracting the gross groundwater storage volume from groundwater that has been banked from surface water supplies. The calculations will be completed each year per schedule in **Attachment 1**.

4.3.2.3 *Potential Effects on Beneficial Uses and Users (§354.26(b)(3))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(3), the avoidance of an undesirable result for the reduction of groundwater storage is to protect the similar effects of the chronic lowering of groundwater elevation summarized above.

4.3.3 Degraded Water Quality

4.3.3.1 *Causes of Groundwater Conditions That Could Lead to Undesirable Results (§354.26(b)(1))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(1), degraded water quality can occur for a variety of reasons, some reasons that are not applicable to SGMA implementation. An undesirable result would be the significant and unreasonable reduction in groundwater quality due to groundwater pumping and recharge projects such that the groundwater is no longer generally suitable for agricultural irrigation and domestic use. For the purposes of SGMA, degraded water quality causation will include those changes to groundwater quality caused by recharge or lowering of groundwater elevations.

Projects and management actions will be implemented by each GSA in order to decelerate and arrest the degradation of groundwater quality caused by recharge or lowering of groundwater elevations within the Tule Subbasin by 2040.

4.3.3.2 *Criteria to Define Undesirable Results (§354.26(b)(2))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(2), the criteria for an undesirable result for the degradation of groundwater quality is defined as the unreasonable long-term changes of groundwater quality above the minimum thresholds at greater than 50% of GSA Management Area RMS wells caused by groundwater pumping and/or groundwater recharge.

Measurement Methodology: Utilize Data collected by others (Public Water Systems, Irrigated Lands Regulatory Program, other Regulated Dischargers) at the RMS well sites identified in **Attachment 1**. Constituents of Concern (COC) to be established at each Groundwater Quality RMS well which will be determined based on Land Use Suitability (domestic water versus irrigated agriculture).

4.3.3.3 *Potential Effects on Beneficial Uses and Users (§354.26(b)(3))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(3), generally, the avoidance of an undesirable result for degraded groundwater quality is to protect the those using the groundwater, which varies depending on the use of the groundwater. The effects of degraded water quality caused by recharge or lowering of groundwater levels may impact crop growth or impact drinking water systems, both of which would cause additional expense of treatment to obtain suitable water.

4.3.4 Land Subsidence

4.3.4.1 *Causes of Groundwater Conditions That Could Lead to Undesirable Results (§354.26(b)(1))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(1), Land Subsidence occurs when there is prolonged dewatering of groundwater that causes subsequent compaction of water bearing formations composed of substantial thicknesses of fine-grained deposits. Land subsidence shall be considered significant and unreasonable if there is a loss of a functionality of a structure or a facility to the point that, due to subsidence, the structure or facility, such as the Friant-Kern Canal (FKC), cannot reasonably operate to meet contracted for water supply deliveries without either significant repair or replacement.

Projects and management actions will be implemented by each GSA in order to decelerate and eventually arrest land subsidence within the Tule Subbasin by 2040, including measures necessary to reduce or eliminate land subsidence significantly and unreasonably affecting the functionality or a structure or facility, such as the FKC.

4.3.4.2 *Criteria to Define Undesirable Results (§354.26(b)(2))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(2), the criteria for an undesirable result for land subsidence is defined as the unreasonable subsidence below minimum thresholds at greater than 50% of GSA Management Area RMS resulting in significant impacts to critical infrastructure. Individual GSAs may adopt more stringent criteria than that established in this section. The Parties to this Agreement hereby acknowledge the need to include an additional standard that an undesirable result will also occur if land subsidence in particularized areas within a given GSA causes significant and unreasonable adverse effects on the functionality of a structure or facility, such as the FKC, regardless of whether more than 50% of the GSA Management Area RMS locations indicate exceedance of the subsidence standard.

4.3.4.3 *Potential Effects on Beneficial Uses and Users (§354.26(b)(3))*

Pursuant to 23 Cal. Code Regs. §354.26(b)(3), the avoidance of an undesirable result of land subsidence is to protect critical infrastructure for the beneficial uses within the Tule Subbasin, including out of the ordinary costs to fix, repair, or otherwise retrofit such infrastructure beyond those which are expected or normal and may also result in an interim loss of benefits to the users of such infrastructure.

An exceedance of minimum thresholds to the extent that the undesirable result for the Tule Subbasin is experienced could likely induce financial hardship on land and property interests, such as the redesign of previously planned construction projects and the fixing and retrofitting of existing infrastructure.

4.3.5 Depletion of Interconnected Surface Waters (Regs. §354.26 (d) & §354.28 (e))

No interconnected surface waters have been identified in any Tule Subbasin GSAs as described more thoroughly in relevant portions of the Basin Setting. Thus, no criteria need be established.

4.3.6 Seawater Intrusion (Regs. §354.26 (d) & §354.28 (e))

Seawater intrusion is defined as "the advancement of seawater into a groundwater supply that results in degradation of water quality in the basin and includes seawater from any source." (23 Cal. Code Regs. §351(af).) As described more thoroughly in the basin setting, there is no potential for the advancement of seawater into any portion of the Tule Subbasin. Thus, no criteria need be established.

4.4 Minimum Thresholds (Reg. § 354.28)

Minimum Thresholds will be quantified at each RMS wells for each applicable sustainability indicator, defined as the numeric value, that if exceeded, may cause undesirable results. Each minimum threshold will be defined and described by each GSA in the GSP.

4.5 Measurable Objectives (Reg. § 354.30)

Measurable Objectives, including interim milestones in increments of five years, will be quantified at each RMS wells for each applicable sustainability indicator, defined as the numeric value in 2040, to achieve the sustainability goal in 20-year of plan implementation. Each measurable objective and interim milestones will be defined and described separately by each GSA in the GSP.

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V. MONITORING PROTOCOLS, NETWORKS, AND IDENTIFICATION OF DATA GAPS (§§352.2, 354.32.)

5.1 Monitoring Network and Representative Monitoring (§§354.34-354.36)

The minimum monitoring network to be used to collect data in the Tule Subbasin is described in the Tule Subbasin Monitoring Plan (see **Attachment 1**). The types of data to be collected as part of the plan include:

- Surface water flow
- Surface water quality
- Groundwater levels
- Groundwater quality
- Land surface elevation from Global Positioning System (GPS) stations
- Land surface elevation changes from satellite data
- Land subsidence data from extensometers

The monitoring plan ensures that the data collected within the subbasin is of sufficient quality, frequency and distribution to provide meaningful results for evaluating changing conditions within the subbasin and informing the decision-making process.

The minimum monitoring network identified in the Tule Subbasin Monitoring Plan is both flexible and iterative, allowing for the addition or subtraction of monitoring features, as necessary, and to accommodate changes in monitoring frequency and alternative methodologies, as appropriate. Any changes to the minimum monitoring network or monitoring protocols identified in **Attachment 1** shall be approved by the Tule Subbasin TAC.

Individual GSAs may include additional monitoring features, not specifically identified in the Tule Subbasin Monitoring Plan, for collecting data to include in their respective GSPs and annual reports. Any monitoring features utilized for the collection of data to be included in GSPs and annual reports that are not identified in the Tule Subbasin Monitoring Plan must meet the minimum design and construction requirements specified in Section 3 of this Coordination Agreement and the Tule Subbasin Monitoring Plan. Any monitoring features not in the Tule Subbasin Monitoring Plan that are to be used by a GSA to collect data for incorporation into GSPs or annual reports will be shared with the Tule Subbasin TAC.

5.1.1 Procedures for Collecting the Data

The Tule Subbasin Monitoring Plan (**Attachment 1**) includes detailed procedures for the collection of surface water flow data, groundwater elevation data, and land surface elevation data. Groundwater quality data will be coordinated with and through the Irrigated Lands Regulatory Program and the existing coalitions. The data collection procedures will ensure that the data collected have the level of accuracy and precision necessary for evaluating conditions relative to minimum thresholds, estimating change in groundwater storage as required for annual reports, and measuring progress toward achieving sustainability. The data collection processes and procedures shall apply to monitoring features specifically identified in the Tule Subbasin Monitoring Plan as well as any additional monitoring features utilized for the collection of data by individual GSAs.

5.1.2 Entities Responsible for Data Collection

All data collection work, as specified in the Tule Subbasin Monitoring Plan (**Attachment 1**) will be performed by each GSA through individuals working under the direct supervision of a California Registered Professional Civil Engineer, Professional Geologist, or Certified Hydrogeologist and who meet the minimum qualifications and training requirements required by the Tule Subbasin TAC's technical consultant. The collection of groundwater quality data will be coordinated with and through the Irrigated Lands Regulatory Program and the existing coalitions. All data will be collected in accordance with the protocols specified in **Attachment 1**.

Nothing in this Agreement prevents multiple GSAs from using the same consultant. It is understood by and among the Parties that there will be individual GSA-specific data that can be collected either through the Tule Subbasin TAC's technical consultant or through the consultant/staff hired by that GSA. The goal is that the data collection be done following the same processes and procedures throughout the Tule Subbasin. If a GSA prefers to use the technical consultant hired by the Tule Subbasin TAC for the purposes of collecting information beyond what is required for Tule Subbasin Monitoring Plan, then that GSA shall pay for the consultant's fees and costs separately and above what the Tule Subbasin GSAs agree to cost share. In the event that a GSA hires its own consultant for site or GSA-specific data collection, such data shall be shared through the data sharing provisions of this Agreement.

All data collected by the GSAs shall be submitted to the Tule Subbasin TAC's technical consultant in accordance with the schedule described in Section 4.1.3 for QA/QC and entry into the Tule Subbasin Water Management Database (see Section 4.3).

5.1.3 How and When Data are Distributed to the GSAs

The complete Tule Subbasin Water Management Database will be available to authorized representatives as set forth by the GSAs of the Tule Subbasin GSAs at any time upon request.

The schedule to distribute data to the individual GSAs for preparation of annual reports has been prepared to enable the Tule Subbasin TAC to submit the compiled annual reports by the SGMA reporting deadline of April 1 following a water year. As per Groundwater Sustainability Plan Regulations Section 356.2, annual reports will include data and analyses for the preceding water year (October 1 through September 30). The distribution of data to the GSAs for the preparation of annual reports will be in accordance with the following schedule:

- The Tule Subbasin TAC's technical consultant will update the database between October 1 and January 30 following a subject water year.
- Individual GSAs will be required to submit groundwater extractions (i.e. pumpage) to the technical consultant by January 1 following a subject water year.
- Following Quality Assurance/Quality Control checks by the technical consultant, the previous water year's data will be submitted to each GSA by February 1 so the

GSAs can prepare their respective annual reports. The data will be formatted for easy incorporation into annual reports and distributed electronically.

- Annual reports will be submitted to the Tule Subbasin TAC for compilation by March 1 following the preceding water year.
- All annual reports will be submitted to the California Department of Water Resources by April 1 following the preceding water year.

5.2 Assessment and Improvement of Monitoring Network and Identification of Data Gaps (§354.38.)

The Tule Subbasin TAC will periodically evaluate the monitoring network in **Attachment 1** to determine if there are data gaps that could affect the ability of the subbasin to meet its sustainability goals. Current data gaps are identified in **Attachment 1**. Every five years, the Tule Subbasin TAC will provide an evaluation of data gaps in the five-year assessment, including steps to be taken to address data gaps before the next five-year assessment.

5.3 Data Management System (DMS) (§357.4(e).)

Efficient data management will be a critical to ensure that each GSA can access the data needed to prepare their respective annual reports in a timely manner and to ensure that the Tule Subbasin TAC can meet deadlines for submittal of the coordinated reports. The Monitoring Plan, **Attachment 1**, describes the Tule Subbasin Water Management Database, the procedures for updating and maintaining the database, and protocols for database security, file access and reporting. Data to be managed will include:

A. Historical data used as a basis for preliminary estimates of the Water Budget and Sustainable Yield of the Tule Subbasin.
B. Data to be collected in accordance with the Tule Subbasin Monitoring Plan (**Attachment 1**).

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VI. IMPLEMENTATION OF GSPS (§357.4(c).)

Pursuant to 23 Cal. Code Regs. §357.24(c), the coordination agreement shall explain how the GSPs when implemented together satisfy the requirements of SGMA and are in substantial compliance with its regulations. SGMA requires the development and implementation of GSPs by GSAs to achieve sustainable groundwater management by 2040.

Throughout this Coordination Agreement, the Tule Subbasin GSAs have agreed upon various data and methodologies critical to understanding the hydrogeology of the Subbasin, and addressing and understanding what remedies are available to avoid undesirable results.

The GSAs within the Tule Subbasin will work together to implement their respective GSPs within the Tule Subbasin. The Tule Subbasin TAC, the technical advisory committee composed of representatives from each GSA, has developed Subbasin-wide data and methodologies for each of the following items, and made them available to each GSA to adopt and utilize in the development of its respective GSP:

- Groundwater elevation data.
- Groundwater extraction data.
- Surface water supply.
- Total water use.
- Change in groundwater storage.
- Water budget.
- Sustainable yield.

The GSAs understand there is local, site-specific data particular to each GSA and which each GSA may utilize in the development of its respective GSP in addition to the Subbasin-wide data. If an individual GSA has identified monitoring features for use in collecting data specific to its jurisdictional area and the features are not included in Section 3 or **Attachment 1** of this Coordination Agreement, then the GSA can incorporate the features and data into its GSP upon confirming that those particular monitoring features meet the minimum criteria specified in Section 3 and that the data has been collected in accordance with this Coordination Agreement.

Each GSA shall submit its respective GSP, and any updates thereto, to the Tule Subbasin TAC so that the other Tule Subbasin GSAs may review and comment prior to documents being submitted to DWR. Each GSA shall comply with 23 Cal. Code Regs. §354.10, regarding comments received on the GSP, and such GSP shall be made available on the GSA's website.

Each GSA acknowledges and agrees that it is responsible to ensure that its GSP complies with the statutory requirements of SGMA. The GSAs further acknowledge the obligation for each GSA to coordinate the implementation of their respective GSPs in order to, collectively, achieve the Sustainability Goal for the Subbasin, as required by SGMA.

Additionally, to better implement and refine the projects and management actions adopted in their respective GSPs, the GSAs are committed to work together on developing and maintaining a data management system and are implementing quality control and quality assurance measures to collect reliable GSA-specific and Subbasin-wide data to ensure Subbasin-wide Sustainability Goal is achieved.

The Tule Subbasin GSAs are committed to implementing their respective projects and management actions set forth in their respective GSPs for the purpose of reaching sustainability for the Subbasin by 2040. The GSAs are also committed to further refine and update their projects, management actions and GSPs in accordance with SGMA as more and better data becomes available.

In relation to subsidence, the Parties acknowledge that the technical understanding of projected subsidence effects post 2020 is still being developed at the time of GSP preparation, and that, in addition to monitoring and identifying where subsidence occurs, the GSAs will need to develop and implement projects and management actions to either prevent or mitigate for the undesirable results from post 2020 subsidence that is likely to occur as the subbasin works towards sustainability. The Parties acknowledge and agree that monitoring subsidence is an important first step and that it necessarily must be accompanied with projects and management actions to address the impacts of post 2020 subsidence levels, including consideration of actions such as the collection of mitigation fees to have the responsible party or entity bear their proportionate share of responsibility in relation to impacts reasonably attributable to such party or entity, which would require adherence to procedural and substantive standards under any applicable provisions of Proposition 218, Proposition 26 or other laws or regulations related to fees or penalties imposed by public agencies. Further, the Parties have begun to work with Friant Water Authority on the development of a Friant-Kern Canal mitigation program, potentially to include targeted pumping reductions and mitigation fees, to be imposed by GSAs within specific areas, based on an analysis of each GSA's likely proportional impact on post 2020 subsidence. The Parties to this Agreement agree to work diligently to develop an initial localized mitigation program based on the best available information related to the projected cause of post 2020 subsidence, with the intent to have said mitigation program effective upon or before the occurrence of any localized or basin wide subsidence undesirable result.

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VII. TULE SUBBASIN ORGANIZATIONAL STRUCTURE

7.1 Tule Subbasin Technical Advisory Committee

The Tule Subbasin TAC was previously formed under a Memorandum of Agreement executed by all Tule Subbasin GSAs. The Parties agree to the continued existence of the Tule Subbasin TAC pursuant to the terms below. The Tule Subbasin TAC is an advisory committee only and has no authority or power to bind any individual GSA to any recommendation or action item taken by its members.

Nothing in this Agreement is intended to affect the statutory powers granted under SGMA, or any other applicable law, to the Tule Subbasin GSAs. Each Tule Subbasin GSA shall be solely responsible for the adoption and enforcement of any ordinances, bylaws, or other legally enforceable actions taken within their respective GSA boundaries to implement SGMA, including, but not limited to, the preparation of the GSP applicable within their GSA boundaries. Each GSA agrees that as required by this Coordination Agreement, they shall utilize the same data and methodologies contained in this Coordination Agreement. The Parties understand there will be basin-wide data, in addition to certain local site-specific data collected and/or utilized by each GSA.

7.1.1 Members and Voting

A Tule Subbasin TAC shall be formed with one (1) representative appointed from each GSA, as well as one (1) alternate from each GSA. The Subbasin TAC shall make technical recommendations regarding the Coordination Agreement and other Tule Subbasin related SGMA compliance issues to each GSA. The Tule Subbasin TAC shall meet as necessary. Each GSA shall be entitled to one (1) vote. Recommendations to each GSA shall only be made upon consensus of the Tule Subbasin TAC. Should consensus not be reached, the votes shall be reported to each GSA Board for further direction. A quorum shall exist when five of the seven GSAs have representatives in attendance. The chairperson and secretary will not hold any separate voting rights on the Tule Subbasin TAC.

7.1.2 Consultants

The Parties agree that the Tule Subbasin TAC should obtain the services of consultants to facilitate the collection of data and the submission of information to the Tule Subbasin GSAs. Prior to hiring consultants, or approving scopes of work, the TAC shall obtain approval from the Tule Subbasin GSAs.

7.1.3 Legal Services

The Tule Subbasin TAC shall not retain independent legal services, unless agreed upon by all Parties hereto. Each Party shall be responsible for any legal fees incurred by its own counsel in the course of performing any legal work related to Subbasin matters.

7.1.4 Chairman and Secretary

A Chairman and Secretary shall be appointed to serve the Tule Subbasin TAC. The Chairperson shall be responsible for managing all Tule Subbasin TAC meetings, preparing agenda materials, managing consultants hired by the Tule Subbasin TAC, and coordinating the delivery of information between GSAs and Tule Subbasin TAC consultants. The Secretary shall be responsible for distributing Tule Subbasin TAC agenda materials to all Tule Subbasin GSAs and to all interested parties that request to be notified of Tule Subbasin TAC meetings, as well as ensuring compliance with all applicable legal requirements, including, but not limited to, the Ralph M. Brown Act. The Secretary shall also be responsible for record keeping of the Tule Subbasin TAC group, maintaining minutes of Tule Subbasin TAC meetings, maintaining copies of all executed agreements, maintaining copies of documents produced by consultants, and providing such information to individual Tule Subbasin GSAs upon request. The appointed Chairperson or Secretary may meet with Tule Subbasin GSAs or GSA member agency employees as necessary.

7.1.5 Meetings

All meetings shall be subject to the Ralph M. Brown Act. The Chairman and Secretary shall be responsible for ensuring compliance. Interested parties shall be provided an opportunity to comment on Coordination Agreement issues. Parties acknowledge the Tule Subbasin TAC duties may include public outreach.

7.1.6 Cost Sharing and Governance

Parties shall share on an equitable basis the costs related to the preparation of the data required for the Coordination Agreement to be drafted. Costs shall be allocated between GSAs based on the number of acres within a GSA.

Each Party to this Agreement shall be responsible for their respective share of costs based on their proportionate acreage within the Tule Subbasin. Through a separate agreement, the Tule Subbasin GSAs have appointed a fiscal agent and that fiscal agent shall have authority to enter into any contract necessary to assist with the preparation of the Coordination Agreement, subject to the direction and authorization of the Tule Subbasin TAC. The fiscal agent shall be responsible for invoicing the respective GSAs and for providing an accounting of all funds received and spent on behalf of the GSAs. The fiscal agent shall attend all Tule Subbasin TAC meetings but has no separate voting rights on the Tule Subbasin TAC.

The Tule Subbasin TAC shall annually prepare a schedule, scope of work, and budget of items required for the Coordination Agreement, which shall identify the estimated expenses and the estimated portions each respective Tule Subbasin GSA will be expected to be responsible for. This information shall be submitted to the GSAs for review and approval. The Tule Subbasin TAC may request funds under the approved budget from the GSAs as needed to reimburse the GSA's fiscal agent and may also request budget amendments.

The Parties agree that if grant funds become available for the Coordination Agreement components, then the Parties shall utilize grant funds to pay for those costs. The Parties agree to coordinate specific grant application requests by separate agreement. The Parties agree that grant funds shall be utilized based on the grant application budget and that if any grant funds are available for distribution to the GSAs, then the remaining grant funds shall be distributed based on GSA acreage within the Tule Subbasin.

7.1.7 Procedures for Timely Exchange of Information (§357.4(b)(2))

7.1.7.1 *Exchange of Information*

Pursuant to 23 Cal. Code Regs. §357.4(b)(2), the GSAs acknowledge and recognize that for this Coordination Agreement to be effective in the enhancement of the goals of basin-wide groundwater sustainability and compliance with the SGMA and the basin level coordinating and reporting regulations, the GSAs will have an affirmative obligation to exchange certain minimally necessary information among and between the other GSA Parties. Likewise, the GSA Parties acknowledge and recognize that individual GSA Parties, in providing certain information, and in particular certain raw data, may contend that limitations apply in the sharing and other dissemination of certain types of said information, which may subject the individual GSA Party to certain duties regarding non-disclosure and privacy restrictions and protections.

7.1.7.2 *Procedure Governing the Exchange of Information*

The GSAs may exchange information through collaboration and/or informal requests made at the Tule Subbasin TAC. To the extent it is necessary to make a written request for information to another GSA, each GSA shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Tule Subbasin TAC. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine or other electronic means to the appropriate representative as named in this Agreement.

Nothing in this Agreement shall be construed to prohibit any Party from voluntarily exchanging information with any other Party by any other mechanism separate from the Tule Subbasin TAC.

7.1.8 Procedures for Resolving Disputes Dispute Resolution (§§357.4(b)(2), 357.4(h))

The Parties agree that all disputes under this Coordination Agreement that concern the applicability and requirements of SGMA by or between GSAs within the Tule Subbasin, shall be handled under the terms of this Agreement. Any GSA may choose to initiate a dispute resolution process by serving written notice to the remaining GSAs of the following: (1) identification of the conflict; (2) description of how the conflict may negatively impact the sustainability of the Tule Subbasin; and (3) a proposal for one or more resolutions. The Parties agree to designate representatives to meet and confer with each other within thirty (30) days of the date such notice is given and said representatives shall then meet within a reasonable time to address all issues identified in the notice. Should the representatives be unable to reach a resolution within ninety (90) days of the written notice, the Parties shall enter into informal mediation in front of a mutually agreeable mediator. After attempting to settle or resolve a dispute or disagreement through informal resolution and mediation, as described above, nothing within this Agreement shall prevent the Parties from pursuing legal action. The resolution of any dispute or claim related to a water right alleged by a Party is outside the scope contemplated in this Section 7.1.8 and the Coordination Agreement.

7.2 Amendments to this Coordination Agreement

This Coordination Agreement shall become effective on the dates executed by all Parties and shall remain in effect until revised or replaced by a subsequent agreement. This Agreement may be amended upon the mutual written agreement of all the Parties. Pursuant to 23 Cal. Code Regs. §357.4(i), this Coordination Agreement shall be reviewed as part of the five-year assessment, revised if necessary, and executed by all parties.

7.3 Construction

This Agreement is for the sole benefit of the Parties and shall not be construed as granting rights to or imposing obligations on any person other than the Parties.

7.4 Good Faith

Each Party shall use its best efforts and work in good faith for the expeditious completion of the purposes and goals of this Agreement and the satisfactory performance of its terms.

7.5 Execution

This Agreement may be executed in counterparts and the signed counterparts shall constitute a single instrument. The signatories to this Agreement represent that they have the authority to sign this agreement and to bind the Party for whom they are signing.

7.6 Third Party Beneficiaries

This Agreement shall not create any right of interest in any non-Party or in any member of the public as a third-party beneficiary.

7.7 Notices

All notices, requests, demands or other communications required or permitted under this Agreement shall be in writing unless provided otherwise in this Agreement, and shall be deemed to have been duly given and received on: (i) the date of service if personally served or served by electronic mail or facsimile transmission on the Party to whom notice is to be given at the address(es) below; (ii) on the first day after mailing, if mailed by Federal Express, U.S. Express Mail, or other similar overnight courier service; or (iii) on the third day after mailing if mailed to the Party to whom notice is to be given by first class mail, registered certified as follows:

Alpaugh Groundwater Sustainability Agency
Attn: Bruce Howarth
P.O. Box 129
Alpaugh, CA 93201

Delano-Earlimart Irrigation District
Groundwater Sustainability Agency
Attn: Eric Quinley
14181 Avenue 24
Delano, CA 93215

Eastern Tule Groundwater Sustainability Agency
Attn: Rogelio Caudillo, Interim Executive Director
881 W. Morton Avenue, Suite D
Porterville, CA 93257

Lower Tule River Irrigation District GSA
Attn: Eric Limas
357 E. Olive Avenue
Tipton, CA 93272

Pixley Irrigation District GSA
Attn: Eric Limas
357 E. Olive Avenue
Tipton, CA 93272

Tri-County Water Authority GSA
Attn: Deanna Jackson
944 Whitley Avenue Suite E
Corcoran, CA 93212

County of Tulare
c/o Denise England
County Administration Building
2800 W. Burrel Avenue
Visalia, California 93291

7.8 No Waiver; No Admission

Nothing in this Coordination Agreement is intended to modify the water rights of any Party or of any Person (as that term is defined under Section 19 of the Water Code) . Nothing in this Coordination Agreement shall be construed as an admission by any Party regarding any subject matter of this Coordination Agreement, including without limitation any water right or priority of any water right that is claimed by a Party or any Person. Nor shall this Coordination Agreement in any way be construed to represent an admission by a Party with respect to the subject or sufficiency of another Party's claim to any water or water right or priority or defenses thereto, or to establish a standard for the purposes of the determining the respective liability of any Party or Person, except to the extent otherwise specified by law. Nothing in this Coordination Agreement shall be construed as a waiver by any Party of its election to at any time assert a legal claim or argument as to water, water right or any subject matter of this Coordination Agreement or defenses thereto. The Parties hereby agree that this Coordination Agreement, to the fullest extent permitted by law, preserves the water rights of each of the

Parties as they may exist as of the effective date of this Coordination Agreement or at any time thereafter. Any dispute or claim arising out of or in any way related to a water right alleged by a Party shall be separately resolved before the appropriate judicial, administrative or enforcement body with proper jurisdiction and is specifically excluded from the dispute resolution procedures set forth under this Coordination Agreement, including without limitation under Section 7.1.8.

7.9 It is understood and agreed that this Coordination Agreement supersedes that certain "Memorandum of Understanding to Develop and Implement a Coordination Agreement" and all oral agreements and negotiations between the Parties relating to the subject matter hereof.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement to be effective as of the date noted below.

______________________________________ ______________
Alpaugh Groundwater Sustainability Agency Date

______________________________________ ______________
Delano Earlimart Irrigation District GSA Date

______________________________________ ______________
Eastern Tule Groundwater Sustainability Agency Date

______________________________________ ______________
Lower Tule River Irrigation District GSA Date

______________________________________ ______________
Pixley Irrigation District GSA Date

______________________________________ ______________
Tri-County Water Authority GSA Date

______________________________________ ______________
Tulare County GSA Date