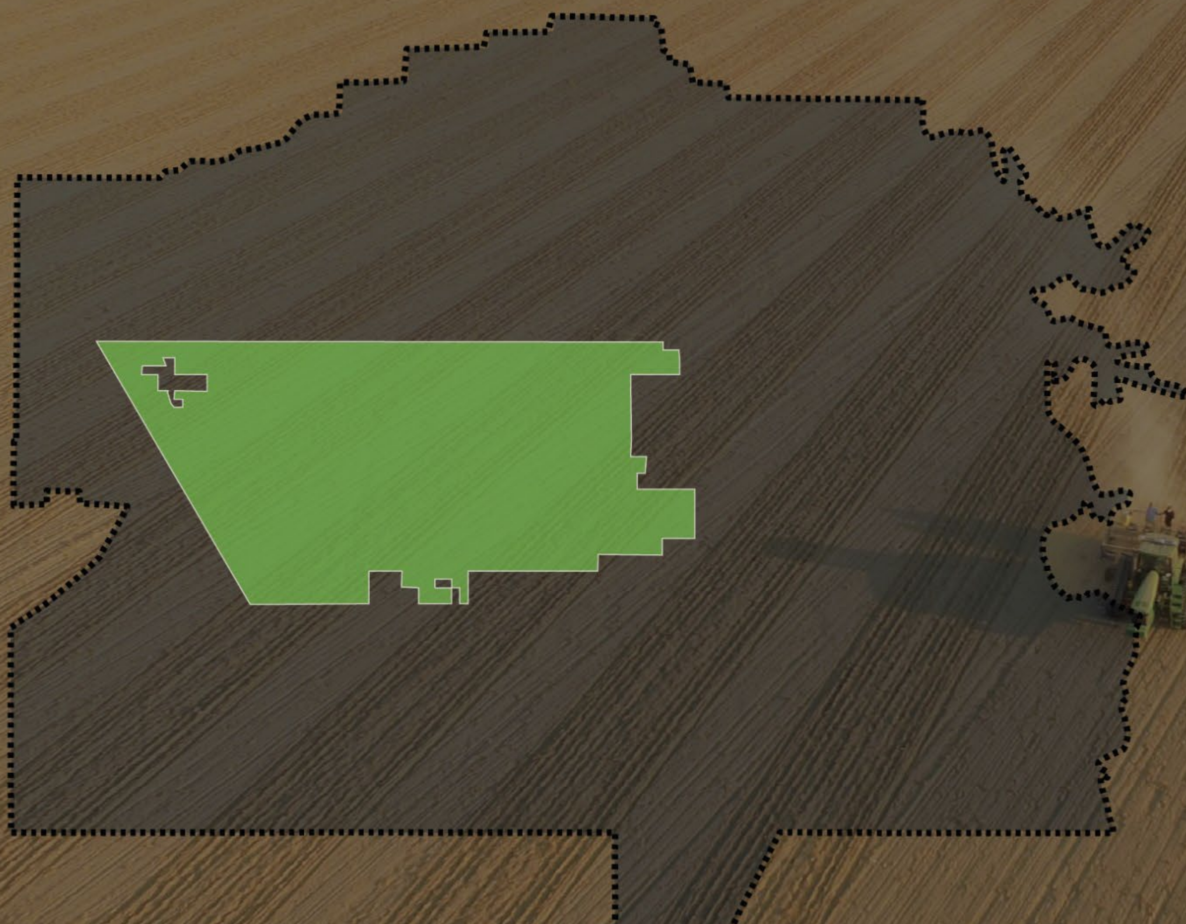
Sustainable Groundwater Management Act
Annual Report



Pixley Irrigation District
Groundwater Sustainability Agency
Tule Subbasin
October 2020 - September 2021

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ATTACHMENTS

ABBREVIATIONS & ACRONYMS

amsl	above mean sea level
CASGEM	California State Groundwater Elevation Monitoring
CDWR	California Department of Water Resources
CEOP	Communication, Engagement and Outreach Plan
CEQA	California Environmental Quality Act
CGQMP	Comprehensive Groundwater Management Plan
CIMIS	California Irrigation Management Information System
CSD	Community Services District
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DCTRA	Deer Creek Tule River Authority
DDW	Division of Drinking Water
DMS	Data Management System
DWR	Department of Water Resources
EC	Electrical Conductivity
ET	Evapotranspiration
EIR	Environmental Impact Report
FKC	Friant-Kern Canal
GAMA	Groundwater Ambient Monitoring and Assessment
GAR	Groundwater Assessment Report
GDEs	Groundwater Dependent Ecosystems
GFM	Groundwater Flow Model
GP	General Plan
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GQTMP	Groundwater Quality Trend Monitoring Program
GQTMW	Groundwater Quality Trend Monitoring Workflow
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
IRWM	Integrated Regional Water Management
IRWMGs	Integrated Regional Water Management Groups
IRWMP	Integrated Regional Water Management Plan
ITRC	Irrigation Training and Research Center

LTRID	Lower Tule River Irrigation District
LUSTs	leaking underground storage tanks
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NC	Natural Communities
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
NTFGW	net to and from groundwater
PixID	Pixley Irrigation District
PPUD	Pixley Public Utility District
PUD	Public Utility District
RMS	representative monitoring sites
RWQCB	Regional Water Quality Control Board
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SREP	Success Reservoir Enlargement Project
SWRCB	State Water Resources Control Board
TBWQC	Tule Basin Water Quality Coalition
TCSD	Teviston Community Service District
TSMP	Tule Subbasin Monitoring Plan
UABs	Urban Area Boundaries
UDBs	Urban Development Boundaries
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WDL	Water Data Library

EXECUTIVE SUMMARY [§356.2(A)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(a) *General information, including an executive summary and a location map depicting the basin covered by the report.*

The Tule Subbasins hydrogeologist, Thomas Harder and Company, has prepared an Annual Report summarizing the 2020/21 groundwater conditions for the entirety of the subbasin (see **ATTACHMENT 1**). Appendices A through F of the subbasin-wide annual report describes groundwater conditions as it relates to each of the six (6) adopted Groundwater Sustainability Plans (GSPs) that collectively cover the subbasin. The data for describing the groundwater conditions within the Pixley GSA Plan area is provided as Appendix D of the subbasin-wide annual report and will be referenced throughout this report (see **ATTACHMENT 1**).

This is the third annual report of the Pixley Irrigation District Groundwater Sustainability Agency (Pixley GSA, GSA), as part of the Tule Subbasin identified by the California Department of Water Resources (CDWR) as No. 5-22-13 of the Tulare Lake Hydrologic Region (see **ATTACHMENT 1**, Figure 1). This report is being submitted in compliance with Title 23 of the California Code of Regulations, Division 2, Chapter 1.5, Subchapter 2, Article 7, Section 356.2, as required under the Sustainable Groundwater Management Act (SGMA). As per Section 356.2, this report addresses data collected for the preceding water year, which covers October 1, 2020 through September 30, 2021.

Sections of the Pixley GSA Annual Report Include the following:

SECTION 1. INTRODUCTION. A brief background on the GSA and coordination within the Tule Subbasin, a summary of the GSA Hydrogeologic Setting and Monitoring Networks.

SECTION 2. GROUNDWATER ELEVATION DATA [§356.2(b)(1)(A)]. A description of 2020/21 groundwater elevation monitoring data with contours for spring and fall monitoring events and representative hydrographs.

SECTION 3. GROUNDWATER EXTRACTION [§356.2(b)(2)]. A description of 2020/21 groundwater extractions by water use sector.

SECTION 4. SURFACE WATER USE [§356.2(b)(3)]. A description of 2020/21 surface water use by source.

SECTION 5. TOTAL WATER USE [§356.2(b)(4)]. A description of 2020/21 total groundwater extractions and surface water use.

SECTION 6. CHANGE IN GROUNDWATER STORAGE [§356.2(b)(4)]. A description of 2019/20 to 2020/21 water years change in groundwater storage through maps and graphs depicting water year type, groundwater use, the annual change in groundwater storage, and the cumulative change in groundwater in storage.

SECTION 7. PROGRESS TOWARDS PLAN IMPLEMENTATION [§356.2(c)]. A description of the 2020/21 groundwater conditions compared to SMC established in the GSA's GSP and the GSA's progress towards implementing projects and management action identified in the GSP.

Groundwater Elevations

The GSA has identified nine (9) wells to use as Representative Monitoring Sites (RMS), six (6) of which are perforated in the upper aquifer, while two (2) are perforated in the lower aquifer, and one (1) identified as composite. Data collected during the 2020/21 water year is provided in **Table ES-1.**

Table ES-1: 2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well ID	Groundwater Elevation (ft amsl)	
	Spring 2021	Fall 2021
Upper Aquifer		
22S/24E-23J01	-37.1	-35.3
23S/24E-28J02	95.0	83.0
22S/25E-25N01	17.7	7.4
23S/25E-08G01	N/A	54.6
23S/25E-16N04	-31.7	-74.6
PIDGSA-01 U	N/A	141.0
Lower Aquifer		
TSMW 1L	N/A	-146.2
PIDGSA-01 L	N/A	82.9
Composite Aquifer		
22S/25E-30	95.3	90.5

Groundwater Extractions

The primary extractor of groundwater within the GSA was identified agricultural as it makes up the majority of the area covered by the GSP. The communities of Pixley and Teviston were identified as the only other extractor of groundwater for municipal purposes. Volumes of groundwater extraction by sector for the 2020/21 water year is provided in **Table ES-2**.

Table ES-2: Total Groundwater Extractions

Management Area	Agricultural (AF)	Municipal (AF)	Total (AF)
Pixley ID	165,000	0	**165,000**
Pixley PUD	0	610	**610**
Teviston CSD	0	80	**80**
Total	**165,000**	**690**	**165,690**

Surface Water Use

Surface water supplies are available to the GSA as Deer Creek streamflow diversions, Central Valley Project (CVP) Friant Division imports, recycled municipal wastewater effluent, and precipitation. Volumes of surface water supplies used with the GSA during the 2020/21 water year is provided in **Table ES-3**.

Table ES-3: Total Surface Water Supply

Management Area	Stream Diversions (AF)	Imported Water (AF)	Recycled Water (AF)	Precipitation (AF)	Total (AF)
Pixley ID	0	0	0	17,400	**17,400**
Pixley PUD	0	0	220	500	**720**
Teviston CSD	0	0	0	400	**400**
Total	**0**	**0**	**220**	**18,300**	**18,520**

Total Water Use

Total water use is the combination of groundwater extractions and surface water supplies. While surface water is used to meet agricultural crop demands and when available at times in excess of demands recharged for conjunctive management, groundwater meets agricultural demands in excess of available surface water as well as municipal demands. Precipitation makes up a portion of the agricultural demand met by surface water. **Table ES-4** breaks down total water use by sector and supply.

Table ES-4: Total Water Use by Water Use Sector

Management Area	Groundwater (AF)		Surface Water (AF)		Total (AF)
Source:	Ag.	Municipal	Ag[1].	Recharged[2]	
Pixley ID	165,000	0	17,400	0	**182,400**
Pixley PUD	0	610	500	220	**1,330**
Teviston CSD	0	80	400	0	**480**
Total	**165,000**	**690**	**18,300**	**220**	**184,210**

1) Includes precipitation
2) Recharged volume includes channel losses

Groundwater Storage

Change in groundwater storage is calculated using several methodologies in this annual report, one to represent the conditions directly underlying the GSAs plan area using groundwater elevations and aquifer specific yield characteristics and the other based a net water balance accounting determined from surface water supplies less total water consumption. The first method is utilized for comparing change in groundwater storage to established SMCs but is influenced by groundwater flowing away from areas of natural and artificial recharge towards pumping depressions which is not indictive of a GSA's actions. The second method allows the GSA to account for storage strictly based on total consumptive water use, using remotely sensed ETc data and metered municipal use, compared to total surface water supplies to derive a net water balance accounting of change in groundwater storage.

Using the first methodology change in groundwater storage in the GSA plan area amounted to 29,000 acre-feet decrease in storage from the 2019/20 to 2020/21 water years. While this methodology is useful for understanding total groundwater storage in the Subbasin, it is not intended to account for ownership of water in storage. The volume of groundwater each GSA has access to will differ due to the accumulation of Net Water Balance contributions and extractions by the individual GSA over time. This apparent discrepancy is noted and will be investigated further as more data become available.

The second methodology, calculating net water balance yields 132,190 acre-feet decline in groundwater storage from during the 2020/21 water year and is accounted for in **Table ES-5**.

TABLE ES-5: GSA ACCOUNTING OF GROUNDWATER STORAGE

October 2020 thru September 2021	Volume (AF)			Total (AF)
	Pixley ID	Pixley PUD	Teviston CSD	
Total Non-Groundwater Supply	**17,400**	**720**	**400**	**18,520**
Surface Water (streamflow, imported)	*0*	*220*	*0*	*220*
Applied Irrigation	*0*	*0*	*0*	*0*
Recharged[1]	*0*	*220*	*0*	*220*
Total Precipitation[2]	*17,400*	*500*	*400*	*18,300*
Total Consumptive Use	**(143,860)**	**(4,910)**	**(80)**	**(150,710)**
ETc (agricultural)	*(143,860)*	*(4,300)*	*(1,860)*	*(150,020)*
Metered (municipal, exported)	*0*	*(610)*	*(80)*	*(690)*
Water Balance	**(126,460)**	**(4,190)**	**(1,540)**	**(132,190)**

1) Recharge volumes include channel losses
2) Total precipitation is used rather than effective precipitation because portion that is not effective is accounted for in ETc

The volume of groundwater each GSA has access to will differ due to the accumulation of Net Water Balance contributions and extractions by the individual GSA over time. This apparent discrepancy is noted and will be investigated further as more data become available.

PROGRESS TOWARDS PLAN IMPLEMENTATION

Groundwater conditions experienced in the 2020/21 water year were compared to 2025 interim milestone and minimum thresholds established at RMS locations for the four (4) applicable sustainability indictors within the Tule Subbasin. Although conditions experienced during the previous water year were not within the implementation period for the GSP, the comparison provides insightful information for understanding how the aquifer(s) react to conditions as presented in this report. Based on the available data representing from RMS locations used to track groundwater conditions for the sustainability indicators, all RMS were within the 2025 interim milestones and minimum thresholds corresponding to the RMS.

Progress towards plan implementation was also evaluated in terms of progress of implementing projects and management actions proposed in the GSP. Several of the projects and management actions have been or are in the process of being implemented in the GSA in order to meet the sustainable groundwater management by the year 2040. Many of these projects and management action include policies providing for a structured reduction in groundwater use above sustainable supplies and incentives to promotes conjunctive management of water resources, along with other capital projects. Some of the completed and ongoing efforts include:

- Groundwater Accounting
- Water Supply Optimization
- Surface Water Development
- Managed Aquifer Recharge and Banking
- Municipal Management Actions

1 INTRODUCTION

1.1 DESCRIPTION OF THE TULE SUBBASIN

The Tule Subbasin is identified by the California Department of Water Resources (CDWR) as No. 5-22-13 of the Tulare Lake Hydrologic Region (see **ATTACHMENT 1** – Tule Subbasin 2020/21 Annual Report, Figure 1) is completely located within Tulare County. The following seven (7) GSAs are located within Tule Subbasin (see **FIGURE 1-1**):

1. Eastern Tule Groundwater Sustainability Agency (ETGSA),
2. Tri-County Water Authority Groundwater Sustainability Agency (TCWA GSA),
3. Pixley Irrigation District Groundwater Sustainability Agency (Pixley GSA),
4. Lower Tule River Irrigation District Groundwater Sustainability Agency (LTRID GSA),
5. Delano-Earlimart Irrigation District Groundwater Sustainability Agency (DEID GSA)
6. Alpaugh Groundwater Sustainability Agency (Alpaugh GSA), and
7. Tulare County Groundwater Sustainability Agency (Tulare County GSA)

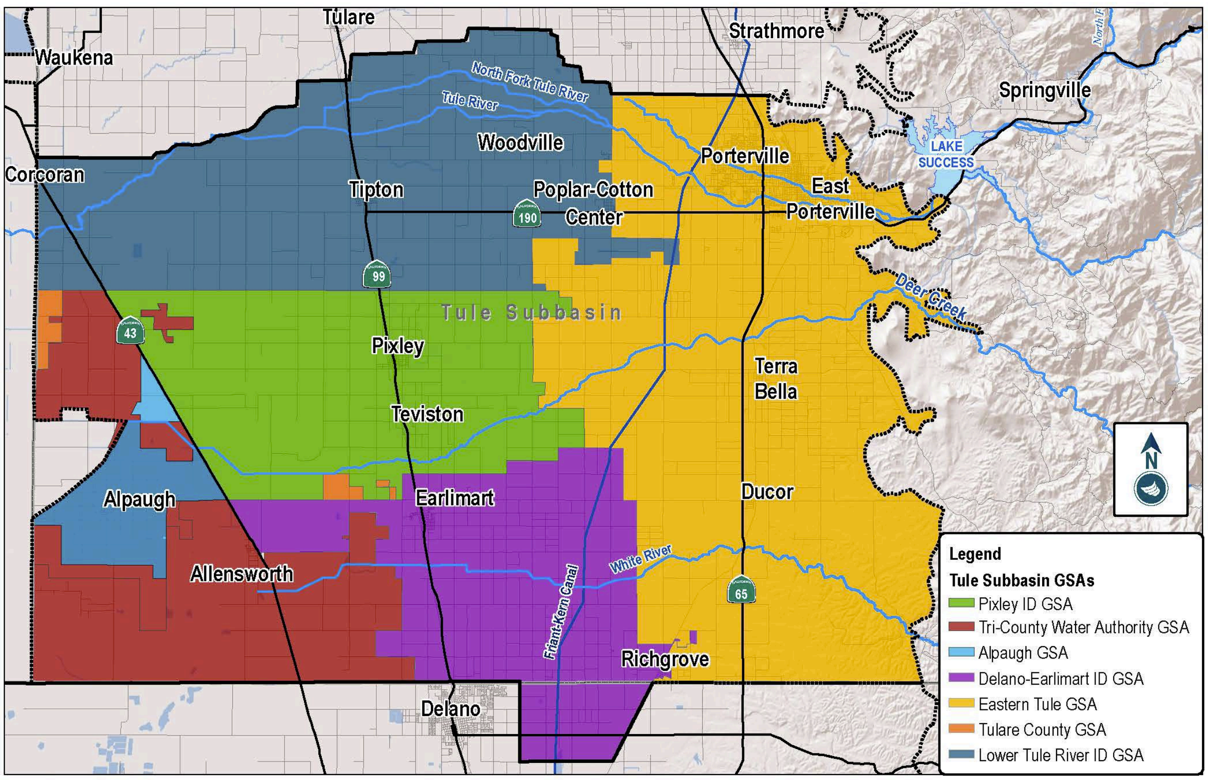


FIGURE 1-1: TULE SUBBASIN LOCATION MAP

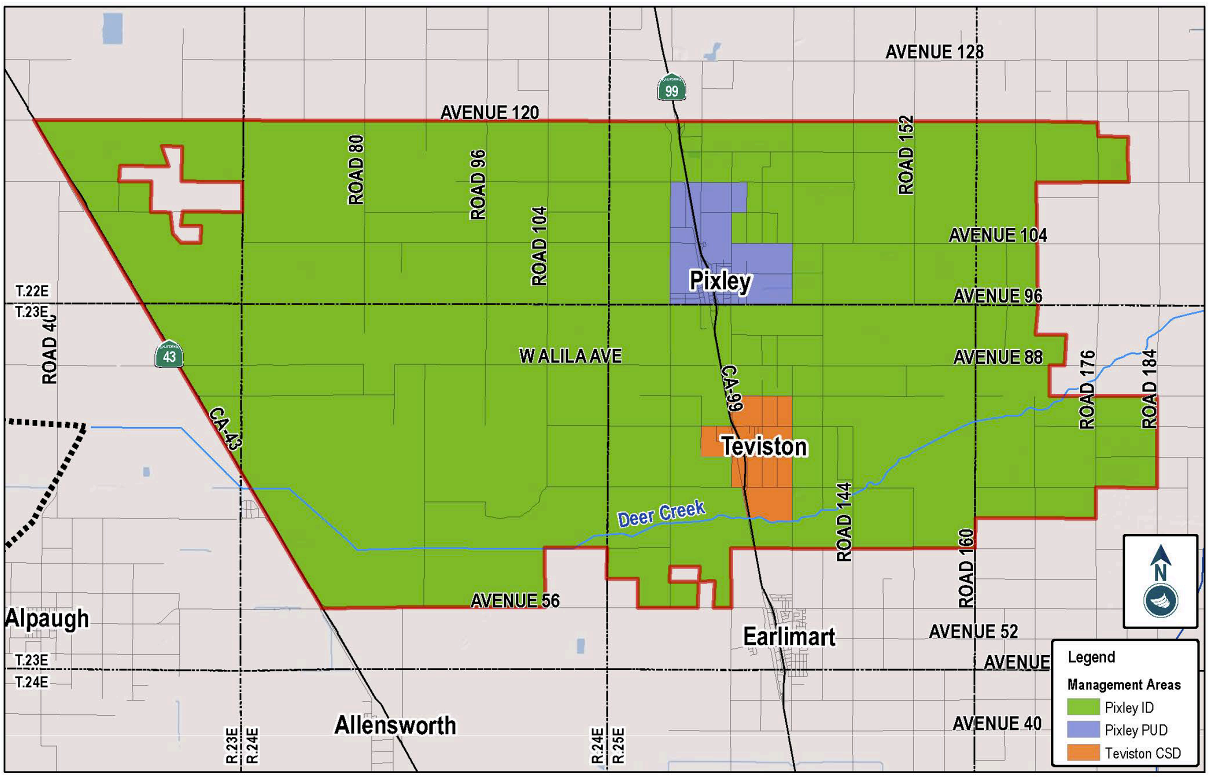
Six (6) of the seven (7) GSAs within the Tule Subbasin have developed and submitted to the CDWR independent Groundwater Sustainability Plans (GSPs) pursuant to 23 CCR §353.6. Tulare County GSA has entered into Memoranda of Understanding (MOUs) concerning coverage of territories under adjacent GSPs. As such, their jurisdictional areas are included in the other six (6) GSPs.

Pursuant to 23 Cal. Code Regs. §357.4(a), the six (6) GSPs for the Tule Subbasin have been developed and submitted under a Coordination Agreement to fulfill all statutory and regulatory requirements related to intra-basin coordination agreements pursuant to SGMA. The Coordination Agreement includes two attachments: **ATTACHMENT 1** describes the subbasin-wide monitoring network that all Tule Subbasin GSAs shall utilize for the collection of data to be used in annual reports. Attachment 2 describes the subbasin setting, which represents the coordinated understanding of the physical characteristics of the subbasin.

1.2 Description of the Pixley GSA

The Pixley GSA is located in the west-central portion of the Tule Subbasin and encompasses 71,314 acres within Tulare County. The GSA Plan area includes lands within the jurisdictional boundaries of Pixley Irrigation District (Pixley ID, District) and the municipalities adjacent to the District, each of which the Agency has entered into agreements providing for the management of groundwater under the Pixley GSA GSP (see **Figure 1-2**).

Figure 1-2: Pixley GSA Plan Area



Management Areas have been established to corresponded to the jurisdictional status and principle land use of their respective areas for defining different minimum thresholds and operate to different measurable objectives, understanding each management area presents unique circumstances and objectives for managing sustainably. Management areas are described by the following two (2) categories and displayed on **Figure 1-2**:

1. Pixley ID/ Agricultural Management Area
2. Municipal Management Area
    - Pixley PUD & Teviston CSD

1.3 Hydrogeological Setting

The hydrogeological of the Tule subbasin is described in Section 1.2 of the Tule Subbasin 2020/21 Annual Report (see **Attachment 1**), and a description relating to the Pixley GSA is provided below.

The GSA is located on a series of coalescing alluvial fans that extend toward the center of the San Joaquin Valley from the Sierra Nevada Mountains (see **Attachment 1**, Figure 3). The alluvial fans merge with lacustrine deposits of the Tulare Lakebed in the western portion of the GSA Plan area. Land surface elevations within the GSA range from approximately 400 ft above mean sea level (amsl) along the eastern boundary of the GSA to approximately 200 ft amsl at the western boundary (see **Attachment 1**, Figure 3).

Where saturated in the subsurface, the permeable sand and gravel layers form the principal aquifers in the Plan Area and adjacent areas to the north, south and west. Individual aquifer layers consist of lenticular sand and gravel deposits of varying thickness and lateral extent. The aquifer layers are interbedded with low permeability silt and clay confining layers. There are four (4) aquifer/aquitard units in the subsurface beneath the Plan Area (see **Attachment 1**, Figure 4):

1. Upper Aquifer
2. The Corcoran Clay Confining Unit
3. Lower Aquifer
4. Pliocene Marine Deposits (generally considered an aquitard)

Two primary aquifers have been identified within the Plan Area: 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 GSA.

In general, groundwater in the GSA Plan area flows towards a pumping depression located west portion of the GSA Plan area (see **Attachment 1**, Appendix D, Figures 9 & 12).

1.4 Monitoring Features within the Plan Area

The Tule Subbasin Technical Advisory Committee has developed a subbasin-wide monitoring plan, which describes the monitoring network and monitoring methodologies to be used to collect the data to be included in Tule Subbasin GSPs and annual reports. The subbasin-wide monitoring plan is included as **Attachment 1** to the Coordination Agreement.

The groundwater level monitoring network for the Tule Subbasin includes monitoring features to enable collection of data from the Upper Aquifer, Lower Aquifer and Santa Margarita Formation aquifer (see **Attachment 1**, Figure 5). Groundwater levels are collected in the late winter/early spring (February to March) and in the fall (August to November) to account for seasonal high and low groundwater conditions.

A land surface elevation monitoring network has also been established and is shown on Figure 6. This monitoring network consists of 16 benchmarks installed in 2020 and 2021. Each benchmark is a representative monitoring site. The elevations of the benchmarks are surveyed annually. Land surface changed from 2020 to July 2021 as measured at available benchmarks (see **Attachment 1**, Appendix D, Figure 8).

A subset of groundwater level, groundwater quality and subsidence monitoring features in the monitoring plan have been identified as representative monitoring sites to be relied on for the purpose of assessing progress with respect to groundwater level, groundwater quality, and subsidence sustainability indicators in the GSA Plan area. The representative monitoring sites are shown on **Figure 1-3**.

The most recent land surface elevation data are provided in **Attachment 1**, Appendix D, Table 4, along with established measurable objectives and minimum thresholds. Land subsidence measured from InSAR data provided by the DWR from October 2020 to September 2021 is shown on Figure 8 in Appendix D of **Attachment 1**.

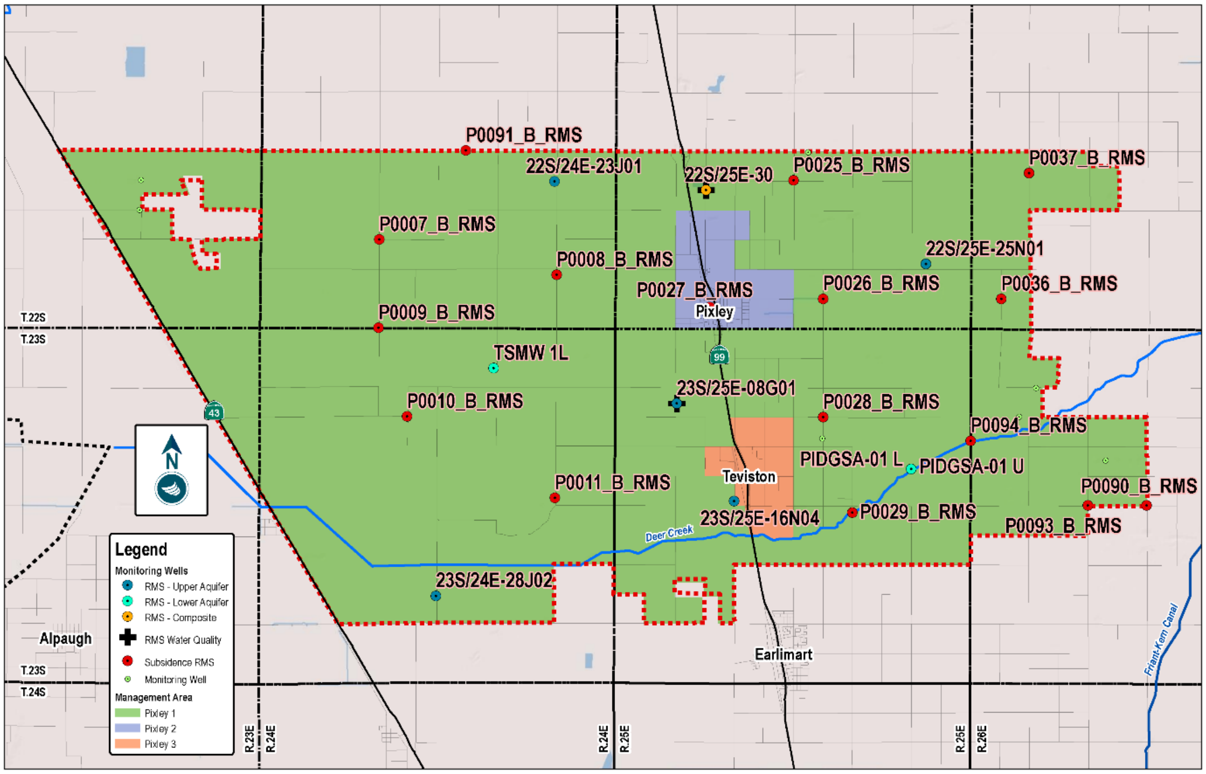


FIGURE 1-3: RMS MONITORING NETWORK

2 GROUNDWATER ELEVATIONS [§356.2(B)(1)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*
(b) *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*
(1) *Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:*

2.1 GROUNDWATER ELEVATION CONTOUR MAPS [§356.2 (b)(1)(A)]

Groundwater elevation contour maps were developed using data compiled from wells that are part of the Tule Subbasin Monitoring Plan (e.g. Representative Monitoring Site Wells), wells monitored as part of the Irrigated Lands Regulatory Program (ILRP), and wells from other monitoring programs, which are primarily monitored by local irrigation districts. Wells from the first two sources were identified as being perforated in either the Upper Aquifer or Lower Aquifer or both the Upper and Lower aquifers (i.e. composite aquifer wells). The perforation depths for most wells from the other monitoring programs are unknown. Sources of uncertainty in the available data included:

- Lack of representative monitoring well data in some areas.
- Limitations in the number of monitoring wells with known perforation intervals.
- Variations in monitoring frequency, such as due to lack of access, resulting in different spatial and temporal coverage from contour map to contour map.
- Utilization of groundwater level data from private agricultural wells in which the pumping
- status was unknown or where the length of time between turning the pumps off and obtaining the measurements was unknown.
- New data that was available for the 2021 contour map(s) but was not available at the time the 2020 contour map(s) was developed.

In general, TH&Co used as much of the available data as possible to generate the contour maps presented in this annual report. However, given uncertainties in the data, some professional judgment was involved. The process for generating the contours was as follows:

- For the Upper Aquifer contour maps, the basemaps originally included groundwater level data for Upper Aquifer wells (based on available documentation), wells with perforations in composite aquifers, and wells with unknown perforation intervals.
- Based on available data, the hydraulic head of the Upper Aquifer in the Tule Subbasin is always higher than the hydraulic head of the Lower Aquifer. In areas where multiple groundwater levels were available, the highest elevation was used to constrain the contours.
- Groundwater levels from wells for which documentation showed them to be Upper Aquifer wells were given the highest weight in generating the contours. However, in some cases, groundwater levels in designated Upper Aquifer wells were significantly lower than groundwater levels in other area wells whose perforation interval was unknown. In those, cases, the contours were constrained to the higher levels.
- Groundwater levels measured in dedicated monitoring wells were always relied on.
- The Upper Aquifer groundwater contour maps shown on Figures 9 and 10 show only the data upon which the contours were developed (see **ATTACHMENT 1**).

- For the Lower Aquifer the only data used to generate the contour maps were groundwater levels from dedicated Lower Aquifer monitoring wells or wells known to be perforated exclusively in the Lower Aquifer (see Figures 11 and 12, **ATTACHMENT 1**).

Uncertainties in the groundwater level monitoring network are being addressed through the drilling and construction of dedicated, aquifer specific monitoring wells as well as investigations and improvements to the other wells being monitored. As new monitoring wells are constructed, they will replace some of the agricultural wells that are currently relied on. To date, two nested monitoring wells, two cluster monitoring wells, and one single completion monitoring well have been added to the monitoring network. Further, four additional nested monitoring wells and one single completion monitoring well are planned for construction. As these monitoring features are installed, it is expected that groundwater elevation contour maps from year to year will become more representative.

2.1.1 UPPER AQUIFER

Figures 9 and 10 of Appendix D in the Tule Subbasin 2020/21 Annual Report displays groundwater contours for the upper aquifer in the Pixley GSA Plan area for the spring and fall of 2021, respectively (see **ATTACHMENT 1**).

From visual examination of the groundwater contour maps, groundwater in the upper aquifer of the GSA Plan area flows towards a pumping depression located in the middle portion the GSA Plan area, with seasonal high elevation of 141 feet above mean sea level (amsl) in the spring occurring along the east boundary of the GSA and seasonal low of -75 feet amsl elevation in the fall occurring at the pumping depression.

The pumping depression has reversed the natural groundwater flow direction in the western portion of the subbasin and is most pronounced between the Tule River and Deer Creek near Highway 99. The groundwater level depression was observed from data collected in both the spring and fall of 2020. Groundwater flow patterns in the upper aquifer did not change significantly between the spring and fall of 2020.

2.1.2 LOWER AQUIFER

Figures 11 and 12 of Appendix D in the Tule Subbasin 2020/21 Annual Report displays groundwater contours maps for the lower aquifer in the Pixley GSA Plan area for the spring and fall of 2021, respectively (see **ATTACHMENT 1**).

From visual examination of the groundwater contour maps, groundwater in the lower aquifer generally flows east to west and there is some influence of the pumping depression prevalent in the upper aquifer.

2.2 GROUNDWATER HYDROGRAPHS [§356.2 (b)(1)(B)]

Groundwater level hydrographs for Representative Monitoring Site (RMS) wells in the Pixley GSA Plan area are provided in Figures 1 through 6 of Appendix D in the Tule Subbasin 2020/21 Annual Report (see **ATTACHMENT 1**).

Spring and fall 2021 groundwater levels for the RMS wells are summarized in **TABLE 2-1**.

TABLE 2-1: 2021 GROUNDWATER LEVELS AT REPRESENTATIVE MONITORING SITE WELLS

Well ID	Groundwater Elevation (ft amsl)	
	Spring 2021	Fall 2021
Upper Aquifer		
22S/24E-23J01	-37.1	-35.3
23S/24E-28J02	95.0	83.0
22S/25E-25N01	17.7	7.4
23S/25E-08G01	N/A[1]	54.6
23S/25E-16N04	-31.7[2]	-74.6
PIDGSA-01 U	N/A[3]	141.0
Lower Aquifer		
TSMW 1L	N/A[3]	-146.2
PIDGSA-01 L	N/A[3]	82.9
Composite Aquifer		
22S/25E-30	95.3	90.5

1) Unable to measure well
2) The groundwater levels reported for 16N04 are below the total depth of the well, as reported by the driller's log. Investigations are planned to confirm the construction and perforation interval for the well. Until those investigations have been completed, the groundwater level for this well, as it relates to the Upper Aquifer, is considered provisional.
3) Not part of monitoring network until Fall 2021
4) Data not collected by Pixley PUD

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. In Well 22S/24E-23J01, both groundwater levels are below the measurable objective but above the minimum threshold. With the exception of Well 23S/25E-16N04, all other measured groundwater levels in Upper Aquifer wells were above their respective minimum thresholds. The groundwater levels in Well 23S/25E-16N04 are below the reported total depth of the well and are considered suspect and subject to further investigation.

Two monitoring wells with perforations exclusive to the Lower Aquifer have recently been constructed and monitoring was initiated in Fall 2021, as shown in the table above.

For RMS wells that were not monitored during WY 2020/2021, the GSA will take the following provisions moving forward to ensure sufficient data is being collected for characterizing groundwater conditions and progress towards reaching the GSA's Sustainability Goal:

1. Resolve issues that prevented the RMS well from being monitored, or
2. Replace RMS well with a nearby existing well with similar characteristics, or
3. Prioritize the location for constructing a dedicated monitoring well.

3 GROUNDWATER EXTRACTIONS [§356.2(B)(2)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(b) *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*

(2) *Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.*

Groundwater extractions within the GSA Plan area are categorized as agricultural or municipal. Being that the land use within the GSA Plan area is predominantly associated with agriculture, the majority of the groundwater extractions within the GSA Plan area are attributed to meeting crop demands that are not met through effective precipitation, or diverted surface and imported water supplies.

3.1 AGRICULTURAL

The process for determining agricultural groundwater pumping within the Tule Subbasin is described in Section 3.1 of the Tule Subbasin 2020/21 Annual Report (see **ATTACHMENT 1**).

In summary, total agricultural groundwater pumping is estimated as a function total agricultural water demand derived from remotely sensed ET data using Landsat satellites and applying irrigation efficiencies based CDFW land use map and crop surveys, less surface water deliveries and effective precipitation.

Within the GSA Plan area, estimated volume of groundwater pumped for agricultural use in 2020/21 water year amounted to approximately 165,000 acre-feet.

3.2 MUNICIPAL

Within the Pixley GSA Plan area the volume of groundwater pumped for municipal purposes in 2020/21 water year was provided by the two (2) municipalities and amounted to approximately 690 acre-feet.

3.3 SUMMARY OF TOTAL GROUNDWATER EXTRACTIONS

Total groundwater extraction from the Pixley GSA Plan area for the 2020/21 water year was 165,690 acre-ft (see **TABLE 3-1**).

TABLE 3-1: TOTAL GROUNDWATER EXTRACTIONS

Management Area	Agricultural (AF)	Municipal (AF)	Pumping for Export	Total (AF)
Pixley ID	165,000	0	0	**165,000**
Pixley PUD	0	610	0	**610**
Teviston CSD	0	80	0	**80**
Total	**165,000**	**690**	**0**	**165,690**

4 SURFACE WATER SUPPLY [§356.2(B)(3)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(b) *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*

(3) *Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.*

Surface water is supplied to lands within the Pixley GSA Plan area through the Pixley Irrigation District (Pixley, District) as diverted stream flow from native Deer Creek, imported Central Valley Project (CVP) contracts, exchanges with other irrigation districts, and effective precipitation.

The District delivers the available surface and imported water to meet crop demands for landowners within the District as a first priority of use. During times surface water supplies are available in excess of crop demands, the supplies can be diverted to recharge basins owned by the District for future landowner in-lieu pumping of groundwater. The GSA and District also encourages their landowners to develop on-farm recharge basins to maximize surface water supplies when available in large volumes during short periods of time.

4.1 DIVERTED DEER CREEK STREAMFLOW

For water year 2020/21, 0 acre-ft of water was diverted into the Pixley ID service area to meet crop demands or as in-lieu pumping of groundwater to recharge basin owned by the District or landowners.

4.2 IMPORTED WATER SUPPLIES

Water imported into the Pixley GSA Plan area is from the Central Valley Project (CVP), as well as, local and imported supplies purchased from neighboring irrigation districts. The District delivers imported supplies from the Friant-Kern Canal (FKC) through Deer Creek to District diversion structures at which point the supplies are introduced into the Districts distribution system consisting of unlined canals for delivery to landowners and recharge basins within the District.

Imported water delivery data for 2020/21 was obtained from United States Bureau of Reclamation (USBR) Central Valley Operation Annual Reports and totaled 0 acre-ft.

4.3 PRECIPITATION

Section 4.5 of the Tule Subbasin 2020/21 Annual Report describes the methodology used to estimate the precipitation for the Tule Subbasin (see **ATTACHMENT 1**).

The volume of precipitation available for crops in 2020/21 was based on California Irrigation Management Information Systems (CIMIS)[1] estimated to be 18,300 acre-ft.

4.4 SUMMARY OF TOTAL SURFACE WATER SUPPLIES

Total surface water supplied to the Pixley GSA Plan Area for the 2020/21 water year was estimated to be 18,520 acre-feet (**TABLE 4-1**).

[1] CIMIS, 2020 (Irrigation Training and Research Center 2020)

TABLE 4-1: TOTAL SURFACE WATER SUPPLY

Management Area	Stream Diversions (AF)	Imported Water (AF)	Recycled Water (AF)	Precipitation (AF)	Total (AF)
Pixley ID	0	0	0	17,400	**17,400**
Pixley PUD	0	0	220	500	**720**
Teviston CSD	0	0	0	400	**400**
Total	**0**	**0**	**220**	**18,300**	**18,520**

5 TOTAL WATER USE [§356.2(B)(4)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(b) *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*

(4) *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. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.*

Total water use within the Pixley GSA Plan area during the water year 2020/21 consisted of water for meeting agricultural and municipal demand, along with groundwater exports. Agricultural demands were met through a combination of groundwater extractions and surface water deliveries, while municipal demands were met entirely from groundwater extractions. The total water use within the GSA Plan area was 184,210 acre-ft. **TABLE 5-1** describes the volumes of water use by use sector, source, method of measurement, and level of accuracy for measurement method.

TABLE 5-1:TOTAL WATER USE BY WATER USE SECTOR

Management Area	Groundwater (AF)		Surface Water (AF)		Total (AF)
Source:	Ag.	Municipal	Ag[1].	Recharged[2]	
Pixley ID	165,000	0	17,400	0	**182,400**
Pixley PUD	0	610	500	220	**1,330**
Teviston CSD	0	80	400	0	**480**
Total	**165,000**	**690**	**18,320**	**220**	**184,210**

1) Includes precipitation
2) Recharged volume includes channel losses

6 GROUNDWATER STORAGE [§356.2(B)(5)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(b) *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*

(4) *Change in groundwater in storage shall include the following:*

(A) *Change in groundwater in storage maps for each principal aquifer in the basin.*

(B) *A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.*

The change in storage estimate for this annual report is specific to the Upper aquifer. The calculations were made using a Geographic Information System (GIS) map of the Tule Subbasin discretized into 600-foot by 600-foot grid cells to allow for spatial representation of aquifer specific yield and groundwater level change. Although the storage change in the Lower Aquifer is expected to be significantly less than the Upper Aquifer due to its confined nature, future annual reports will include storage change from the Lower Aquifer as well.

The areal distribution of specific yield for the Upper Aquifer is based on the values obtained from the updated calibrated groundwater flow model of the Tule Subbasin.

The areal distribution of change in hydraulic head across the Tule Subbasin was estimated by plotting the difference in groundwater level at wells that were measured in both fall 2020 and fall 2021 and then interpolating the subbasin-wide changes in groundwater levels in GIS using a kriging algorithm. Change in hydraulic head (groundwater level) at any given location was assigned to the overlapping grid cell.

The change in groundwater storage was estimated for each grid cell by multiplying the change in groundwater level by the specific yield and then by the area of the cell. Results of the change in groundwater in storage analysis showed that between fall 2020 and fall 2021, groundwater in storage decreased by approximately 29,000 acre-ft (see Figure 16, **ATTACHMENT 1**). Recent dry conditions have resulted in more limited surface water supplies and higher groundwater pumping relative to previous years, which has contributed to the negative groundwater storage change in the 2020/21 water year.

A change in groundwater storage map within the GSA Plan area is displayed as Figure 12 in Appendix A of the Tule Subbasin 2020/21 Annual Report (see **ATTACHMENT 1**) using groundwater elevations as the basis for estimating groundwater change in storage.

Figure 17 of the Tule Subbasin 2020/21 Annual Report utilizes a column chart depicting water year type, groundwater pumping, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the Tule Subbasin between 1986/1987 water year through the 2020/21 water year (see **ATTACHMENT 1**).

Several of the GSAs and irrigation districts also maintain a separate water accounting system to track the amount of groundwater that has been banked by the Irrigation Districts and/or individual landowners, which will be internally calculated from the gross groundwater storage volume for the GSA. This is necessary as surface or imported water banked by irrigation districts or landowners is not to be considered groundwater storage that is available to or be a part of other agencies or the subbasin as a whole quantification of sustainability but remain in ownership with the banker. This methodology uses **EQUATION**

6-1 to determine change in groundwater storage based on total water use (ETc, metered) and total non-groundwater supply **TABLE 6-1** provides a summary of this accounting for the GSA.

$$\Delta\, GW\ Storage = Total\ Surface\ Water + Precipitation - Total\ Water\ Use \qquad \textbf{Eq. } 6\text{-}1$$

TABLE 6-1: GSA ACCOUNTING OF GROUNDWATER STORAGE

October 2020 thru September 2021	Volume (AF)			Total (AF)
	Pixley ID	Pixley PUD	Teviston CSD	
Total Non-Groundwater Supply	**17,400**	**720**	**400**	**18,520**
Surface Water (streamflow, imported)	*0*	*220*	*0*	*220*
Applied Irrigation	*0*	*0*	*0*	*0*
Recharged[1]	*0*	*220*	*0*	*220*
Total Precipitation[2]	*17,400*	*500*	*400*	*18,300*
Total Consumptive Use	**(143,860)**	**(4,910)**	**(80)**	**(150,710)**
ETc (agricultural)	*(143,860)*	*(4,300)*	*(1,860)*	*(150,020)*
Metered (municipal, exported)	*0*	*(610)*	*(80)*	*(690)*
Water Balance	**(126,460)**	**(4,190)**	**(1,540)**	**(132,190)**

1) Recharge volumes include channel losses
2) Total precipitation is used rather than effective precipitation because portion that is not effective is accounted for in ETc

Based on the GSA's accounting of change in groundwater storage from the 2020 to 2021, groundwater in storage decreased by 132,190 acre-feet.

The difference in the change in groundwater storage volumes between the GIS methodology and the GSA's accounting is approximately 103,190 acre-feet. This apparent discrepancy is noted and will be investigated further as more data become available. While the GIS methodology is representative of the physical groundwater storage conditions, the GSA relies on their accounting of groundwater storage for determining the volume of groundwater in storage as a result of their actions and available to their benefit for future extraction.

7 Progress Towards Plan Implementation [§356.2(c)]

23 Cal. Code Regs. § 356.2 Annual Reports. *Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(c) *A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.*

Progress of plan implementation will be evaluated through comparing monitoring data to sustainable management criteria (SMC) established in Section 3 of the GSP and the GSAs progress towards implementing projects and management actions compared to the schedules outlined in Section 5 of the GSP.

7.1 Interim Milestones, Measurable Objectives, and Minimum Thresholds

Throughout this section measured data for the 2020/21 water year within the Pixley GSA Plan area relating to the four (4) sustainability indicators identified as occurring within Tule Subbasin will be compared to the 2025-interim milestone, measurable objective, and minimum threshold established for each RMS feature in Section 3 of the Pixley GSA GSP to determine the GSAs progress toward successfully implementing its GSP.

With the exception of groundwater quality, the other three (3) sustainability indicators relied on the Tule Subbasin Groundwater Flow Model (GFM) projections for establishing SMC's. By incorporating historical data, climate change, and GSAs proposed projects and management actions, the GFM predicted conditions relative to each sustainability indicators as the basis for the established quantifiable interim milestones, measurable objectives, and minimum thresholds. As the GSPs are implemented, resulting in refined monitoring and data collection, the GFM will provide more accurate predictions of groundwater conditions and adjustments will be made to SMCs to reflect the best available data. Adjustments will be made during the first periodic evaluation of the GSP in 2025.

It is noted that some of the RMS wells shown in **Table 7-1** have been added since the Tule Subbasin GSPs were finalized in 2020. Most of the added RMS wells are new dedicated monitoring wells that have been drilled and constructed since January 2020. Some existing wells have been identified and added as RMS wells to address data gaps. Finally, some of the previously designated RMS wells were found to be inadequate for collecting reliable data and alternate existing wells were identified as replacements. These changes are consistent with Section 4.1 of the Tule Basin Monitoring Plan (TSMP), which states that the 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."*

The newly added RMS wells have not yet been assigned Sustainable Management Criteria (SMC; measurable objectives, intermediate milestones, and minimum thresholds). These SMC will be assigned for the 2021/22 water year annual report utilizing the methodology described in the Tule Subbasin Coordination Agreement. Additional consideration may be made to the criteria listed in DWR's letter designating the Pixley ID GSP as "Incomplete" with reference to established minimum thresholds for groundwater levels, groundwater quality and subsidence.

On-going data collected at new RMS wells allows the Tule Subbasin TAC to address areas of data gaps and improve the accuracy of the subbasin-wide groundwater model, which is relied upon as a tool for establishing SMC. The Tule Subbasin TAC intends to reevaluate SMC established at all existing and new RMS sites during the five-year GSP update in 2025, or sooner as appropriate.

7.1.1 GROUNDWATER ELEVATIONS

There are nine (9) RMS wells in the Pixley GSA (see **FIGURE 1-3**). Of these wells, six (6) are perforated in the upper aquifer, two (2) are perforated in the lower aquifer, and one (1) has been identified as composite. Hydrographs for each of the wells are provided in Appendix D of the Tule Subbasin 2020/21 Annual Report as Figures 1 through 5 (see **ATTACHMENT 1**). Available groundwater level data for RMS wells from spring 2021 are summarized in **TABLE 7-1** and is used for comparing measured 2020/21 water year data at RMS wells to sustainable management criteria established in Section 3 of the GSP.

TABLE 7-1: RMS WELL GROUNDWATER ELEVATION DATA

Well ID	Groundwater Elevation (ft amsl)			
	Spring 2021	2025 Interim Milestone	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/24E-23J01	-37.1	2	-13	-68
23S/24E-28J02	95.0	84	78	54
22S/25E-25N01	17.7	14	-8	-54
23S/25E-08G01	N/A[1]	N/A	N/A	N/A
23S/25E-16N04	-31.7[2]	65	62	14
PIDGSA-01 U	N/A[3]	N/A	N/A	N/A
Lower Aquifer				
TSMW 1L	N/A[3]	N/A	N/A	N/A
PIDGSA-01 L	N/A[3]	N/A	N/A	N/A
Composite Aquifer				
22S/25E-30	95.3	N/A	N/A	N/A

1) Unable to measure well
2) The groundwater levels reported for 16N04 are below the total depth of the well, as reported by the driller's log. Investigations are planned to confirm the construction and perforation interval for the well. Until those investigations have been completed, the groundwater level for this well, as it relates to the Upper Aquifer, is considered provisional.
3) Not part of monitoring network until Fall 2021
4) Data not collected by Pixley PUD

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. In Well 22S/24E-23J01, both groundwater levels are below the measurable objective but above the minimum threshold. With the exception of Well 23S/25E-16N04, all other measured groundwater levels in Upper Aquifer wells were above their respective minimum thresholds. The groundwater levels in Well 23S/25E-16N04 are below the reported total depth of the well and are considered suspect and subject to further investigation to revise SMCs and potentially reclassify as a lower aquifer well.

Two monitoring wells with perforations exclusive to the Lower Aquifer have recently been constructed and monitoring was initiated in Fall 2021, as shown in the table above.

7.1.2 GROUNDWATER STORAGE

Groundwater storage since 2020/21 WY was estimated according to the equation and methodology described in Section 6 of the Tule Subbasin 2020/21 Annual Report using available groundwater elevation data (see **ATTACHMENT 1**). Based on this estimation, approximately 40.975 million acre-feet of groundwater was stored within the aquifers beneath the Pixley GSA Plan area. Applying the loss of groundwater storage volume previously mentioned in **SECTION 6** of 29,000 acre-feet occurring between 2020 and 2021, the volume of groundwater storage beneath the Pixley GSA Plan area amounts to approximately 40.943 million acre-feet. While this methodology is useful for understanding total groundwater storage in the Subbasin, it is not intended to account for ownership of water in storage. The volume of groundwater each GSA has access to will differ due to the accumulation of Net Water Balance contributions and extractions by the individual GSA over time.

The interim milestones/measurable objective and minimum threshold for volume of groundwater storage in the aquifers beneath the Pixley GSA Plan area were identified in Tables 3-3 and 3-8, respectively, in Section 3 of the Pixley GSA GSP. **Table 2-1** provides a comparison of the 2020/21 WY groundwater storage conditions to the 2025 interim milestone, measurable objective and minimum threshold.

Table 7-2: Groundwater Storage Data

Groundwater Storage (millions AF)					
2018/2019 WY	2019/20 WY	2020/21 WY	2025 Interim Milestone	Measurable Objective	Minimum Threshold
41.043	40.975	**40.943**	39.790	39.200	36.600
Annual Δ in Storage:	0.068[1]	0.029[2]	*0.2506[4]*	*0.0922[5]*	*0.2222[6]*
Average Δ in Storage:	**0.0485[3]**				

1) [41.043 million AF – 40.975 million AF]
2) [40.975 million AF – 40.943 million AF]
3) [41.043 million AF – 40.943 million AF] ÷ 2 years
4) [41.043 million AF – 39.79 million AF] ÷ 5 years
5) [41.043 million AF – 39.20 million AF] ÷ 20 years
6) [41.043 million AF – 38.60 million AF] ÷ 20 years

The volume of groundwater storage in 2021 remains greater than the established 2025 interim milestone, measurable objective and minimum threshold volumes established for the GSA Plan area. The average annual rate of decline in groundwater storage for Pixley GSA Plan area between 2018/19 WY to 2020/21 WY amounts to 48,500 acre-feet per year. Whereas the average annual rate of decline for groundwater storage between 2018/19 WY and the established 2025-interim milestone and minimum threshold in 2040 is 250,600 acre-feet per year and 222,200 acre-feet per year, respectively, putting the experienced annual average rate of decline in groundwater storage less than the rate for achieving the established 2025 interim milestone.

7.1.3 Groundwater Quality

The GSA utilizes the Irrigated Lands Regulatory Program and community Consumer Confidence Reports as the existing regulatory water quality programs for monitoring water quality and setting baseline standards that are applicable to the agriculture management areas.

SMCs established for the RMS location are provided in Tables 3-5 and 3-9 of Section 3 of the GSP. The basis for setting SMCs at each RMS location as described in the GSP is outlined below:

<u>Interim Milestones/ Measurable Objective</u>

Establish interim milestones and the measurable objective at each RMS well with calculating a change above the baseline groundwater quality to not exceed 10% of long term 10 year running average.

<u>Minimum Threshold</u>

Establish minimum threshold for COCs associated at each RMS well with calculating a change above the baseline groundwater quality to not exceed 15% of long term 10 year running average.

The GSP further states that the 10-year running average will be re-calculated each year based on monitoring data and the change in groundwater quality will be evaluated in comparison to lowering of groundwater elevations and groundwater recharge efforts. For RMS wells that a change in the10-year running average by 10-percent and 15-percent does not result in an MCL exceedance, the MCL is used for establishing the SMCs.

Since most community's water systems are supplied groundwater through multiple production wells, the average concentration for COCs for a given year across all wells is used for determining the 10-year average and monitoring results relative the water year being reported.

The GSA 2020/21 water year water quality data at RMS wells is provided in **Table 7-3** compared the 10-year running average and re-established interim milestones, measurable objectives and minimum thresholds.

Table 7-3: RMS Water Quality Data

Constituent	Period of Record	Results			
		2021	10-Year Average[1]	Interim Milestone/ Measurable Objective	Minimum Threshold
RMS Well: **E0259438**					
Conductivity (*μm/cm*)	2020-2021	**664.0**	*543.7*	<700	<700
pH	2020-2021	**7.47**	*7.6*	>6.5, <8.3	>6.5, <8.3
Nitrate as N (*mg/L*)	2020-2021	**14.0**	*10.8*	<10	<10
RMS Well: **724662**					
Conductivity (*μm/cm*)	2018-2021	**242.2**	*243*	<700	<700
pH	2018-2021	**8.15**	*8.2*	>6.5, <9.13	>6.5, <9.55
Nitrate as N (*mg/L*)	2018-2021	**2.3**	*1.9*	<10	<10
RMS Well: **Pixley PUD CCR**[2]					
Nitrate as N (*mg/L*)	2015-2021	**3.66**	*2.75*	<10	<10
Arsenic (*ppb*)	2010-2021	**15.93**	*14.32*	<16.39	<17.15
Chromium (*μg/L*)	2011-2018	**0**	*2.40*	<10	<10
RMS Well: **Teviston CSD CCR**[3]					
Nitrate as N (*mg/L*)	2018-2021	**4.10**	*3.66*	<10	<10
Arsenic (*ppb*)	2018-2021	**7.10**	*5.85*	<10	<10
Chromium (*μg/L*)	2018-2021	**0.00**	*3.05*	<10	<10

1) Depending on the period of record for COCs, average may be shorter than 10 years

From a review of the 2021 water quality data available at the RMS locations all are within the established SMCs. Data obtained from the ILRP program well E0259438 first became available in 2020, and is based on a two monitoring events. The well saw a significant increase in nitrate levels during the 2021 WY and will continue to be monitored. For well 724662, also a part of the ILRP program, data was only available from 2018 through 2021 being the program was established in 2018.

Community wells have a longer history of being monitored under State regulations allowing the 10-year running average to be used for establishing SMCs for arsenic and chromium. However, for the Pixley PUD nitrogen concentration in groundwater using nitrate as N started in 2015/2016, which resulted in a shortened period of record to determine long-term averages when setting SMCs. Teviston CSD water quality results were only available from 2018 and 2021, with nitrate as N being the only constituent of

[2] https://sdwis.waterboards.ca.gov/PDWW/JSP/MonitoringResults.jsp?tinwsys_is_number=5939&tinwsys_st_code=CA&counter=0

[3] https://sdwis.waterboards.ca.gov/PDWW/JSP/MonitoringResults.jsp?tinwsys_is_number=6936&tinwsys_st_code=CA&counter=0

concern results available in the 2020/21 water year. Of the two (2) communities, using available data, none were approaching the established SMCs. However, Pixley PUD has historically exceed the MCL for arsenic but showed a decline in concentration in the 10-year average of 14.61 ppb to 13.02 ppb in 2020/21 water year. The Teviston CSD and Pixley PUD areas are a focus of potential projects to assist with groundwater recharge in those areas; the potential for these projects to also improve water quality is being analyzed as part of the planning process.

7.1.4 LAND SUBSIDENCE

As described in the 2018/19 Annual Report, RMS for subsidence were proposed and arbitrary locations were identified until RMS subsidence benchmark could be constructed. Using National Aeronautics and Space Administration (NASA) Interferometric Synthetic Aperture Radar (InSAR) Jet Propulsion laboratory historical ground surface elevation data, SMCs were established at each of the arbitrary subsidence RMSs using the GFM to project ground surface elevations (see Section 3.5.14 and Section 3.5.2.4 of the Pixley ID GSA GSP for process to establish subsidence SMC). During the first part of 2020, benchmarks were constructed throughout the subbasin to replace the arbitrary subsidence RMSs with physical subsidence RMS benchmarks. Baseline elevations were taken at each of the benchmarks during the summer of 2020. Using the baseline elevations and applying the same process used to for the arbitrary sites, SMC was established at each of the newly constructed subsidence RMSs benchmarks.

Twelve (12) subsidence RMS benchmarks were constructed in 2020 within the Pixley ID GSA Plan area. An additional four (4) benchmarks were constructed and added to the RMS network in 2021, as a result there is not two years of data to compute the rate of decline at these benchmarks. The rate of subsidence is shown in **TABLE 7-4** for benchmarks that were measure in both 2020 and 2021.Elevations taken during the summer of 2021 at each of the RMS benchmarks are compared to the established 2025-interim milestones, measurable objectives, and minimum thresholds in **TABLE 7-5**.

TABLE 7-4: RATE OF SUBSIDENCE

RMS Benchmark ID	Ground Surface Elevation (ft amsl)		
	2020 (baseline)	2021	Rate (ft/year)
P0007_B_RMS	209.98	209.251	0.729
P0008_B_RMS	229.07	228.605	0.465
P0009_B_RMS	205.16	204.468	0.692
P0010_B_RMS	202.36	201.85	0.510
P0011_B_RMS	218.49	217.818	0.672
P0025_B_RMS	273.43	273.005	0.425
P0026_B_RMS	277.23	276.43	0.800
P0027_B_RMS	255.34	254.826	0.514
P0028_B_RMS	278.02	277.447	0.573
P0029_B_RMS	283.52	283.469	0.051
P0036_B_RMS	323.58	323.074	0.506
P0037_B_RMS	324.56	324.074	0.486
P0090_B_RMS	N/A	368.39	N/A
P0091_B_RMS	N/A	224.75	N/A
P0093_B_RMS	N/A	349.96	N/A
P0094_B_RMS	N/A	310.79	N/A

Notes:
1) Negative value indicates increase in ground surface elevation

TABLE 7-5: RMS SUBSIDENCE DATA

RMS Benchmark ID	Ground Surface Elevation (ft amsl)			
	2021	2025 Interim Milestone	Measurable Objective	Minimum Threshold
P0007_B_RMS	209.251	207	203	201
P0008_B_RMS	228.605	227	226	224
P0009_B_RMS	204.468	203	198	195
P0010_B_RMS	201.850	202	196	193
P0011_B_RMS	217.818	216	212	210
P0025_B_RMS	273.005	272	271	270
P0026_B_RMS	276.430	277	276	275
P0027_B_RMS	254.826	254	253	252
P0028_B_RMS	277.447	278	277	276
P0029_B_RMS	283.469	283	282	281
P0036_B_RMS	323.074	323	322	321
P0037_B_RMS	324.074	324	323	322
P0090_B_RMS	368.390	N/A	N/A	N/A
P0091_B_RMS	224.750	N/A	N/A	N/A
P0093_B_RMS	349.960	N/A	N/A	N/A
P0094_B_RMS	310.790	N/A	N/A	N/A

From review of the 2021 subsidence monitoring data in **Table 7-5** two (2) of the benchmarks exceeded the 2025 interim milestone (P0026, P0028) but none exceed the measurable objectives or minimum thresholds.

7.2 IMPLEMENTATION OF PROJECTS OR MANAGEMENT ACTIONS

This section describes the projects and management actions that are being implemented by the GSA in order to achieve the groundwater sustainability in the GSA. The projects and management actions primarily consist of adaptive policies to define rules for extraction and management of groundwater to reduce the over drafting of the resource in the GSA and subbasin by 2040. These sorts of projects allow for the greatest benefit experienced in a shorter period of time with the least amount of capital being invested. The policies adopted by the governing board of the GSA are included as **ATTACHMENT 2 – PIXLEY GSA RULES AND OPERATING POLICIES** to this report.

The following projects and management actions were proposed by the GSA in the GSP:

1. Agency Groundwater Accounting Action
2. Existing Water Supply Optimization Projects
3. Surface Water Development Projects
4. Managed Aquifer Recharge and Banking Projects
5. Agricultural Land Retirement Projects
6. Municipal Management Area Projects

In parts or collectively the above-mentioned projects and management actions will help the GSA avoid undesirable results. Throughout implementation of the GSP the GSA will monitor the effectiveness of projects and management actions at maintaining a path toward sustainability, and when necessary adjust accordingly. The following sections briefly summarize and catalog progress towards implementing projects and management actions.

7.2.1 Groundwater Accounting

The Pixley GSA began implementing the "Agency Groundwater Accounting Action", as described in Section 5.2.1 of the Pixley GSP, before GSP adoption. Many of the key components described under this Action were undertaken in the beginning stages of the GSP development both by the GSA and the Tule Subbasin GSAs collectively, as they were recognized as essential or required elements for defining a successful path to achieving sustainability.

The GSAs progress towards implementing the key components of this action are summarized below.

<u>Identification of groundwater users and groundwater allocations</u>

Status: partially *complete; ongoing*

The Groundwater Flow Model (GFM) for the Tule Subbasin established water budgets depicting water uses and users for the past, present, and future. Based on the water budgets, Sustainable Yield allocation of groundwater consumption was determined to be 0.15 acre-feet per acre. Precipitation was all recognized as an allocation of groundwater that was available to landowners for consumption, with allocation amounts varying throughout the subbasin. Within the GSA this amounted to 0.71 acre-feet per acre based on the 27-year average.

The governing board to the GSA has also adopted the *District Allocated Groundwater Credits* policy to define rules for groundwater allocations and is attached to this report as Policy 6 in **Attachment 2.**

Regarding identifying domestic water users, the GSP acknowledges a data gap in this regard, and includes a description of future actions to correct this data gap. These potential actions to identify data gaps and to plan for potential drought mitigation on behalf of domestic users within the GSA continues to be monitored. The GSP identifies Representative Monitoring Sites for each management zone to continue to monitor the changes in groundwater levels. Pixley GSA has added the additional monitoring to address lack of data available. As a part of implementation, collection of the available data within the Pixley GSA in addition to the monitoring data, will be coordinated with the County of Tulare (well permits), and the online databases established by DWR. Furthermore, coordinated efforts with other regulatory programs (such as the Irrigated Lands Regulatory Program) has taken place to help fill any remaining data gaps.

Regarding identification of Groundwater Dependent Ecosystems, the Pixley GSA GSP indicates that no GDE meeting the criteria exists within the GSA planning area. Pixley GSA continues to consider the Pixley National Wildlife Refuge ("PNWR") as not meeting the groundwater dependent ecosystem definition, and is not a managed wetland requiring specific consideration in the GSP as a beneficial user entitled to special consideration as a specific use. Groundwater Dependent Ecosystems has a specific definition under SGMA, and PNWR does not meet that definition.

At the same time, the Pixley GSA GSP acknowledges that there are potential data gaps regarding the complete identification of Groundwater Dependent Ecosystems throughout the planning area. Potential management actions to address the concerns raised about the identified environmental usage of PNWR can and should be considered, particularly if surface water that has been allocated to PNWR could be delivered. The use of surface water for PNWR, which to date has not been delivered, and monitoring of use by PNWR are items that will continue to be studied in annual reports and potentially considered as a management action as identified in the prior responses to GSP comments. As previously identified, potential conveyances could be identified to allow PNWR to utilize the surface water supplies that have been allocated, but not delivered to date. CVPIA provided a Level 2 (1,280 a/f) and Level 4 (4,720 a/f) allocation to the PNWR. In September of 2003, the Bureau of Reclamation completed a Finding of No

Significant Impact outlining four alternatives for providing Level 2 and Level 4 supplies to the PNWR. None of those alternatives were ever implemented. In 2013, the PNWR completed the construction of two new wells to increase total annual pumping in excess of the Level 2 baseline. To date, the PNWR has not delivered any of the allocated Level 2 or Level 4 water and instead pumped groundwater to meet refuge needs. Prior to the passage of CVPIA, and in many years since, the Pixley Irrigation District has coordinated with the PNWR to deliver District sources of water to the PNWR at no cost to the PNWR. Doing so helped with recharge of the underlying aquifer and was generally consistent with the periods when the PNWR would otherwise use wells to meet Level 2 needs. The PNWR has claimed exemption from SGMA regulations and related SMGA policies now being applied to other landowners in the GSA. The PNWR has a water supply provided to it under federal statute and a completed plan and related environmental document that would allow for delivery of surface water to the PNWR. The PNWR is not dependent on groundwater. It simply chooses not to exercise the use of its surface water assets provided to it through federal statute and instead pump groundwater. The Pixley Irrigation District and Pixley GSA have offered to cooperate with the PNWR on the delivery of the Level 2 and Level 4 water in a way that would make the continued use of groundwater by the PNWR practical and in balance with SGMA. The substance of the program would be short term, large volume delivery of the Level 2 and Level 4 water to the GSA who would recharge and bank the water for in-lieu use by the PNWR through groundwater pumping. This method was one of the alternatives considered in the 2003 EA/FONSI.

Further action by Pixley GSA on the issues of identification of domestic groundwater users and Groundwater Dependent Ecosystems will also benefit from the work being coordinated by Pixley GSA through the Watershed Coordinator position discussed below.

<u>Accurate accounting groundwater extractions</u>

Status: *complete*

The Tule Subbasin and GSA have hired consultants to provide groundwater extractions data in the form of remotely sensed crop evapotranspiration (ET) data using satellite imagery. This technology coupled with the Districts detailed records of surface water deliveries to landowners allows for the GSA to spatially determine the greater majority of groundwater extractions, being agriculture it the primary user of groundwater in the GSA Plan area. Meters will be used to account for groundwater users that are not associated with agriculture, such as municipalities.

The governing board to the GSA has also adopted the *Water Measurement and Metering* policy to define the accounting of groundwater consumption and is attached to this report as Policy 1 in **ATTACHMENT 2**.

<u>Gradually reduce total groundwater consumption</u>

Status: *complete*

The governing board to the GSA has adopted the *Transitional Groundwater Consumption* policy to define rules for groundwater use above sustainable yield and is attached to this report as Policy 4 in **ATTACHMENT 2**.

The rampdown schedule described in Policy 4 (see **TABLE 7-5**), was adopted by the GSA governing board to gradually reduce groundwater consumption to sustainable levels by 2040.

TABLE 7-6: RAMP DOWN SCHEDULE

Groundwater Consumptive Use Allowed Above Sustainable Yield (AF)			
2020-2024	**2025-2029**	**2030-2034**	**2035-2039**
2	1.5	1.0	0.5

By adopting the schedule, the GSA is allowing landowners to not feel the economic impacts of reducing groundwater use "overnight" to sustainable levels, but also enforces immediate actions for achieving sustainability, by making consumptions restrictions in effect as of February 2020.

As noted in the GSP, the rules for transitional pumping will require adaptive management to include an accounting of usage to ensure that overall pumping levels will not increase during transitional pumping and that over time groundwater pumping will decrease under the GSP. The GSA identified potential management actions to reduce FKC subsidence including but not limited to using collected fees to strategically retire land or implement (and adjust if necessary) fees to reduce groundwater pumping.

The water accounting system to track transitional pumping to collect fees per rules and policies has been established. Additionally, the Tule Subbasin Groundwater Flow Model (GFM) has been updated to incorporate data through water year 2021 to provide a more accurate analysis of future subsidence based on the GSA management actions. Continued updates to the GFM will allow for more accurate projections of conditions within the subbasin as data being collected through implementation becomes more robust. Lastly, the Tule Subbasin monitoring program defined in the Coordination Agreement baseline groundwater depth and land subsidence benchmarks have been established, including in the area of Pixley GSA.

The subsidence along the FKC continues to be evaluated with more specific analysis within the neighboring Eastern Tule GSA. In cooperation with the Eastern Tule GSA, PIXIDGSA has developed a Land Subsidence Management Area along the Friant Kern Canal. As this further analysis continues to identify the causes of subsidence along the FKC and relative impacts from Pixley GSA, adaptive updates to management actions as outlined in the GSP will take place, while monitoring continues and tracking transitional pumping. During 2021, the GSA entered into a settlement agreement regarding transitional overdraft pumping and anticipated subsidence damages/repairs to the Friant Kern Canal with the Friant Water Authority, to mitigate impacts to the canal caused by groundwater pumping in the Pixley GSA.

<u>Water accounting</u>

Status: *complete, on-going refinement*

All of the previous and after-mentioned key components of the Groundwater Accounting Action rely on accurate water accounting for them to successfully be implemented. The GSA recognized this in the early stages of GSP development and worked with a consultant to build a system that incorporated both subbasin and GSA policies for tracking groundwater use. The GSA water accounting system has been operational since February 2020 and is being utilized by the GSA and its landowners as an integral part of the Groundwater Accounting Action.

The accounting system is designed to give landowners the ability to view and track annual allocations, monthly water consumption based on remotely sensed ET data, surface water deliveries, and volumes of surface water recharged or banked for future in-lieu use, among other features that give the landowners the tools to successfully manage their operation in a sustainable manner.

<u>Develop policy for crediting groundwater recharge and banking activities</u>

Status: *complete, on-going refinement*

The governing board for the GSA has adopted the *Groundwater Banking at the Landowner Level* policy to define rules for developing groundwater consumption credits from landowner and District recharge and banking activities and is attached to this report as Policy 2 in **ATTACHMENT 2**. The policy incentivizes landowners to user groundwater for recharge and banking when it is available in excess of what's needed for crop demands by crediting the landowners water account with a percentage of the total volume surface water recharged as a groundwater credit. As a result, many landowners have constructed and are operating recharge basins on their farms.

<u>Develop policy for transferring groundwater credits</u>

Status: *complete, on-going refinement*

The governing board for the GSA has adopted policies for *Water Accounting and Water Transfers* and *Landowner Surface Water Imported* into the GSA, which define rules for movement of groundwater credits from one landowner to another within the GSA Plan area and for surface water imported into the GSA by landowners. The policies are attached to this report as Policy 3 and Policy 5, respectively, in **ATTACHMENT 2**.

These policies are intended to provide landowners with the tools to feasibly and economically manage groundwater resources during the implementation of the GSP.

<u>Adjustment of policies for groundwater allocations and transfers</u>

Status: *subject to future consideration*

The GSA has included this component in the Groundwater Accounting Action understanding that all options for transferring and allocating groundwater credits will be based on the best available data. Adjustment of policies for groundwater allocations or transfers are intended to continue granting landowners all opportunities available to feasibly and economically manage groundwater resources to the extent undesirable results are not experienced within the GSA Plan area or the subbasin. As a result, the GSA reserves its right to increase or reduce groundwater allocations and expand or limit transferring of groundwater credits based on the GSA progress toward reaching its sustainability goal.

<u>Create revenue for financing GSA operation, mitigation, monitoring, and projects</u>

Status: *complete, future implementation*

The GSA has established a fee structure for consumption of groundwater above sustainable amounts, also known as transition groundwater consumption. Revenues from the fees collected will be used to mitigate impacts and implement projects and programs to help reach the GSA sustainability goals.

The fee structure for transitional groundwater consumption is included as part of the *Transitional Groundwater Consumption* policy and is attached to this report as Policy 4 in **ATTACHMENT 2**.

<u>Develop policy for enforcement to ensure compliance with rules established to achieve sustainability.</u>

Status: *complete, subject to future refinement*

The governing board to the Pixley GSA has adopted the *Implementation and Enforcement of Plan Actions* policy to clearly outlines the process the GSA will use to enforce compliance with the policies adopted in order to achieve sustainability.

The rules for GSP implementation and enforcement are included as part of the Policy 8 within **ATTACHMENT 2** of this report.

7.2.2 WATER SUPPLY OPTIMIZATION

Projects for optimization of existing surface supplies is discussed in Section 5.2.2 of the Pixley GSA GSP and has been a joint implementation between the Pixley and the landowners within the District.

Modify existing key water control structures

Status: *on-going*

Annually the district performs maintenance on the distribution systems when the system is not in use. This includes routine maintenance to natural water ways and district owned channels. Additionally, the District was awarded grant funding to install meters at all recharge facilities to more accurately track volumes of surface water diverted for recharge activities. This project is expected to be completed in 2021.

Modify existing District recharge basins

Status: future/*on-going*

As previously mentioned, the District was awarded grant funding to install meters at all recharge facilities to more accurately track volumes of surface water diverted for recharge activities during 2021.

Expand Supervisory Control and Data Acquisition (SCADA) system

Status: *on-going*

As part of the Groundwater Accounting Action, the Pixley has expanded its SCADA system for tracking and managing the delivery of surface within its distribution system and to landowners. Upgrades to the system allows the district to utilize real time data to remotely monitor and adjust target flow rates at key bifurcation points. The recharge basin grant funding would give the District the ability to expand its SCADA system.

Expand the District Distribution System to area not currently served

Status: *in-progress*

The District will continue to utilize funding made available to expand the distribution system that do not currently have access to surface water. The District has done the environmental documents and design work to construct a 5.5 mile canal that would serve approximately 5,500 acres of farmland in the North West area of the District that currently does not have access to surface water and relies solely on groundwater. The District is currently negotiating with landowners to obtain easements for the construction of the canal.

Replace open channel canals with pipeline distribution systems

Status: *in-progress*

The District will continue to utilize funding made available for similar open channel replacement projects to increase efficiency of surface water delivers to members of its district.

<u>Maintain existing pipeline distribution systems</u>

Status: *on-going*

Maintaining existing pipeline distribution systems in an on-going project the districts perform as part of their annual maintenance activities and in real time as issues arise.

<u>Upgrade on-farm irrigation distribution systems</u>

Status: *on-going*

Upgrading of on-farm irrigation distribution systems are implemented at the landowner level to ensure the most efficient practices for irrigating crops is used to maximum resources available. This is an on-going project and will occur throughout the implementation of the GSP.

7.2.3 Surface Water Development

Surface water development projects are discussed in Section 5.2.3 of the Pixley GSA GSP and include additional supplies made available through purchase excess supplies from neighboring irrigation districts, surface water infrastructure development, and delivery of Central Valley Project (CVP) Shasta Division contract. Progress towards implementing these projects is summarized below.

<u>Surface water infrastructure development</u>

Status: *on-going*

A feasibility study and environmental documentation have been completed to expand the distribution system in the northwestern area of the District. The project alignment has been identified, discussions with landowners to obtain the easements needed are ongoing and the 100% construction plans are currently being finalized.

<u>Delivery of CVP Shasta Division Contract</u>

Status: *on-going*

While the District endeavors to find ways to deliver this water directly into the District, during 2018, 2019 and 2020 short term exchange agreements were put in place to exchange this water for water supplies available out of watersheds and reservoirs on the East side of the Valley.

7.2.4 Managed Aquifer Recharge and Banking

Managed aquifer recharge and banking projects are discussed in Section 5.2.4 of the Pixley GSA GSP and in **Section 7.2.1** of this report and consists of both expansion of the Pixley recharge operations and development of landowner recharge projects. As previously mentioned, the governing board for the GSA has adopted the *Groundwater Banking at the Landowner Level* policy and is attached to this report as Policy 2 in **Attachment 2**.

A summary of progress towards implementing these projects is provided below.

<u>Expansion of District recharge basins</u>

Status: *on-going*

The District purchased approximately 160 acres in 2019 that will be developed into recharge basins to add to the existing 940 acres of recharge basins owned and operated by the District. The continues to assess potential opportunities for developing additional land to utilized for recharge basin. During 2021, the District purchased 831 acres, some of which will be developed into recharge basins. In 2022, the District applied for a grant that will expand the District's recharge capabilities near the Disadvantaged Communities of Pixley and Teviston.

<u>Development of landowner recharge basins</u>

Status: *on-going*

Since the District adopted the *Groundwater Banking at the Landowner Level* policy, landowners within the district have constructed 252 acres of recharge basins. This is expected to be a continuing trend as landowners adjust to the policies adopted by the GSA for sustainable groundwater management.

7.2.5 Agriculture Land Retirement Projects

Agriculture land retirement projects are discussed in Section 5.2.5 of the Pixley GSA GSP and consists of the Pixley purchasing land for permanent retirement, landowners taking a portion of their farm permanently out of production, and landowners taking a portion of their farm annually out of production depending on water supplies available.

To date the GSA has not implemented any agriculture retirement programs. Although, some lands within the district have been converted uses from crop production to manage recharge basins by landowners, resulting in dual benefit of reduced groundwater consumption and increased managed recharge and banking. This was previously discussed in **Section 7.2.4**.

The GSA Board adopted an annual land fallowing policy during 2021, which encourages landowners to fallow land in dry years. The Pixley GSA was also a funding contributor and founder of the Tule Basin Land & Water Conservation Trust. The Trust was formed in part as a means of supporting the GSA in the work being done to meet plans and objectives outlined in the GSP. Pixley faces a groundwater deficit that cannot be overcome without long term conversion of farmland away from a water intensive use. The Trust is working with landowners in the GSA to retire and/or fallow active farmland into conservation easements that will have numerous ecosystems and groundwater benefits. The Tule Basin Land & Water Conservation Trust will interface with the Watershed Coordinator described in Section 7.2.6 regarding the plans outlined in the Tule Subbasin GSPs. In 2021, the District purchased 831 acres which will be permanently retired. A portion of the property will be developed into recharge basins. The GSA is also working with the Trust, for the Trust to purchase a portion of the property and restorer it to upland habitat.

7.2.6 Municipal Management Area Projects and Management Actions

Municipal management area projects and management actions are described under Section 5.2.6 of the Pixley GSA GSP and describes the process by which the CSDs and PUDs that are encompassed within the GSA are able to participate in projects and management actions described within Section of the GSP as well as rules for working cooperatively with the GSA to ensure the GSA meets its sustainability goal. These rules include reporting of community water use and measurable objective and minimum thresholds required by the communities. These rules can be found in *Policy 7 – CSD and PUD Water Use* within the GSA adopted by the GSA governing board and is included as **ATTACHMENT 2** to this report.

In 2022, the District applied for a grant that will expand the District's recharge capabilities near the Disadvantaged Communities of Pixley and Teviston. These projects provide benefits to the adjacent communities and surrounding private domestic wells through groundwater reliability in terms of both stabilizing groundwater levels and groundwater quality. If funding is awarded for the projects the approximate expected completion date is early 2024.

The Pixley GSA continues to believe that the most effective representation of domestic and municipal water users within the planning area is through the existing and longstanding governmental agencies that directly serve domestic water, all which have established governance structures. Post adoption, the PIDGSA has continued working with these agencies.

The Pixley Irrigation District entered into a cooperative Memorandum of Understanding (MOU) with the Pixley Public Utility District (PUD) and the Teviston Community Services District (CSD). Under the MOU, Pixley agreed to cooperate with the PUD and CSD on the development of the Groundwater Sustainability Plans for the region. The PUD and CSD were included in the Pixley GSA and were given a seat on the Groundwater Planning Commission formed by the GSA to coordinate and draft the GSP. The intent behind the MOU was to assist the PUD and CSD in the SGMA process using the resources and coordination of the Pixley GSA. The PUD and CSD named a representative to the Planning Commission. The PIXIDGSA considers these MOUs to be the most effective and extensive form of outreach to the domestic water user community possible.

To augment this further, the Pixley GSA submitted an application to the Department of Conservation to create a Watershed Coordinator position to further assist in identifying data gaps and to develop strong working connection with local stakeholders and communities throughout the planning area. The GSA was notified in January 2021 that it was awarded the grant for the Watershed Coordinator. A Watershed Coordinator was hired in 2021.

Key Watershed Coordinator tasks and objectives, including those related to DACs are:

1. Develop site-specific projects with benefits to critically underserved communities (DACs) in the Tule Subbasin.
2. Assist underserved communities in the Tule Subbasin to engage and participate in scoping and development of projects that align with community needs and groundwater sustainability goals within the watershed.
3. Ensure continuity with the existing MOUs between Pixley ID GSA and the communities of Pixley PUD and Teviston CSD.
4. Working with Disadvantage Communities to identify projects up-gradient from domestic well-fields to protect water quality
5. Evaluate effects of GSP implementation on Groundwater Dependent Ecosystems (GDE) in collaboration with the California Department of Fish and Wildlife
6. Assist with development of multi-benefit projects with local community, ecosystem, and wildlife habitat benefits.

7. Lead upland habitat restoration efforts with partners (TNC, Audubon, NRCS, US Bureau of Reclamation, US Fish and Wildlife Service the Tule Land and Water Conservation Trust, Pixley ID)
8. Working with willing landowners, identify potential agricultural lands coming out of production to meet groundwater sustainability goal
9. Coordinate on-farm recharge with landowners. Collaborate with Fresno State, UC Davis and Sustainable Conservation on monitoring and evaluation of effects of recharge.

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ATTACHMENT 1 – TULE SUBBASIN 2020/21 ANNUAL REPORT

Tule Subbasin 2020/21 Annual Report

March 2022

Prepared for

Tule Subbasin Technical Advisory Committee

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Executive Summary

This is the third annual report of the Tule Subbasin, identified by the California Department of Water Resources (CDWR) as No. 5-22-13 of the Tulare Lake Hydrologic Region (see Figure 1). This report is being submitted in compliance with Title 23 of the California Code of Regulations, Division 2, Chapter 1.5, Subchapter 2, Article 7, Section 356.2, as required under the Sustainable Groundwater Management Act (SGMA). As per Section 356.2, this report addresses data collected for the preceding water year, which covers October 1, 2020 through September 30, 2021.

The Tule Subbasin includes seven Groundwater Sustainability Agencies (GSAs; see Figure 2):

1. Eastern Tule Groundwater Sustainability Agency (ETGSA),
2. Tri-County Water Authority Groundwater Sustainability Agency (TCWA GSA),
3. Pixley Irrigation District Groundwater Sustainability Agency (Pixley GSA),
4. Lower Tule River Irrigation District Groundwater Sustainability Agency (LTGSA),
5. Delano-Earlimart Irrigation District Groundwater Sustainability Agency (DEID GSA)
6. Alpaugh Groundwater Sustainability Agency (Alpaugh GSA), and
7. Tulare County Groundwater Sustainability Agency (Tulare County GSA).

Six of the seven GSAs within the Tule Subbasin have developed and submitted to the CDWR independent Groundwater Sustainability Plans (GSPs) pursuant to 23 CCR §353.6. Tulare County GSA has entered into Memoranda of Understanding (MOUs) concerning coverage of territories under adjacent GSPs. As such, their jurisdictional areas are included in the other six GSPs. DEID GSA has identified four separate management areas (MAs) within their boundary: DEID Management Area, Annex Management Area, Richgrove Management Area, and Earlimart Management Area.

Groundwater Elevation Data

Two primary aquifers have been identified within the Tule Subbasin: an upper unconfined to semi-confined aquifer (the Upper Aquifer) and a lower semi-confined to confined aquifer (the Lower Aquifer). Groundwater elevation contour maps and hydrographs have been developed for each of these two primary aquifers.

Groundwater in the Upper Aquifer of 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 central portion of the subbasin. Groundwater flow patterns did not change significantly between the spring and fall 2021. In the Upper Aquifer, groundwater generally flows from the northeast to the southwest towards groundwater level depressions in the northwestern and western portions of the subbasin. The same groundwater level conditions and flow patterns were observed from Lower Aquifer contour maps generated from both the spring and fall of 2021.

Groundwater levels in the Tule Subbasin vary seasonally and over longer periods based on precipitation trends and groundwater pumping. Groundwater levels were generally lower across much of the Tule Subbasin for the 2020/21 water year as a result of recent dry conditions, limited surface water supplies and higher groundwater pumping relative to previous years.

Groundwater Extractions

Total groundwater extraction from the Tule Subbasin for water year 2020/21 was 887,530 acre-ft, as summarized by water use sector in the following table:

Table ES-1
Tule Subbasin Groundwater Extraction for Water Year 2020/21

	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Agricultural MA	281,000	0	250	281,250
Municipal MA	0	1,280	0	1,280
Tulare County MOU MA	2,000	0	0	2,000
LTRID GSA	283,000	1,280	250	284,530
Greater Tule MA	208,000	0	0	208,000
Porterville Community MA	0	11,810	0	11,810
Ducor Community MA	0	200	0	200
Terra Bella Community MA	0	0	0	0
Kern-Tulare WD MA	11,000	0	0	11,000
ETGSA	219,000	12,010	0	231,010
DEID MA	96,000	0	0	96,000
Western MA	16,000	0	0	16,000
Richgrove CSD MA	0	870	0	870
Earlimart PUD MA	0	2,930	0	2,930
DEID GSA Total	112,000	3,800	0	115,800
Pixley ID MA	165,000	0	0	165,000
Pixley PUD MA	0	610	0	610
Teviston CSD MA	0	80	0	80
Pixley GSA	165,000	690	0	165,690
North MA	9,100	0	17,050	26,150
Southeast MA	44,000	100	0	44,100
TCWA GSA	53,100	100	17,050	70,250
Alpaugh GSA	20,000	250	0	20,250
Totals	**852,100**	**18,130**	**17,300**	**887,530**

Note: All values are in acre-ft.
MA = Management Area.

Surface Water Use

Total surface water available for use within the Tule Subbasin for water year 2020/21 was 243,250 acre-ft as summarized by water use sector in the following table:

Table ES-2
Tule Subbasin Surface Water Supplies for Water Year 2020/21

	Stream Diversions[1]	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Agricultural MA	0	0	0	0	27,200	27,200
Municipal MA	0	0	80	0	300	380
Tulare County MOU MA	0	0	0	0	400	400
LTRID GSA	0	0	80	0	27,900	27,980
Greater Tule MA	10,900	31,700	0	0	37,300	79,900
Porterville Community MA	1,700	0	4,930	0	4,800	11,430
Ducor Community MA	0	0	0	0	100	100
Terra Bella Community MA	0	1,040	0	0	400	1,440
Kern-Tulare WD MA	0	7,780	0	1,100	2,800	11,680
ETGSA	12,600	40,520	4,930	1,100	45,400	104,550
DEID MA	0	53,800	0	0	15,900	69,700
Western MA	0	0	0	0	1,900	1,900
Richgrove CSD MA	0	0	0	0	100	100
Earlimart PUD MA	0	0	0	0	300	300
DEID GSA Total	0	53,800	0	0	18,200	72,000
Pixley ID MA	0	0	0	0	17,400	17,400
Pixley PUD MA	0	0	220	0	500	720
Teviston CSD MA	0	0	0	0	400	400
Pixley GSA	0	0	220	0	18,300	18,520
North MA	0	0	0	0	3,100	3,100
Southeast MA	0	0	0	0	13,400	13,400
TCWA GSA	0	0	0	0	16,500	16,500
Alpaugh GSA	0	0	0	0	3,700	3,700
Totals	**12,600**	**94,320**	**5,230**	**1,100**	**130,000**	**243,250**

Note: All values are in acre-ft.
[1]Provisional data subject to revision.

Total Water Use

Total water use in the Tule Subbasin for water year 2020/21, including both groundwater extractions and surface water supplies, was 1,130,780 acre-ft as shown in the following table:

Table ES-3

Tule Subbasin Total Water Use for Water Year 2020/21

	Groundwater Extraction	Surface Water Supplies	Total
Agricultural MA	281,250	27,200	308,450
Municipal MA	1,280	380	1,660
Tulare County MOU MA	2,000	400	2,400
LTRID GSA	284,530	27,980	312,510
Greater Tule MA	208,000	79,900	287,900
Porterville Community MA	11,810	11,430	23,240
Ducor Community MA	200	100	300
Terra Bella Community MA	0	1,440	1,440
Kern-Tulare WD MA	11,000	11,680	22,680
ETGSA	231,010	104,550	335,560
DEID MA	96,000	69,700	165,700
Western MA	16,000	1,900	17,900
Richgrove CSD MA	870	100	970
Earlimart PUD MA	2,930	300	3,230
DEID GSA Total	115,800	72,000	187,800
Pixley ID MA	165,000	17,400	182,400
Pixley PUD MA	610	720	1,330
Teviston CSD MA	80	400	480
Pixley GSA	165,690	18,520	184,210
North MA	26,150	3,100	29,250
Southeast MA	44,100	13,400	57,500
TCWA GSA	70,250	16,500	86,750
Alpaugh GSA	20,250	3,700	23,950
Totals	**887,530**	**243,250**	**1,130,780**

Note: All values are in acre-ft.

Change in Groundwater in Storage

Results of the change in groundwater in storage analysis showed that between fall 2020 and fall 2021, groundwater in storage decreased by approximately 343,000 acre-ft.

Since 1986/87, the volume of groundwater in storage in the Tule Subbasin has decreased by approximately 2,967,000 acre-ft. The volume of groundwater in storage is estimated to have increased by approximately 160,000 acre-ft since 2015/16.

1. Introduction

This is the third annual report of the Tule Subbasin, identified by the California Department of Water Resources (CDWR) as No. 5-22-13 of the Tulare Lake Hydrologic Region (see Figure 1). This report is being submitted in compliance with Title 23 of the California Code of Regulations, Division 2, Chapter 1.5, Subchapter 2, Article 7, Section 356.2, as required under the Sustainable Groundwater Management Act (SGMA). As per Section 356.2, this report addresses data collected for the preceding water year, which covers October 1, 2020 through September 30, 2021.

The Tule Subbasin includes seven Groundwater Sustainability Agencies (GSAs; see Figure 2):

1. Eastern Tule Groundwater Sustainability Agency (ETGSA),
2. Tri-County Water Authority Groundwater Sustainability Agency (TCWA GSA),
3. Pixley Irrigation District Groundwater Sustainability Agency (Pixley GSA),
4. Lower Tule River Irrigation District Groundwater Sustainability Agency (LTGSA),
5. Delano-Earlimart Irrigation District Groundwater Sustainability Agency (DEID GSA)
6. Alpaugh Groundwater Sustainability Agency (Alpaugh GSA), and
7. Tulare County Groundwater Sustainability Agency (Tulare County GSA).

Six of the seven GSAs within the Tule Subbasin have developed and submitted to the CDWR independent Groundwater Sustainability Plans (GSPs) pursuant to 23 CCR §353.6. Tulare County GSA has entered into Memoranda of Understanding (MOUs) concerning coverage of territories under adjacent GSPs. As such, their jurisdictional areas are included in the other six GSPs.

The six GSPs for the Tule Subbasin have been developed and submitted under a Coordination Agreement. The purpose of the Coordination Agreement is to fulfill all statutory and regulatory requirements related to intra-basin coordination agreements pursuant to SGMA. The Coordination Agreement includes two attachments: Attachment 1 describes the subbasin-wide monitoring network that all Tule Subbasin GSAs shall utilize for the collection of data to be used in annual reports. Attachment 2 describes the subbasin setting, which represents the coordinated understanding of the physical characteristics of the subbasin.

1.1 Tule Subbasin Description

The Tule Subbasin is in the southern portion of the San Joaquin Valley Groundwater Basin in the Central Valley of California. The area of the Tule Subbasin is defined by the latest version of CDWR Bulletin 118[1] and is approximately 744 square miles (475,895 acres). The lateral boundaries of the subbasin include both natural and political boundaries (see Figure 2). 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

California Department of Water Resources, 2016. Final 2016 Bulletin 118 Groundwater Basin Boundaries shapefile. http://www.water.ca.gov/groundwater/sgm/basin_boundaries.cfm 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. Communities within the subbasin include Allensworth, Alpaugh, Porterville, Tipton, Woodville, Poplar, Teviston, 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.

1.2 Hydrogeologic Setting

The Tule Subbasin is located on a series of coalescing alluvial fans that extend toward the center of the San Joaquin Valley from the Sierra Nevada Mountains (see Figure 3). The alluvial fans merge with lacustrine deposits of the Tulare Lakebed in the western portion of the subbasin. Land surface elevations within the Tule Subbasin range from approximately 850 ft above mean sea level (amsl) along the eastern margins of the subbasin to approximately 180 ft amsl at the western boundary (see Figure 3).

Where saturated in the subsurface, the permeable sand and gravel layers form the principal aquifers in the Tule Subbasin and adjacent areas to the north, south and west. Individual aquifer layers consist of lenticular sand and gravel deposits of varying thickness and lateral extent. The aquifer layers are interbedded with low permeability silt and clay confining layers. In general, there are five aquifer/aquitard units in the subsurface beneath the Tule Subbasin (see Figure 4):

1. Upper Aquifer
2. The Corcoran Clay Confining Unit
3. Lower Aquifer
4. Pliocene Marine Deposits (generally considered an aquitard)
5. Santa Margarita Formation and Olcese Formation of the Southeastern Subbasin

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 the western-central portion of the subbasin.

1.3 Tule Subbasin Monitoring Network

The Tule Subbasin Technical Advisory Committee has developed a subbasin-wide monitoring plan, which describes the monitoring network and monitoring methodologies to be used to collect the data to be included in Tule Subbasin GSPs and annual reports. The subbasin-wide monitoring plan is included as Attachment 1 to the Coordination Agreement. The groundwater level monitoring network from the monitoring plan is shown on Figure 5 and includes monitoring features to enable collection of data from the Upper Aquifer, Lower Aquifer and Santa Margarita Formation aquifer. Groundwater levels are collected in the late winter/early spring (March) and in the fall to account for seasonal high and low groundwater conditions.

A subset of groundwater level monitoring features in the monitoring plan have been identified as representative monitoring sites to be relied on for the purpose of assessing progress with respect to groundwater level sustainability in the subbasin. The representative groundwater level monitoring sites are shown on Figure 5.

A land surface elevation monitoring network has also been established and is shown on Figure 6. This monitoring network consists of 94 benchmarks installed in 2020 and 2021. Each benchmark is a representative monitoring site. The elevations of the benchmarks are surveyed annually. Land surface change from July 2020 to July 2021 as measured at available benchmarks is shown on Figure 7. The most recent land surface elevation data are provided in Appendices A through F, along with established measurable objectives and minimum thresholds. Land subsidence measured from InSAR data provided by the CDWR from October 2020 to September 2021 is shown on Figure 8.

1.4 Purpose and Scope of this Annual Report

The purpose of this annual report is to document groundwater level conditions, groundwater extractions, surface water supply, and changes in groundwater storage in the Tule Subbasin for the 2020/21 water year, in accordance with CCR §356.2. The annual report also provides a description of progress toward implementing the collective GSPs for the six GSAs in the subbasin.

2. Groundwater Elevation Data §356.2 (b)(1)

Groundwater elevation contour maps were developed using data compiled from wells that are part of the Tule Subbasin Monitoring Plan (e.g. Representative Monitoring Site Wells), wells monitored as part of the Irrigated Lands Regulatory Program (ILRP), and wells from other monitoring programs, which are primarily monitored by local irrigation districts. Wells from the first two sources were identified as being perforated in either the Upper Aquifer or Lower Aquifer or both the Upper and Lower aquifers (i.e. composite aquifer wells). The perforation depths for most wells from the other monitoring programs are unknown. Sources of uncertainty in the available data included:

- Lack of representative monitoring well data in some areas.
- Limitations in the number of monitoring wells with known perforation intervals.
- Variations in monitoring frequency, such as due to lack of access, resulting in different spatial and temporal coverage from contour map to contour map.
- Utilization of groundwater level data from private agricultural wells in which the pumping status was unknown or where the length of time between turning the pumps off and obtaining the measurements was unknown.
- New data that was available for the 2021 contour map(s) but was not available at the time the 2020 contour map(s) was developed.

In general, TH&Co used as much of the available data as possible to generate the contour maps presented in this annual report. However, given uncertainties in the data, some professional judgment was involved. The process for generating the contours was as follows:

- For the Upper Aquifer contour maps, the basemaps originally included groundwater level data for Upper Aquifer wells (based on available documentation), wells with perforations in composite aquifers, and wells with unknown perforation intervals.
- Based on available data, the hydraulic head of the Upper Aquifer in the Tule Subbasin is always higher than the hydraulic head of the Lower Aquifer. In areas where multiple groundwater levels were available, the highest elevation was used to constrain the contours.
- Groundwater levels from wells for which documentation showed them to be Upper Aquifer wells were given the highest weight in generating the contours. However, in some cases, groundwater levels in designated Upper Aquifer wells were significantly lower than groundwater levels in other area wells whose perforation interval was unknown. In those, cases, the contours were constrained to the higher levels.
- Groundwater levels measured in dedicated monitoring wells were always relied on.
- The Upper Aquifer groundwater contour maps shown on Figures 9 and 10 show only the data upon which the contours were developed.

- For the Lower Aquifer the only data used to generate the contour maps were groundwater levels from dedicated Lower Aquifer monitoring wells or wells known to be perforated exclusively in the Lower Aquifer (see Figures 11 and 12).

Uncertainties in the groundwater level monitoring network are being addressed through the drilling and construction of dedicated, aquifer specific monitoring wells as well as investigations and improvements to the other wells being monitored. As new monitoring wells are constructed, they will replace some of the agricultural wells that are currently relied on. To date, two nested monitoring wells, two cluster monitoring wells, and one single completion monitoring well have been added to the monitoring network. Further, four additional nested monitoring wells and one single completion monitoring well are planned for construction. As these monitoring features are installed, it is expected that groundwater elevation contour maps from year to year will become more representative.

2.1 Groundwater Elevation Contour Maps §356.2 (b)(1)(A)

Upper Aquifer

Groundwater in the Upper Aquifer of 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 west-central portion of the subbasin (see Figures 9 and 10). The pumping depression is most pronounced between the Tule River and Deer Creek west of Highway 99. The groundwater level depression was observed from data collected in both the spring and fall of 2021. Groundwater flow patterns in the Upper Aquifer did not change significantly between the spring and fall of 2021.

The Upper Aquifer in the southeastern portion of the Tule Subbasin has been largely dewatered since the 1960s.[2]

Lower Aquifer

In the Lower Aquifer, groundwater generally flows from the northeast to the southwest towards groundwater level depressions in the northwestern and western portions of the subbasin (see Figures 11 and 12). Lower Aquifer pumping depressions are observed in the Lower Tule River Irrigation District GSA, Tri-County GSA and Alpaugh GSA. The same groundwater level conditions and flow patterns were observed from Lower Aquifer contour maps generated from both the spring and fall of 2020.

[2] Lofgren, B.E., and Klausing, R.L., 1969. Land Subsidence Due to Groundwater Withdrawal Tulare-Wasco Area California. United States Geological Survey Professional Paper 437-B.

2.2 Groundwater Level Hydrographs §356.2 (b)(1)(B)

Groundwater level hydrographs for Representative Monitoring Site (RMS) wells in each GSA are provided in Appendices A through F. Spring and fall 2021 groundwater levels for the RMS wells are summarized in Tables 1 through 6 of the following sections.

It is noted that some of the RMS wells shown in Tables 1 through 6 have been added since the Tule Subbasin GSPs were finalized in 2020. Most of the added RMS wells are new dedicated monitoring wells that have been drilled and constructed since January 2020. Some existing wells have been identified and added as RMS wells to address data gaps. Finally, some of the previously designated RMS wells were found to be inadequate for collecting reliable data and alternate existing wells were identified as replacements. These changes are consistent with Section 4.1 of the Tule Basin Monitoring Plan (TSMP),[3] which states that the 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."*

The newly added RMS wells in Tables 1 through 6 have not yet been assigned Sustainable Management Criteria (SMC; measurable objectives, intermediate milestones, and minimum thresholds). These SMC will be assigned for the 2021/22 water year.

On-going data collected at new RMS wells allows the Tule Subbasin TAC to address areas of data gaps and improve the accuracy of the subbasin-wide groundwater model, which is relied upon as a tool for establishing SMC. The Tule Subbasin TAC intends to reevaluate SMC established at all existing and new RMS sites during the five-year GSP update in 2025, or sooner as appropriate.

2.1.1. Lower Tule River Irrigation District GSA

There are 13 RMS wells in the LTRID GSA (see Figure 5). Of these wells, seven are perforated in the Upper Aquifer, five are perforated in the Lower Aquifer, and one is a composite well perforated in two aquifers. Hydrographs for each of the wells are provided in Appendix A. Available groundwater level data for LTRID GSA RMS wells from the spring and fall of 2021 are summarized in the following table:

[3] Tule Subbasin Coordination Agreement, Attachment 1. January 2020.

Table 1
Lower Tule River Irrigation District GSA
2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Upper Aquifer				
21S/23E-31	72.7	N/A[1]	N/A	N/A
21S/23E-32K01	62.7	102.1	71	56
21S/24E-35A01	111.8	105.2	57	44
21S/25E-03R01	N/A	N/A	92	58
21S/26E-32B02	182.2	161.9	131	83
21S/26E-34	N/A	N/A	110	73
LTRID TSS U	195.4	186.6	N/A	N/A
Lower Aquifer				
20S/26E-32	159.1	114.7	53	-6
21S/25E-36	79.4	N/A	1	-52
22S/23E-09	70.5	N/A	-139	-174
LTRID TSS M	123.5	105.2	N/A	N/A
LTRID TSS L	21.4	-22.0	N/A	N/A
Composite Aquifer				
22S/24E-01Q01	0.4	19.6	-39	-154

[1]N/A = Not Available

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. All measured groundwater levels in Upper Aquifer wells were above their respective minimum thresholds.

For the Lower Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. All of the groundwater levels in the Lower Aquifer monitoring wells were above both their respective measurable objectives and minimum thresholds.

For the Composite Aquifer monitoring Well 22S/24E-01Q01, groundwater levels in the well varied from 0.4 ft amsl to 19.6 ft amsl between spring and fall 2021. Both groundwater levels are above the measurable objective and minimum threshold for this well.

2.1.2. Eastern Tule GSA

There are 14 RMS wells in the ETGSA (see Figure 5). Of these wells, five are perforated in the Upper Aquifer, four are perforated in the Lower Aquifer, three are perforated in the Santa Margarita Formation, and two are composite wells perforated in two aquifers. Hydrographs for each of the wells are provided in Appendix B. Available groundwater level data for ETGSA RMS wells from the spring and fall of 2021 are summarized in the following table:

Table 2
Eastern Tule GSA
2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Upper Aquifer				
21S/27E-18M01	330.7	293.6	N/A[1]	N/A
C-1	N/A	N/A	377	317
R-11	338.7	328.0	376	264
22S/26E-13R01	245.6	235.5	N/A	N/A
22S/27E-13A01	386.5	N/A	331	259
Lower Aquifer				
22S/26E-24	108.3	19.9	26	-47
23S/26E-23R01	53.2	N/A	-2	-66
24S/27E-23	84.7	85.9	N/A	N/A
TSMW 6L	225.4	207.5	N/A	N/A
Santa Margarita Formation				
23S/27E-27	101.6	-8.7	112	-87
24S/27E-32M01	44.6	-90.4	N/A	N/A
TSMW 6SM	51.2	-50.6	N/A	N/A
Composite Aquifer				
C-16	N/A	292.0	111	2
23S/28E-04K01	571.7	573.0	N/A	N/A

[1]N/A = Not Available

Of the Upper Aquifer monitoring wells from which groundwater level data were available, groundwater levels showed slight declines between spring and fall 2021. All Upper Aquifer groundwater levels are above their respective minimum thresholds. The groundwater levels in R-11 were below the measurable objective for this well.

Of the Lower Aquifer monitoring wells, spring and fall 2021 groundwater levels were available for all wells except 23S/26E-23R01 (fall). In general, groundwater levels in the Lower Aquifer can be highly variable due to the confined nature of the aquifer and may be influenced by nearby pumping. In Well 22S/26E-24, the fall 2021 groundwater level dropped below the measurable objective for this well. None of the Lower Aquifer groundwater levels were measured below their respective minimum thresholds.

For the Santa Margarita Formation monitoring wells, groundwater levels dropped noticeably between spring 2021 and fall 2021 and likely represent seasonal pumping influence in this confined aquifer. Groundwater levels in Well 23S/27E-27 were below the measurable objective for this well but remained above the minimum threshold.

Of the Composite Aquifer monitoring wells, spring and fall 2021 groundwater levels were available for Well 23S/28E-04K01. Groundwater levels in this well varied from 571.7 ft amsl to 573.0 ft amsl between spring and fall 2021.

2.1.3. Delano-Earlimart GSA

There are 12 RMS wells in the DEID GSA (see Figure 5). Of these wells, six are perforated in the Upper Aquifer, four are perforated in the Lower Aquifer and two are composite wells perforated in two aquifers. Hydrographs for each of the wells are provided in Appendix C. Available groundwater level data for DEID GSA RMS wells from the spring and fall of 2021 are summarized in the following table:

Table 3
Delano-Earlimart Irrigation District GSA
2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Upper Aquifer				
23S/26E-29D01	74.5	74.9	45	-15
24S/25E-35H01	171.7	168.3	152	93
24S/26E-04P01	N/A[1]	68.4	84	-4
24S/26E-11	181.5	160.0	84	66
24S/26E-32G01	148.1	139.1	85	-19
M19-U	203.0	171.0	143	85
Lower Aquifer				
23S/25E-36H01	N/A	-3.0	26	-95
24S/24E-03A01	106.7	105.0	-25	-163
25S/26E-9C01	N/A	72.3	109	61
M19 -L	N/A	53.0	128	63
Composite Aquifer				
23S/25E-27	18.7	N/A	-6	-191
24S/27E-31	142.9	N/A	60	-7

[1]N/A = Not Available

For the Upper Aquifer RMS wells in the DEID GSA from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. Groundwater levels in all wells remain above their respective measurable objectives and minimum thresholds.

For the Lower Aquifer monitoring wells, comparative data for spring and fall 2021 were only available for Well 24S/24E-03A01, which showed a 1.7-ft drop over that time period. The fall 2021 groundwater level in Well 25S/26E-09C01 was below the measurable objective but above the minimum threshold for this well. The fall 2021 groundwater level in Well M19-L was below the measurable objective and minimum threshold.

Of the Composite Aquifer monitoring wells, only spring 2021 groundwater levels could be obtained. Groundwater levels for both composite wells were above their respective measurable objectives and minimum thresholds.

2.1.4. Pixley Irrigation District GSA

There are nine RMS wells in the Pixley GSA (see Figure 5). Of these wells, six are perforated in the Upper Aquifer, two are perforated in the Lower Aquifer, and one is a composite well perforated in two aquifers. Hydrographs for each of the wells are provided in Appendix D. Available groundwater level data for Pixley GSA RMS wells from the spring and fall of 2021 are summarized in the following table:

Table 4
Pixley Irrigation District GSA
2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/24E-23J01	-37.1	-35.3	-13	-68
23S/24E-28J02	95.0	83.0	78	54
22S/25E-25N01	17.7	7.4	-8	-54
23S/25E-08G01	N/A[1]	54.6	N/A	N/A
23S/25E-16N04	-31.7[2]	-74.6	62	14
PIDGSA-01 U	N/A	141.0	N/A	N/A
Lower Aquifer				
TSMW 1L	N/A	-146.2	N/A	N/A
PIDGSA-01 L	N/A	82.9	N/A	N/A
Composite Aquifer				
22S/25E-30	95.3	90.5	N/A	N/A

[1]N/A = Not Available
[2]The groundwater levels reported for 16N04 are below the total depth of the well, as reported by the driller's log. Investigations are planned to confirm the construction and perforation interval for the well. Until those investigations have been completed, the groundwater level for this well, as it relates to the Upper Aquifer, is considered provisional.

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2021 compared to Spring 2021. In Well 22S/24E-23J01, both groundwater levels are below the measurable objective but above the minimum threshold. With the exception of Well 23S/25E-16N04, all other measured groundwater levels in Upper Aquifer wells were above their respective minimum thresholds. The groundwater levels in Well 23S/25E-16N04 are below the reported total depth of the well and are considered suspect and subject to further investigation.

Two monitoring wells with perforations exclusive to the Lower Aquifer have recently been constructed and monitoring was initiated in Fall 2021, as shown in Table 4.

2.1.5. Tri-County Water Authority GSA

There are seven RMS wells in the TCWA GSA (see Figure 5). Of these wells, three are perforated in the Upper Aquifer and four are perforated in the Lower Aquifer. Hydrographs for each of the wells are provided in Appendix E. Available groundwater level data for TCWA GSA RMS wells from the spring and fall of 2021 are summarized in the following table:

Table 5
Tri-County Water Authority GSA
2020/21 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/23E-25C01 (E20)	27.4	-9.0	45	-40
24S/23E-22E01	53.6	46.0	130	40
TSMW 5U	N/A[1]	119.4	N/A	N/A
Lower Aquifer				
22S/23E-27F01 (G-13)	-164.0	-107.0	-85	-210
24S/23E-15R01	N/A	N/A	-20	-150
24S/23E-22R02	-143.4	N/A	15	-175
TSMW 5L	-139.7	-205.9	N/A	N/A

[1]N/A = Not Available

For the Upper Aquifer RMS wells in the TCWA GSA from which groundwater levels could be obtained, groundwater levels were generally lower in fall 2021 compared to spring 2021. In Wells 22S/23E-25C01 and 24S/23E-22E01, both spring and fall groundwater levels were below the measurable objective but remain above the minimum threshold.

Of the Lower Aquifer monitoring wells, spring and fall 2020 groundwater levels were available for Well 22S/23E-27F01 (G-13) and TSMW 5L. Groundwater levels in both wells declined between spring 2021 and fall 2021. All of the groundwater levels in Lower Aquifer RMS wells are below the measurable objective but remain above the minimum threshold.

2.1.6. Alpaugh GSA

The Alpaugh GSA has two Lower aquifer RMS wells: Well 23S/23E-25N01 and Well 55 (see Figure 5). The hydrographs for Well 23S/23E-25N01 and Well 55 are provided in Appendix F. Available groundwater level data for Alpaugh GSA RMS wells from the spring and fall of 2021 is summarized in the following table:

Table 6
Alpaugh Irrigation District GSA
2020/21 Groundwater Levels at the Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2021	Fall 2021	Measurable Objective	Minimum Threshold
Lower Aquifer				
23S/23E-25N01	-6.4	-30.6	-5	-110
Well 55	N/A[1]	-161.0	-92	-209

[1]N/A = Not Available

Spring and fall 2020 groundwater levels were available for Well 23S/23E-25N01. Groundwater levels in Well 23S/23E-25N01 varied from -6.4 ft amsl to -30.6 ft amsl between spring and fall 2021. The groundwater levels in both wells are below their respective measurable objectives but remain above the minimum thresholds.

3. Groundwater Extraction for Water Year 2020/2021 §356.2 (b)(2)

3.1 Agricultural Groundwater Pumping

Agricultural groundwater pumping in the Tule Subbasin is estimated as a function of the total agricultural water demand, surface water deliveries, and precipitation. 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). For the 2020/21 water year, crop evapotranspiration was estimated using Land IQ data.

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 correlated with crop types based on either CDWR 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.

Estimated Tule Subbasin 2020/21 agricultural groundwater production for each of the six GSAs is summarized in Table 7. Total agricultural groundwater production for the Tule Subbasin in 2020/21 was approximately 852,100 acre-ft.

Table 7
Tule Subbasin Groundwater Extraction for Water Year 2020/21

	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Agricultural MA	281,000	0	250	281,250
Municipal MA	0	1,280	0	1,280
Tulare County MOU MA	2,000	0	0	2,000
LTRID GSA	283,000	1,280	250	284,530
Greater Tule MA	208,000	0	0	208,000
Porterville Community MA	0	11,810	0	11,810
Ducor Community MA	0	200	0	200
Terra Bella Community MA	0	0	0	0
Kern-Tulare WD MA	11,000	0	0	11,000
ETGSA	219,000	12,010	0	231,010
DEID MA	96,000	0	0	96,000
Western MA	16,000	0	0	16,000
Richgrove CSD MA	0	870	0	870
Earlimart PUD MA	0	2,930	0	2,930
DEID GSA Total	112,000	3,800	0	115,800
Pixley ID MA	165,000	0	0	165,000
Pixley PUD MA	0	610	0	610
Teviston CSD MA	0	80	0	80
Pixley GSA	165,000	690	0	165,690
North MA	9,100	0	17,050	26,150
Southeast MA	44,000	100	0	44,100
TCWA GSA	53,100	100	17,050	70,250
Alpaugh GSA	20,000	250	0	20,250
Totals	**852,100**	**18,130**	**17,300**	**887,530**

Note: All values are in acre-ft.
MA = Management Area.

3.2 Municipal Groundwater Pumping

Groundwater pumping for municipal supply is conducted by the City of Porterville and small municipalities for the local communities in the Tule Subbasin. The City of Porterville groundwater pumping is metered and reported by the city. Municipal groundwater pumping by the other small communities within the Tule Subbasin is estimated based on population density and per capita water use as reported in Urban Water Master Plans. Total estimated municipal pumping in the Tule Subbasin for the 2020/21 water year was approximately 18,130 acre-ft (see Table 7).

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.

3.3 Groundwater Pumping for Export Out of the Tule Subbasin

Some of the groundwater pumping that occurs on the west side of the Tule Subbasin is exported out of the subbasin for use elsewhere. Angiola Water District and the Boswell/Creighton Ranch have historically exported pumped groundwater out of the Tule Subbasin. Total groundwater exports out of the Tule Subbasin for the 2020/21 water year was 17,300 acre-ft (see Table 7). This water is accounted for separately because the water is not applied within the subbasin and there is no associated return flow.

3.4 Total Groundwater Extraction

Total groundwater extraction from the Tule Subbasin for water year 2020/21 was 887,530 acre-ft (see Table 7). The distribution of groundwater production across the subbasin is shown on Figure 13.

4. Surface Water Use for Water Year 2020/2021 §356.2 (b)(3)

4.1 Diverted Streamflow

Surface water inflow to the Tule Subbasin occurs primarily via three native streams: Tule River, Deer Creek, and the White River. Flow in the Tule River is controlled through releases from Lake Success. Stream flow entering Lake Success is measured and distributed to various water rights holders as allocated at Success Dam in accordance with the Tule River Water Diversion Schedule and Storage Agreement.[4] Releases of water from Lake Success and downstream diversions are documented in Tule River Association (TRA) annual reports. For water year 2020/2021, 16,872 acre-ft of water was released to the Tule River from Success Reservoir. Tule River diversions occur in the ETGSA and LTRID GSA (see Table 8). In water year 2020/21, no water flowed out of the Tule Subbasin via the Tule River. Channel infiltration and ET losses account for the balance of Tule River water that was not diverted or did not flow out of the subbasin. No surface water diversions from Deer Creek or White River were reported in 2020/21. Total stream diversions in the Tule Subbasin for 2020/21 totaled 12,600 acre-ft as summarized in Table 8.

[4] TRA, 1966. Tule River Diversion Schedule and Storage Agreement. Dated February 1, 1966; revised June 16, 1966.

Table 8
Tule Subbasin Surface Water Supplies for Water Year 2020/21

	Stream Diversions[1]	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Agricultural MA	0	0	0	0	27,200	27,200
Municipal MA	0	0	80	0	300	380
Tulare County MOU MA	0	0	0	0	400	400
LTRID GSA	0	0	80	0	27,900	27,980
Greater Tule MA	10,900	31,700	0	0	37,300	79,900
Porterville Community MA	1,700	0	4,930	0	4,800	11,430
Ducor Community MA	0	0	0	0	100	100
Terra Bella Community MA	0	1,040	0	0	400	1,440
Kern-Tulare WD MA	0	7,780	0	1,100	2,800	11,680
ETGSA	12,600	40,520	4,930	1,100	45,400	104,550
DEID MA	0	53,800	0	0	15,900	69,700
Western MA	0	0	0	0	1,900	1,900
Richgrove CSD MA	0	0	0	0	100	100
Earlimart PUD MA	0	0	0	0	300	300
DEID GSA Total	0	53,800	0	0	18,200	72,000
Pixley ID MA	0	0	0	0	17,400	17,400
Pixley PUD MA	0	0	220	0	500	720
Teviston CSD MA	0	0	0	0	400	400
Pixley GSA	0	0	220	0	18,300	18,520
North MA	0	0	0	0	3,100	3,100
Southeast MA	0	0	0	0	13,400	13,400
TCWA GSA	0	0	0	0	16,500	16,500
Alpaugh GSA	0	0	0	0	3,700	3,700
Totals	**12,600**	**94,320**	**5,230**	**1,100**	**130,000**	**243,250**

Note: All values are in acre-ft.
[1]Provisional data subject to revision.

4.2 Imported Water Deliveries

Most of the water imported into the Tule Subbasin is from the Central Valley Project (CVP) and delivered via the Friant-Kern Canal. Angiola Water District also imports water from other various sources including the King's River and State Water Project. The water is delivered to farmers and recharge basins via the Tule River and Deer Creek channels, unlined canals, and pipeline distribution systems of Porterville Irrigation District, LTRID, Pixley Irrigation District, Terra Bella Irrigation District, Teapot Dome Water District, DEID, and Saucelito Irrigation District.

Imported water is delivered to eleven water agencies within the Tule Subbasin from the Friant-Kern Canal. Imported water delivery data for 2020/21 was obtained from United States Bureau of Reclamation (USBR) Central Valley Operation Annual Reports. Imported water deliveries to TCWA GSA were obtained from the Angiola Water District. Imported water deliveries for 2020/21 totaled 94,320 acre-ft as summarized in Table 8.

4.3 Recycled Water Deliveries

A portion of the treated effluent from the City of Porterville's wastewater treatment plant is delivered to farmers for agricultural irrigation. Recycled water deliveries for agricultural irrigation are reported by the City. Recycled water deliveries for 2020/21 totaled 5,230 acre-ft, as summarized in Table 8.

4.4 Oilfield Produced Water

The Kern-Tulare Water District receives water generated as a byproduct of oil production but suitable for agricultural irrigation. The total volume of oilfield produced water received for agricultural irrigation in the portion of the Kern-Tulare Water District that is within the Tule Subbasin in 2020/21 was 1,100 acre-ft.

4.5 Precipitation

The volume of water entering the Tule Subbasin as precipitation was estimated based on the long-term average annual isohyetal map and the 2020/21 precipitation data reported for the Porterville precipitation station. An isohyetal map showing the estimated 2020/21 precipitation distribution across the subbasin is shown on Figure 14. Total precipitation at the Porterville precipitation station for water year 2020/21 was 3.6 inches, which is less than the average precipitation for the area (see Figure 13). It was assumed that the relative precipitation distribution for each year was the same as that shown on the long-term average annual isohyetal map. The magnitude of annual precipitation within each isohyetal zone was varied from year to year based on the ratio of annual precipitation at the Porterville Station (see Figure 15) to annual average precipitation at the Porterville isohyetal zone multiplied by the isohyetal zone average annual precipitation. The total volume of precipitation available for crops in 2020/21 was estimated to be approximately 130,000 acre-ft.

4.6 Total Surface Water Use

Total surface water available for use within the Tule Subbasin for water year 2020/21 was approximately 243,250 acre-ft (see Table 8)

5. Total Water Use for Water Year 2020/2021 §356.2 (b)(4)

Total water use in the Tule Subbasin for water year 2020/21, including both groundwater extractions and surface water supplies, was 1,130,780 acre-ft (see Table 9).

Table 9
Tule Subbasin Total Water Use for Water Year 2020/21

	Groundwater Extraction	Surface Water Supplies	Total
Agricultural MA	281,250	27,200	308,450
Municipal MA	1,280	380	1,660
Tulare County MOU MA	2,000	400	2,400
LTRID GSA	284,530	27,980	312,510
Greater Tule MA	208,000	79,900	287,900
Porterville Community MA	11,810	11,430	23,240
Ducor Community MA	200	100	300
Terra Bella Community MA	0	1,440	1,440
Kern-Tulare WD MA	11,000	11,680	22,680
ETGSA	231,010	104,550	335,560
DEID MA	96,000	69,700	165,700
Western MA	16,000	1,900	17,900
Richgrove CSD MA	870	100	970
Earlimart PUD MA	2,930	300	3,230
DEID GSA Total	115,800	72,000	187,800
Pixley ID MA	165,000	17,400	182,400
Pixley PUD MA	610	720	1,330
Teviston CSD MA	80	400	480
Pixley GSA	165,690	18,520	184,210
North MA	26,150	3,100	29,250
Southeast MA	44,100	13,400	57,500
TCWA GSA	70,250	16,500	86,750
Alpaugh GSA	20,250	3,700	23,950
Totals	**887,530**	**243,250**	**1,130,780**

Note: All values are in acre-ft.

6. Change in Groundwater in Storage §354.16 (b)

For this annual report, the change in groundwater in storage for the Tule Subbasin was estimated for the time period between fall 2020 and fall 2021. The change in storage was estimated based on 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 for this annual report is specific to the Upper aquifer. The calculations were made using a Geographic Information System (GIS) map of the Tule Subbasin discretized into 600-foot by 600-foot grid cells to allow for spatial representation of aquifer specific yield and groundwater level change. Although the storage change in the Lower Aquifer is expected to be significantly less than the Upper Aquifer due to its confined nature, future annual reports will include storage change from the Lower Aquifer as well.

The areal distribution of specific yield for the Upper Aquifer is based on the values obtained from the updated calibrated groundwater flow model of the Tule Subbasin.[5]

The areal distribution of change in hydraulic head across the Tule Subbasin was estimated by plotting the difference in groundwater level at wells that were measured in both fall 2020 and fall 2021 and then interpolating the subbasin-wide changes in groundwater levels in GIS using a kriging algorithm. Change in hydraulic head (groundwater level) at any given location was assigned to the overlapping grid cell.

The change in groundwater storage was estimated for each grid cell by multiplying the change in groundwater level by the specific yield and then by the area of the cell.

Results of the change in groundwater in storage analysis showed that between fall 2020 and fall 2021, groundwater in storage decreased by approximately 343,000 acre-ft (see Figure 16). Recent dry conditions have resulted in more limited surface water supplies and higher groundwater pumping relative to previous years, which has contributed to the negative groundwater storage change in the 2020/21 water year. Much of the localized groundwater level decline in the DEID

[5] Thomas Harder & Co., 2021. Update to the Groundwater Flow Model of the Tule Subbasin. Prepared for the Tule Subbasin MOU Group. June 2021.

area is a result of reduced managed recharge at the Turnipseed Recharge Facility and the relaxation of the groundwater mound developed from previous years when surface water was available for recharge.

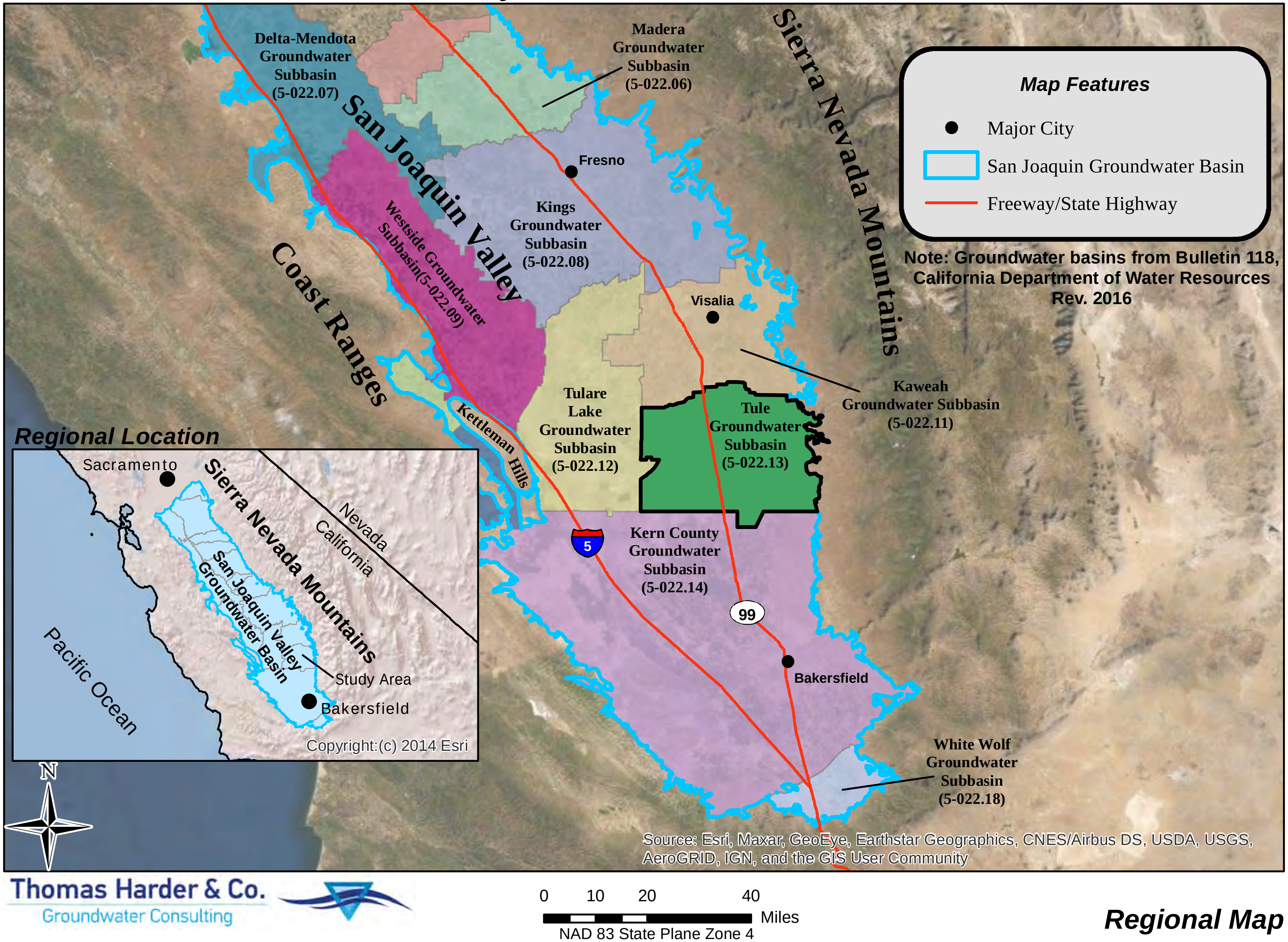
Since 1986/87, the volume of groundwater in storage in the Tule Subbasin has decreased by approximately 2,967,000 acre-ft (see Figure 17).

Figures

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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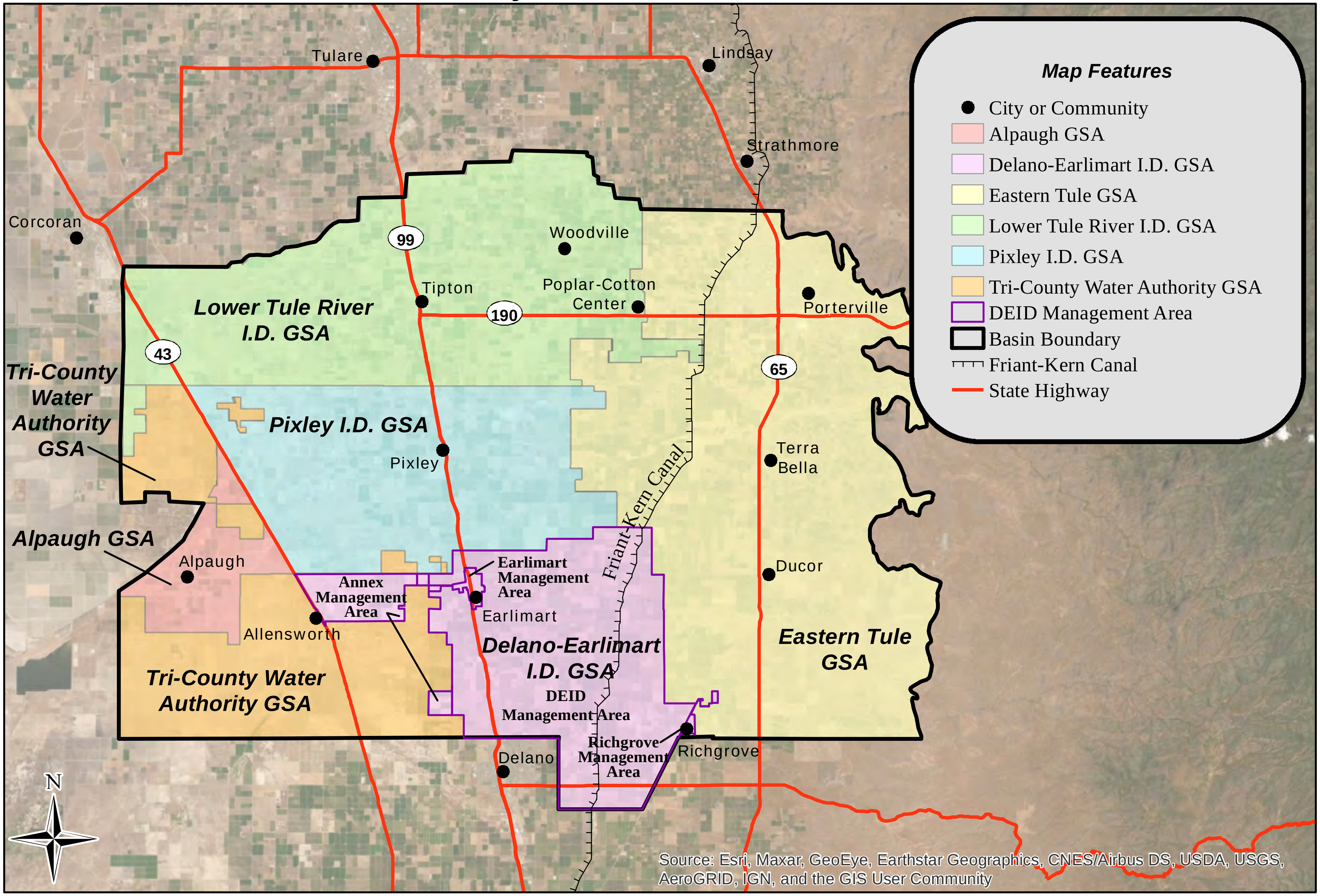
Regional Map

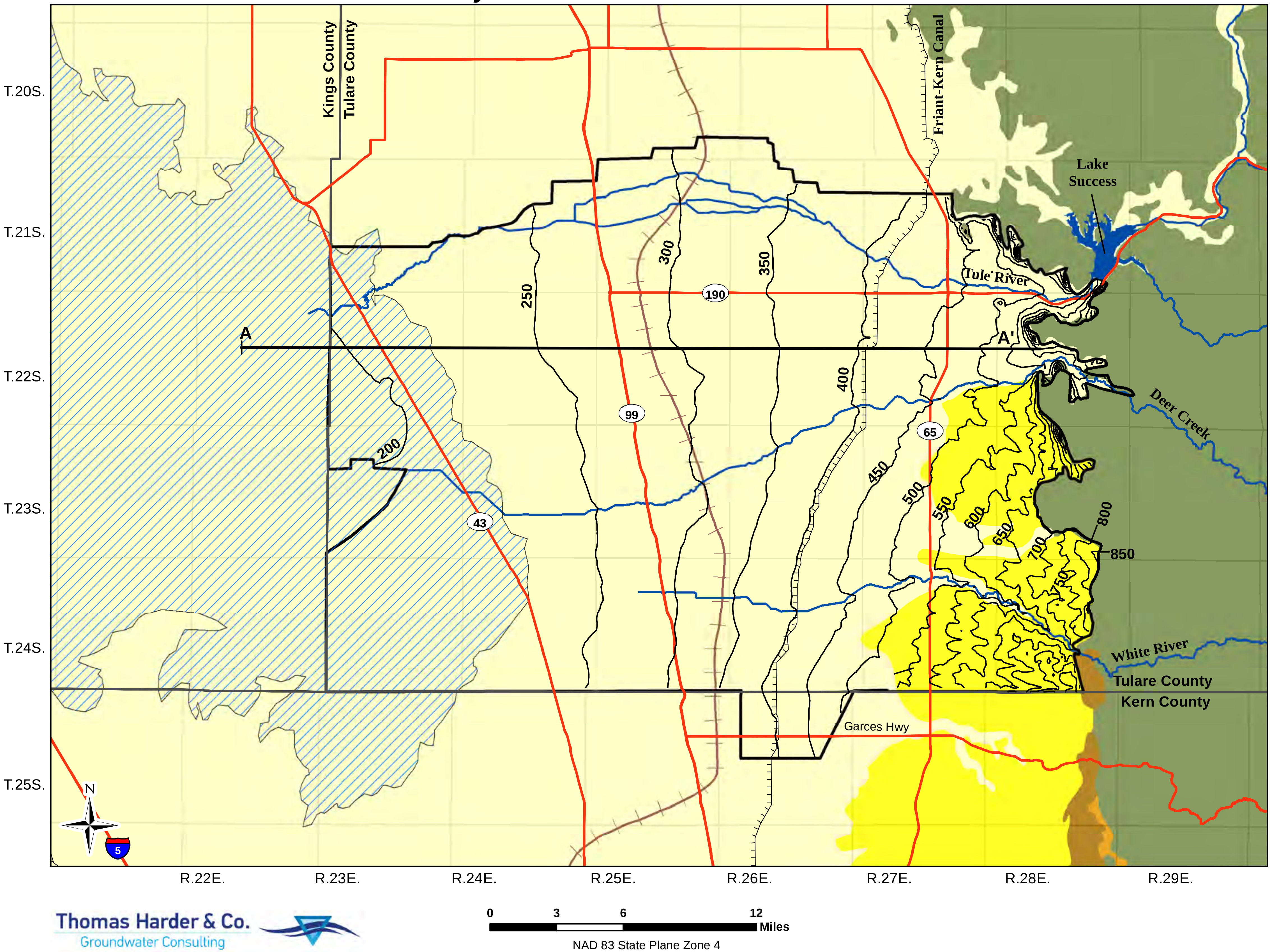
Figure 1



Thomas Harder & Co.
Groundwater Consulting

GSA Boundaries

Figure 2



Map Features

- Surficial Deposits
- Tertiary Loosely Consolidated Deposits
- Non-Marine Sedimentary Rocks
- Marine Sedimentary Rocks
- Crystalline Basement
- Approximate Eastern Extent of the Corcoran Clay
- Tulare Lake Surface Deposits
- County Boundary
- Basin Boundary
- Land Surface Elevation Contour (ft amsl)
- Friant-Kern Canal
- Major Hydrologic Feature
- State Highway/Major Road

Corcoran Clay from USGS Professional Paper 1766, http://water.usgs.gov/GIS/dsdl/pp1766_CorcoranClay.zip

Geologic units modified from USGS Open-File Report 2005-1305

Lake Deposits from California Geological Survey Geologic Atlas of California Map No. 002 1:250,000 scale, Compiled by A.R. Smith, 1964 and Geologic Atlas of California Map No. 005, 1:250,000 scale, Compiled by: R.A. Matthews and J.L. Burnett

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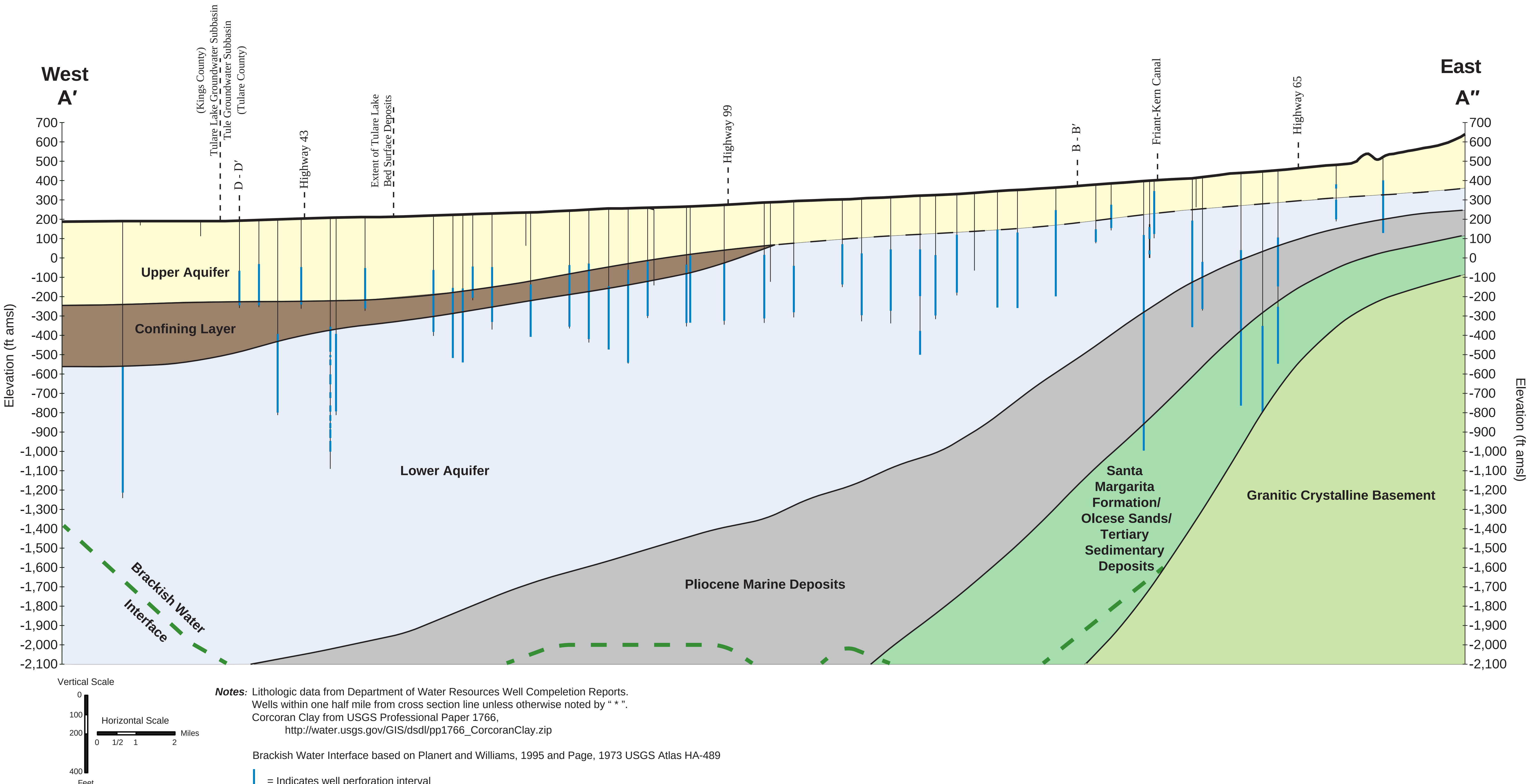
Geology and Cross Section Locations

Figure 3



Notes: Lithologic data from Department of Water Resources Well Compeletion Reports.
Wells within one half mile from cross section line unless otherwise noted by " * ".
Corcoran Clay from USGS Professional Paper 1766,
http://water.usgs.gov/GIS/dsdl/pp1766_CorcoranClay.zip

Brackish Water Interface based on Planert and Williams, 1995 and Page, 1973 USGS Atlas HA-489

| = Indicates well perforation interval

Hydrogeologic Cross Section A′-A″
Tule Groundwater Subbasin
Figure 4

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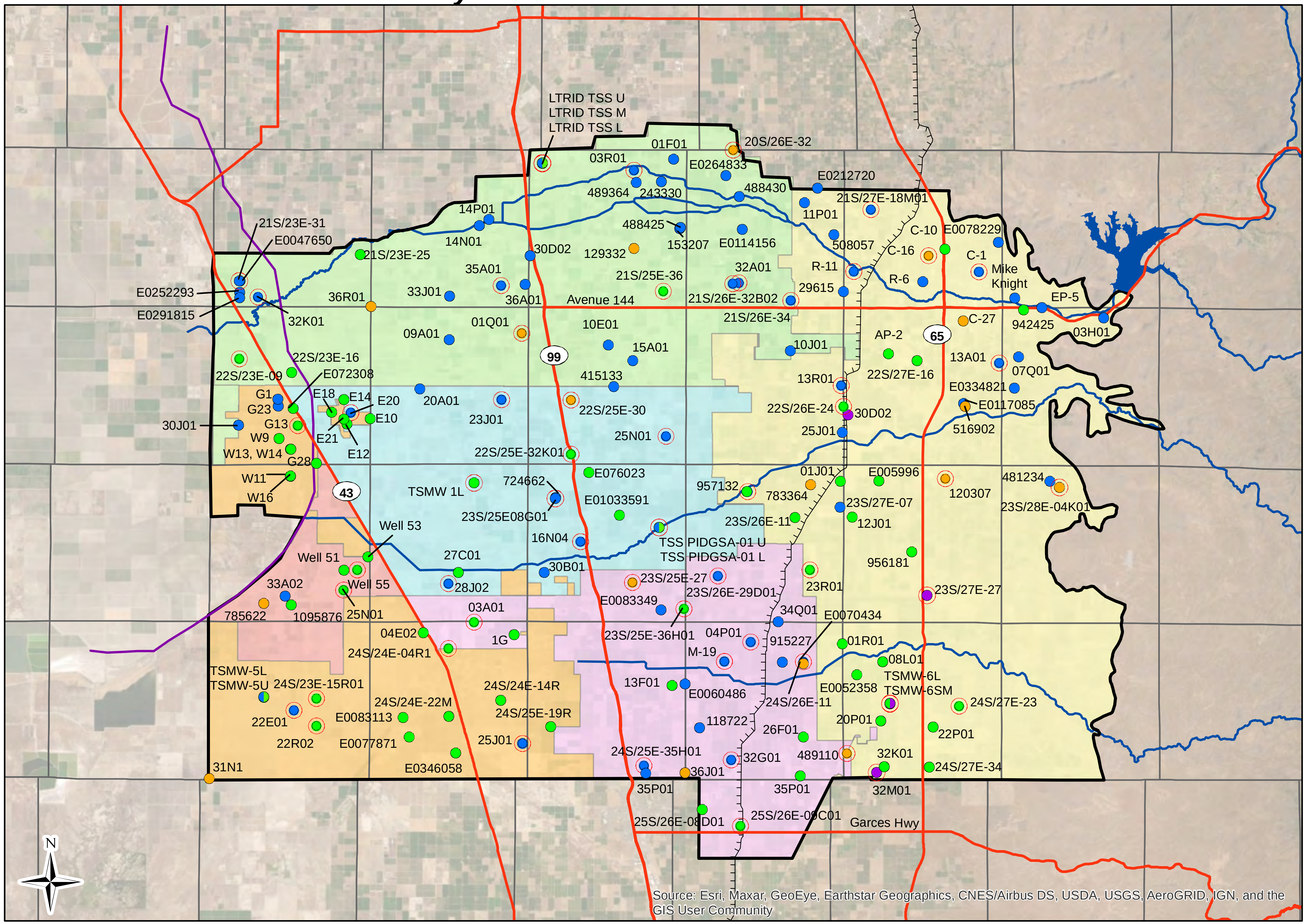
Tule Subbasin Technical Advisory Committee

March 2022

2020/2021 Annual Report



0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

Map Features

- Upper Aquifer Well
- Upper Aquifer RMS Well
- Lower Aquifer Well
- Lower Aquier RMS Well
- Composite Aquifer Well
- Composite Aquifer RMS Well
- Santa Margarita Well
- Santa Margarita RMS Well
- Alpaugh GSA
- Delano-Earlimart I.D. GSA
- Eastern Tule GSA
- Lower Tule River I.D. GSA
- Pixley I.D. GSA
- Tri-County Water Authority GSA
- Basin Boundary
- Canal
- Friant-Kern Canal
- State Highway
- Major Hydrologic Feature

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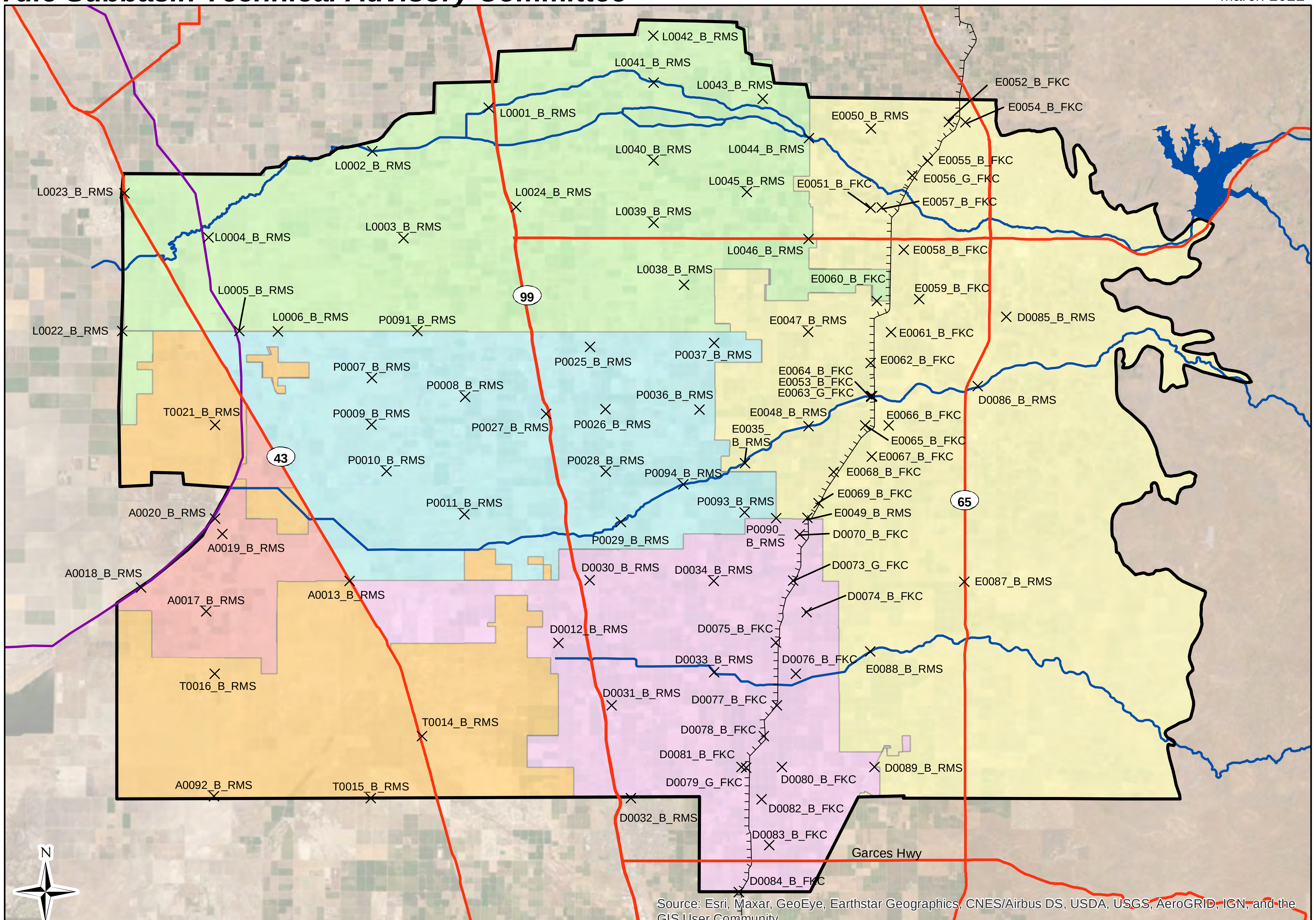
Groundwater Level Monitoring Network

Figure 5



Map Features

- Land Surface Elevation RMS
- Alpaugh GSA
- Delano-Earlimart I.D. GSA
- Eastern Tule GSA
- Lower Tule River I.D. GSA
- Pixley I.D. GSA
- Tri-County Water Authority GSA
- Friant-Kern Canal and California Aqueduct
- Canal
- Basin Boundary
- State Highway

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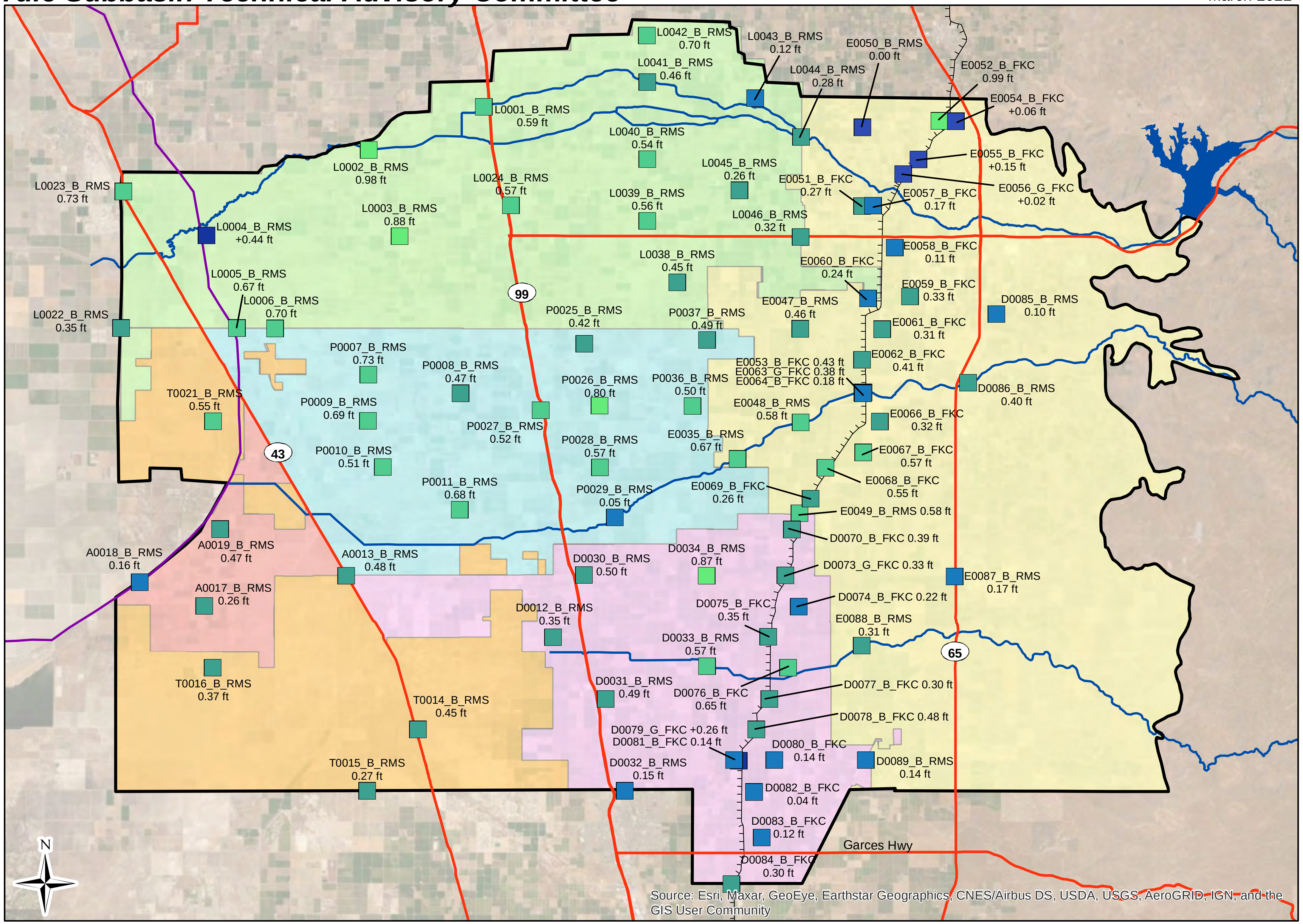
0 2 4 8 Miles
NAD 83 State Plane Zone 4

Land Surface Elevation Monitoring Network
Figure 6



Map Features

Subsidence at Benchmarks (ft)

- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.00 to 0.25
- 0 to +0.25
- +0.25 to +0.50
- Alpaugh GSA
- Delano-Earlimart I.D. GSA
- Eastern Tule GSA
- Lower Tule River I.D. GSA
- Pixley I.D. GSA
- Tri-County Water Authority GSA
- Friant-Kern Canal
- Canal
- Basin Boundary
- State Highway

Positive subsidence equivalent to uplift.

Data from Tule Subbasin Monitoring Network.

0 2 4 8 Miles

NAD 83 State Plane Zone 4

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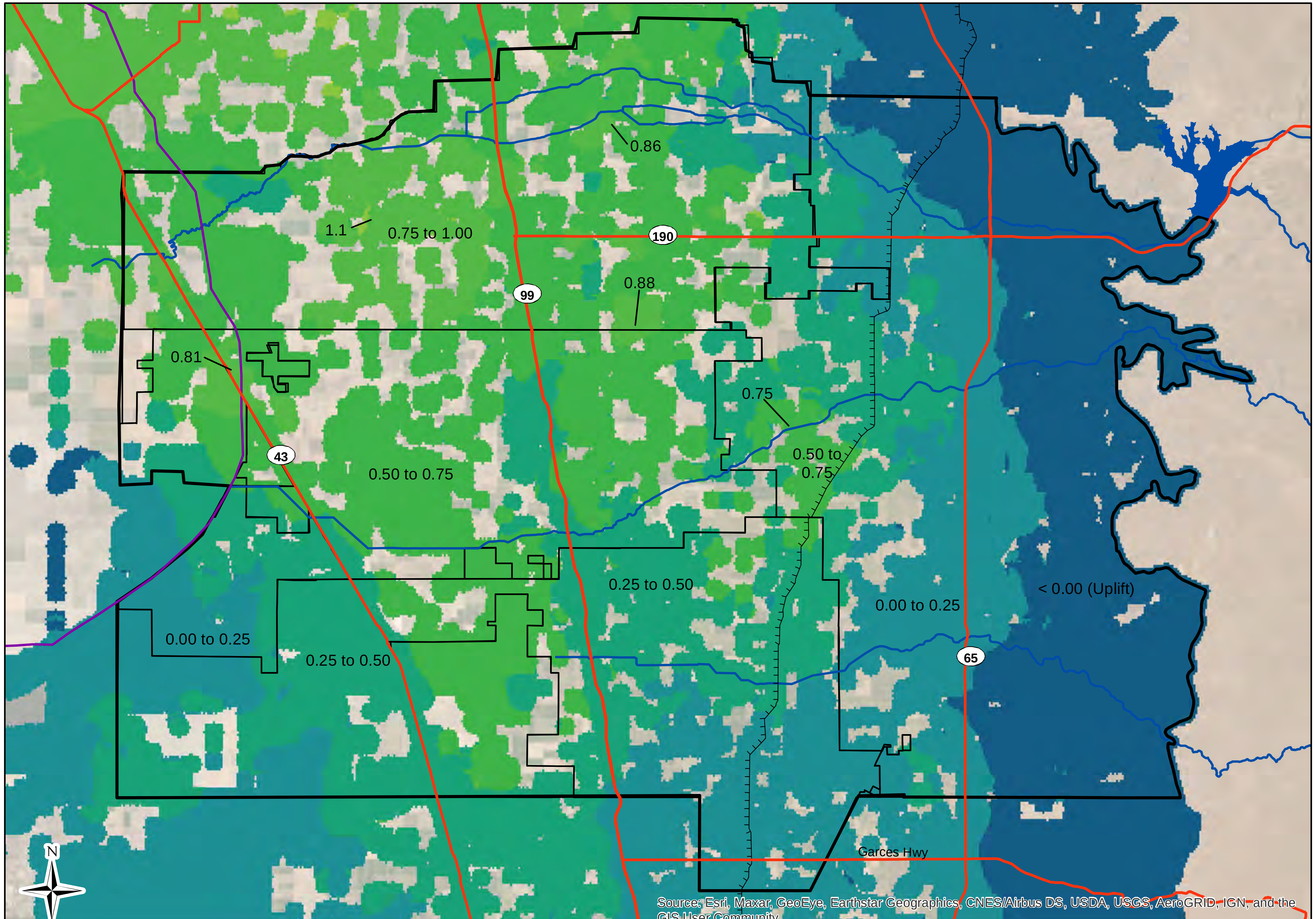
July 2020 to July 2021
Benchmarks Land Subsidence
Figure 7

Tule Subbasin Technical Advisory Committee

March 2022

2020/2021 Annual Report



Map Features

InSAR Subsidence from October 2020 to September 2021 (ft)

- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.00 to 0.25
- < 0.00 (Uplift)
- Friant-Kern Canal
- Canal
- Basin Boundary
- GSA Boundary
- State Highway

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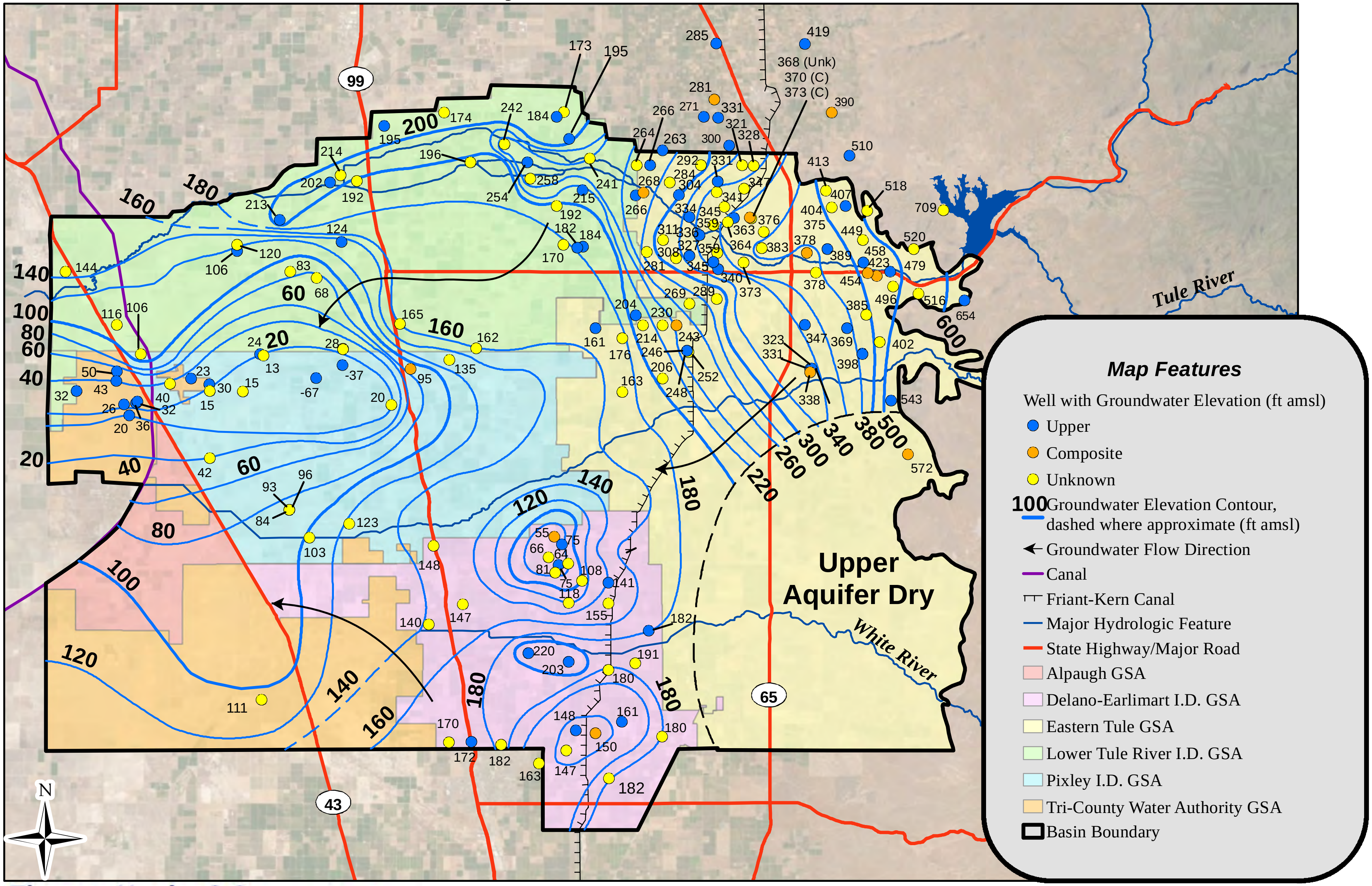
0 2 4 8 Miles
NAD 83 State Plane Zone 4

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2020_Total_Since_20150613_20201001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

Land Subsidence
October 2020 to September 2021

Figure 8

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co. Groundwater Consulting

0 2.5 5 10 Miles

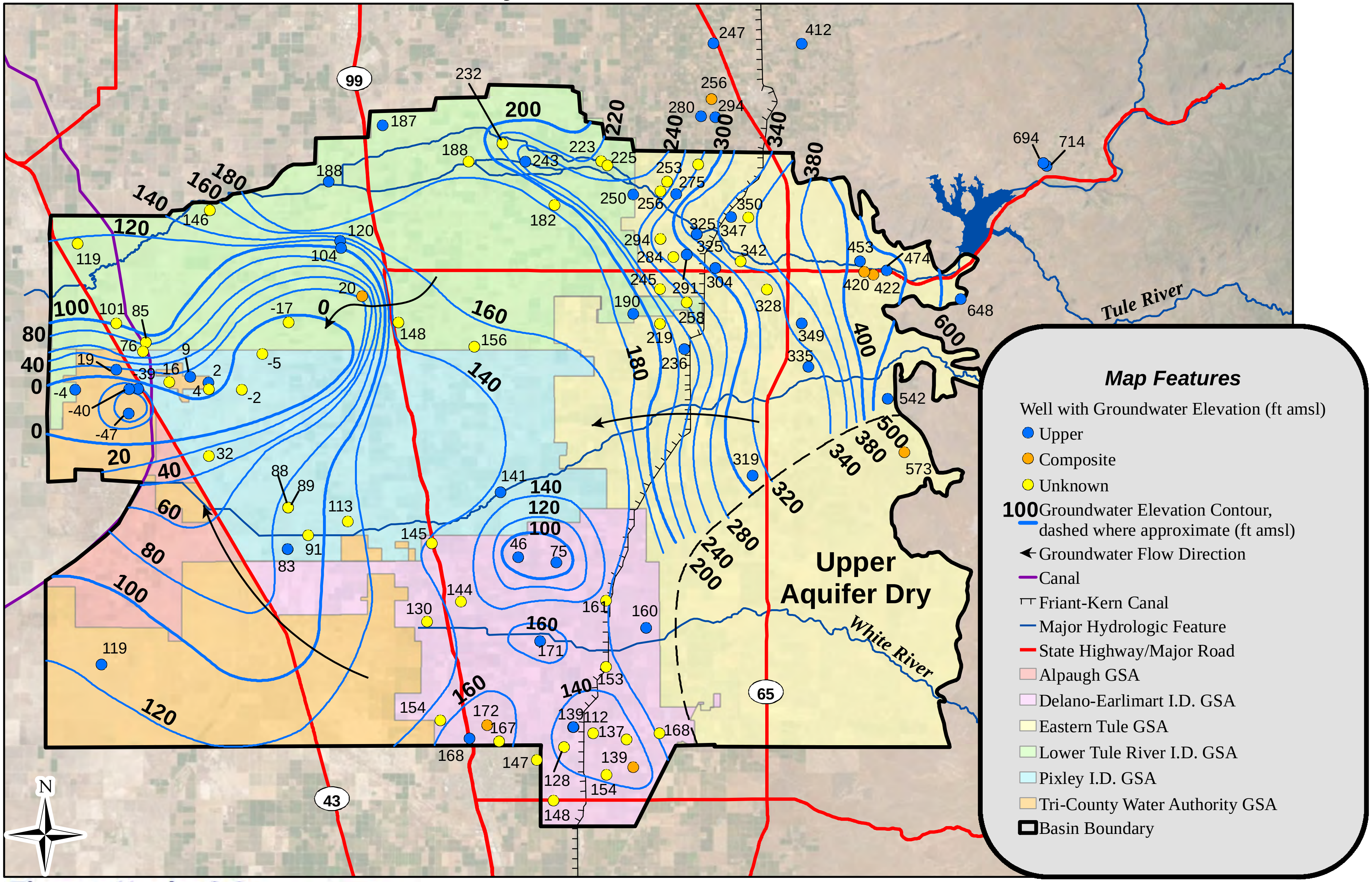
NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer Groundwater Elevation Contours

Figure 9

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

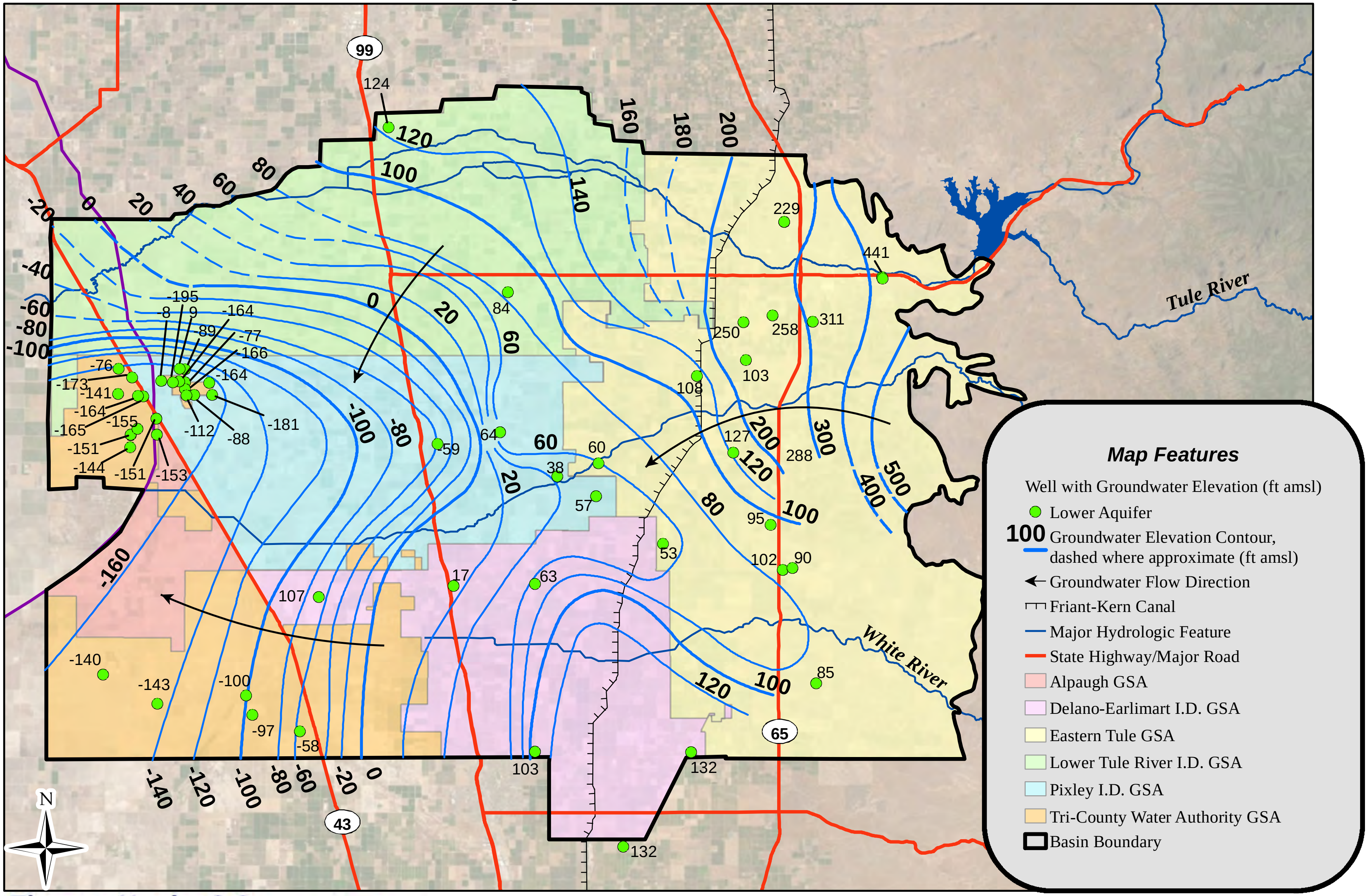
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer Groundwater Elevation Contours

Figure 10

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



Thomas Harder & Co.
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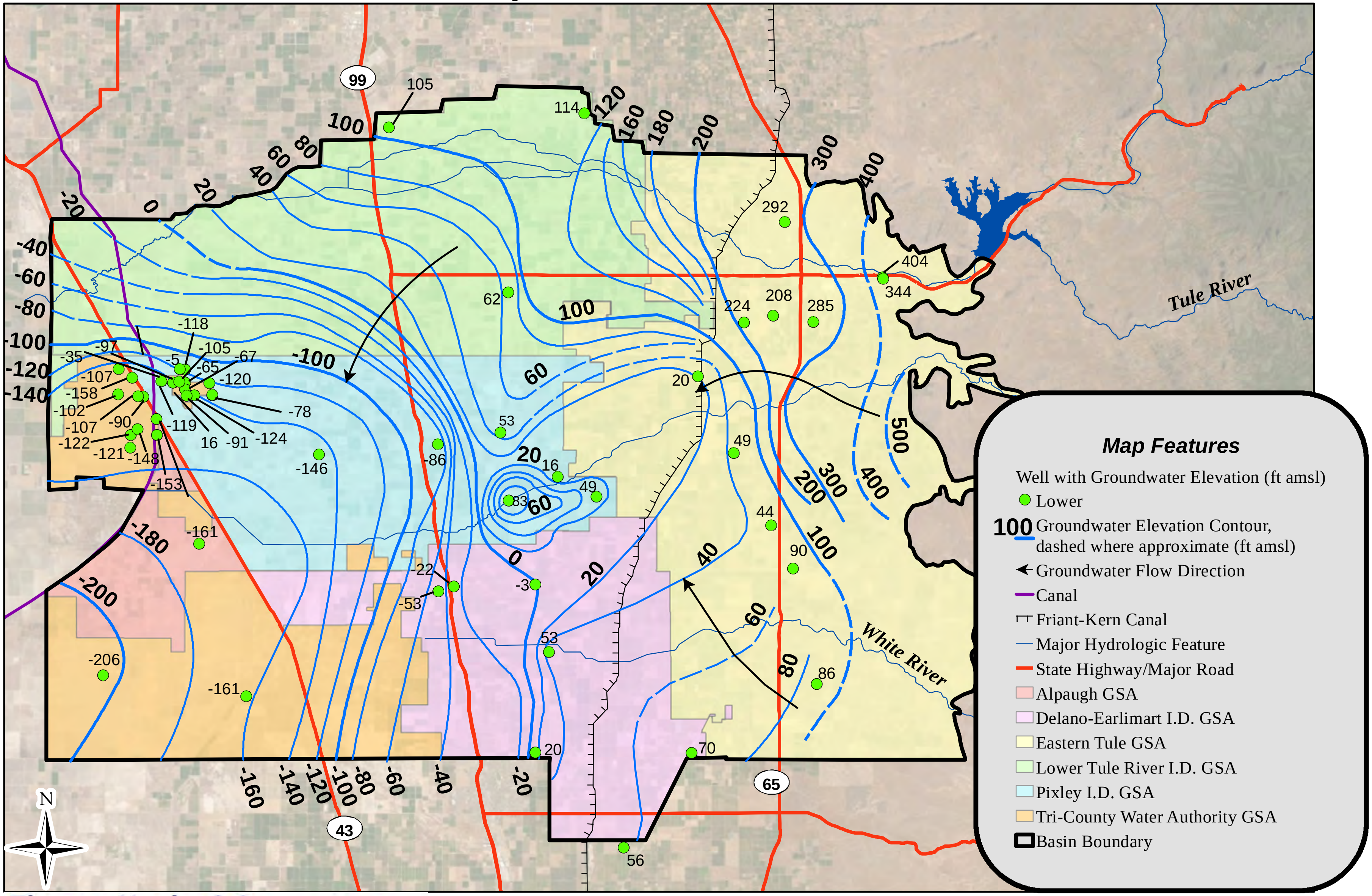
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer Groundwater Elevation Contours
Figure 11

Tule Subbasin Technical Advisory Committee



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NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

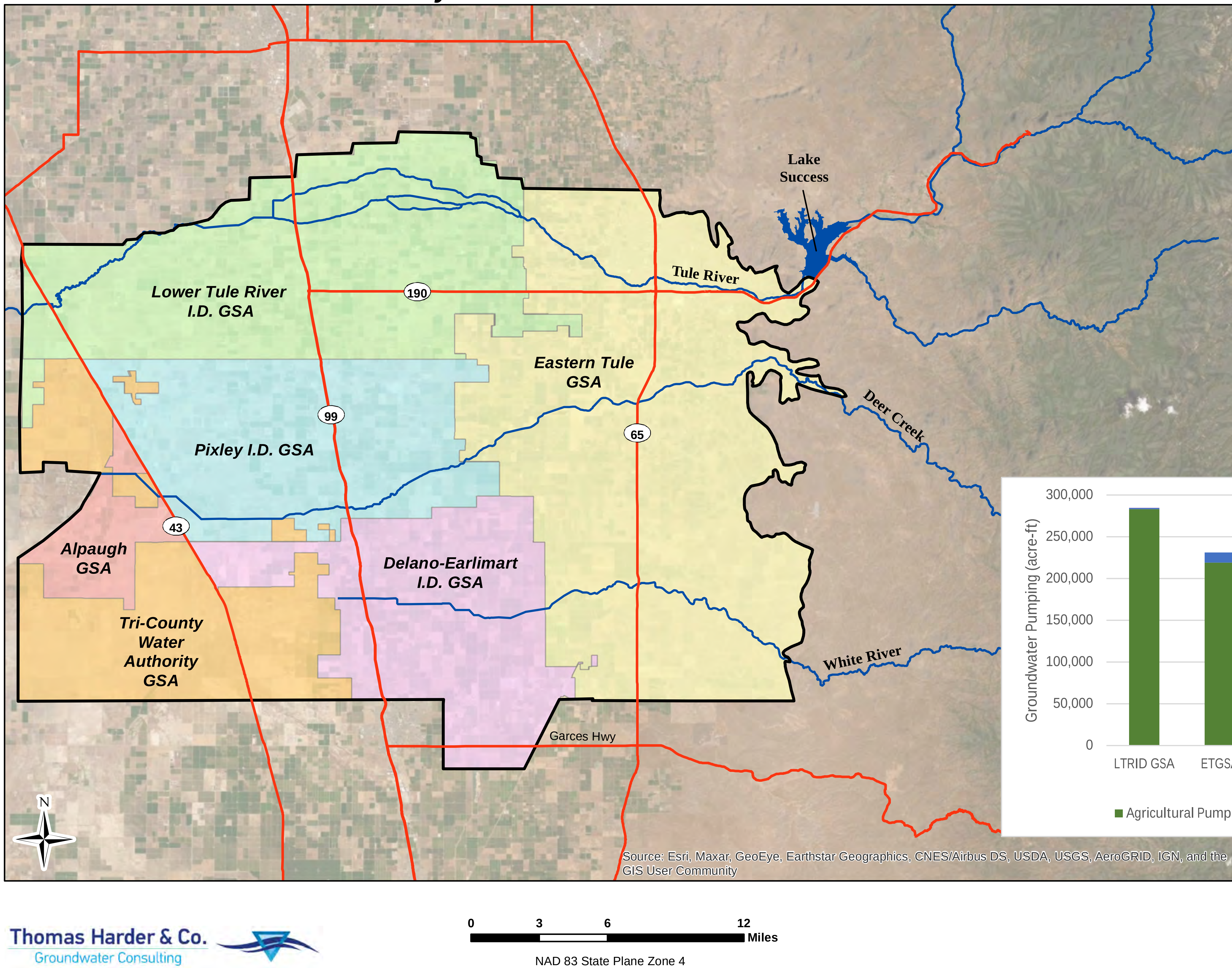
Fall 2021 Lower Aquifer Groundwater Elevation Contours

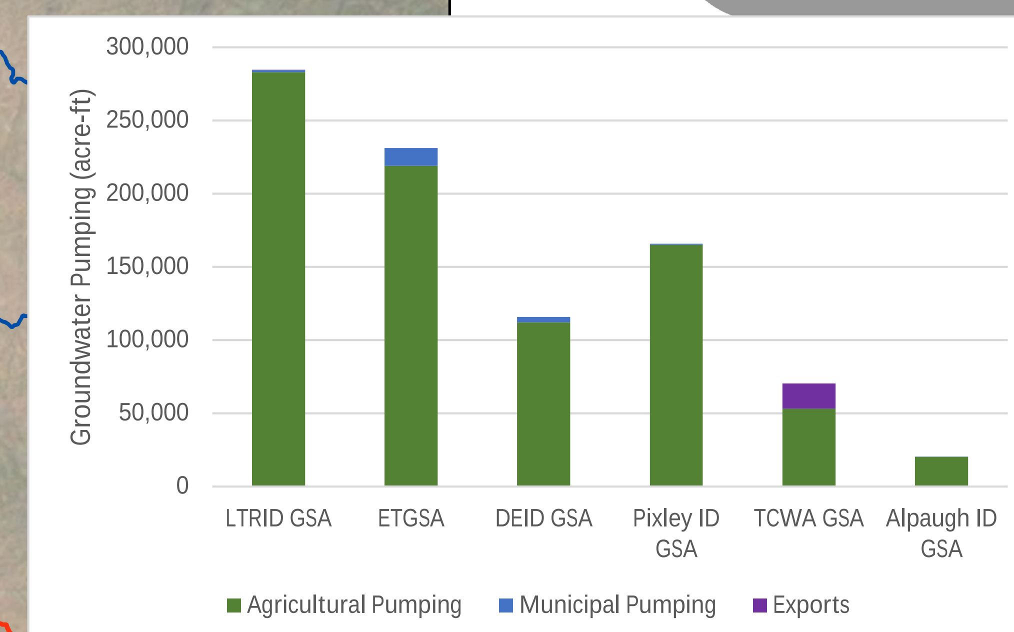
Figure 12

Tule Subbasin Technical Advisory Committee

March 2022

2020/2021 Annual Report





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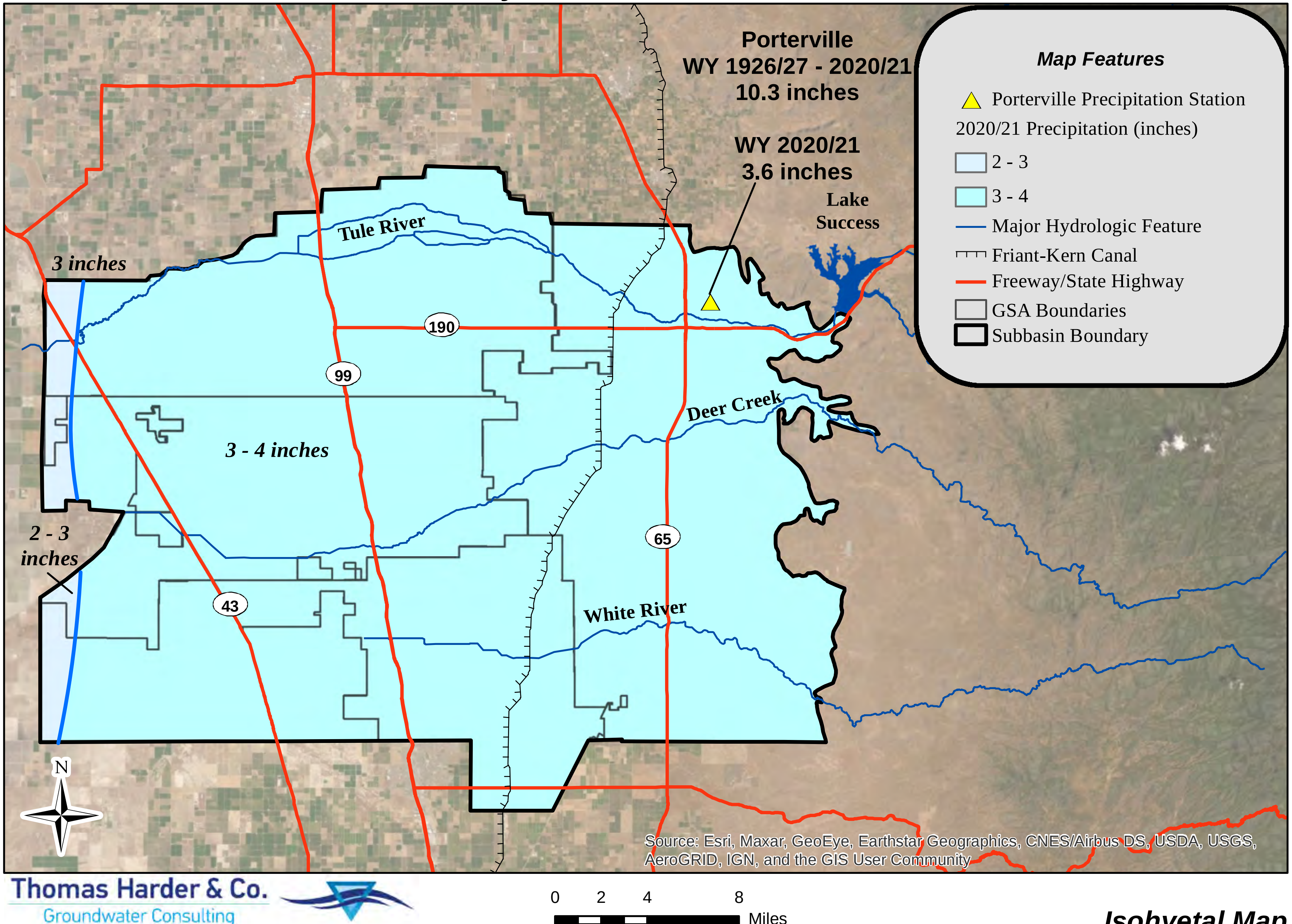
Groundwater Pumping

Figure 13

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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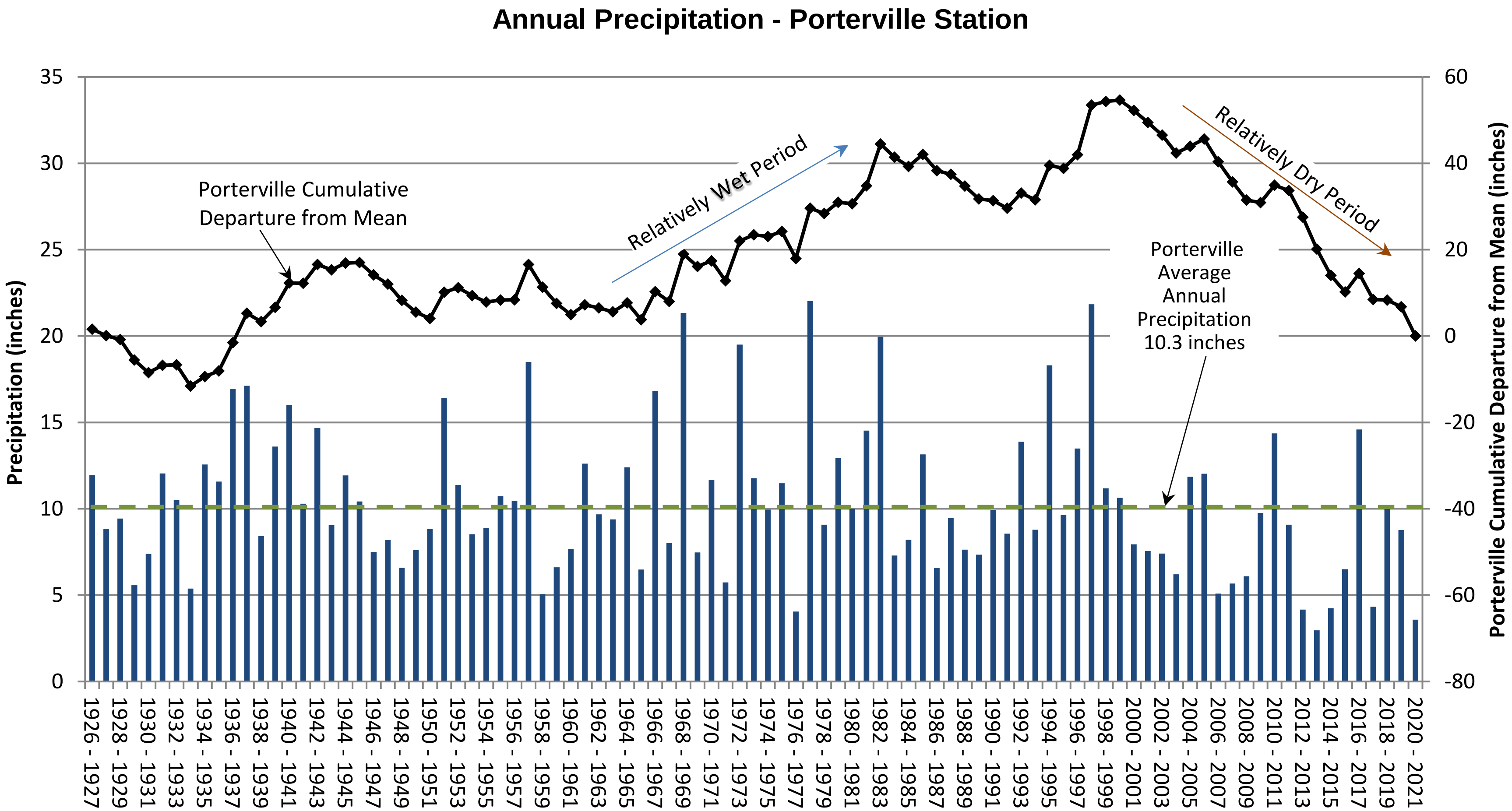
Note: Data from Land IQ.
See Figure 13 for Porterville Station Precipitation Information.

Isohyetal Map

Figure 14

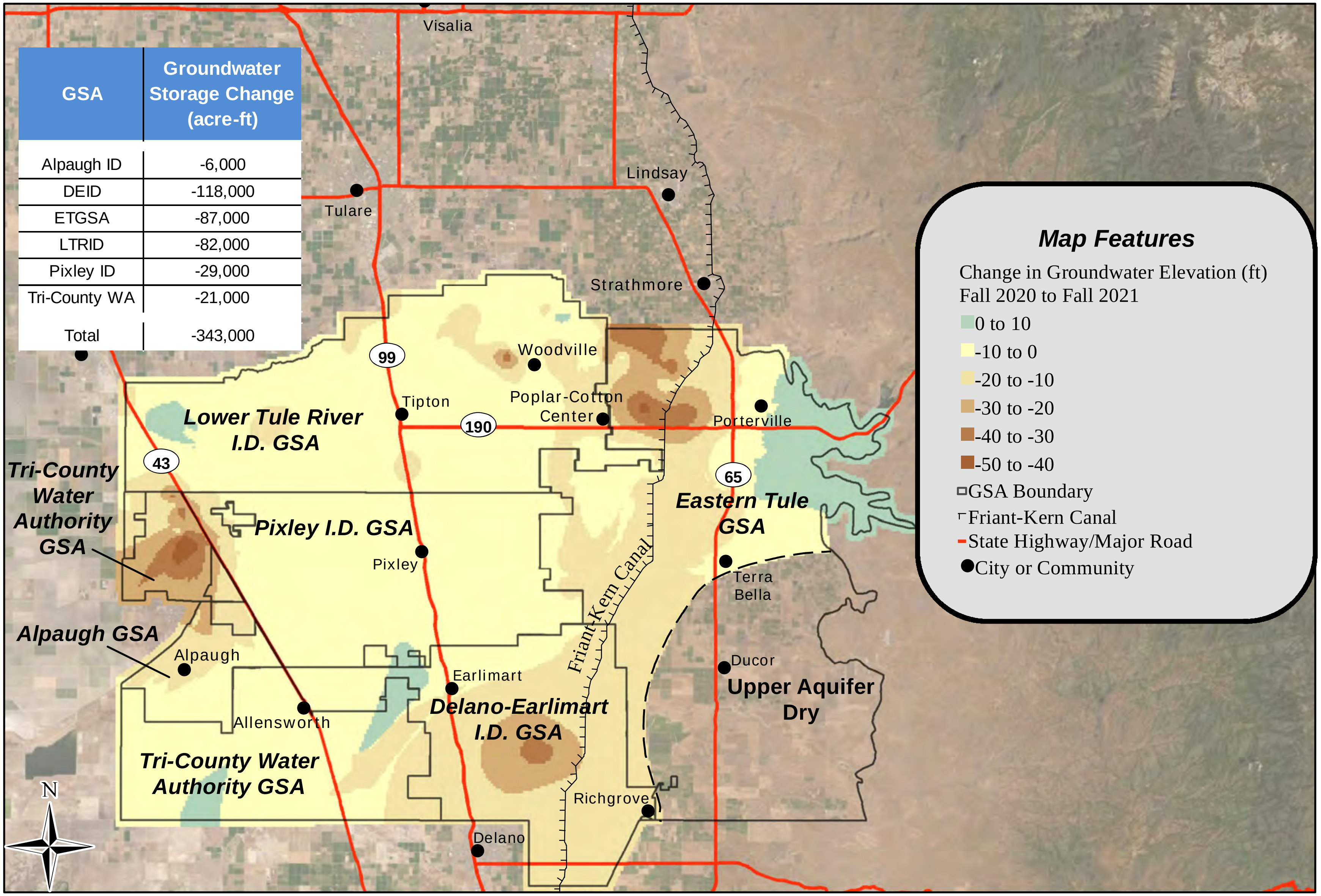
Figure 15



Notes:

Data in water years (October 1 to September 30).
Data from Western Regional Climate Center (1926-2001) and California Irrigation Management Information System (2002-2021).

GSA	Groundwater Storage Change (acre-ft)
Alpaugh ID	-6,000
DEID	-118,000
ETGSA	-87,000
LTRID	-82,000
Pixley ID	-29,000
Tri-County WA	-21,000
Total	-343,000



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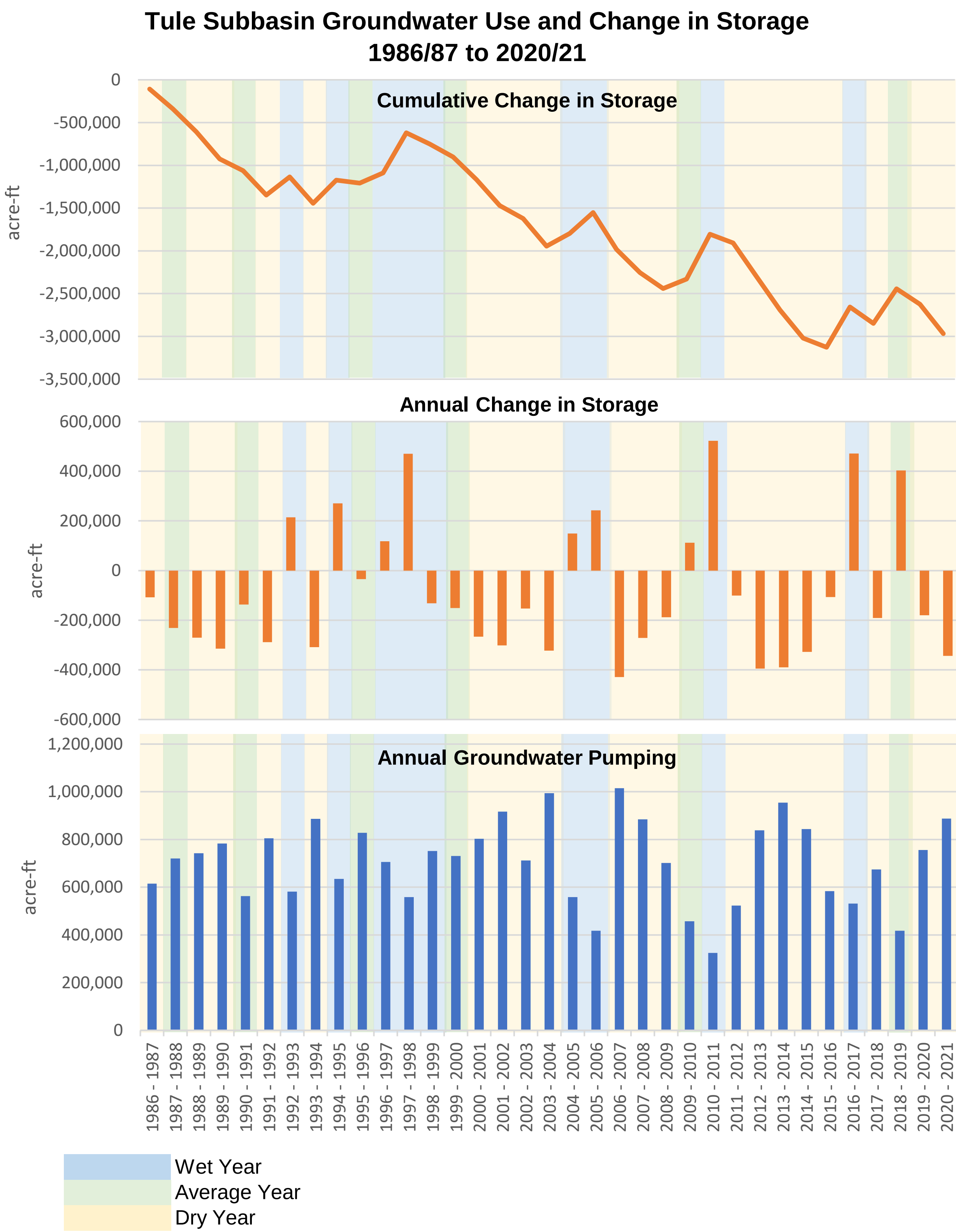
Change in Groundwater Elevation
Upper Aquifer - Fall 2020 to Fall 2021

Figure 16

Figure 17


Tule Subbasin Groundwater Use and Change in Storage
1986/87 to 2020/21
Cumulative Change in Storage
Annual Change in Storage
Annual Groundwater Pumping
acre-ft
0
-500,000
-1,000,000
-1,500,000
-2,000,000
-2,500,000
-3,000,000
-3,500,000
600,000
400,000
200,000
-200,000
-400,000
-600,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
1986 - 1987
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2013 - 2014
2014 - 2015
2015 - 2016
2016 - 2017
2017 - 2018
2018 - 2019
2019 - 2020
2020 - 2021
Wet Year
Average Year
Dry Year

Appendix A

Lower Tule River Irrigation District GSA 2020/21 Annual Data

Lower Tule River Irrigation District GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
LTRID GSA	Agricultural	281,000	0	250	281,250
	Municipal	0	1,280	0	1,280
	Tulare County MOU	2,000	0	0	2,000
	Total	***283,000***	***1,280***	***250***	***284,530***

Lower Tule River Irrigation District GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
LTRID GSA	Agricultural	0	0	0	0	27,200	27,200
	Municipal	0	0	80	0	300	380
	Tulare County MOU	0	0	0	0	400	400
	Total	***0***	***0***	***80***	***0***	***27,900***	***27,980***

Lower Tule River Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
LTRID GSA	Agricultural	281,250	27,200	308,450
	Municipal	1,280	380	1,660
	Tulare County MOU	2,000	400	2,400
	Total	***284,530***	***27,980***	***312,510***

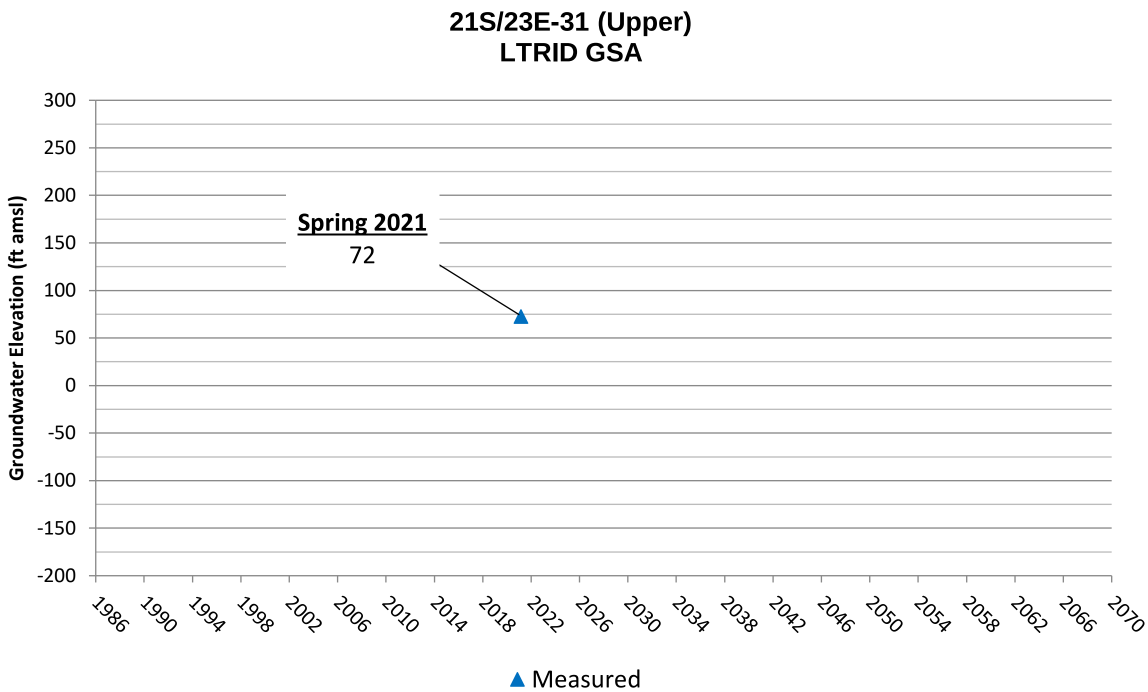
Lower Tule River Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

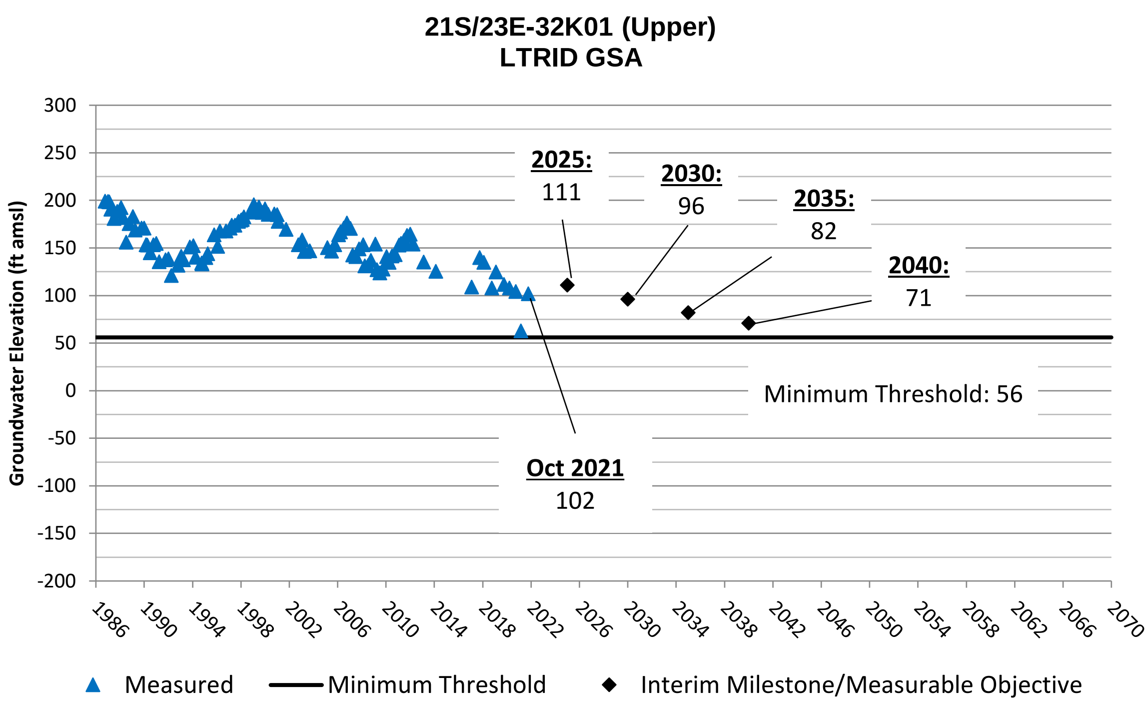
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
L0001_B_RMS	253.0	252.4	238.7	237.8
L0002_B_RMS	228.9	227.9	222.2	220.8
L0003_B_RMS	228.7	227.8	223.5	221.5
L0004_B_RMS	197.3	197.7	193.1	192.1
L0005_B_RMS	190.2	189.6	182.5	181.5
L0006_B_RMS	192.3	191.6	184.5	183.5
L0022_B_RMS	180.0	179.7	170.3	169.3
L0023_B_RMS	190.8	190.1	185.1	184.1
L0024_B_RMS	254.9	254.3	249.8	248.8
L0038_B_RMS	321.6	321.1	319.5	318.1
L0039_B_RMS	307.5	306.9	304.4	303.3
L0040_B_RMS	309.0	308.4	304.4	303.4
L0041_B_RMS	307.3	306.9	302.8	301.8
L0042_B_RMS	306.5	305.8	301.6	300.6
L0043_B_RMS	348.6	348.5	346.4	345.4
L0044_B_RMS	370.6	370.3	370.1	368.9
L0045_B_RMS	346.3	346.0	343.7	342.6
L0046_B_RMS	371.0	370.7	370.0	369.0

Note:

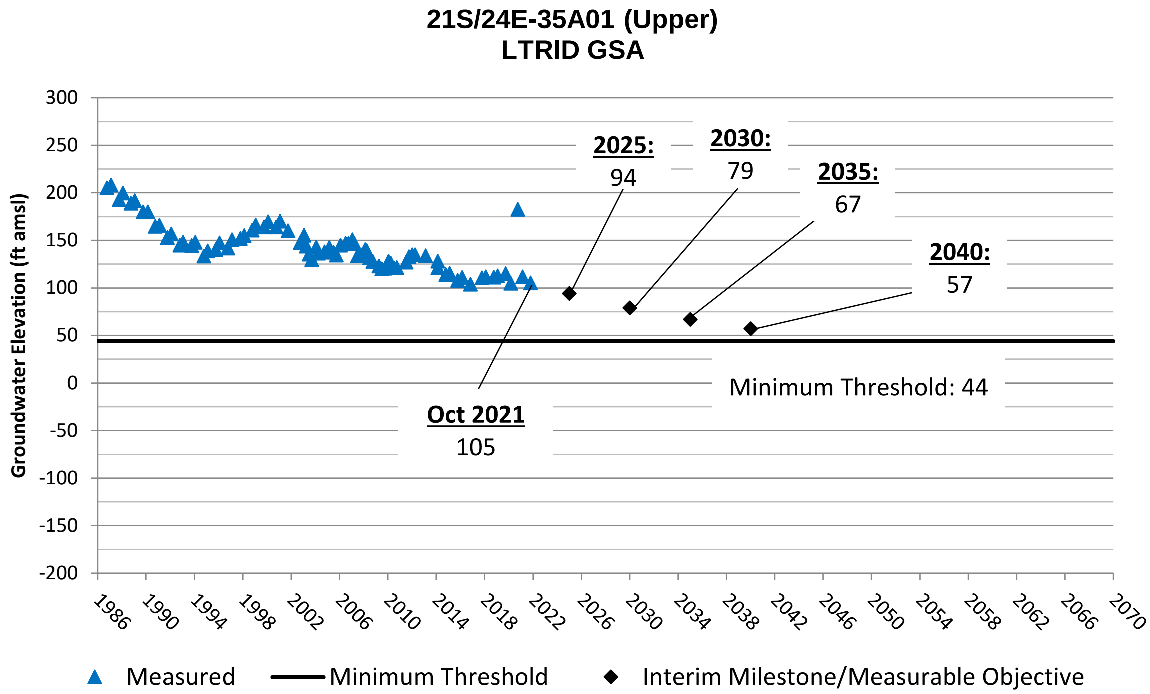
[1] Benchmarks surveyed in July and August of each year.

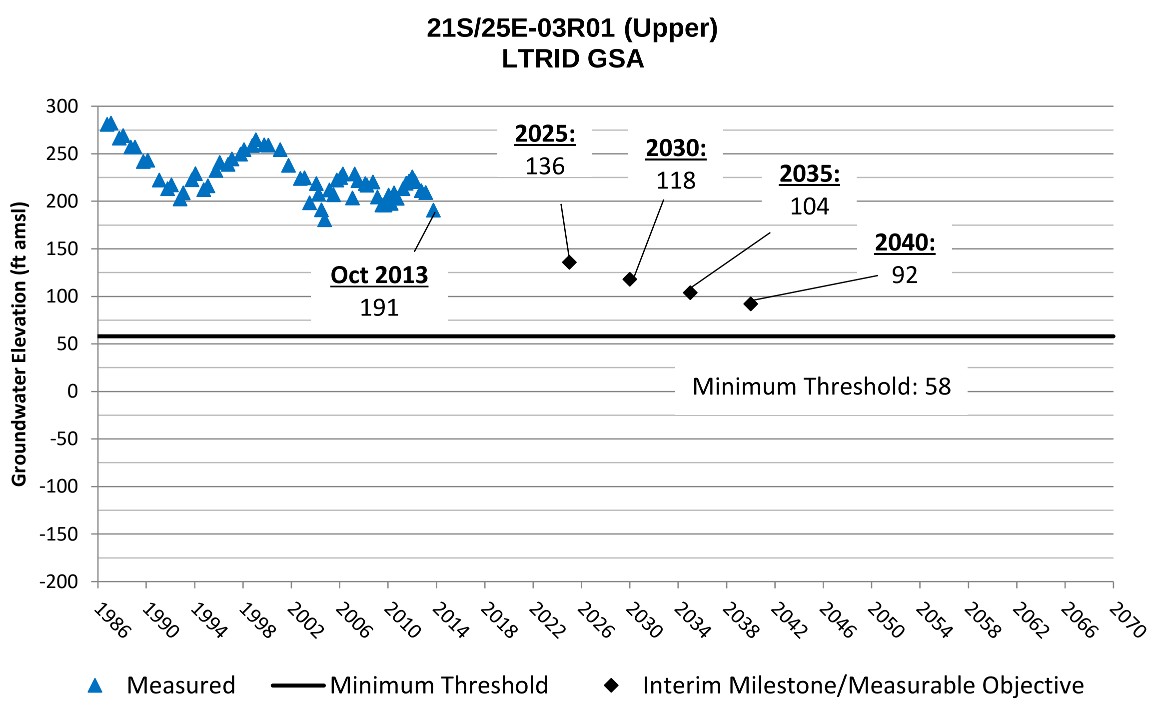
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



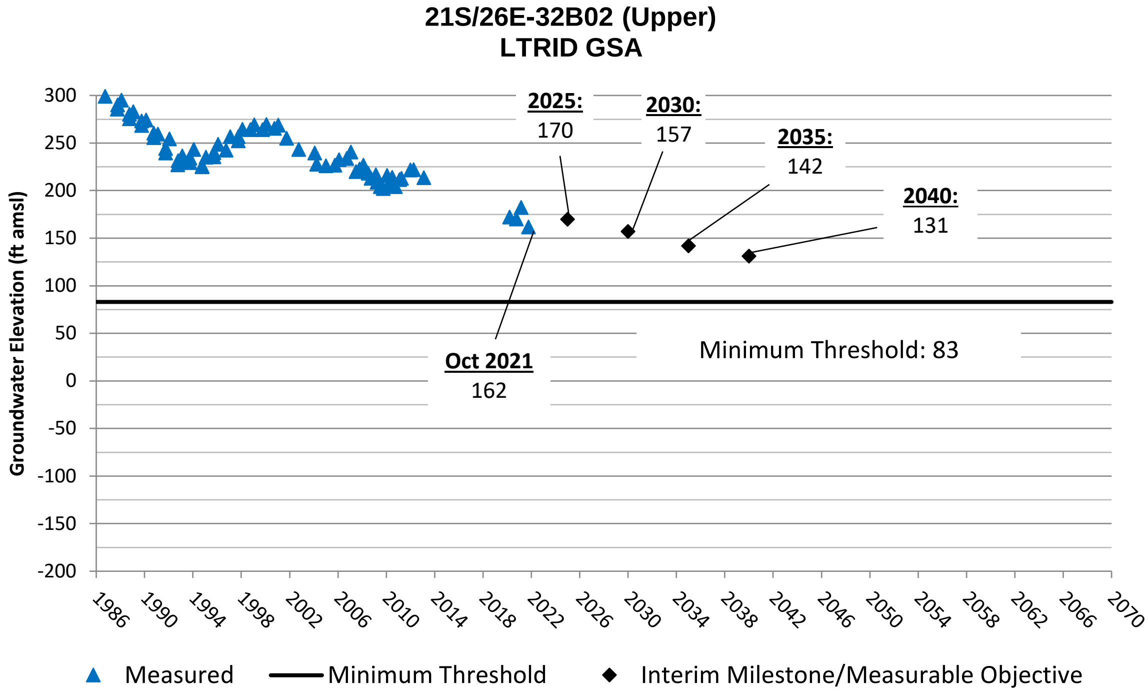


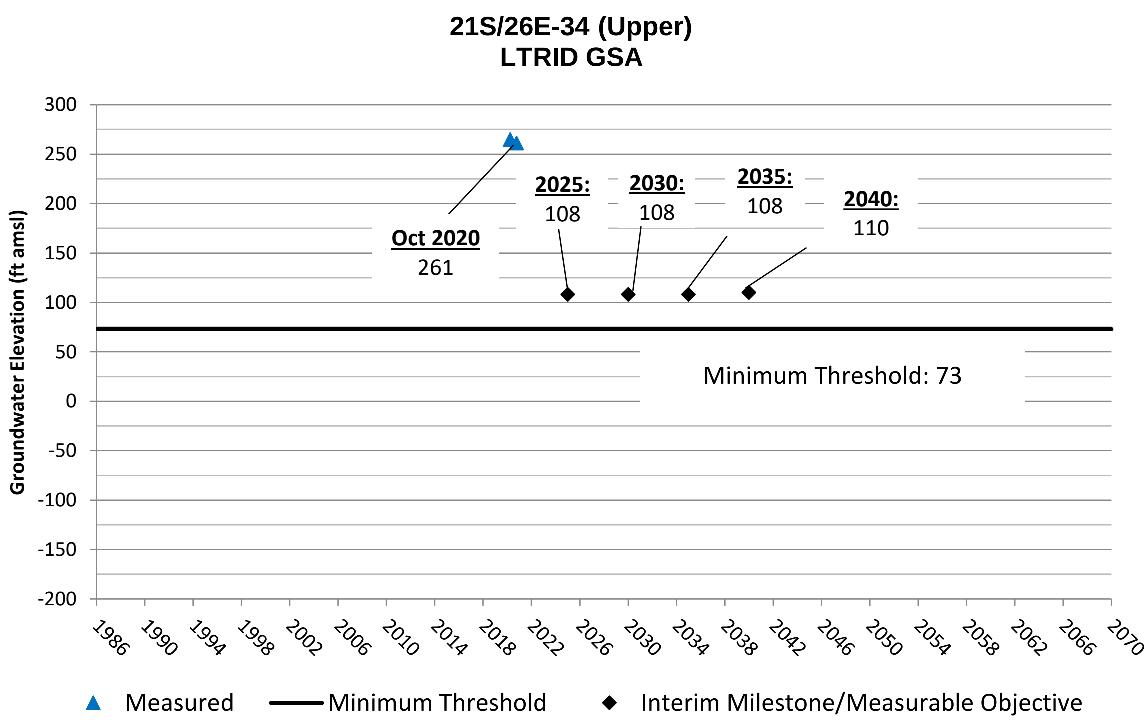
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



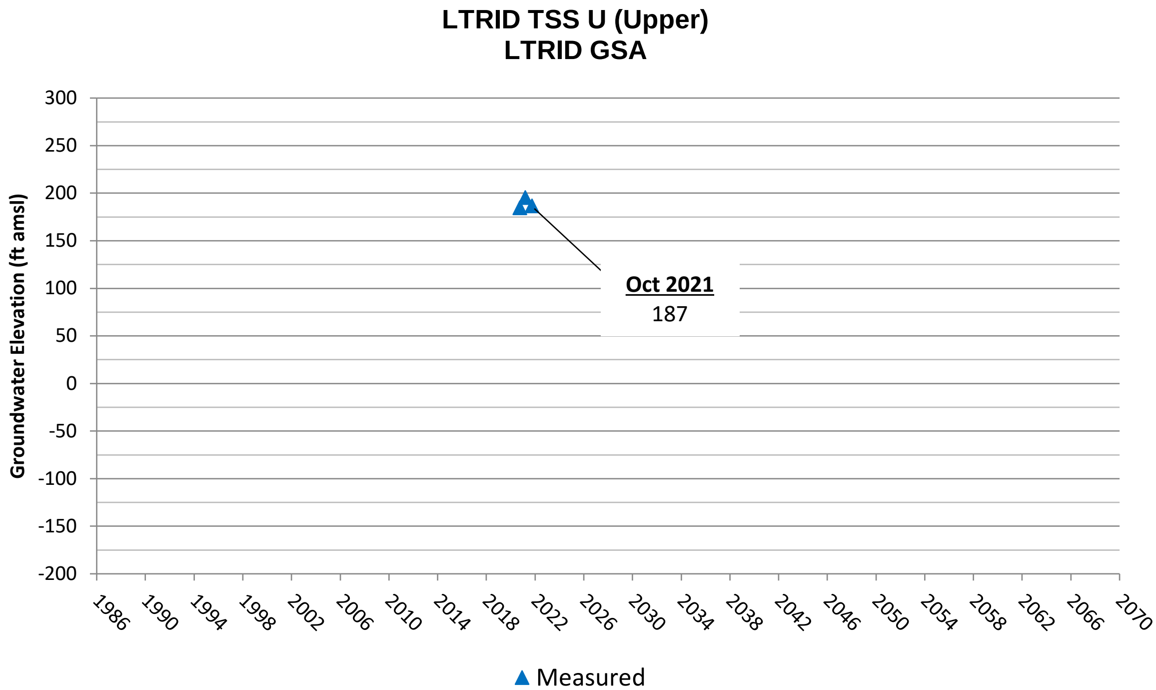


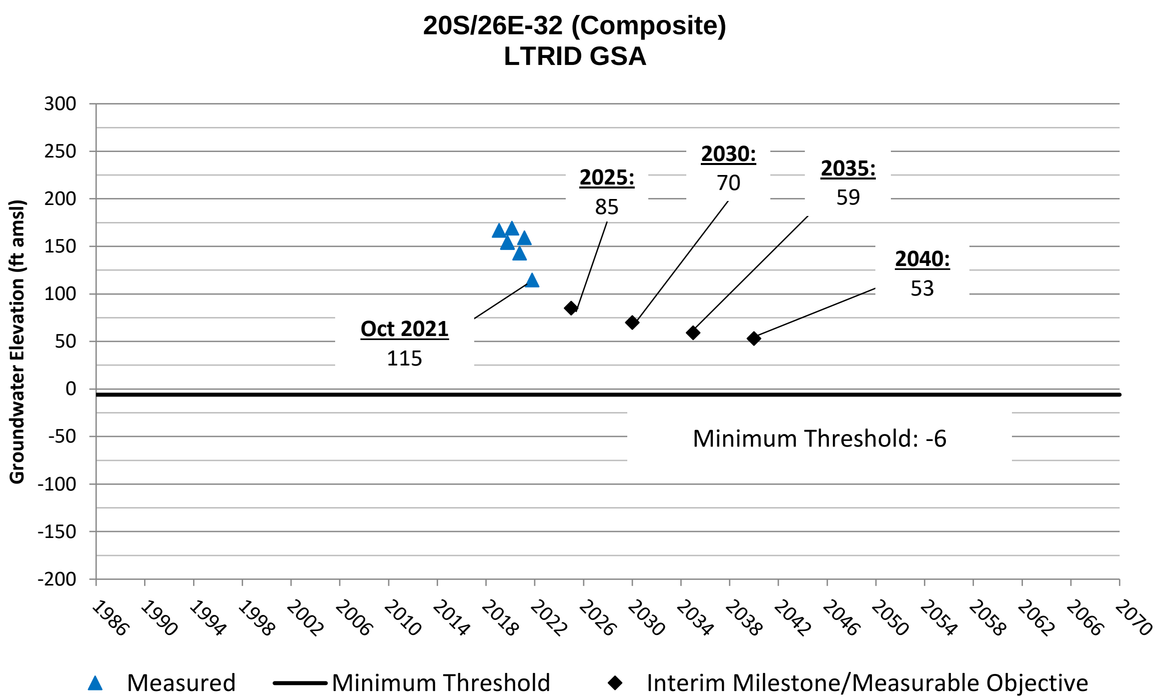
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs





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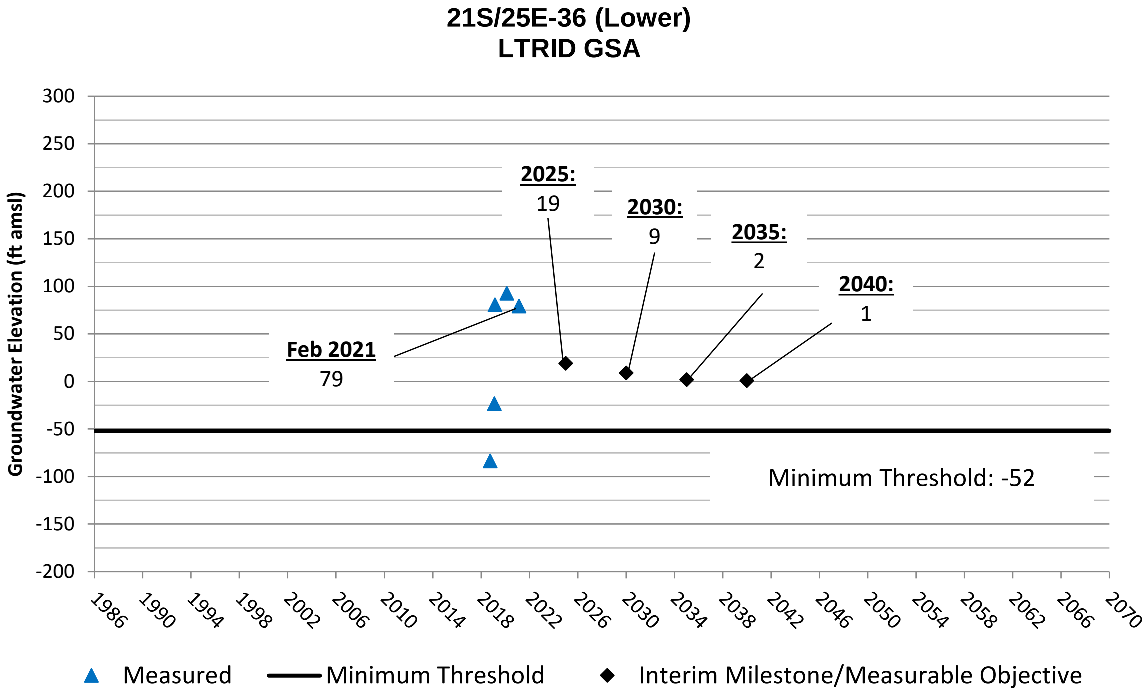
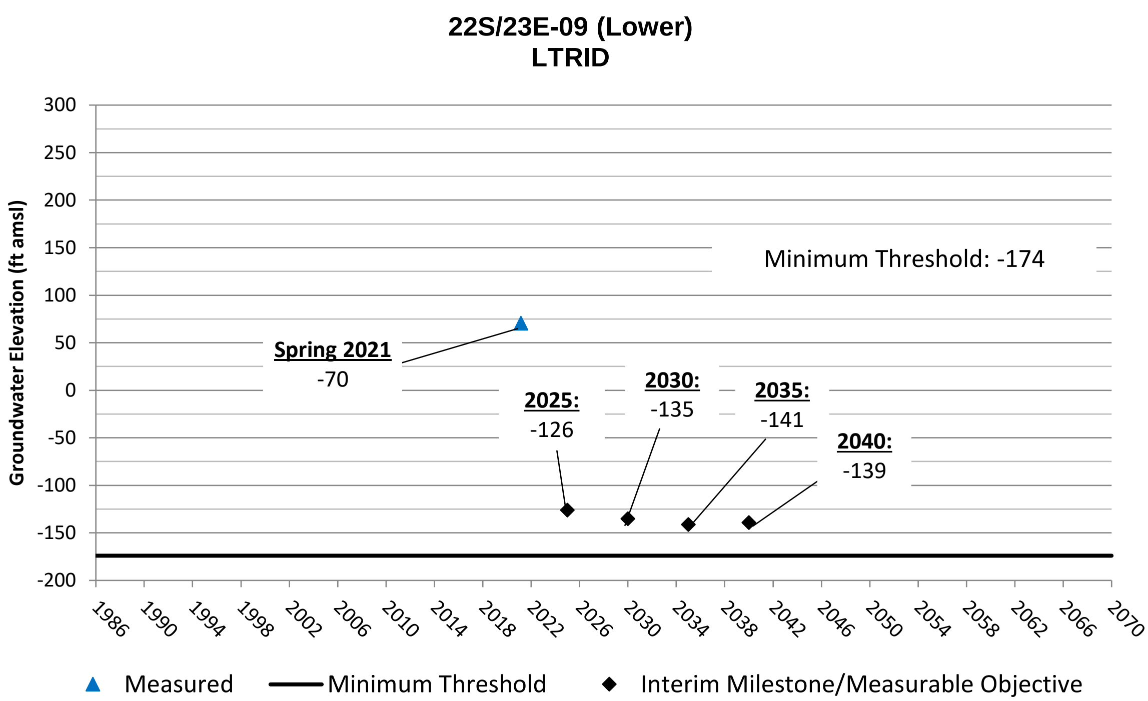
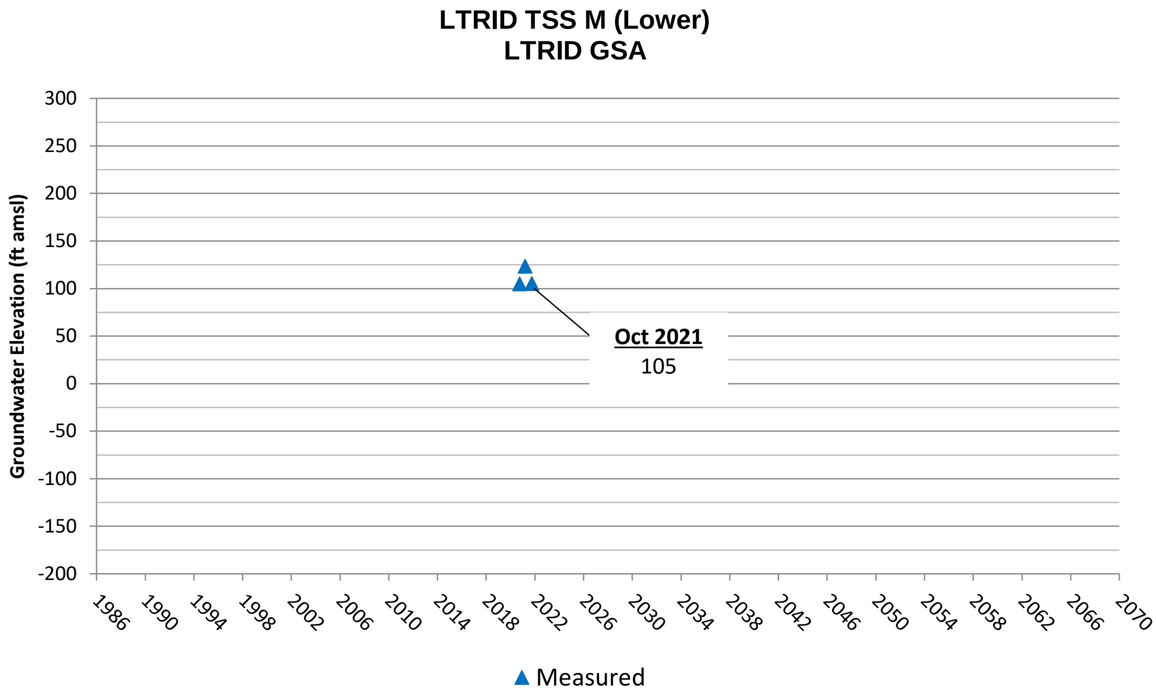
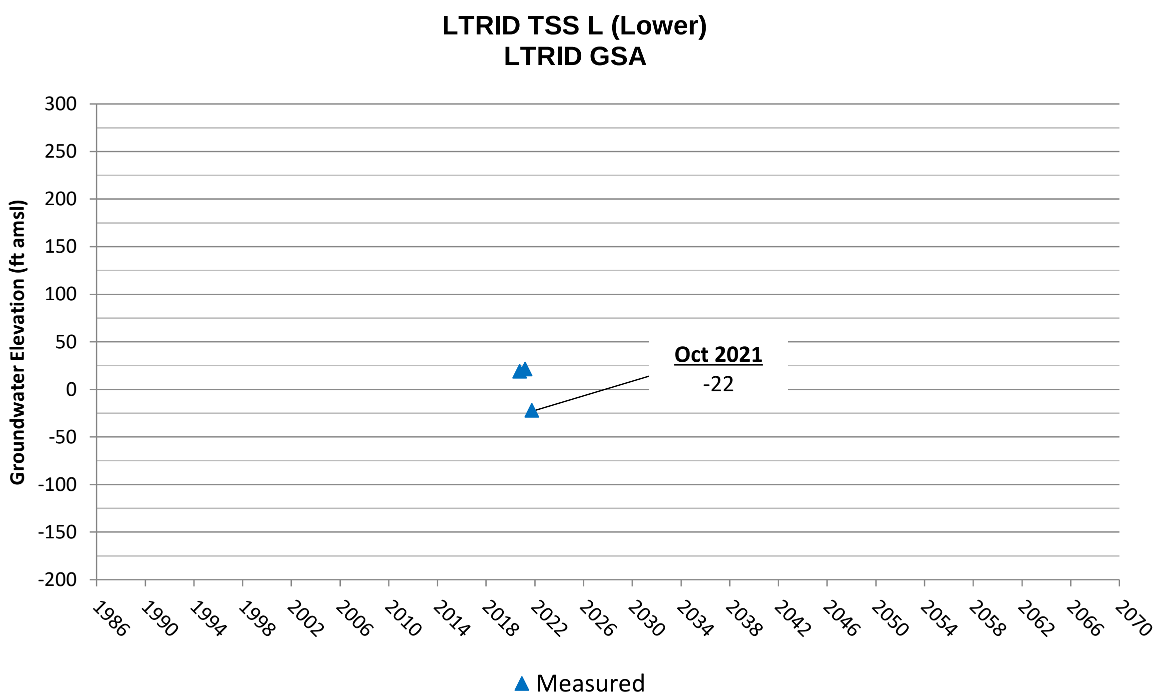
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



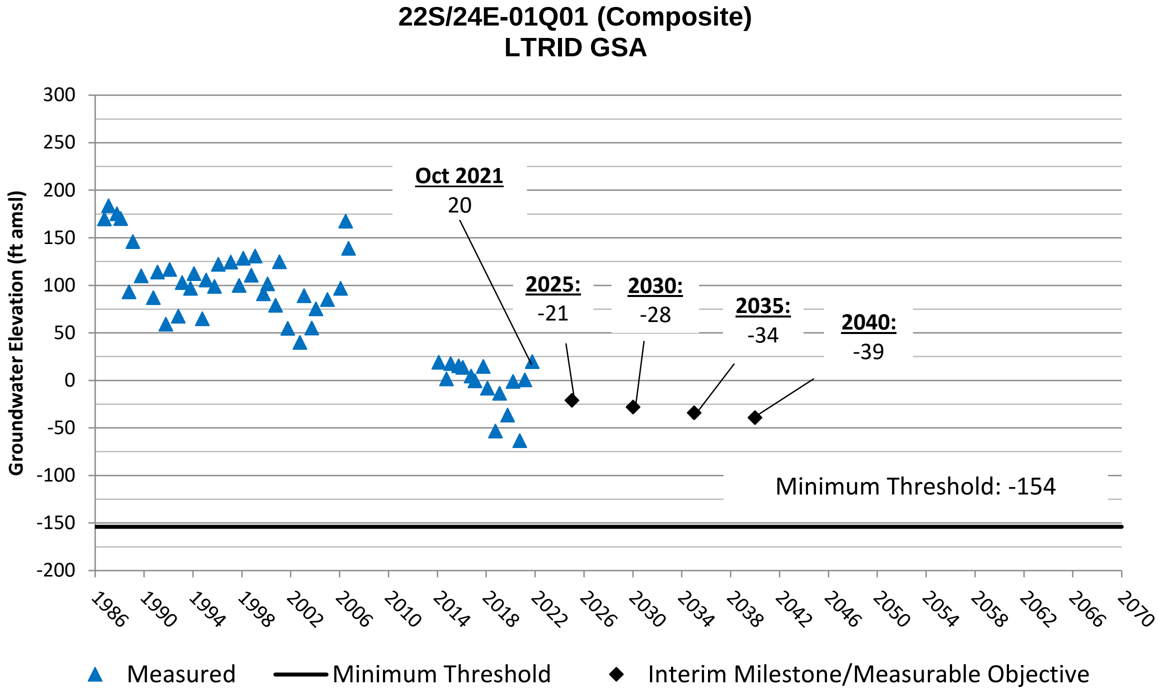


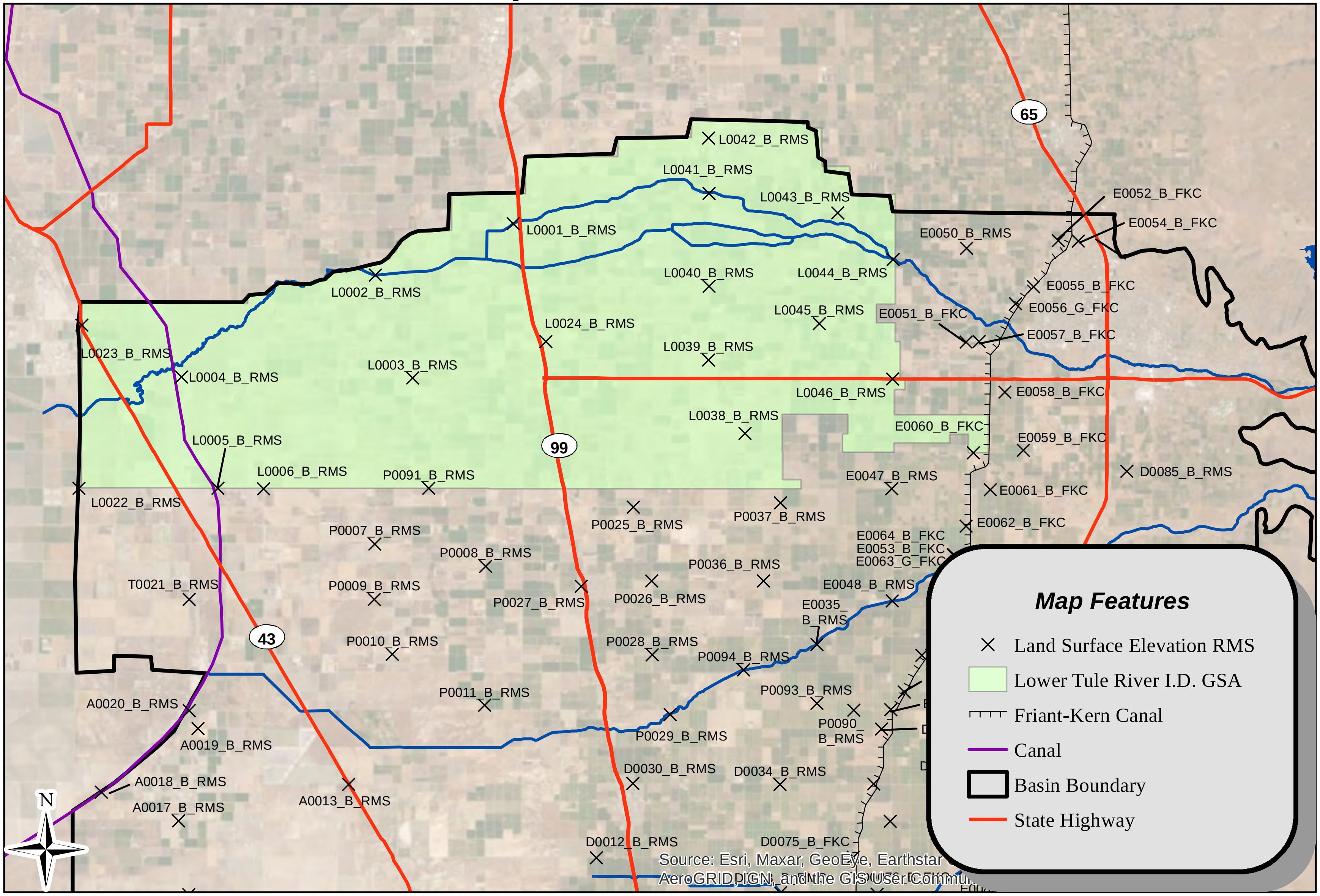
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs





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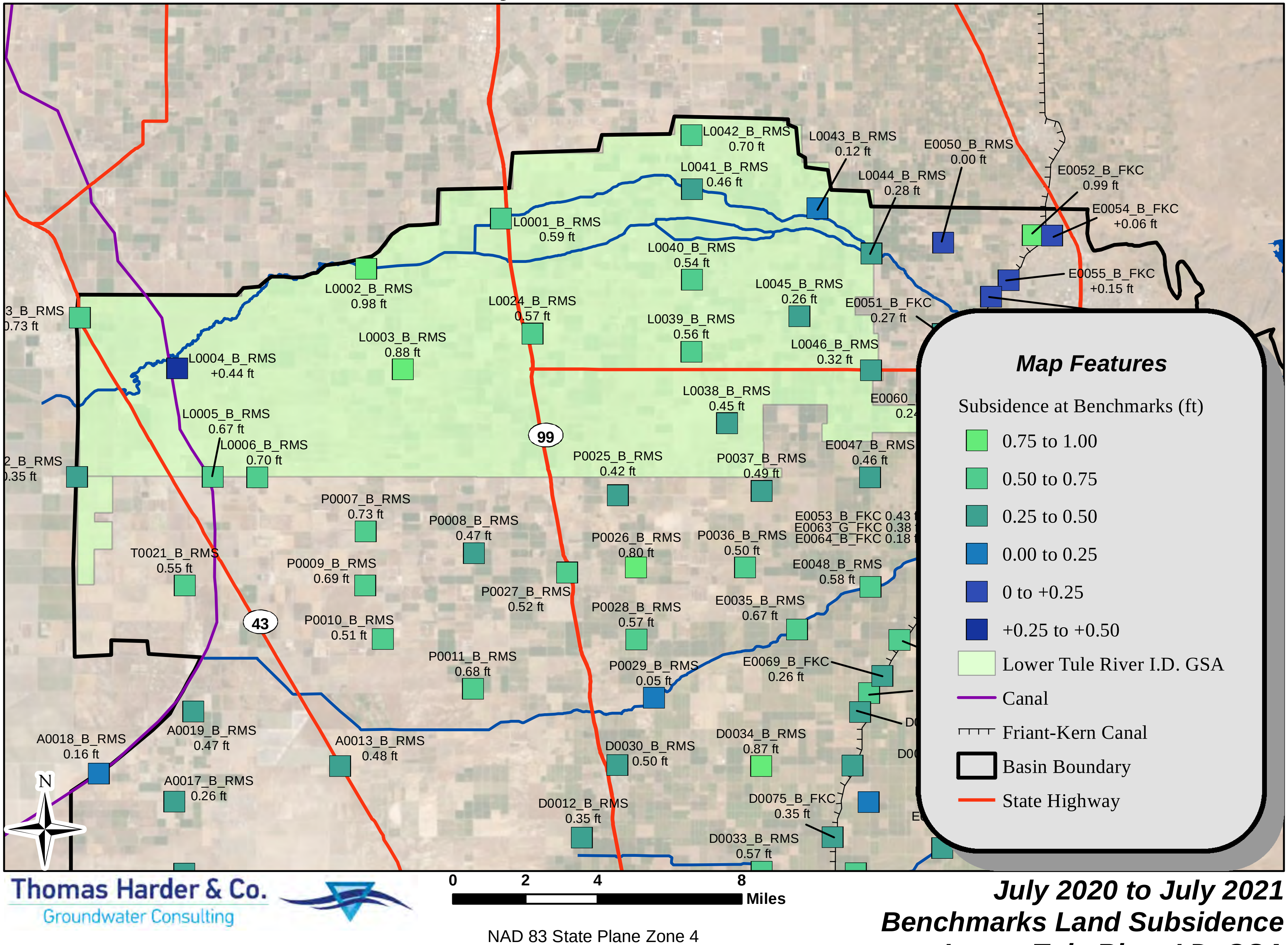
Land Surface Elevation Monitoring Network Lower Tule River I.D. GSA

Appendix A
Figure 8



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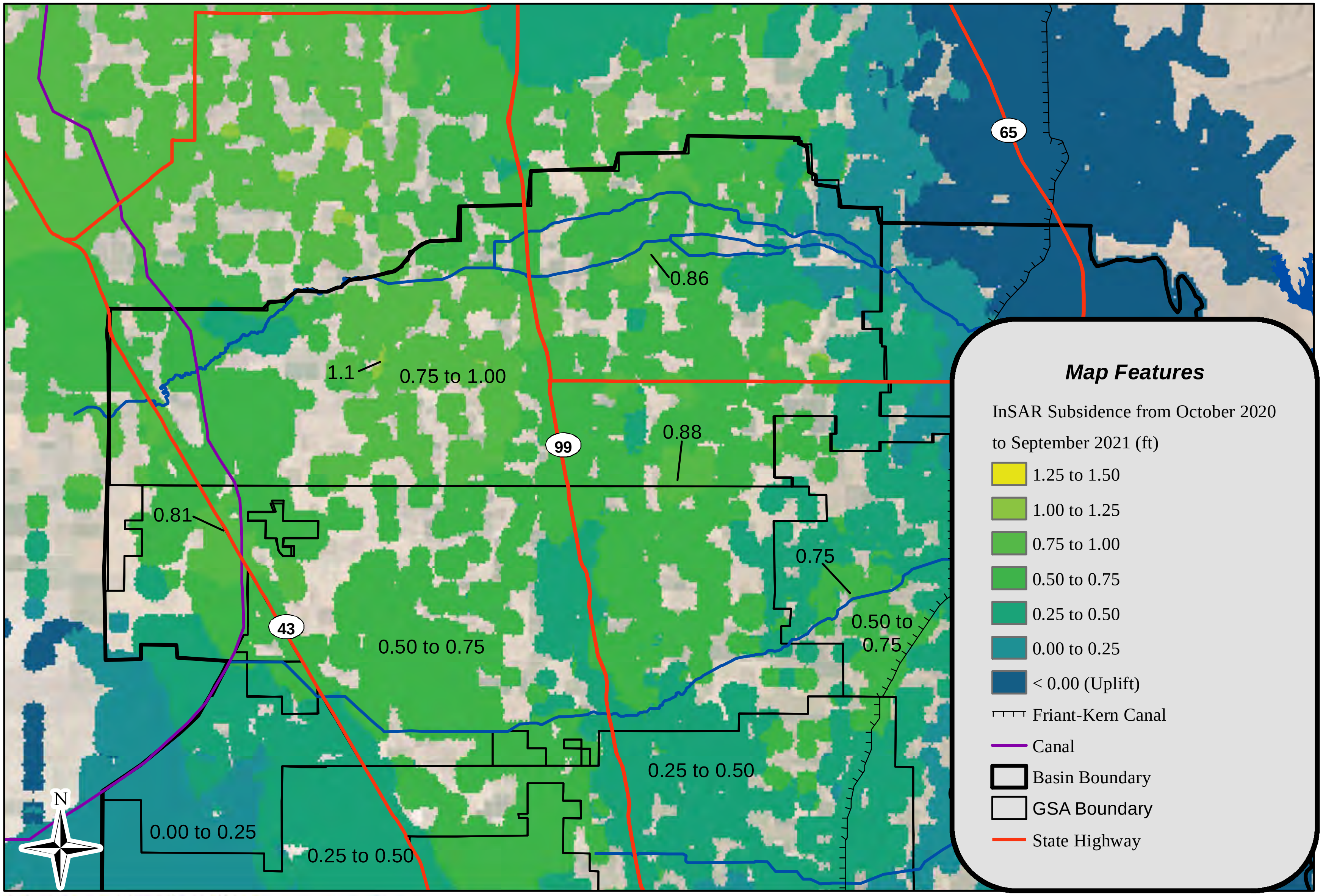
July 2020 to July 2021
Benchmarks Land Subsidence
Lower Tule River I.D. GSA
Appendix A
Figure 9

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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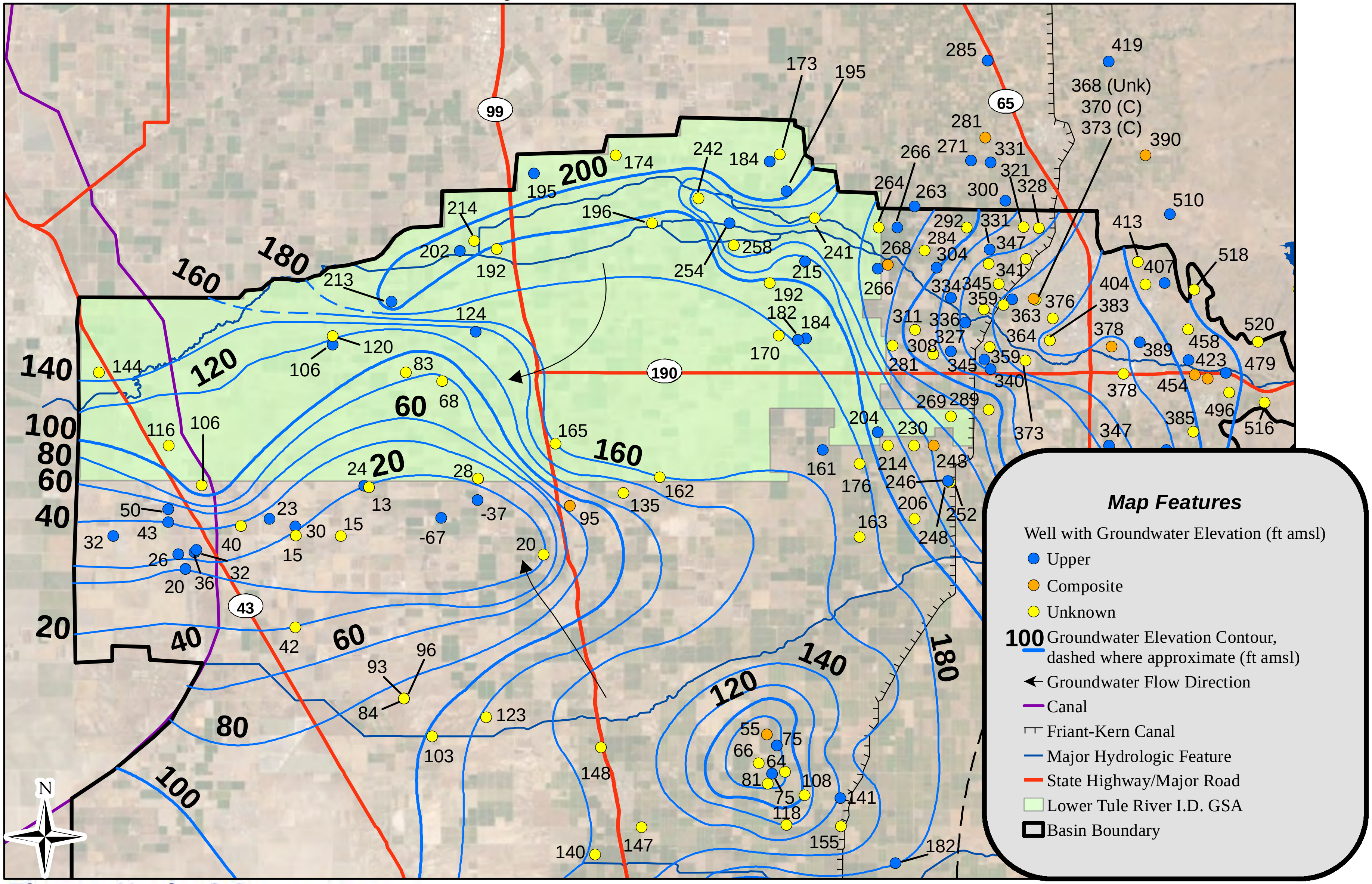
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

Land Subsidence - October 2020 to September 2021
Lower Tule River I.D. GSA
Appendix A
Figure 10



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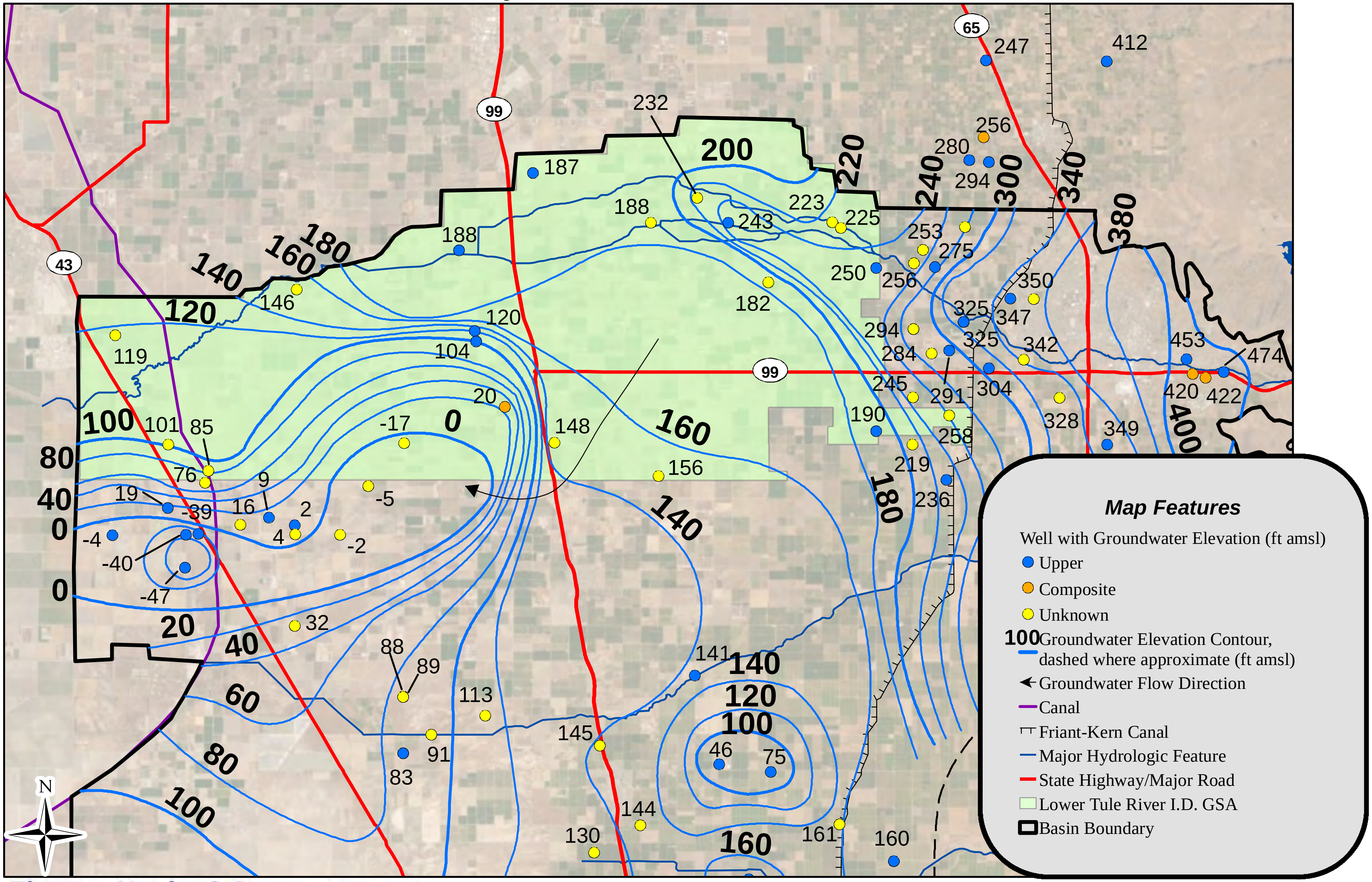
0 2 4 8 Miles

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 11

Tule Subbasin Technical Advisory Committee



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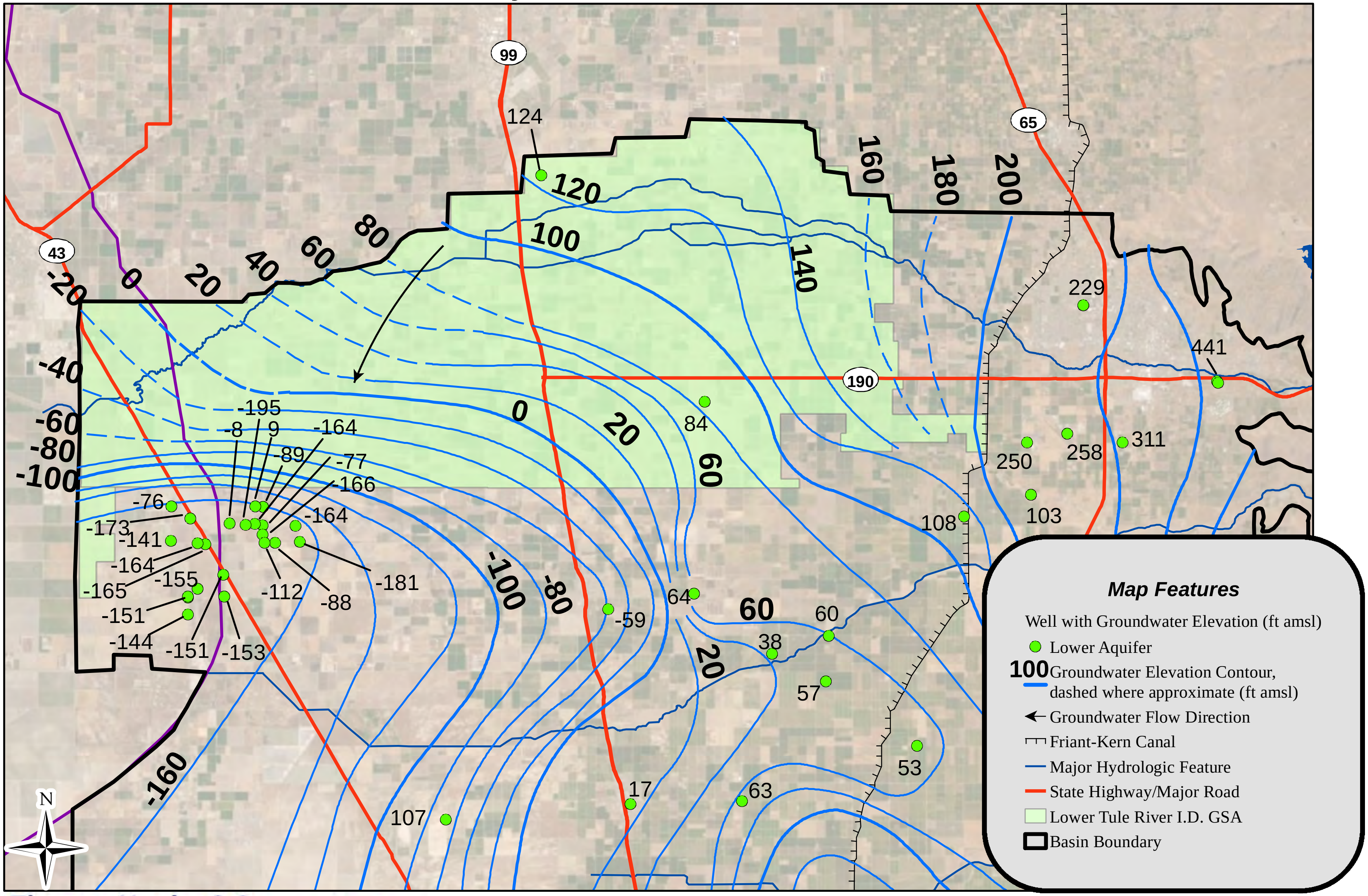
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 12

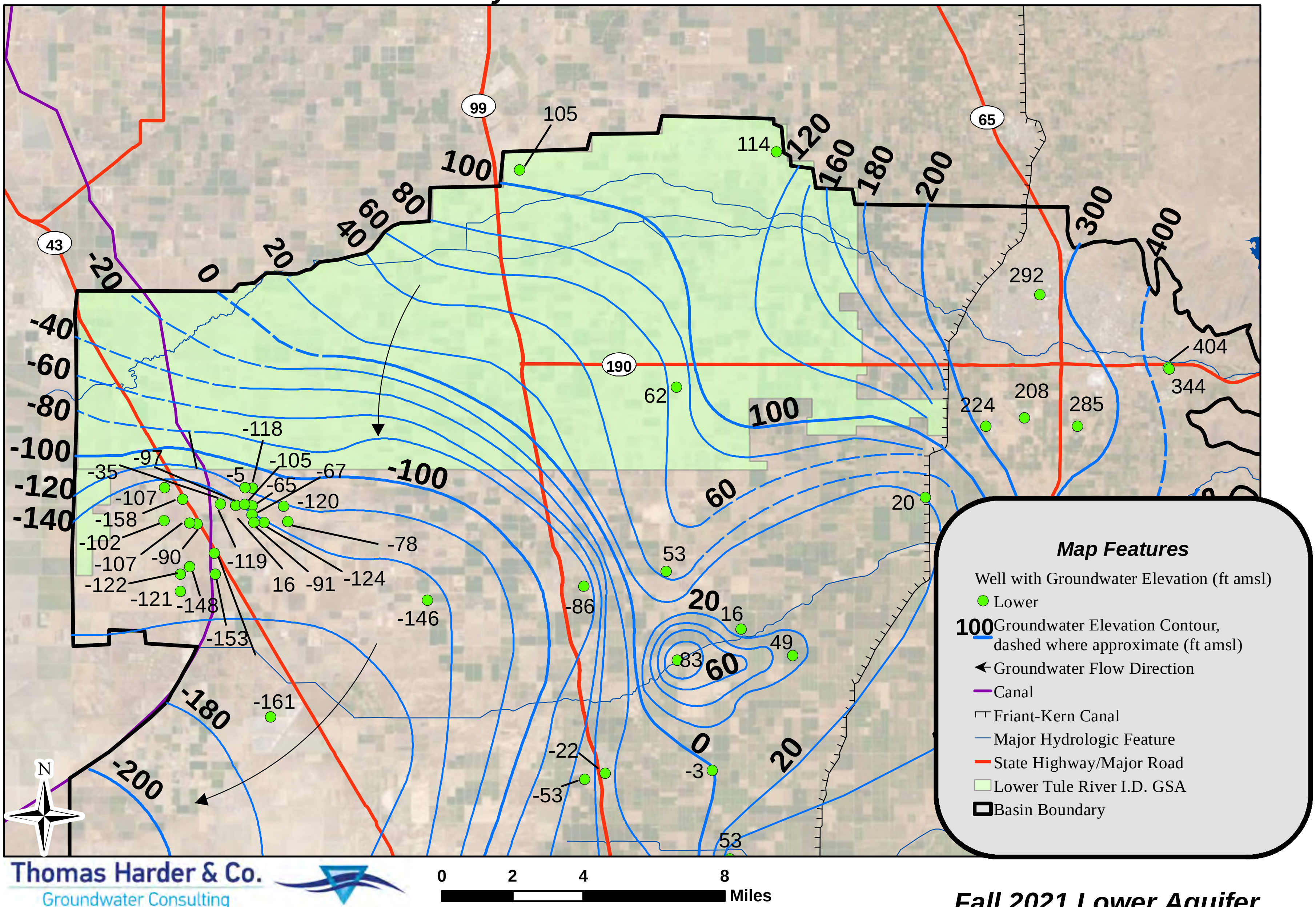
Tule Subbasin Technical Advisory Committee



0 2 4 8 Miles

NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 13



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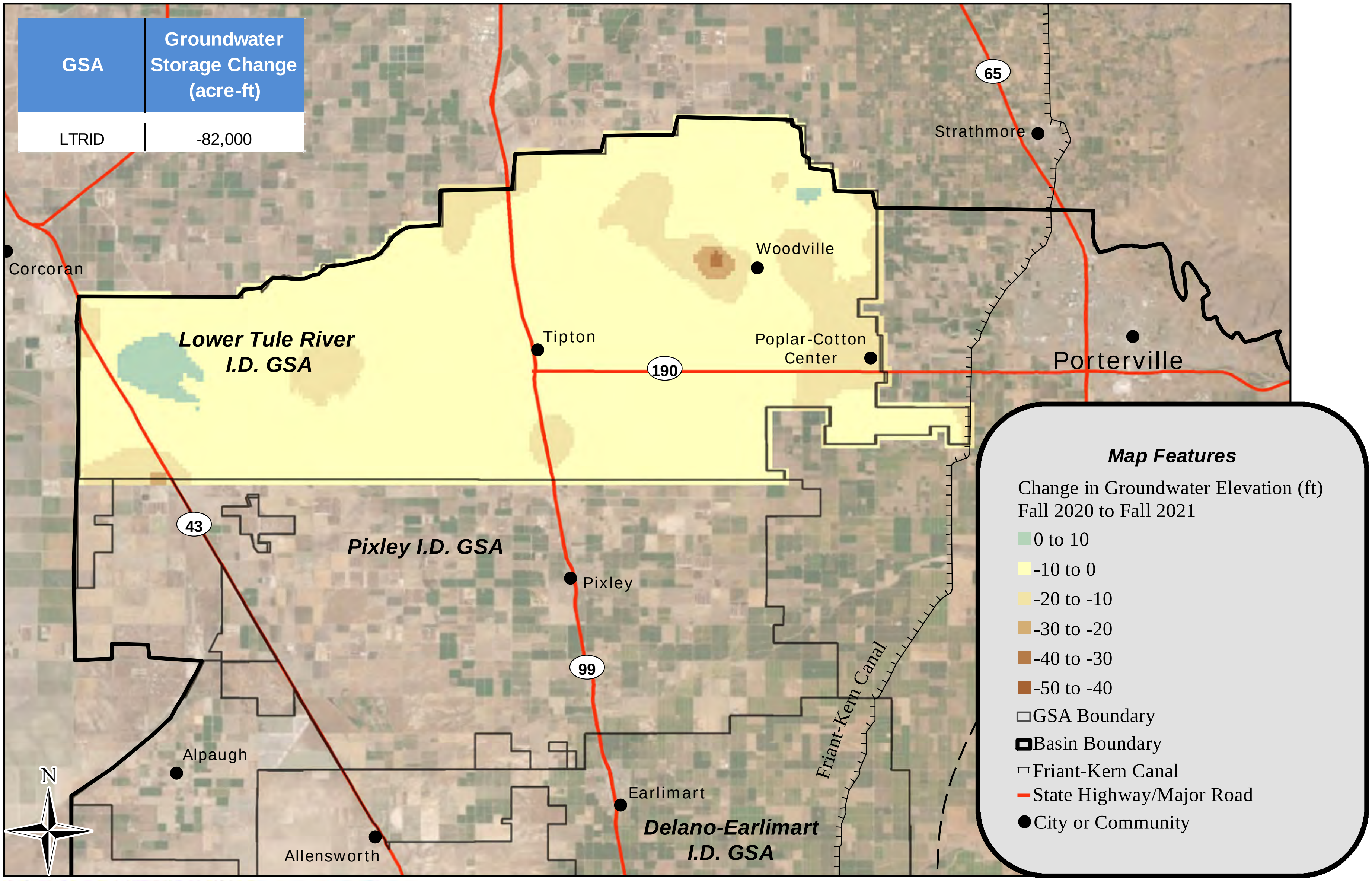
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Lower Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 14

GSA	Groundwater Storage Change (acre-ft)
LTRID	-82,000



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0 1 2 4 Miles
NAD 83 State Plane Zone 4

Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - Lower Tule River I.D. GSA

Appendix A
Figure 15

Appendix B

Eastern Tule GSA 2020/21 Annual Data

Eastern Tule GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
ETGSA	Greater Tule	209,000	0	0	209,000
	Porterville Community	0	11,810	0	11,810
	Ducor Community	0	200	0	200
	Terra Bella Community	0	0	0	0
	Kern-Tulare WD	11,000	0	0	11,000
	Total	***220,000***	***12,010***	***0***	***232,010***

Eastern Tule GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
ETGSA	Greater Tule	10,900	31,000	0	0	37,300	79,200
	Porterville Community	1,700	0	4,930	0	4,800	11,430
	Ducor Community	0	0	0	0	100	100
	Terra Bella Community	0	1,700	0	0	400	2,100
	Kern-Tulare WD	0	7,780	0	1,100	2,800	11,680
	Total	***12,600***	***40,480***	***4,930***	***1,100***	***45,400***	***104,510***

Eastern Tule GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
ETGSA	Greater Tule	209,000	79,200	288,200
	Porterville Community	11,810	11,430	23,240
	Ducor Community	200	100	300
	Terra Bella Community	0	2,100	2,100
	Kern-Tulare WD	11,000	11,680	22,680
	Total	***232,010***	***104,510***	***336,520***

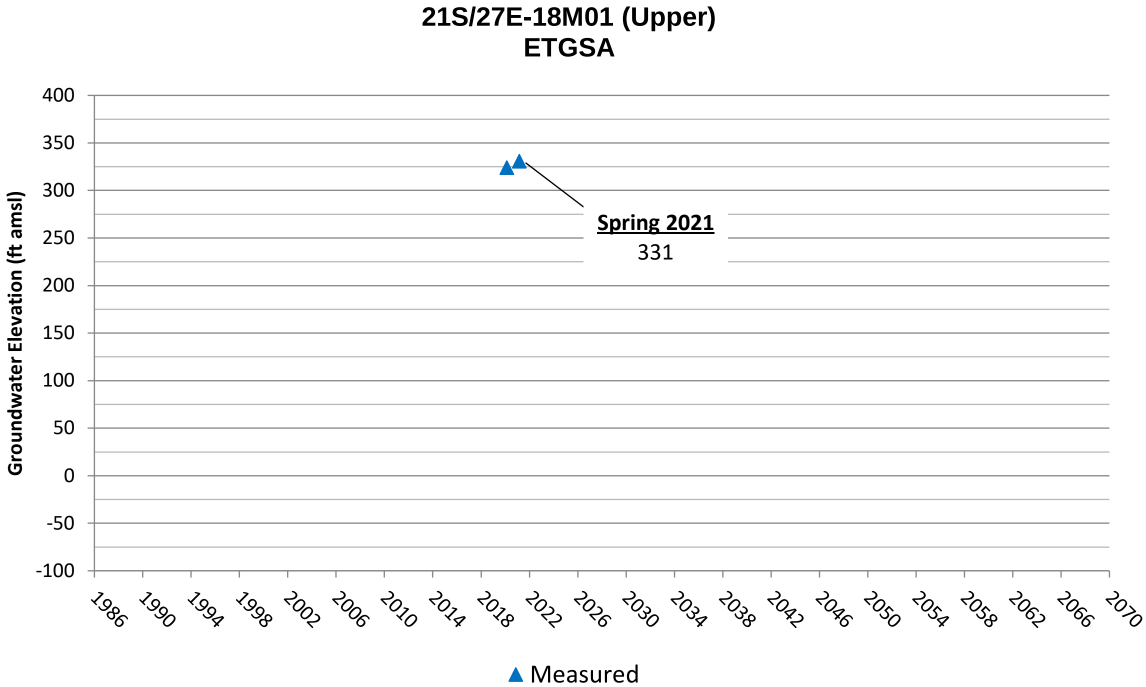
Eastern Tule GSA
Land Surface Elevations at Representative Monitoring Sites

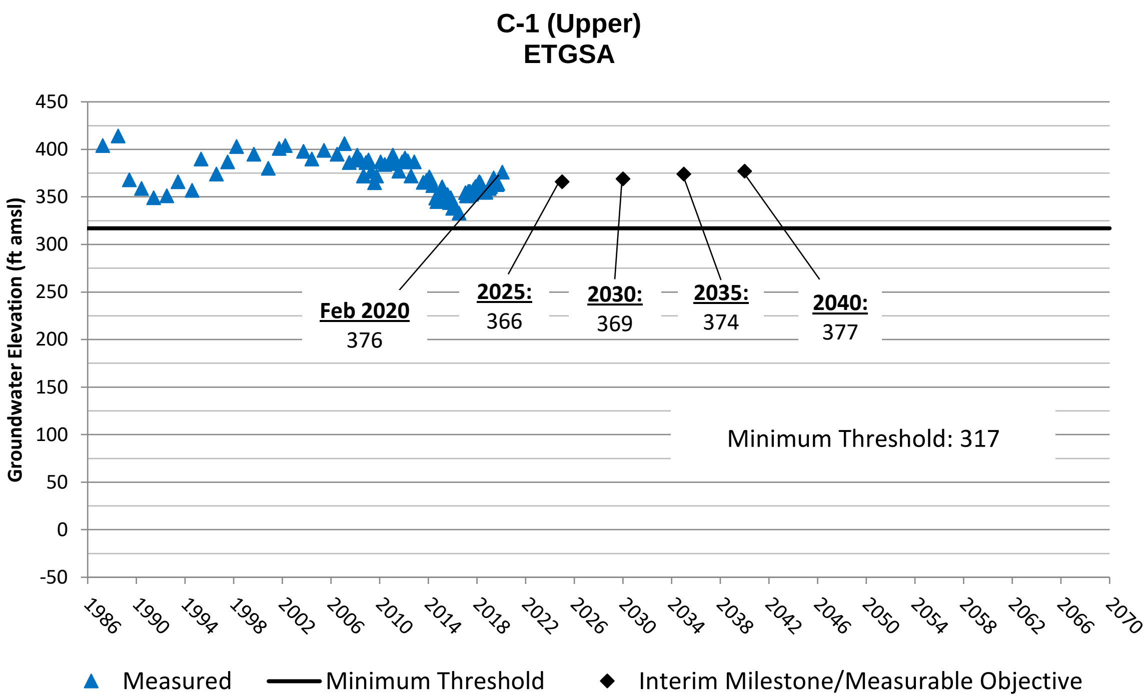
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
E0035_B_RMS	342.1	341.4	340.5	339.5
E0047_B_RMS	366.2	365.7	365.2	363.4
E0048_B_RMS	370.5	369.9	369.5	366.5
E0049_B_RMS	403.2	402.6	402.7	401.8
E0050_B_RMS	386.6	386.6	386.5	385.5
E0051_B_FKC	397.3	397.1	397.3	396.3
E0052_B_FKC	405.7	404.7	405.7	404.7
E0053_B_FKC	399.8	399.3	399.7	398.3
E0054_B_FKC	412.5	412.6	412.4	411.0
E0055_B_FKC	409.1	409.2	409.0	408.0
E0056_G_FKC	406.7	406.8	406.7	405.7
E0057_B_FKC	399.3	399.1	399.3	398.3
E0058_B_FKC	407.8	407.7	407.1	406.0
E0059_B_FKC	418.0	417.7	416.9	415.9
E0060_B_FKC	393.6	393.4	392.8	391.7
E0061_B_FKC	403.8	403.5	402.7	401.7
E0062_B_FKC	403.6	403.2	402.9	401.9
E0063_G_FKC	403.2	402.9	403.2	402.1
E0064_B_FKC	400.8	400.6	400.7	399.4
E0065_B_FKC	393.7	400.1	392.6	389.9
E0066_B_FKC	411.9	411.6	410.2	409.1
E0067_B_FKC	408.0	407.5	407.0	404.7
E0068_B_FKC	391.2	390.7	390.9	389.0
E0069_B_FKC	397.4	397.1	397.4	396.4
E0087_B_RMS	531.1	530.9	531.2	530.2
E0088_B_RMS	457.5	457.2	456.8	455.8

Note:

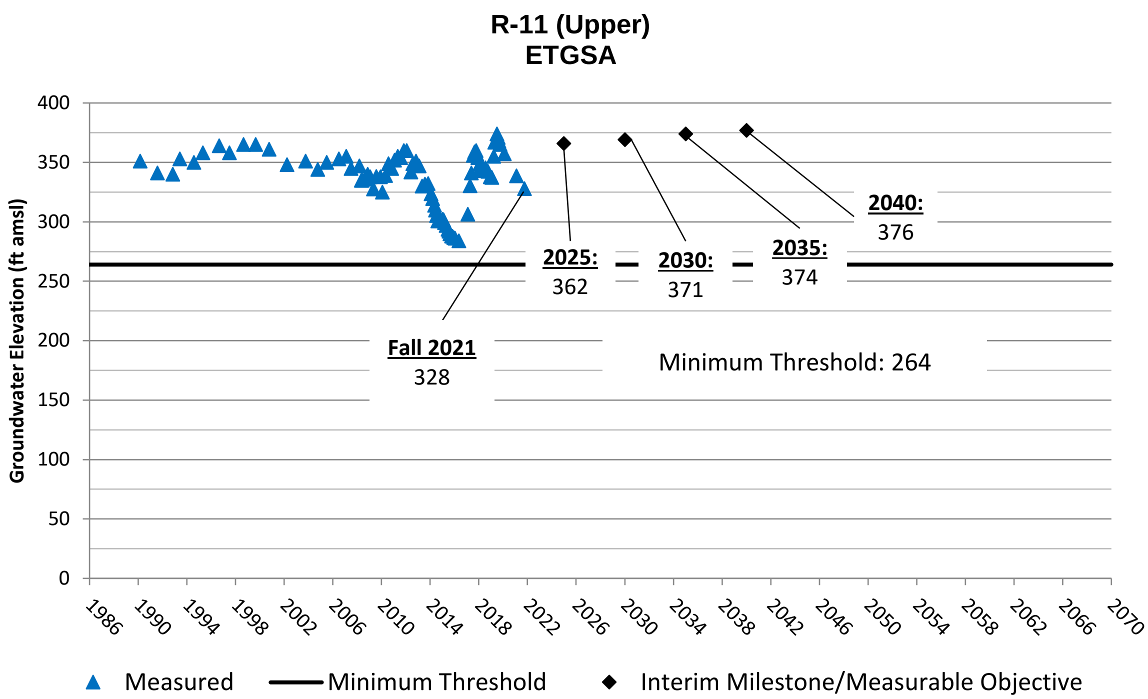
[1] Benchmarks surveyed in July and August of each year.

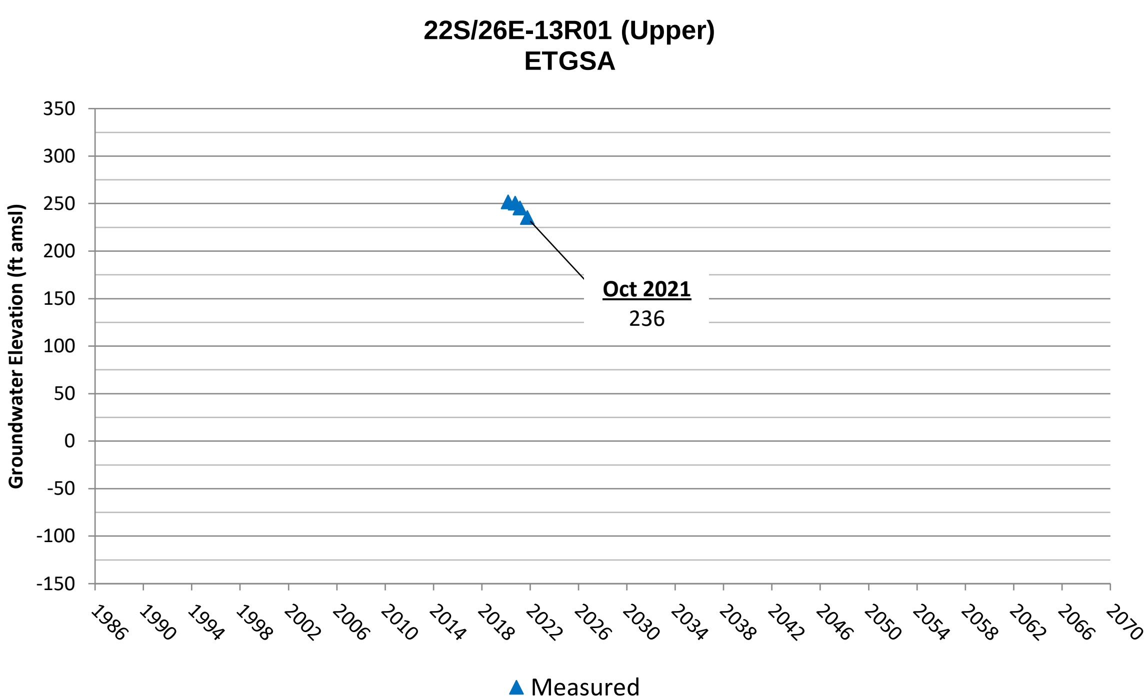
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



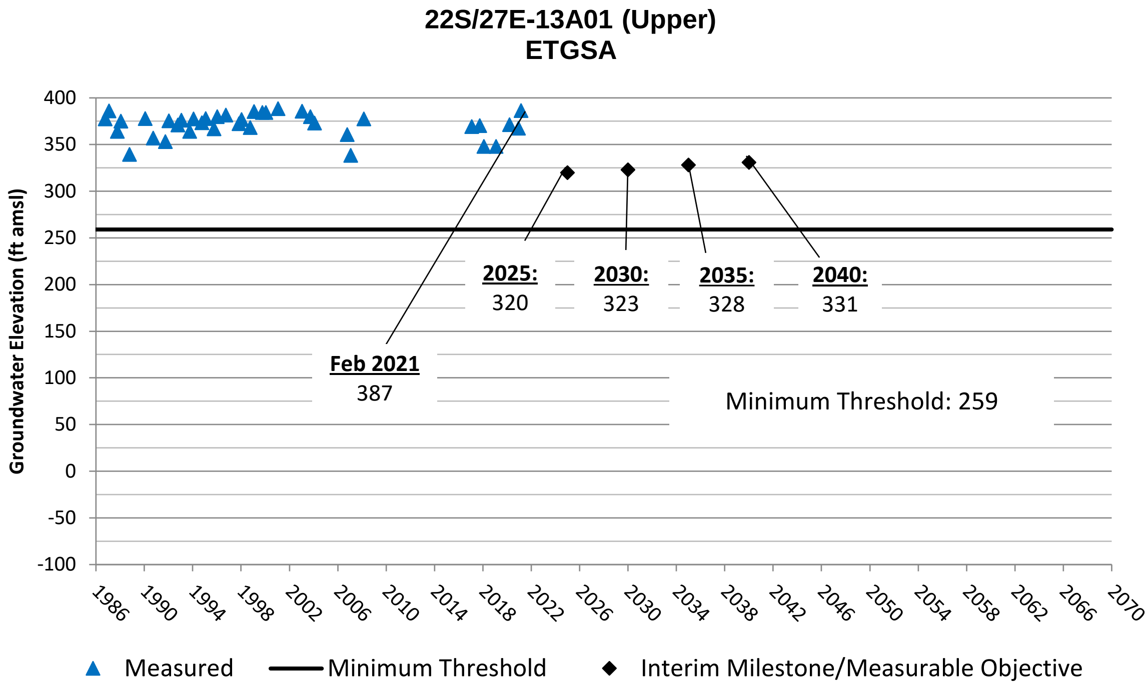


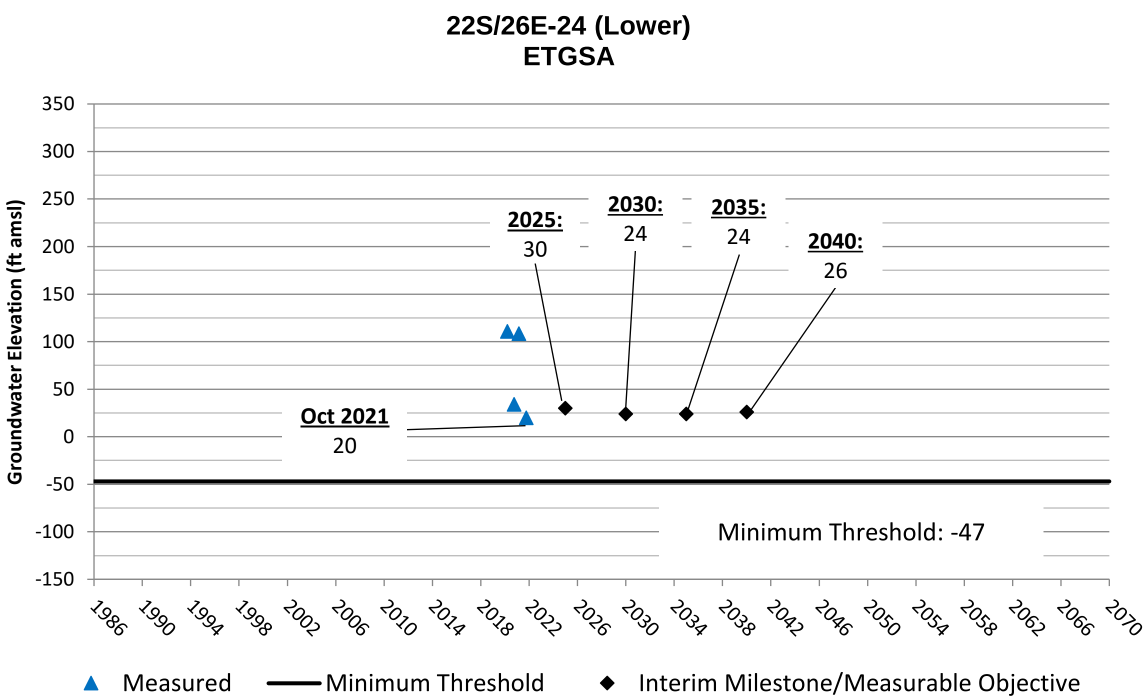
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



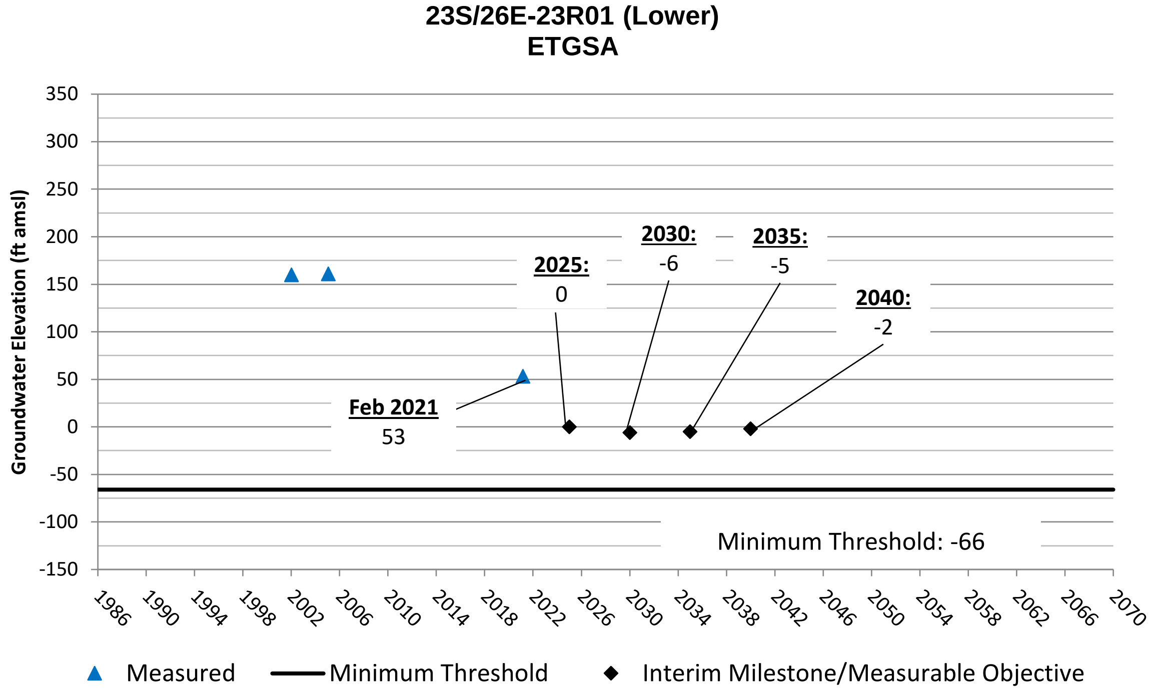


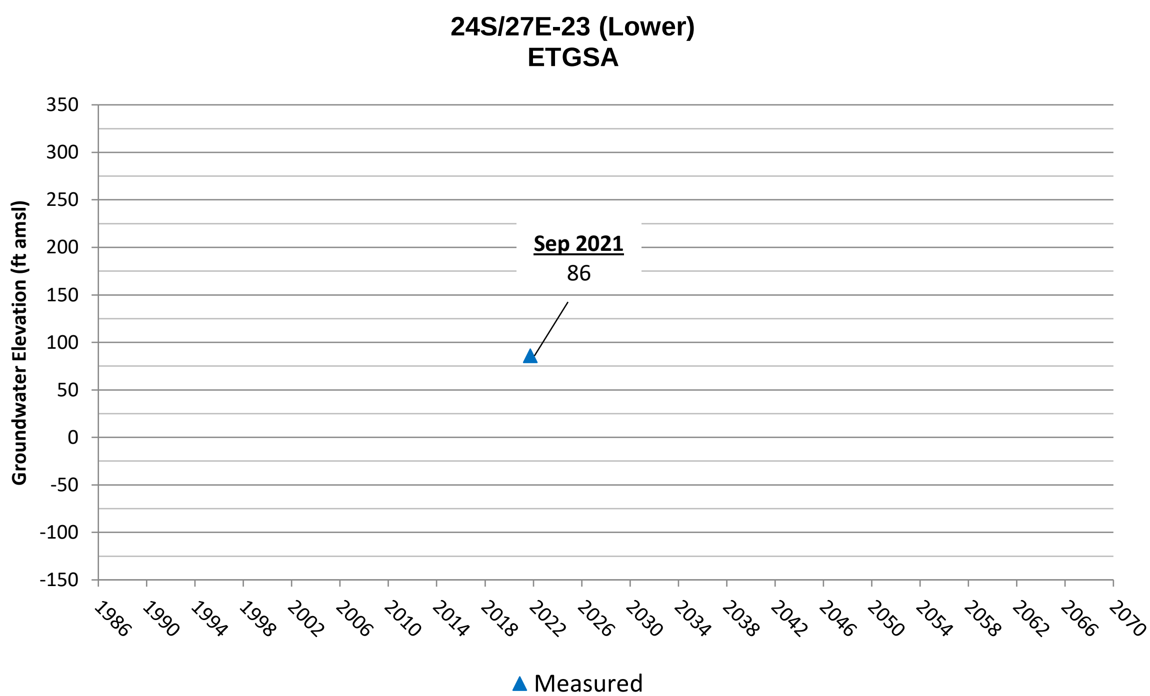
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



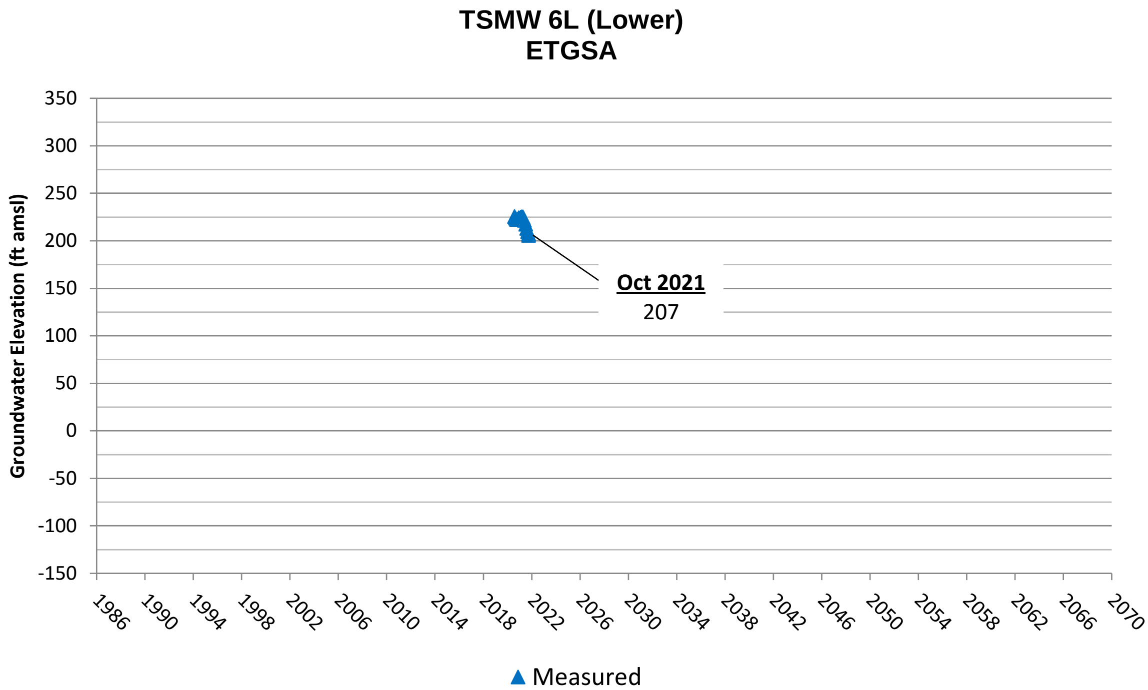


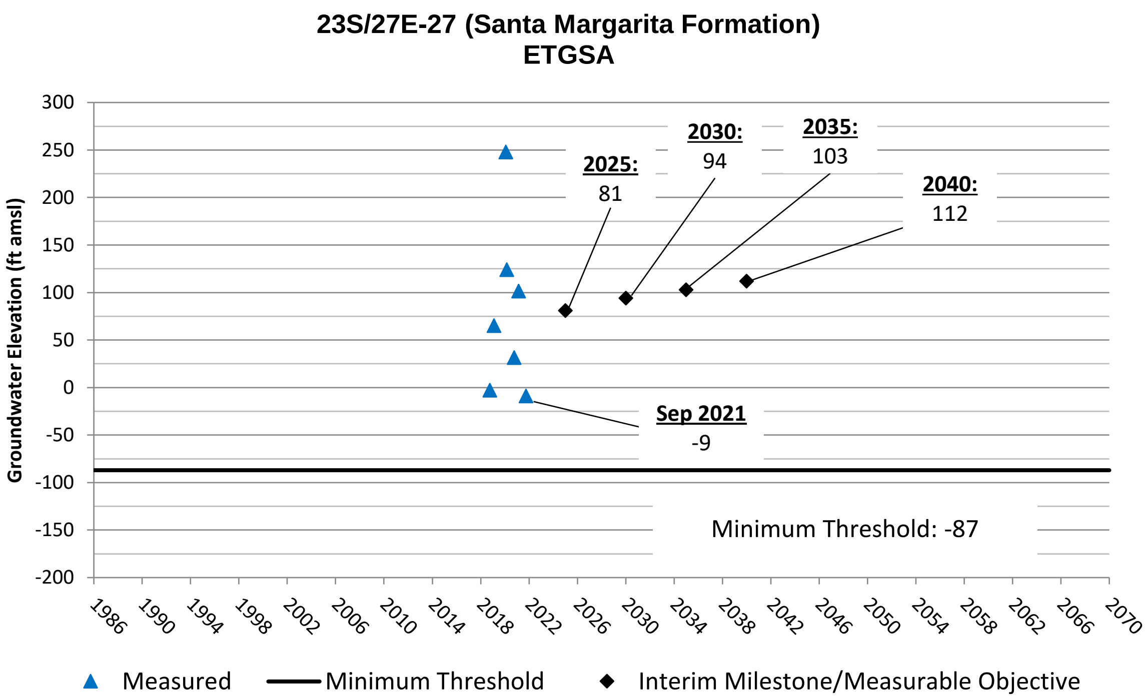
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



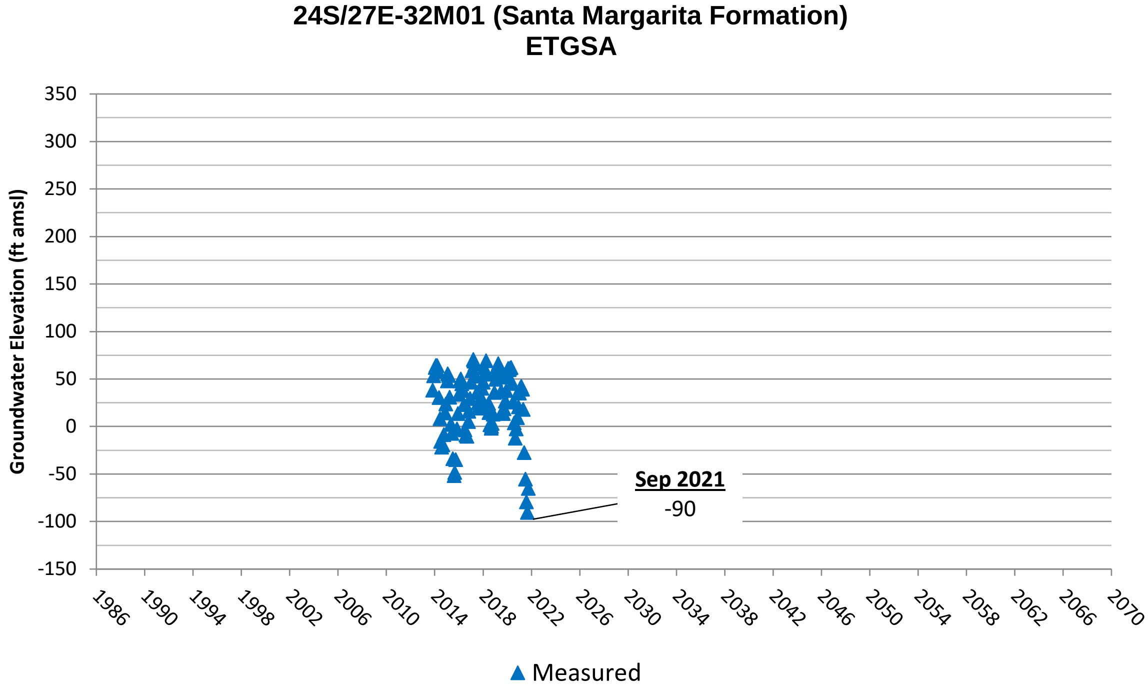


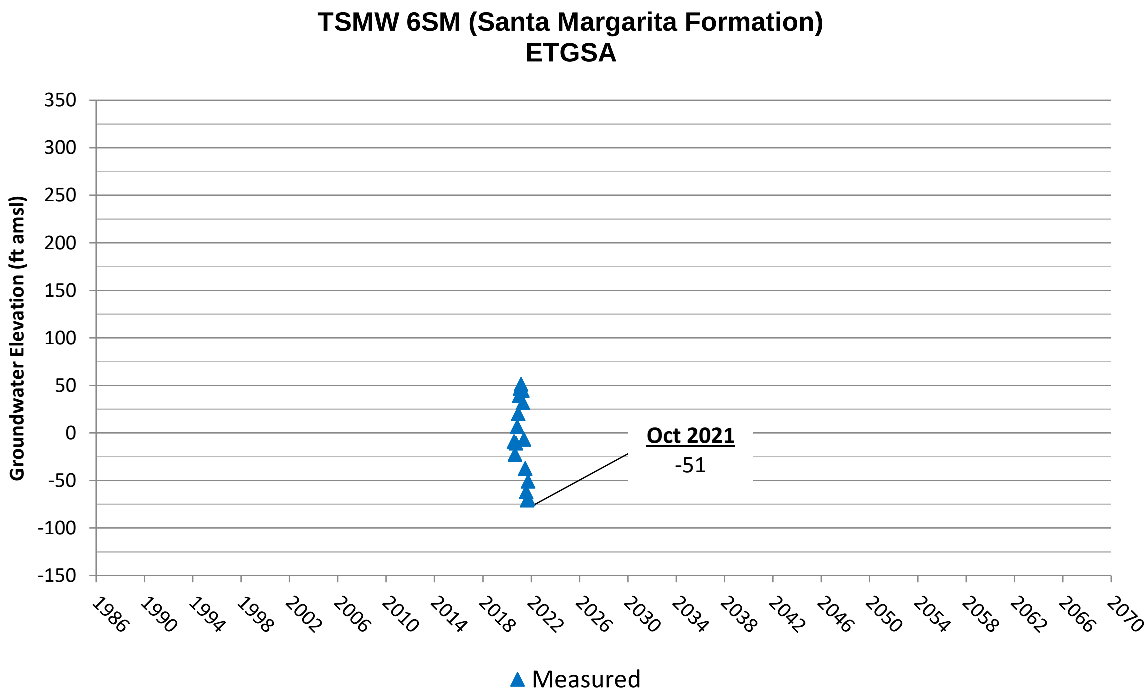
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



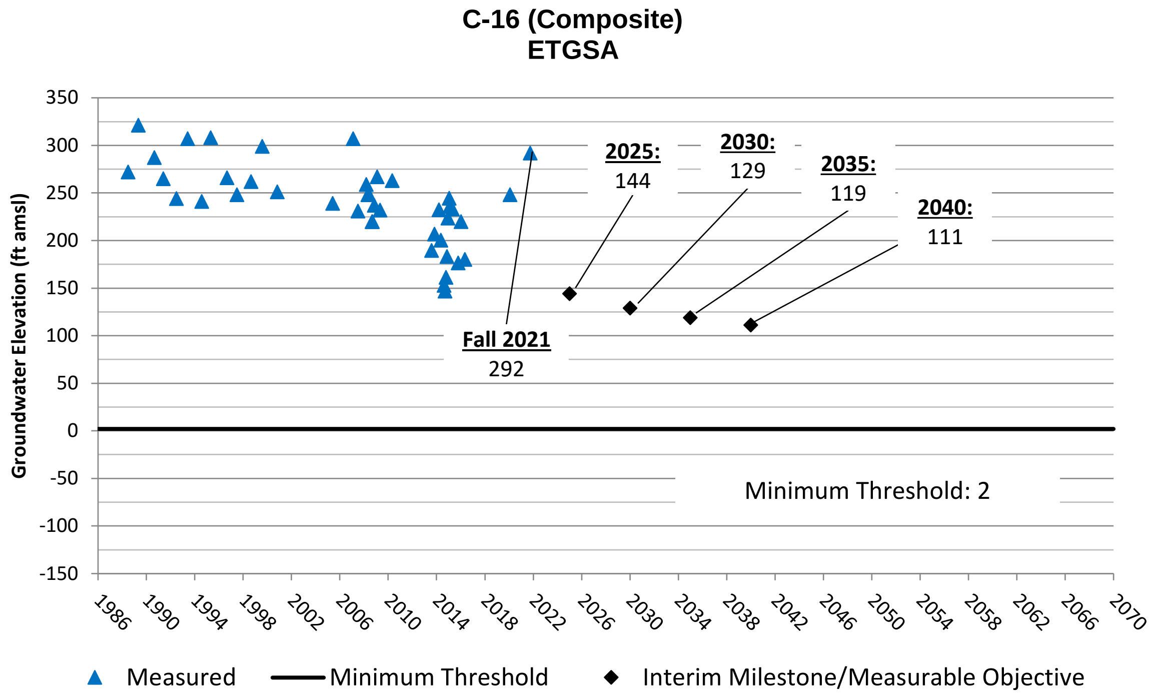


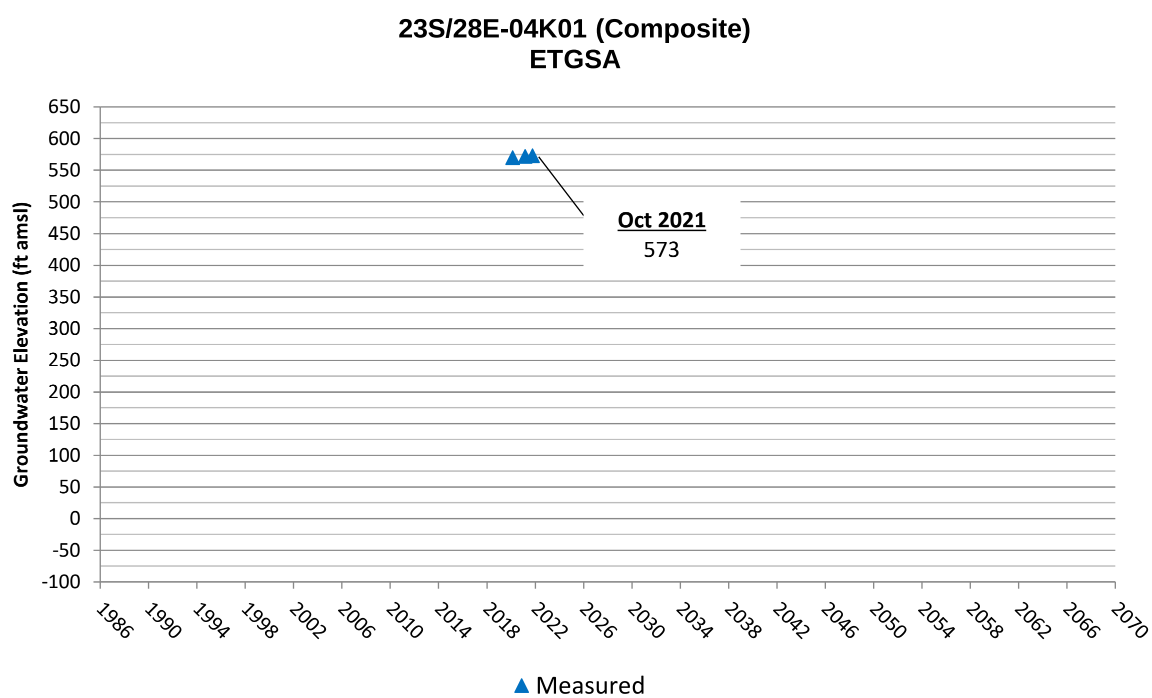
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs





Eastern Tule GSA
RMS Groundwater Elevation Hydrographs

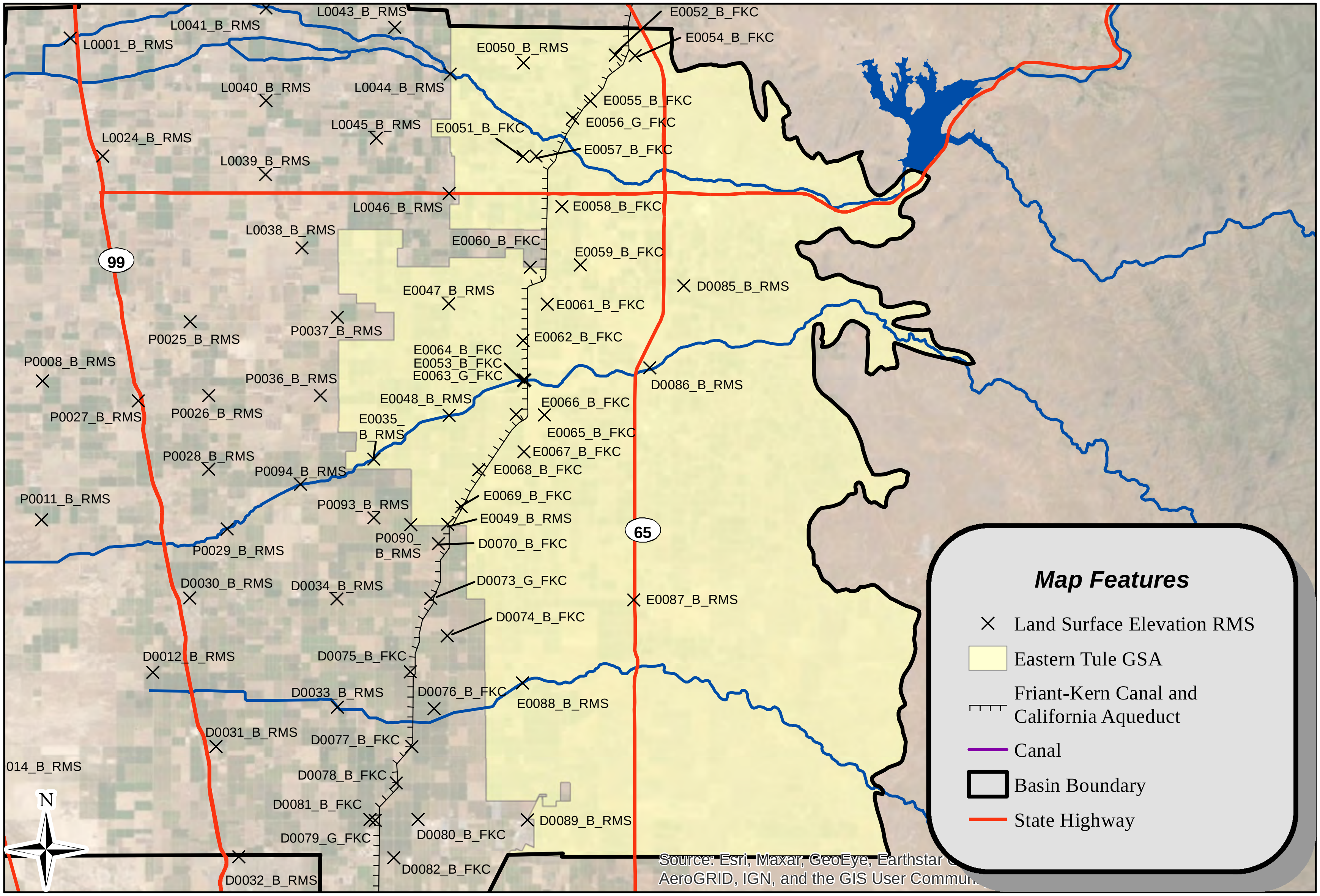




Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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0 2.5 5 10 Miles

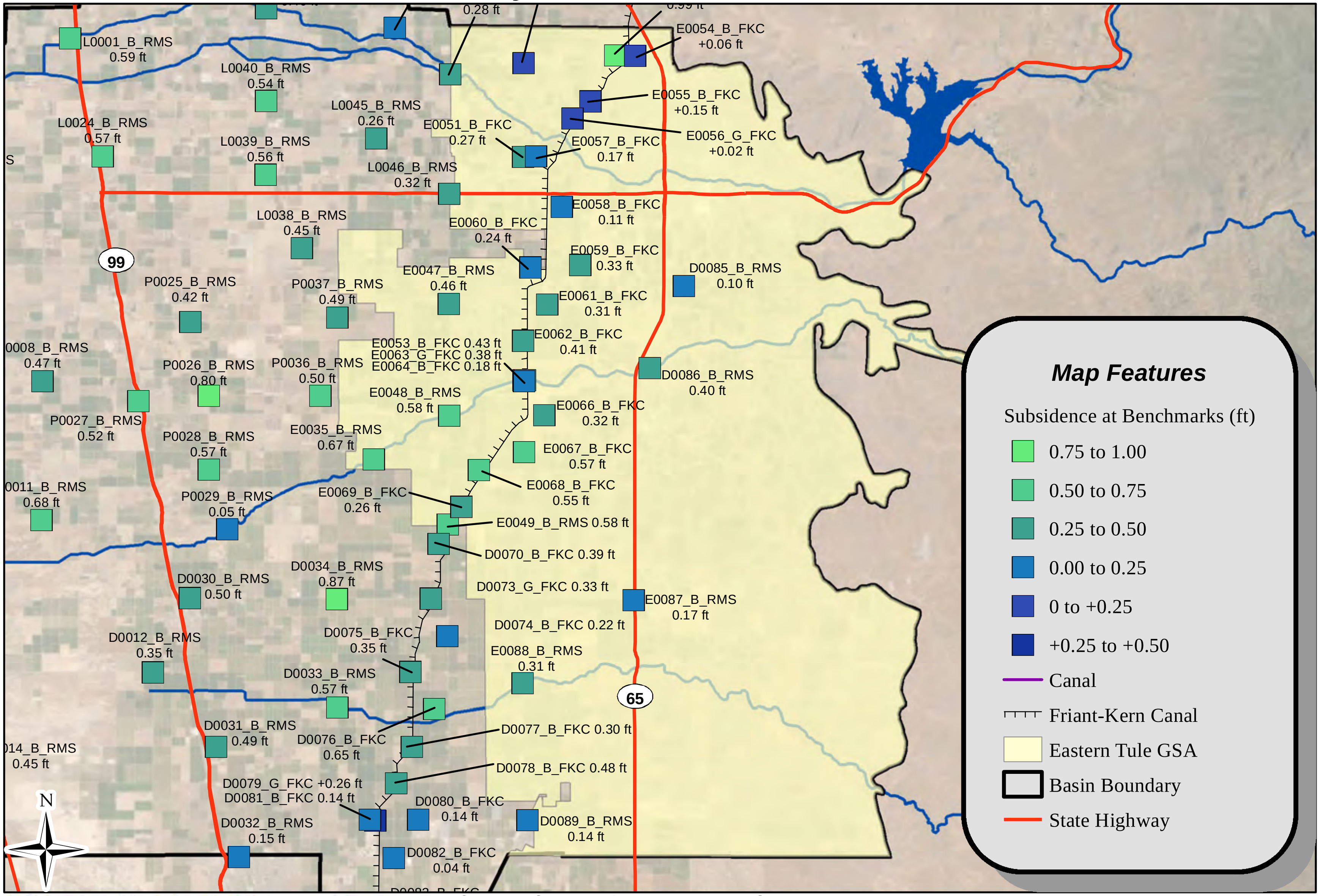
NAD 83 State Plane Zone 4

Land Surface Elevation Monitoring Network
Eastern Tule GSA

Appendix B
Figure 8

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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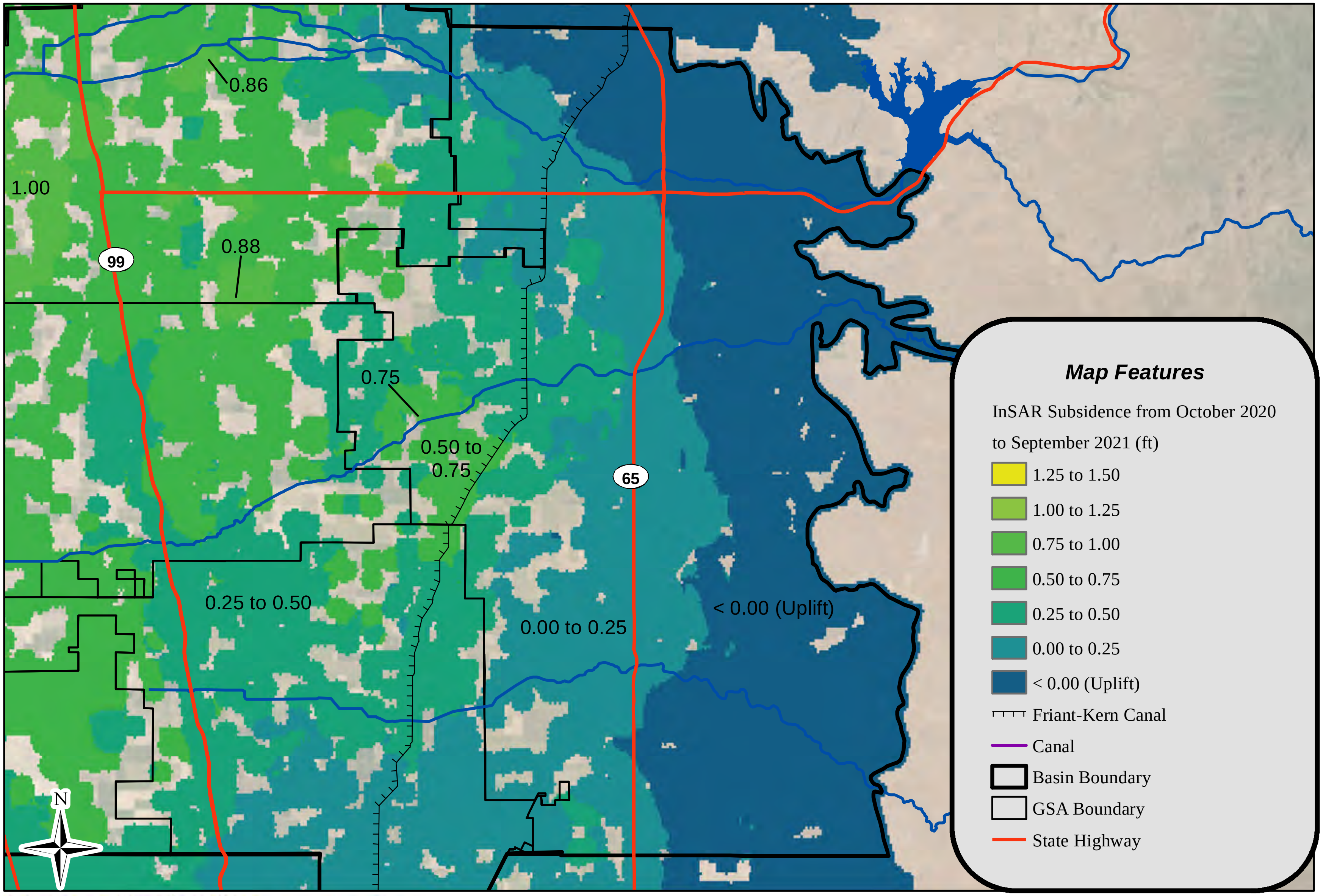
NAD 83 State Plane Zone 4

July 2020 to July 2021
Benchmarks Land Subsidence
Eastern Tule GSA
Appendix B
Figure 9



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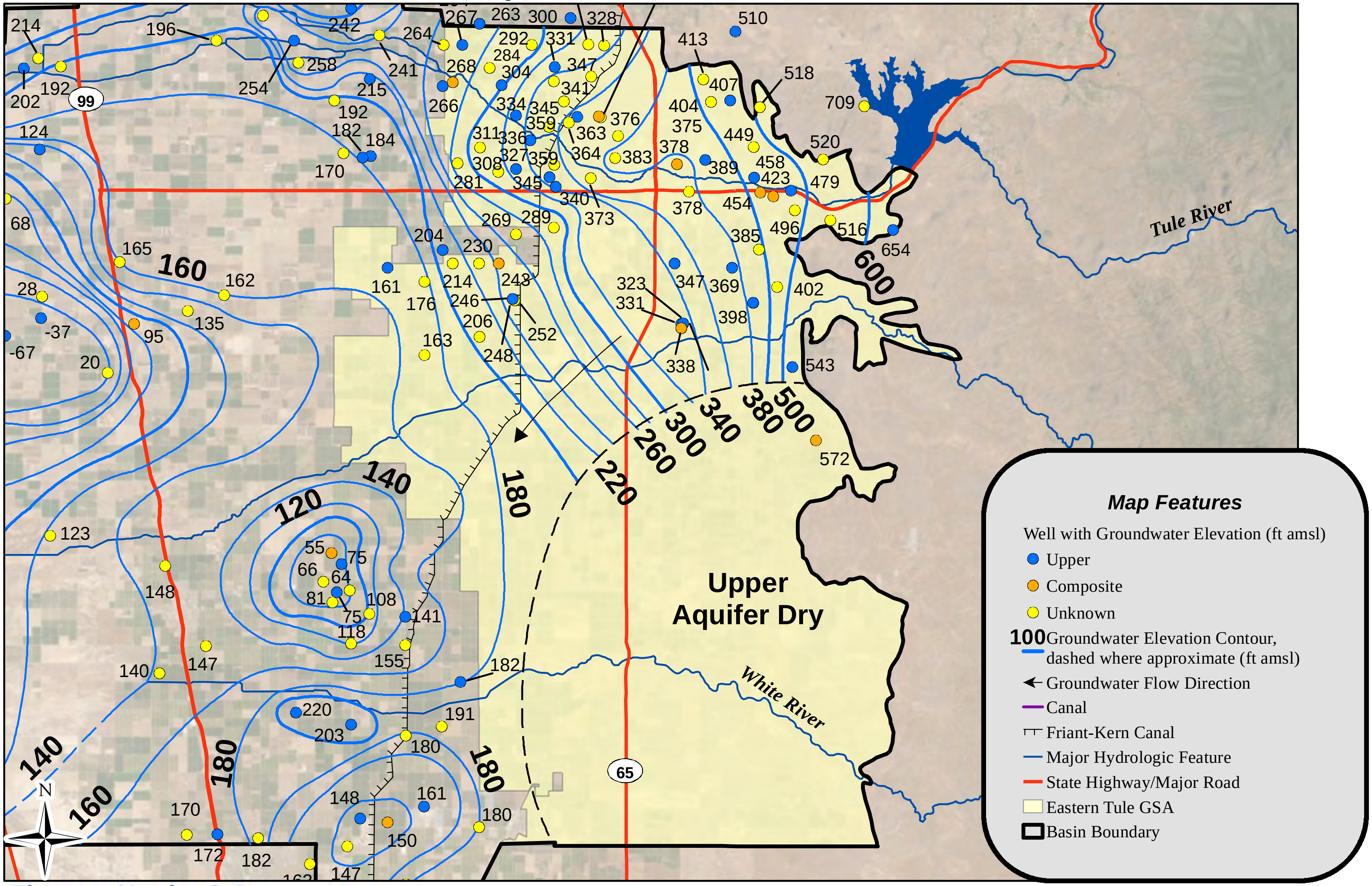
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

Land Subsidence - October 2020 to September 2021
Eastern Tule GSA
Appendix B
Figure 10

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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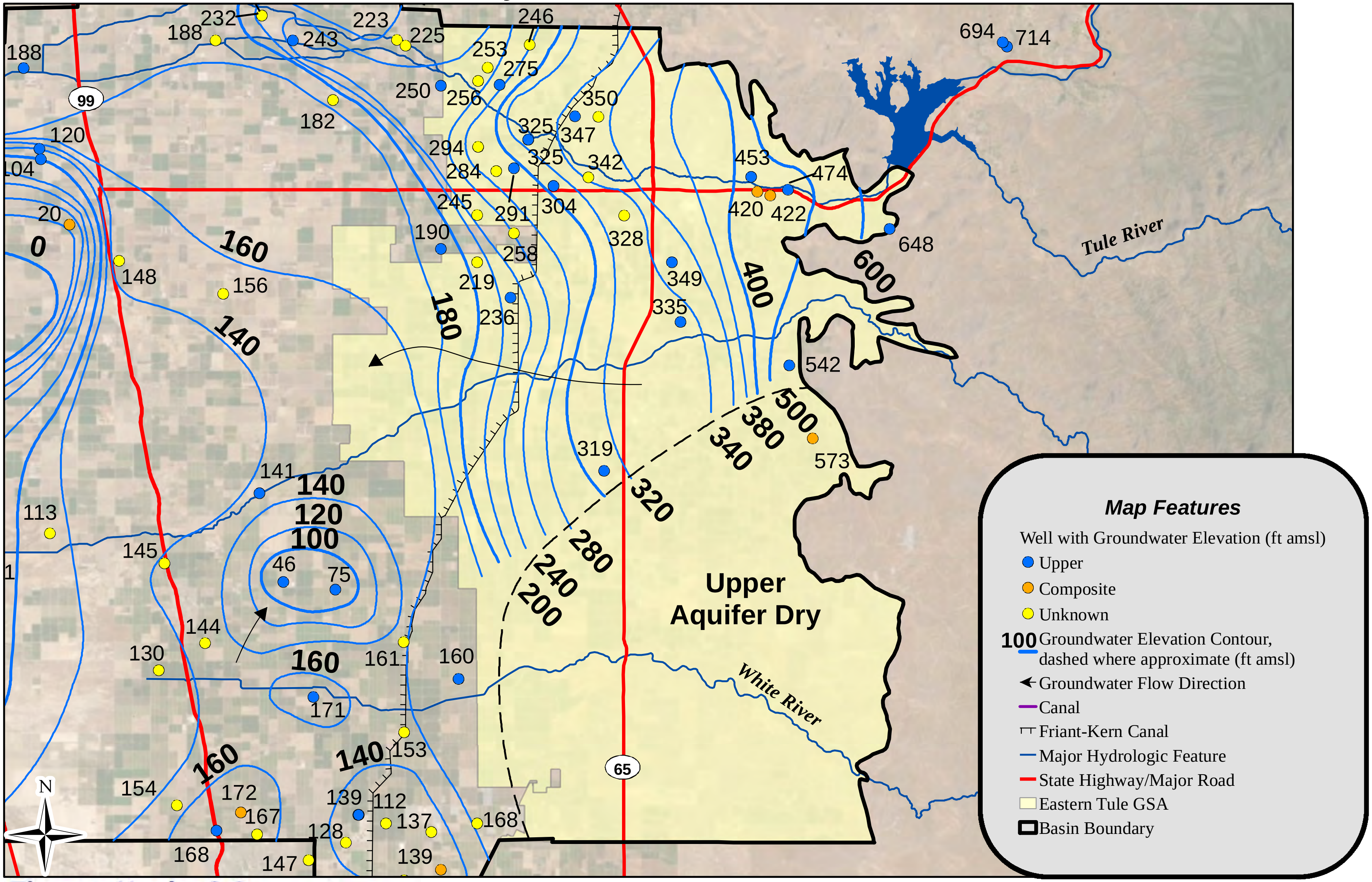
NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
Eastern Tule GSA

Appendix B
Figure 11

Tule Subbasin Technical Advisory Committee



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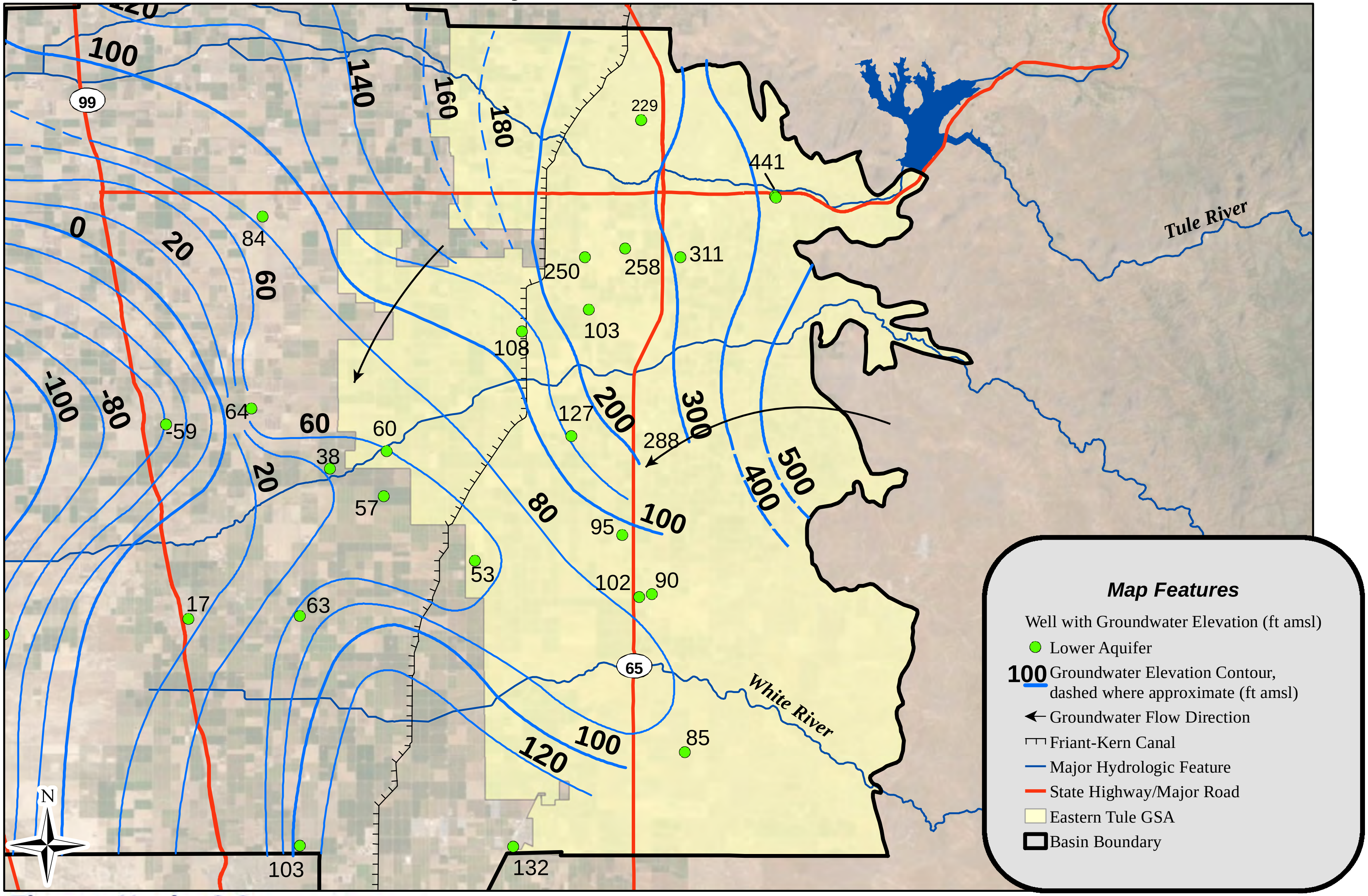
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Eastern Tule GSA
Appendix B
Figure 12



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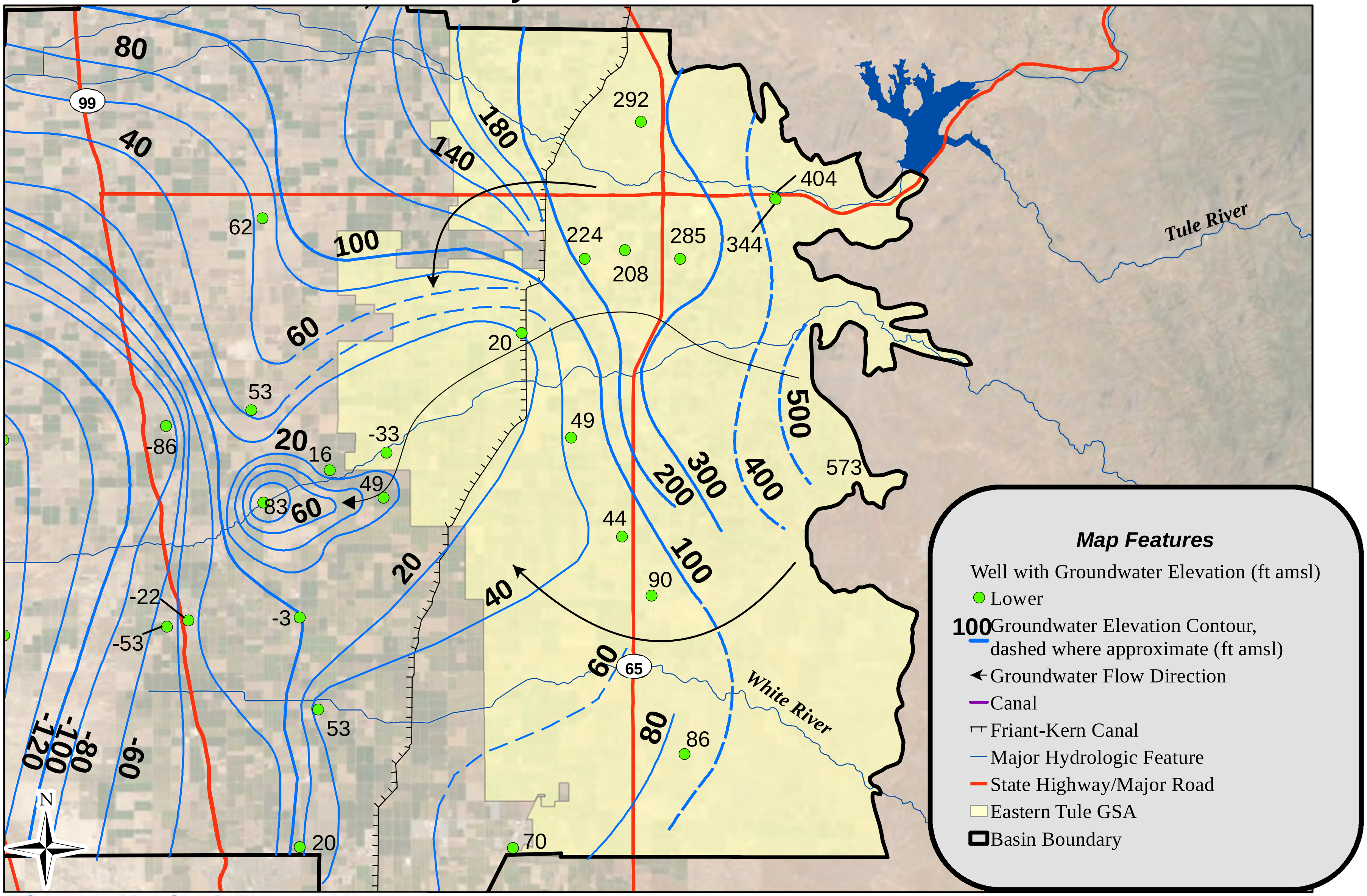
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer
Eastern Tule GSA
Appendix B
Figure 13



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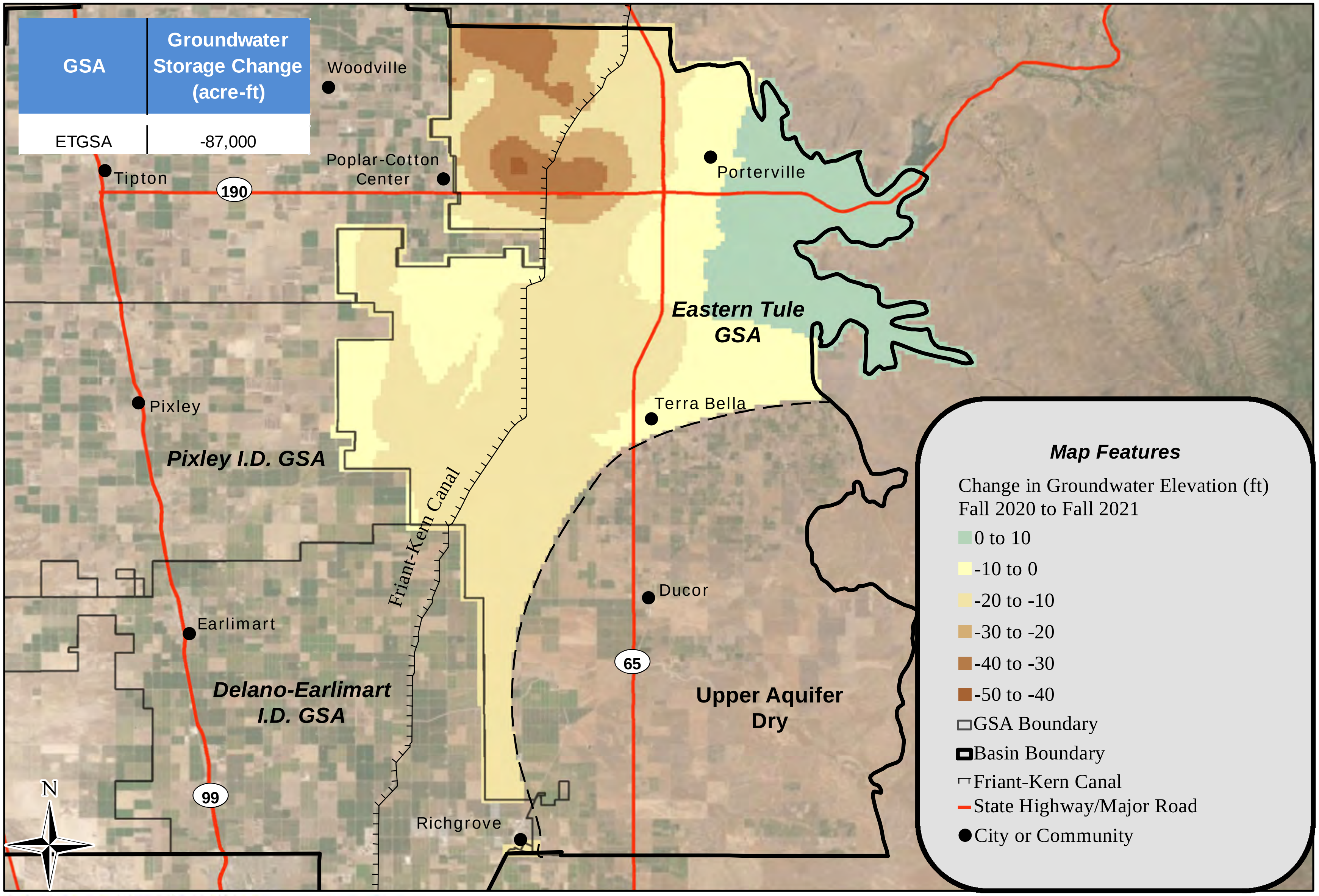
NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Lower Aquifer Eastern Tule GSA

Appendix B
Figure 14



GSA	Groundwater Storage Change (acre-ft)
ETGSA	-87,000

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Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - Eastern Tule GSA

0 1 2 4
Miles
NAD 83 State Plane Zone 4

Appendix B
Figure 15

Appendix C

Delano-Earlimart Irrigation District GSA 2020/21 Annual Data

Delano-Earlimart Irrigation District GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
DEID GSA	DEID	96,000	0	0	96,000
	Western	16,000	0	0	16,000
	Richgrove CSD	0	870	0	870
	Earlimart PUD	0	2,930	0	2,930
	Total	***112,000***	***3,800***	***0***	***115,800***

Delano-Earlimart Irrigation District GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
DEID GSA	DEID	0	53,800	0	0	15,900	69,700
	Western	0	0	0	0	1,900	1,900
	Richgrove CSD	0	0	0	0	100	100
	Earlimart PUD	0	0	0	0	300	300
	Total	***0***	***53,800***	***0***	***0***	***18,200***	***72,000***

Delano-Earlimart Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
DEID GSA	DEID	96,000	69,700	165,700
	Western	16,000	1,900	17,900
	Richgrove CSD	870	100	970
	Earlimart PUD	2,930	300	3,230
	Total	***115,800***	***72,000***	***187,800***

Delano-Earlimart Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

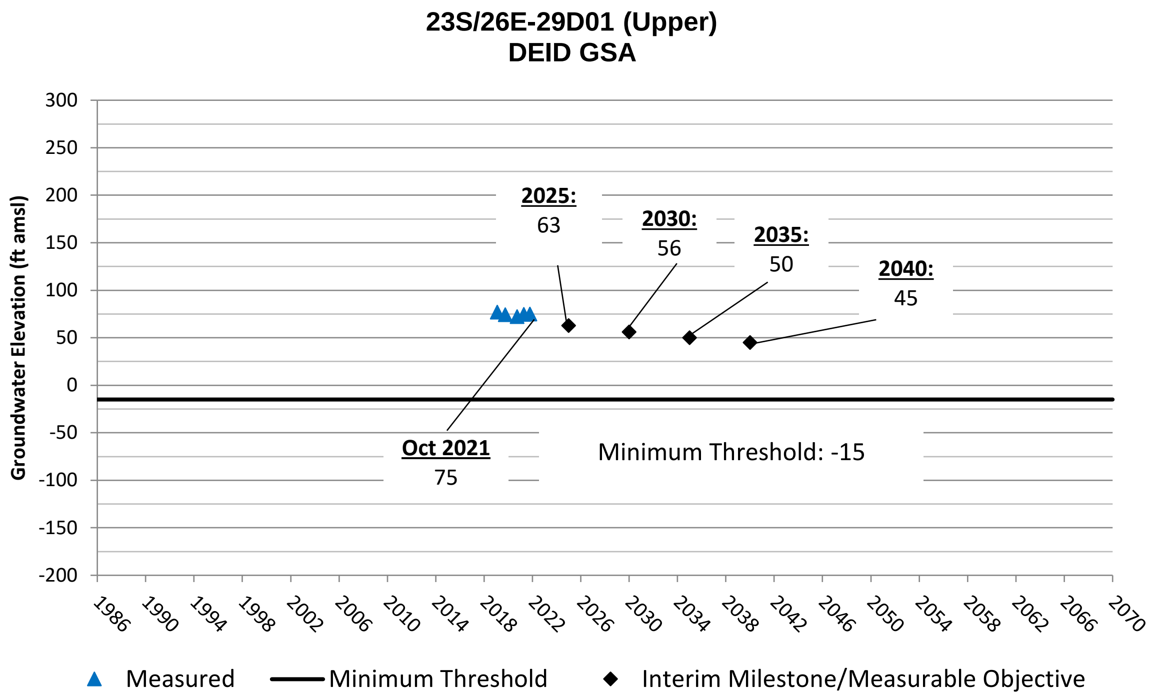
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
D0012_B_RMS	267.1	266.8	263.3	262.1
D0030_B_RMS	272.8	272.3	270.3	269.2
D0031_B_RMS	296.7	296.2	294.9	293.9
D0032_B_RMS	316.7	316.6	316.7	315.7
D0033_B_RMS	366.1	365.6	365.1	364.0
D0034_B_RMS	340.8	340.0	338.8	337.8
D0070_B_FKC	389.4	389.0	389.2	388.2
D0071_B_FKC	N/A	N/A	N/A	N/A
D0072_B_FKC	N/A	N/A	N/A	N/A
D0073_G_FKC	406.2	405.9	405.0	404.0
D0074_B_FKC	415.5	415.3	413.8	412.8
D0075_B_FKC	403.2	402.9	401.7	400.7
D0076_B_FKC	408.9	408.2	408.4	407.4
D0077_B_FKC	401.9	401.6	401.4	400.4
D0078_B_FKC	406.1	405.6	405.6	404.6
D0079_G_FKC	407.1	407.4	406.9	405.9
D0080_B_FKC	433.1	432.9	432.5	431.5
D0081_B_FKC	399.5	399.4	399.3	398.3
D0082_B_FKC	423.4	423.4	423.1	422.1
D0083_B_FKC	419.5	419.4	418.8	417.8
D0084_B_FKC	407.3	407.0	405.9	404.9
D0085_B_RMS	480.6	480.5	480.6	479.6
D0086_B_RMS	447.7	447.3	447.7	446.2
D0089_B_RMS	498.2	498.1	497.3	496.3

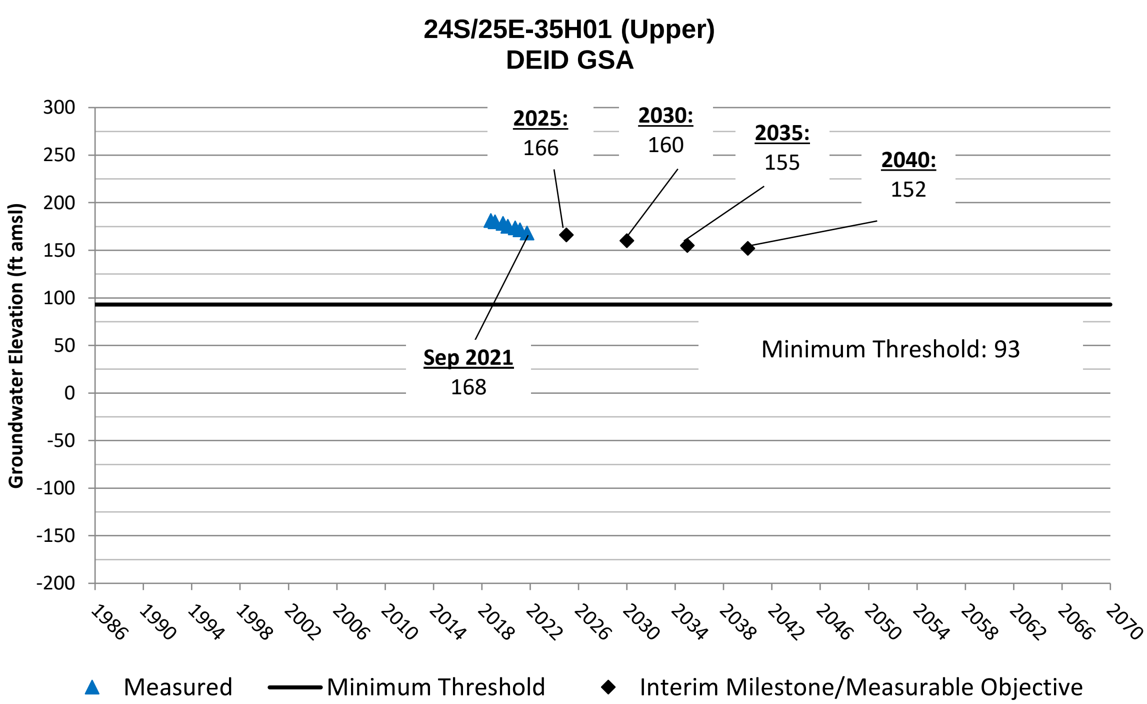
Notes:

N/A = Not available

[1] Benchmarks surveyed in July and August of each year.

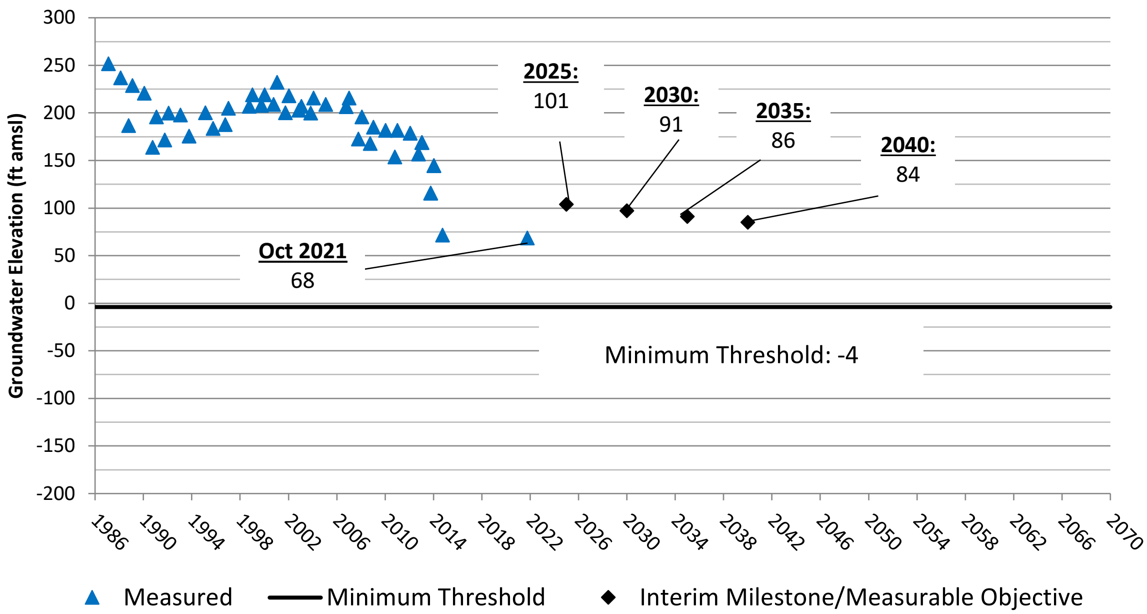
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



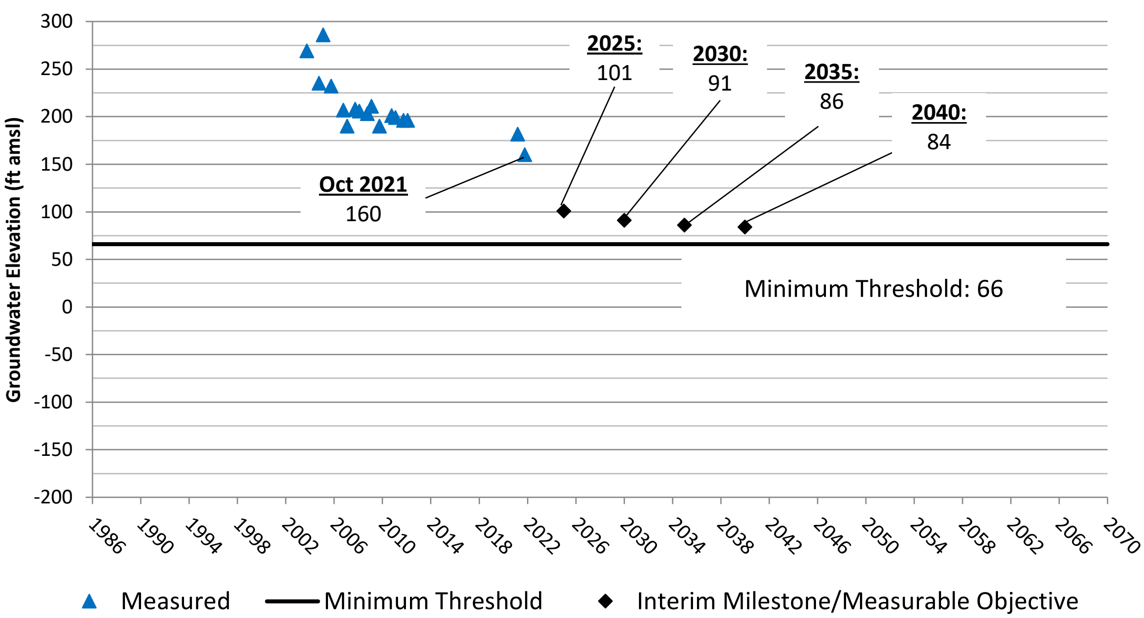


Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs

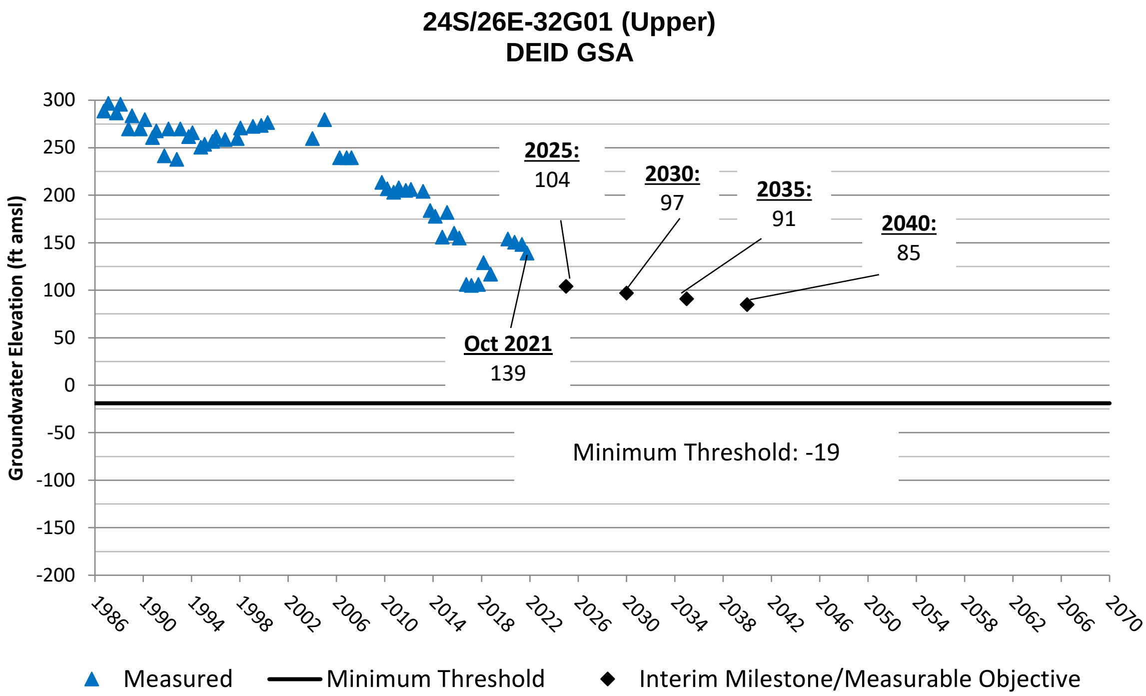
24S/26E-04P01 (Upper)
DEID GSA

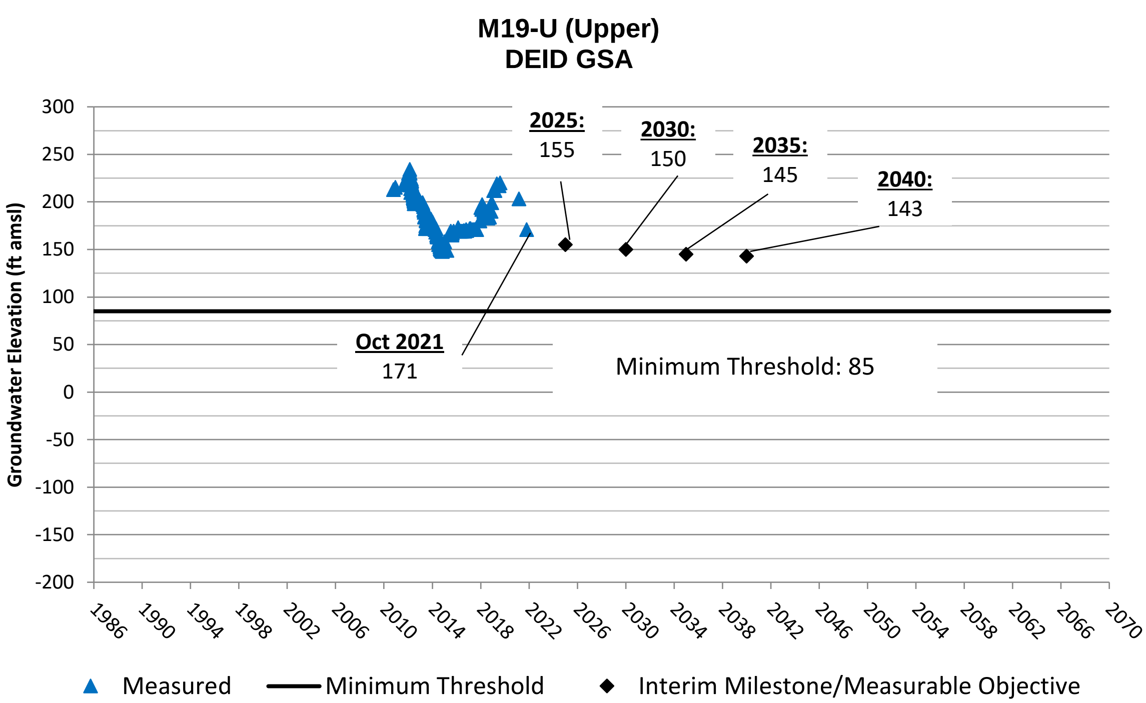


24S/26E-11 (Upper)
DEID GSA

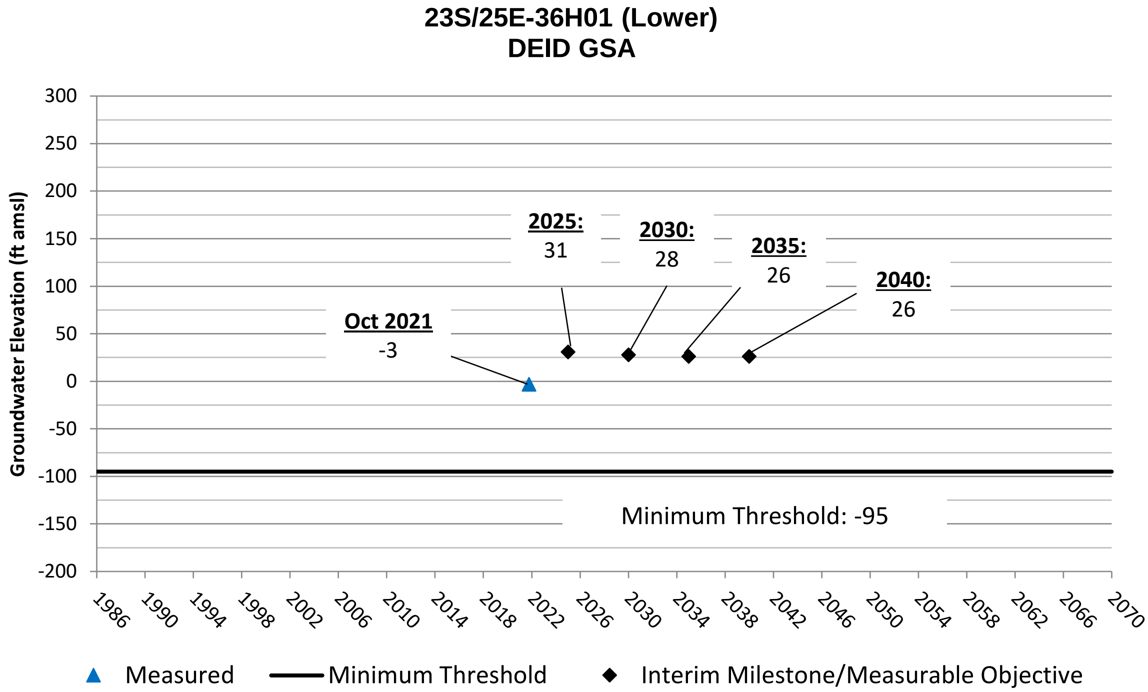


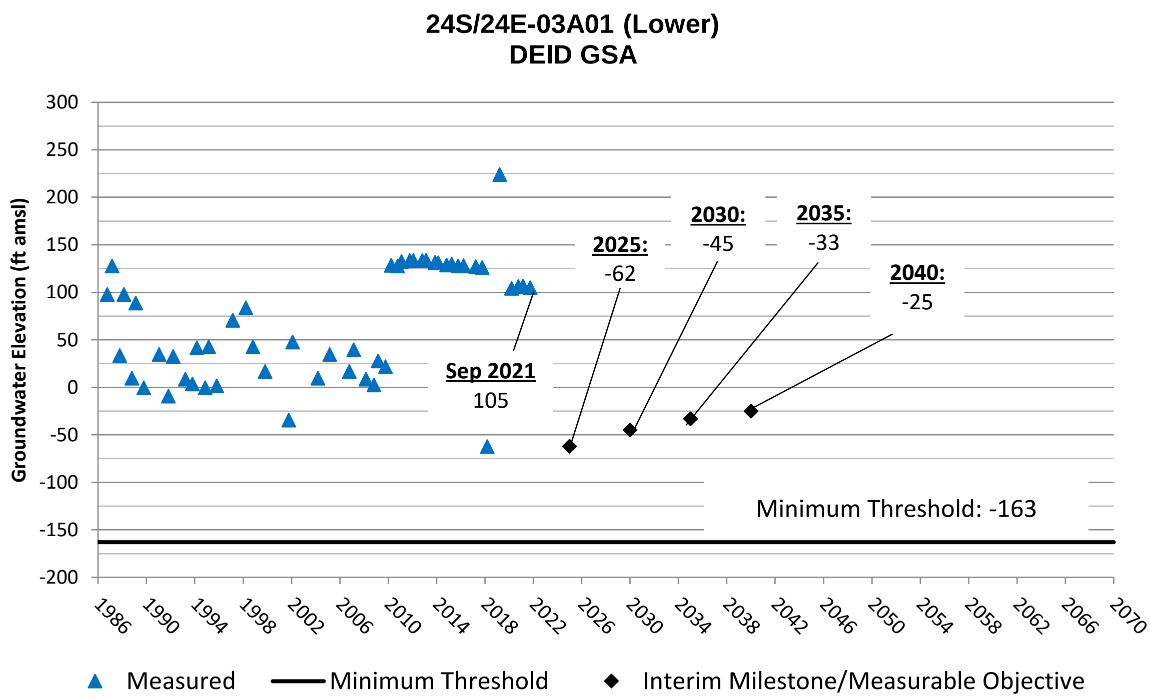
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



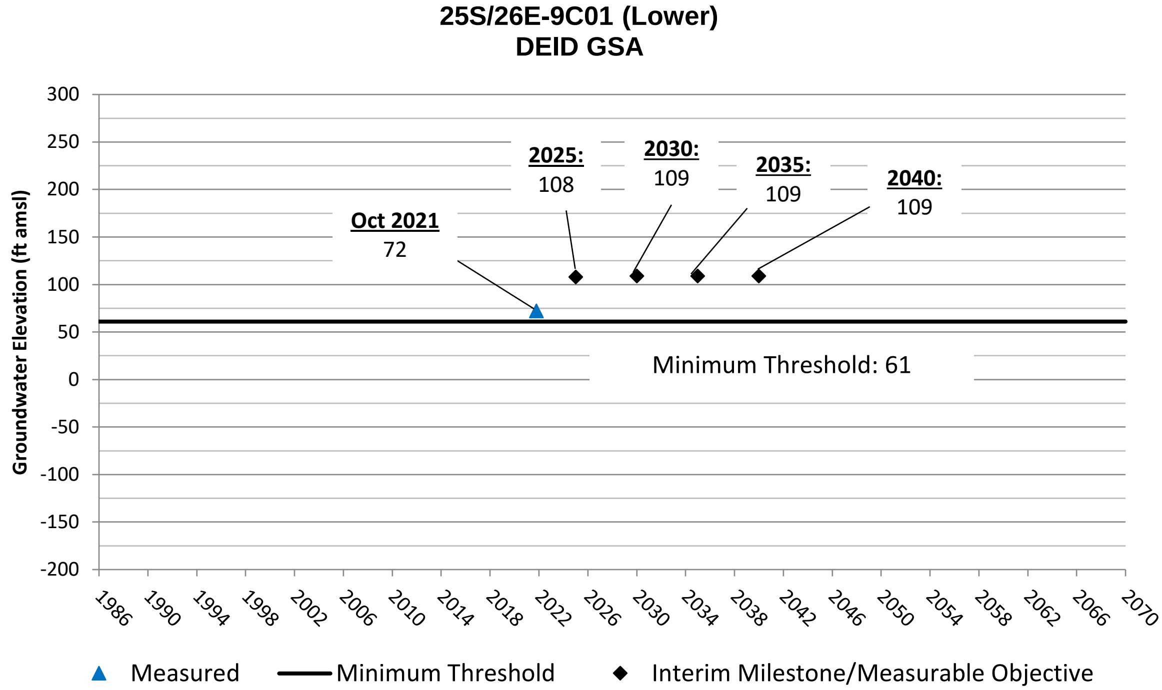


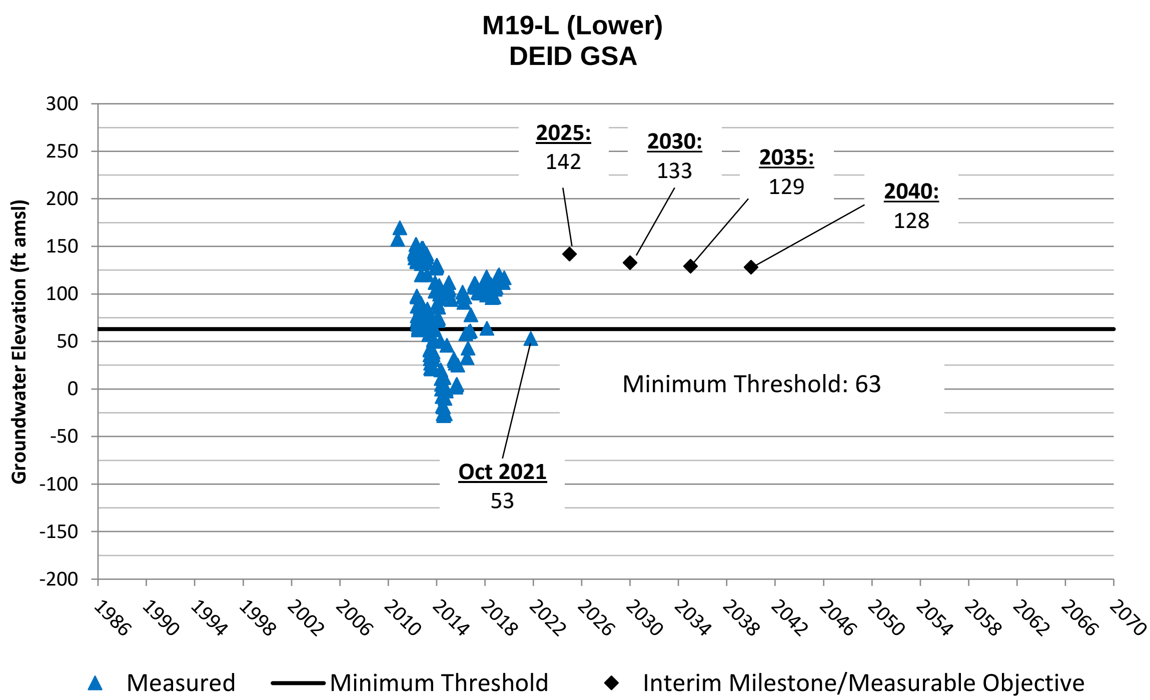
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



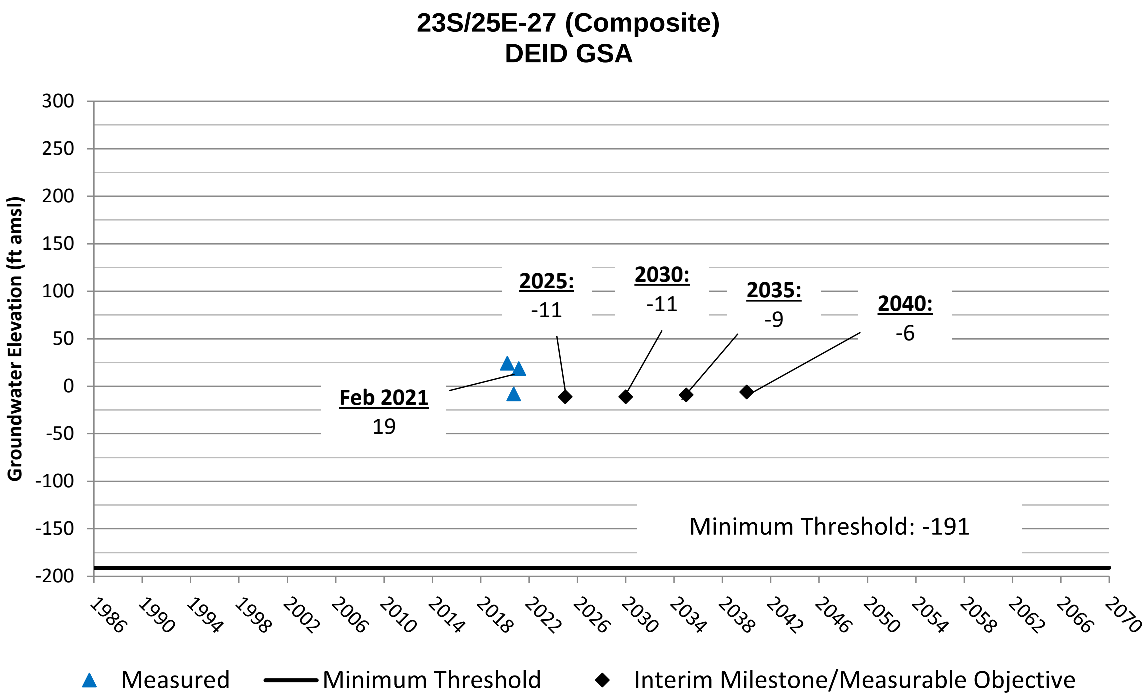


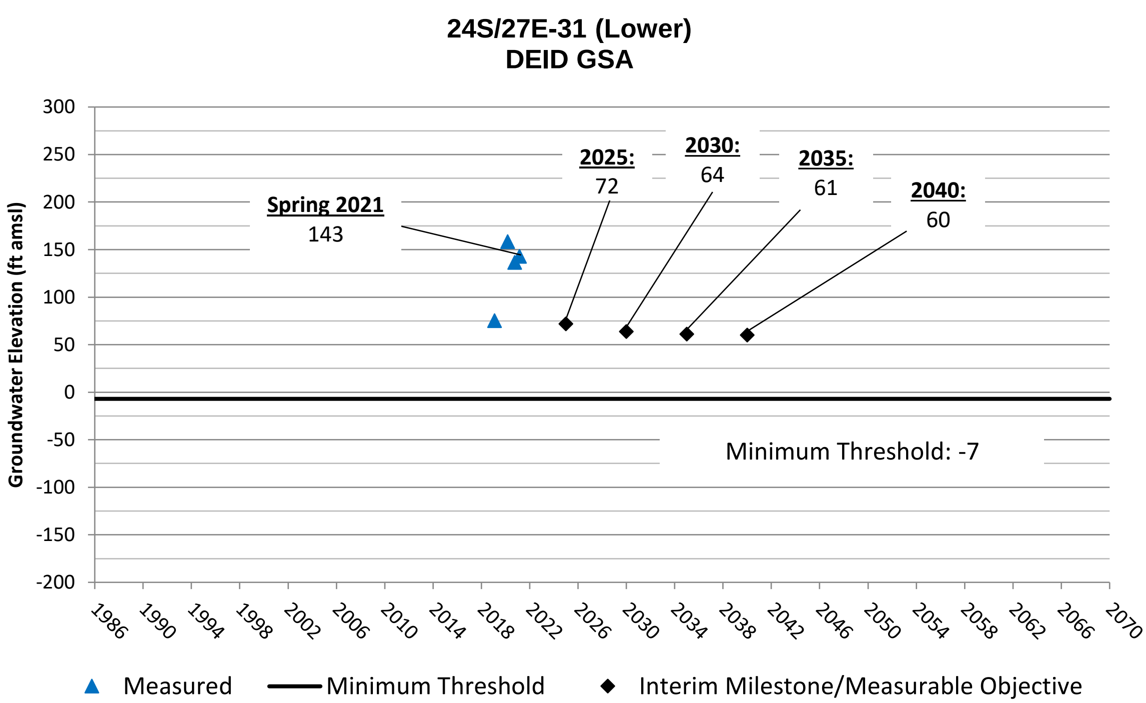
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



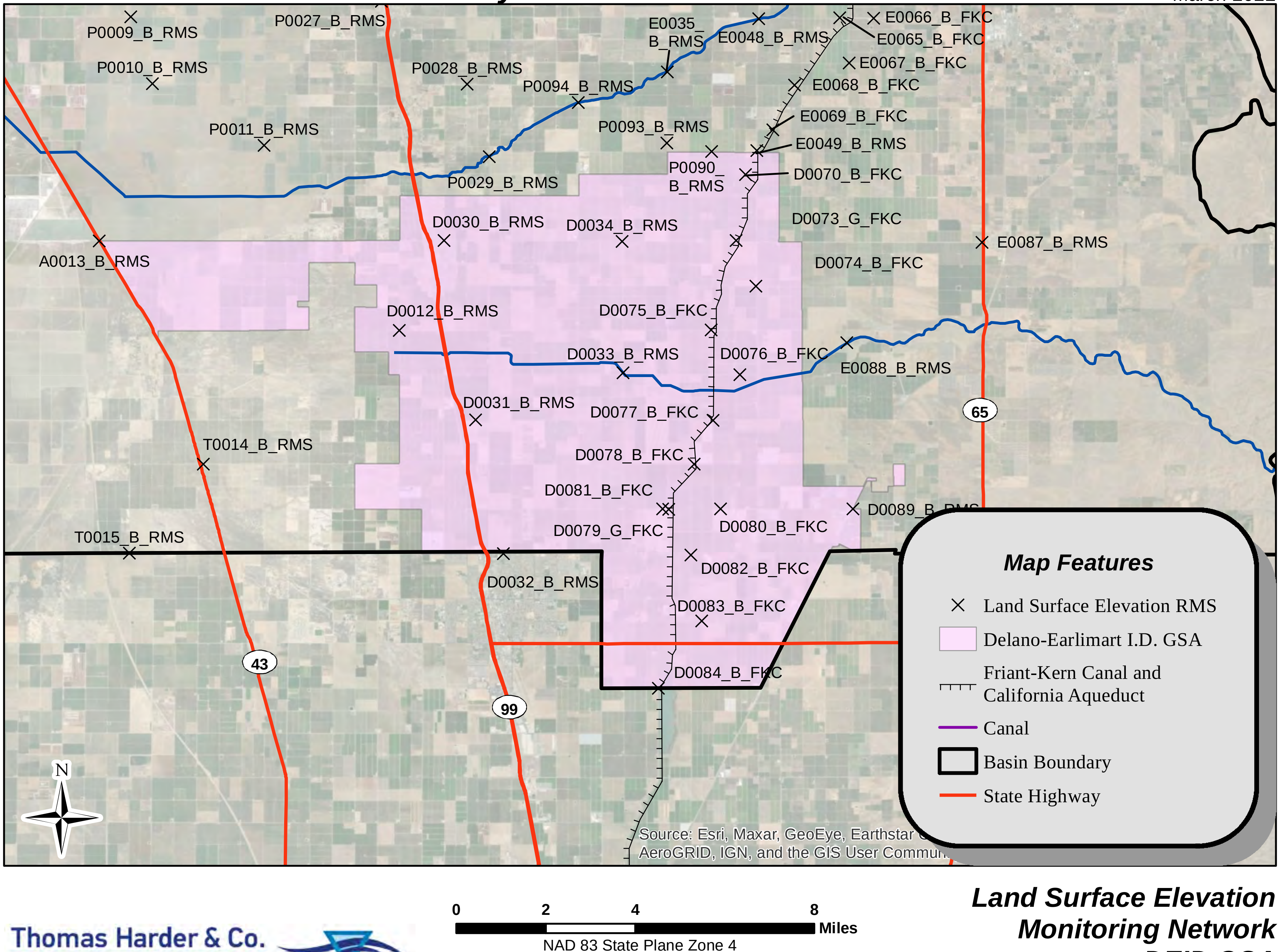


Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Tule Subbasin Technical Advisory Committee



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Land Surface Elevation Monitoring Network DEID GSA

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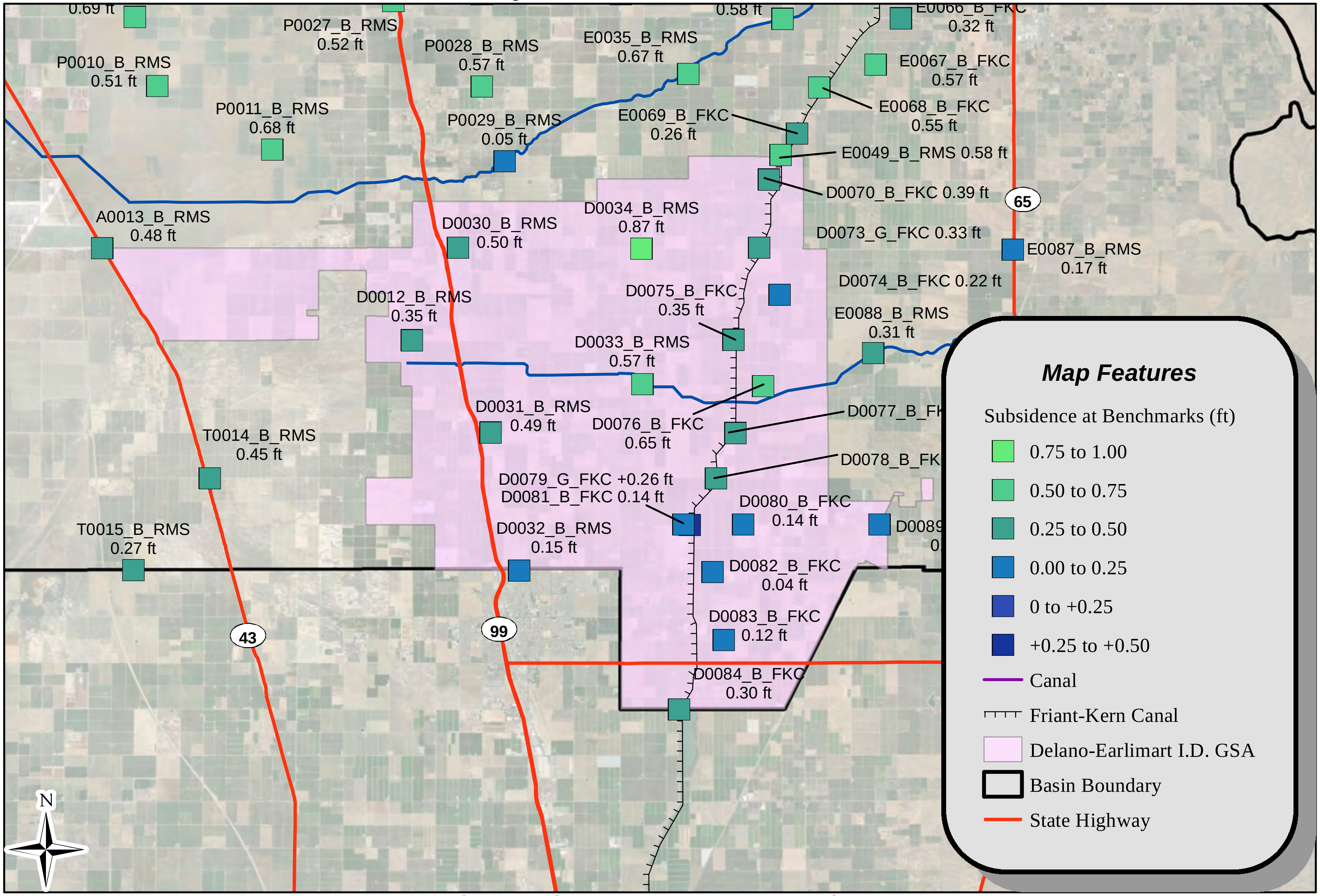
Figure 7

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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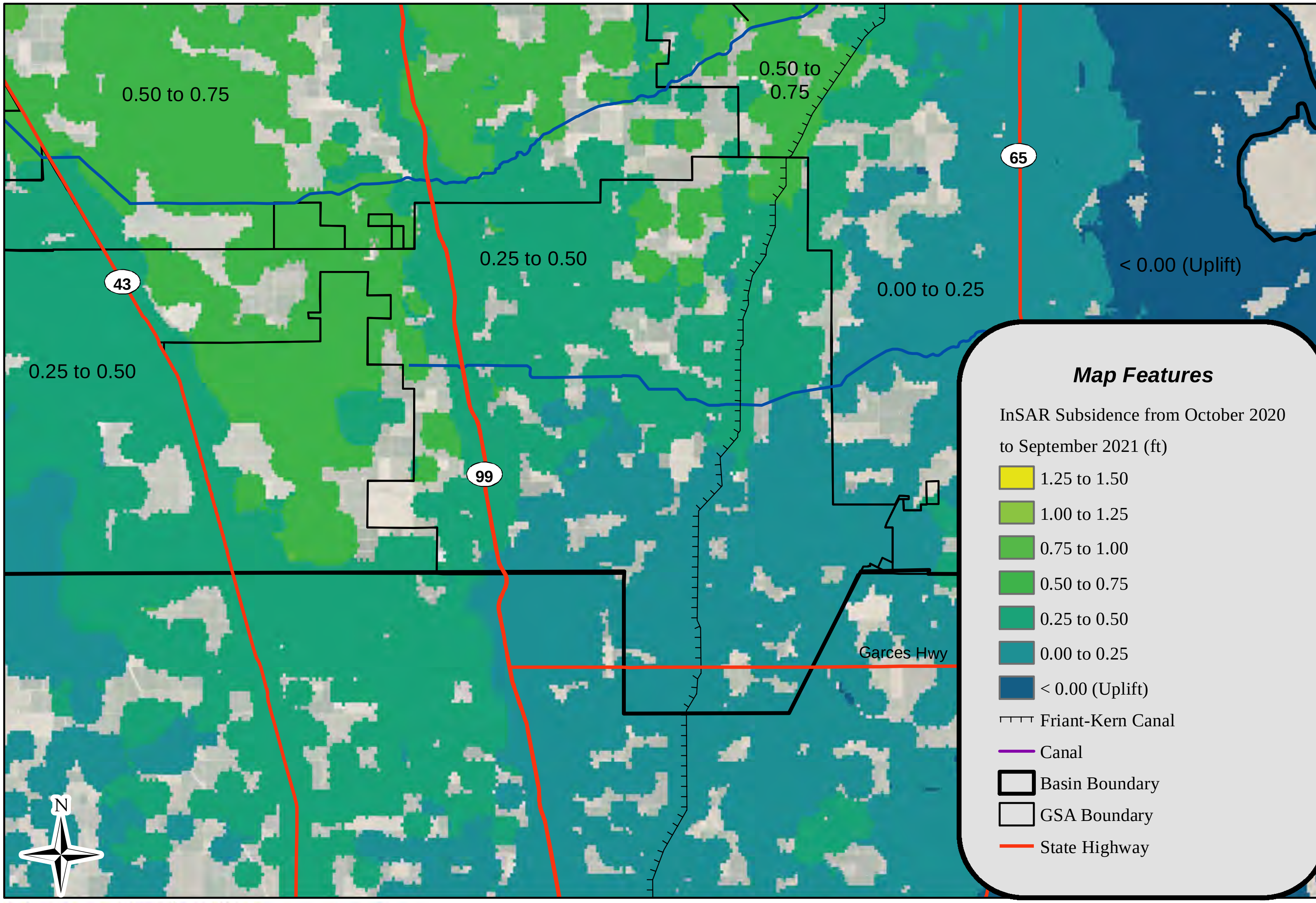
Groundwater Consulting

NAD 83 State Plane Zone 4

July 2020 to July 2021
Benchmarks Land Subsidence
DEID GSA
Appendix C
Figure 8



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Groundwater Consulting

InSAR data from:
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and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

0 1.25 2.5 5 Miles
NAD 83 State Plane Zone 4

Land Subsidence - October 2020 to September 2021
DEID GSA
Appendix C
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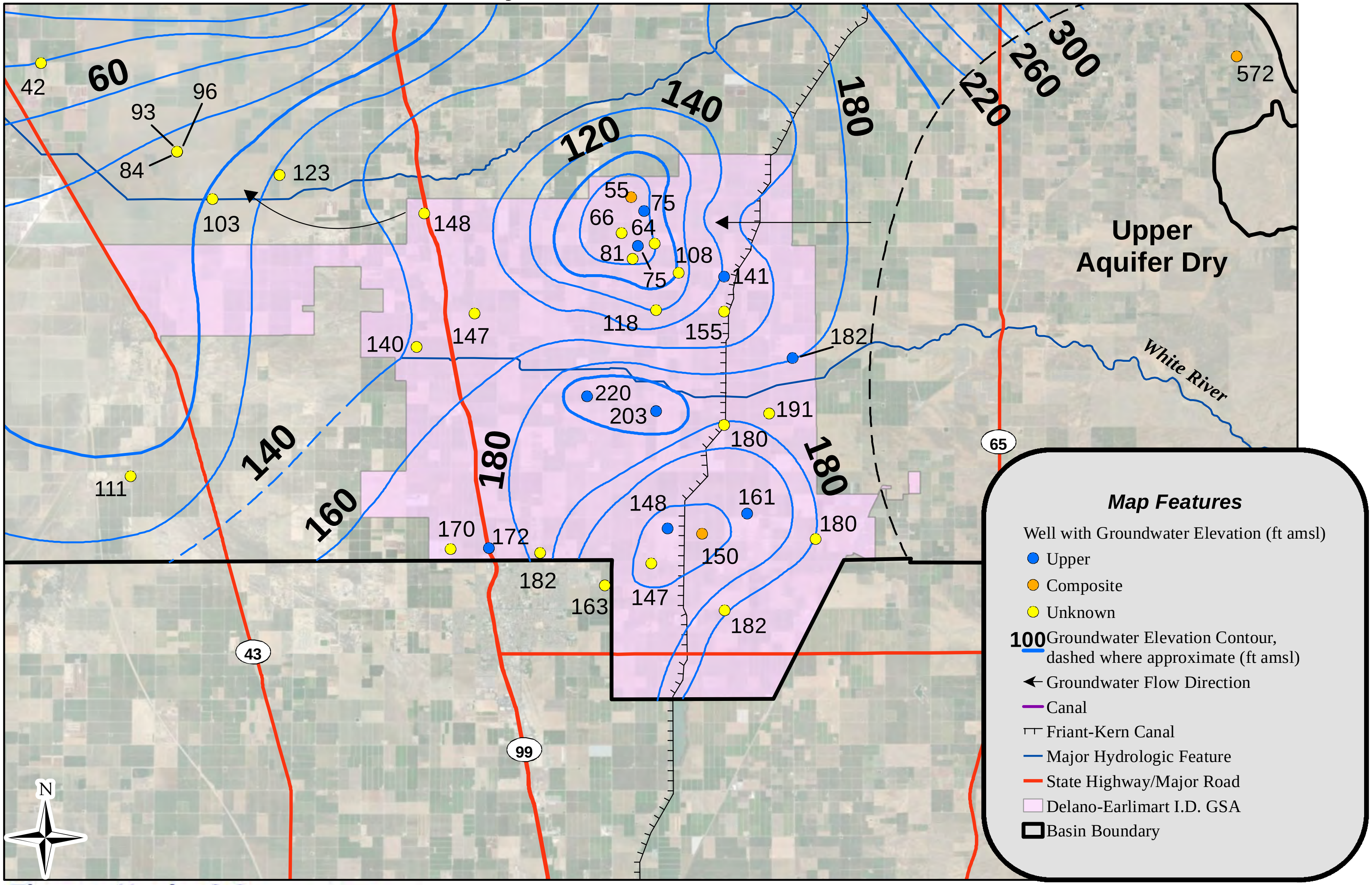
Tule Subbasin Technical Advisory Committee



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NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
DEID GSA
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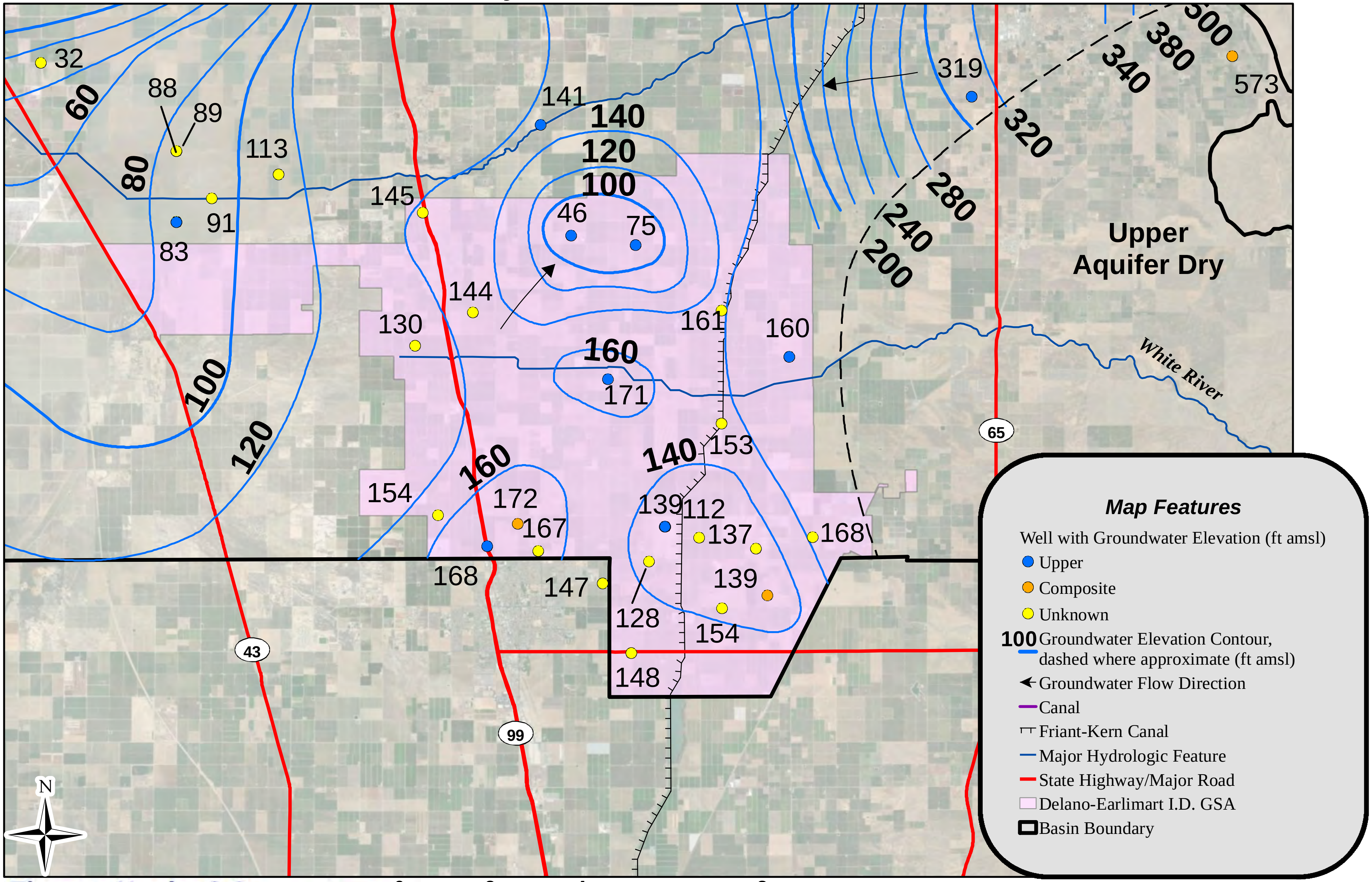

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0 2 4 8 Miles

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer

DEID GSA

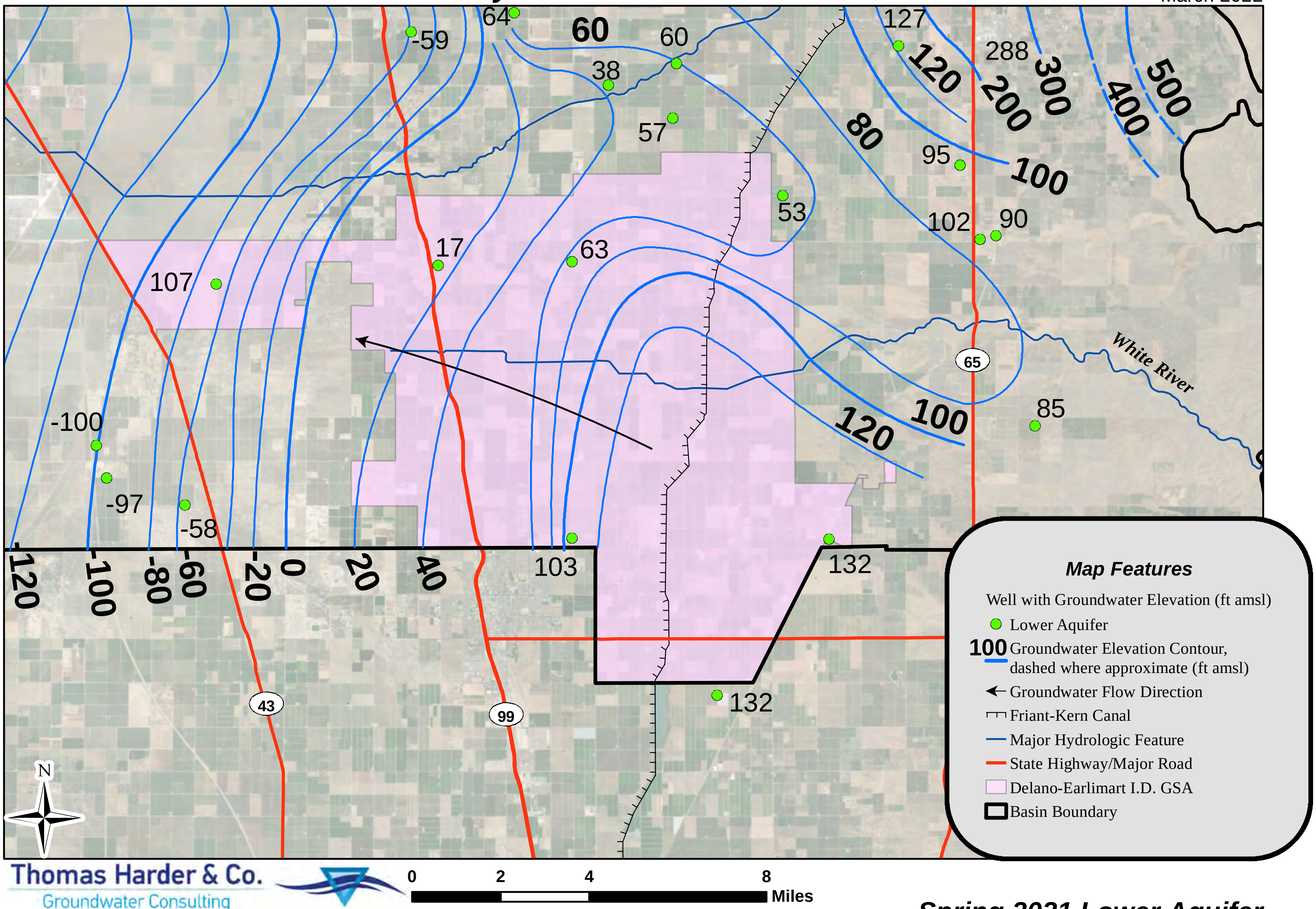
Appendix C

Figure 11

2020/2021 Annual Report

March 2022

Tule Subbasin Technical Advisory Committee



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NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer
DEID GSA
Appendix C
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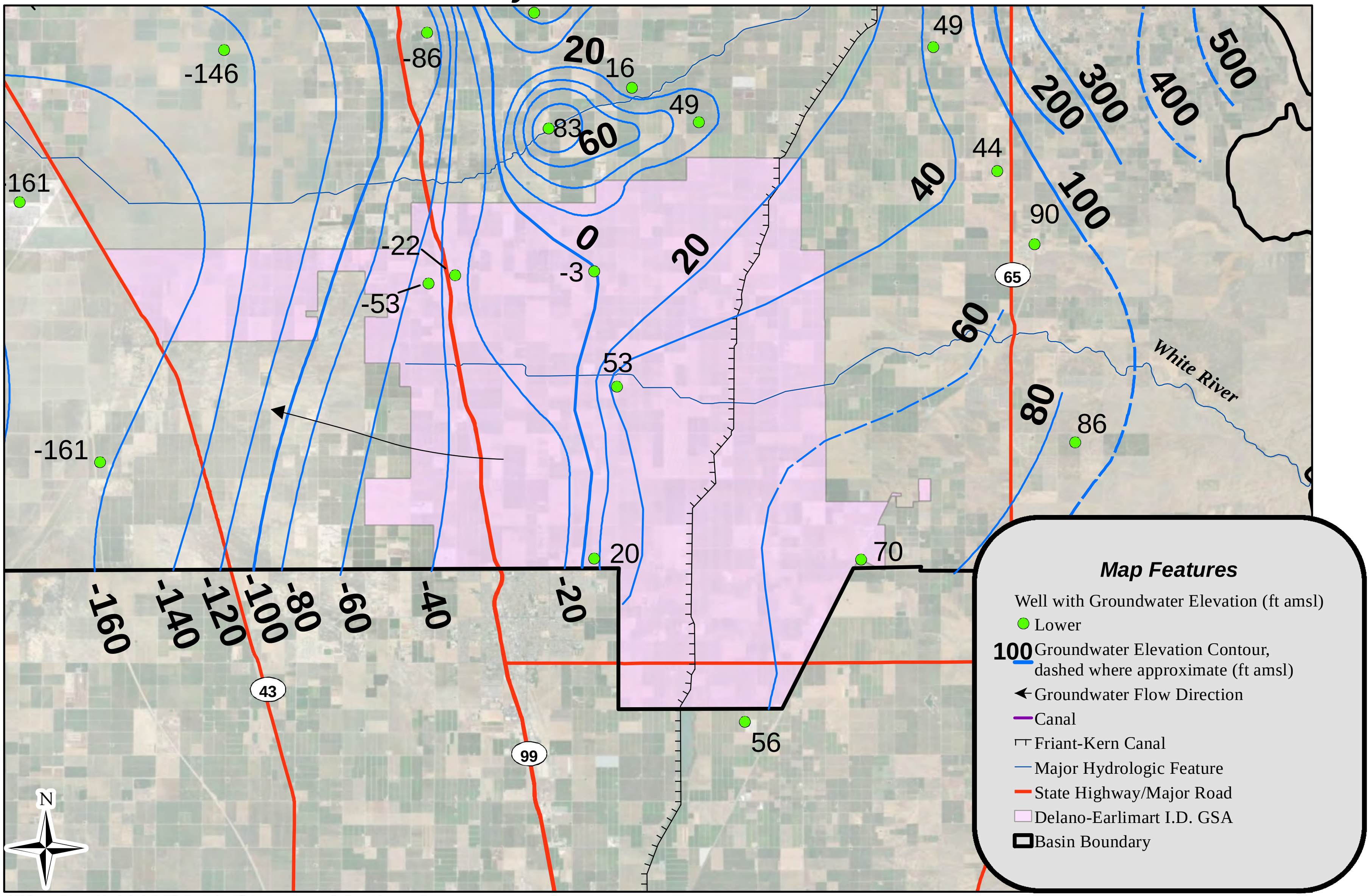
Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Lower Aquifer
DEID GSA
Appendix C
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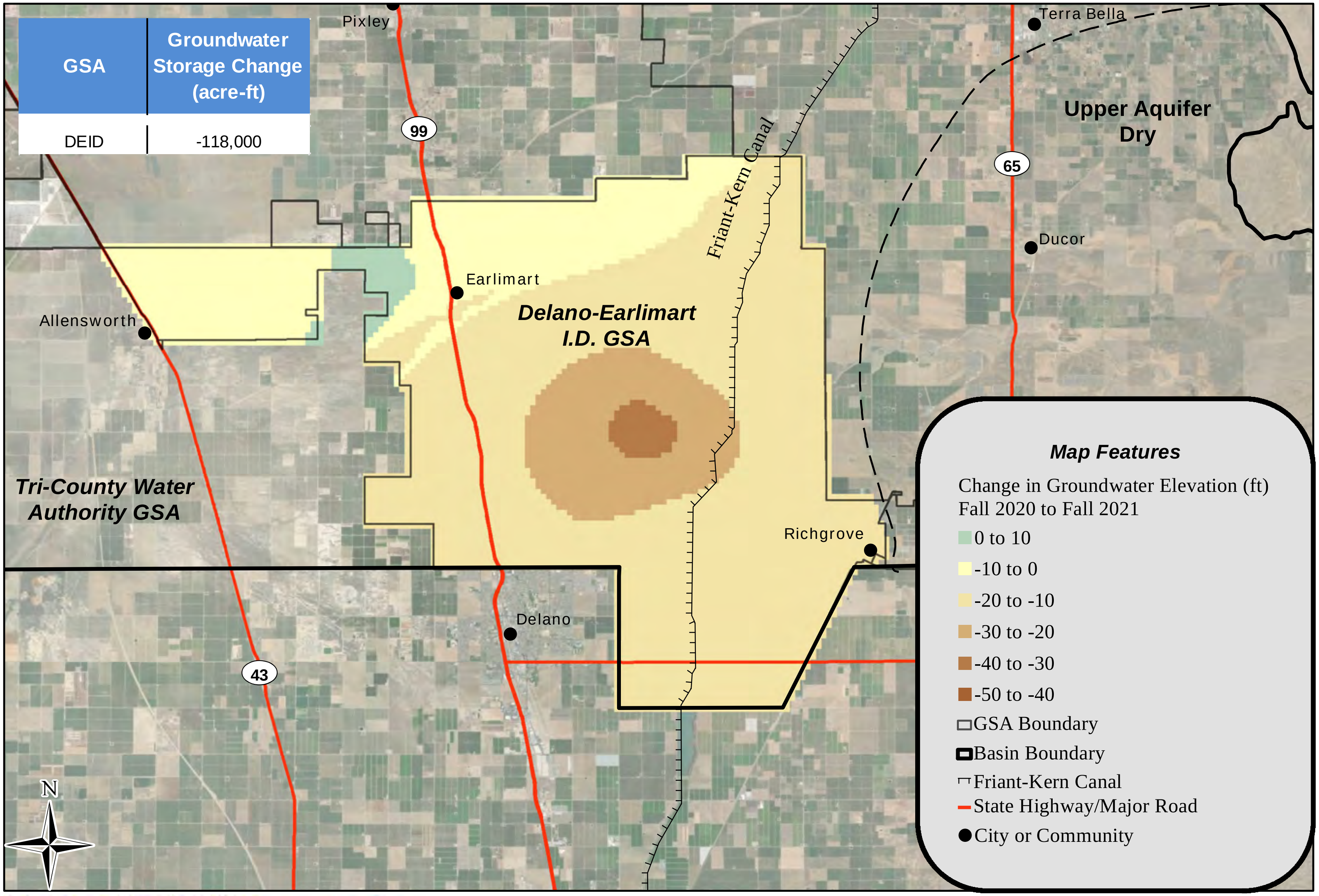
GSA	Groundwater Storage Change (acre-ft)
DEID	-118,000



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Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - DEID GSA

Appendix C
Figure 14

Appendix D

Pixley Irrigation District GSA 2020/21 Annual Data

Pixley Irrigation District GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Pixley ID GSA	Pixley ID	165,000	0	0	165,000
	Pixley PUD	0	610	0	610
	Teviston CSD	0	80	0	80
	Total	***165,000***	***690***	***0***	***165,690***

Pixley Irrigation District GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Pixley ID GSA	Pixley ID	0	0	0	0	17,400	17,400
	Pixley PUD	0	0	220	0	500	720
	Teviston CSD	0	0	0	0	400	400
	Total	***0***	***0***	***220***	***0***	***18,300***	***18,520***

Pixley Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
Pixley ID GSA	Pixley ID	165,000	17,400	182,400
	Pixley PUD	610	720	1,330
	Teviston CSD	80	400	480
	Total	***165,690***	***18,520***	***184,210***

Pixley Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

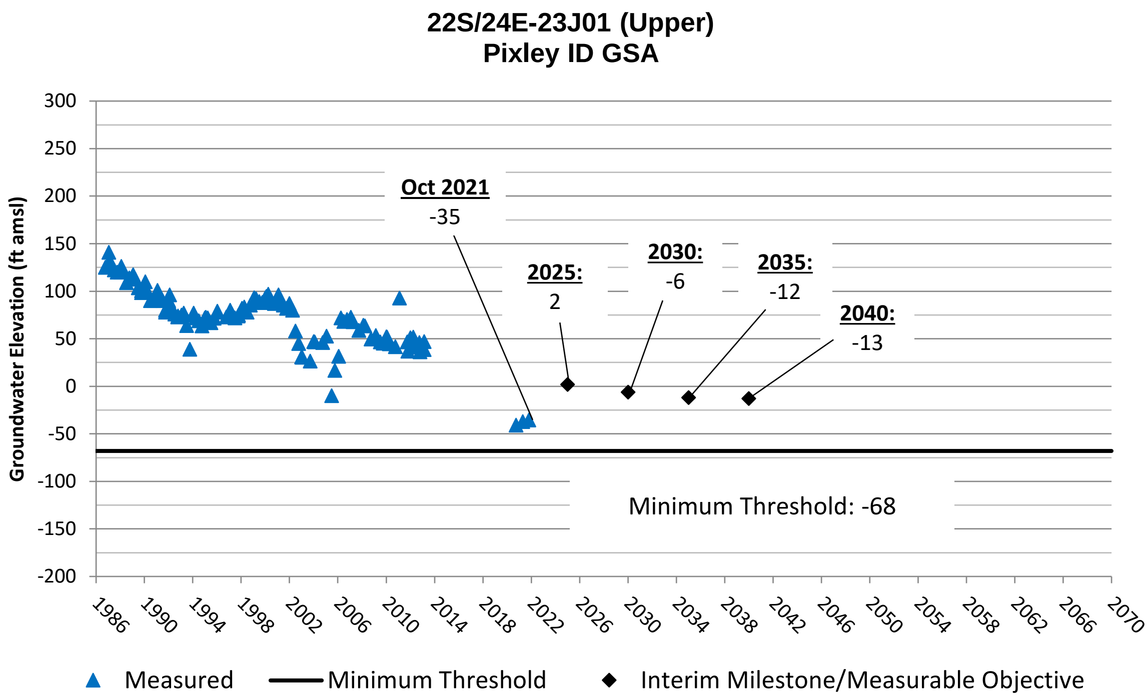
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
P0007_B_RMS	210.0	209.3	203.4	200.6
P0008_B_RMS	229.1	228.6	225.8	223.7
P0009_B_RMS	205.2	204.5	197.8	195.2
P0010_B_RMS	202.4	201.9	195.9	192.8
P0011_B_RMS	218.5	217.8	212.4	210.0
P0025_B_RMS	273.4	273.0	270.6	269.6
P0026_B_RMS	277.2	276.4	276.0	274.9
P0027_B_RMS	255.3	254.8	253.1	252.1
P0028_B_RMS	278.0	277.4	276.9	275.9
P0029_B_RMS	283.5	283.5	282.2	280.9
P0036_B_RMS	323.6	323.1	322.1	321.1
P0037_B_RMS	324.6	324.1	323.0	322.0
P0090_B_RMS	N/A	386	N/A	N/A
P0091_B_RMS	N/A	225	N/A	N/A
P0093_B_RMS	N/A	350	N/A	N/A
P0094_B_RMS	N/A	311	N/A	N/A

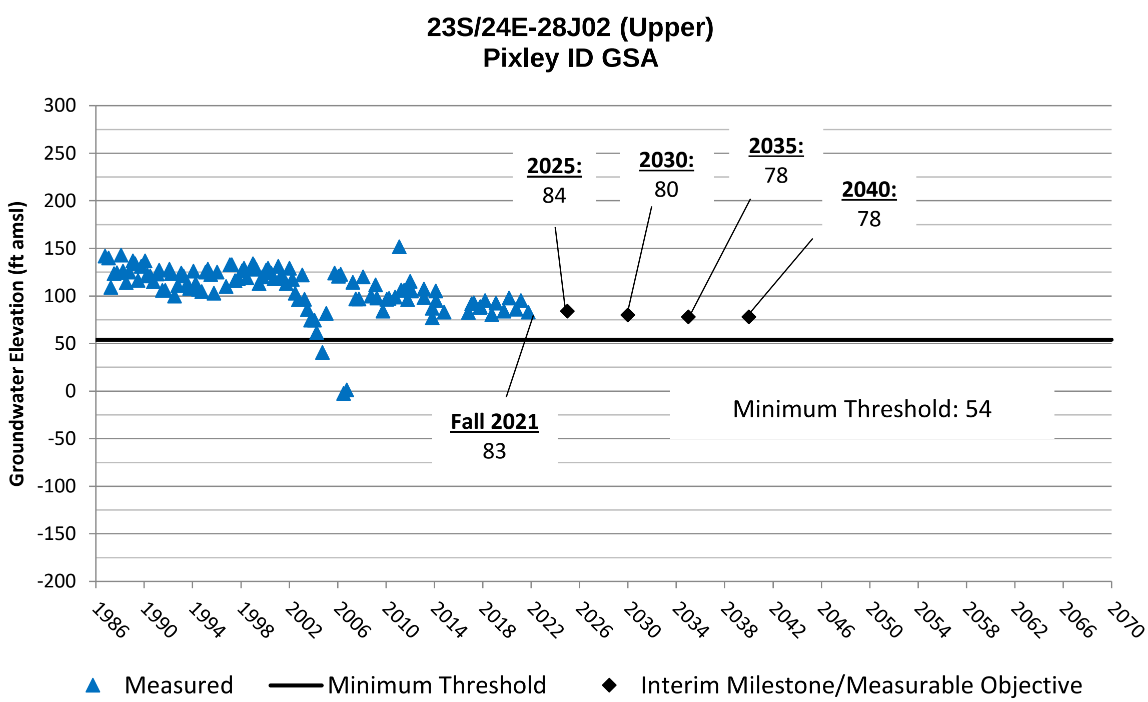
Note:

N/A = Not available

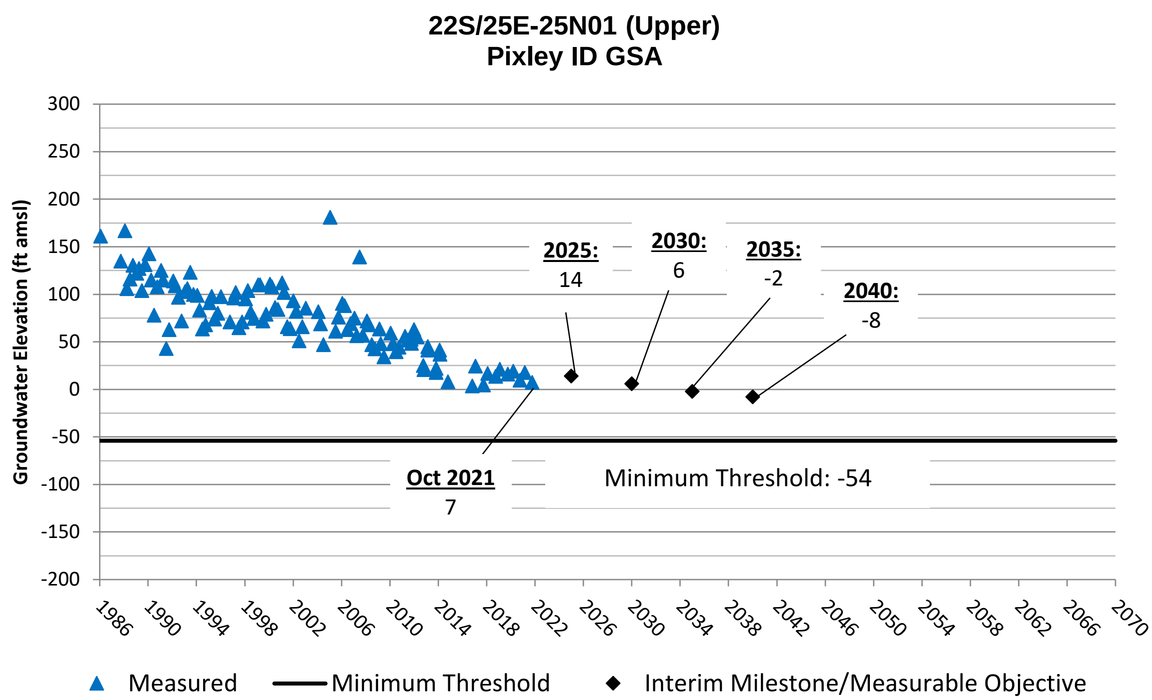
[1] Benchmarks surveyed in July and August of each year.

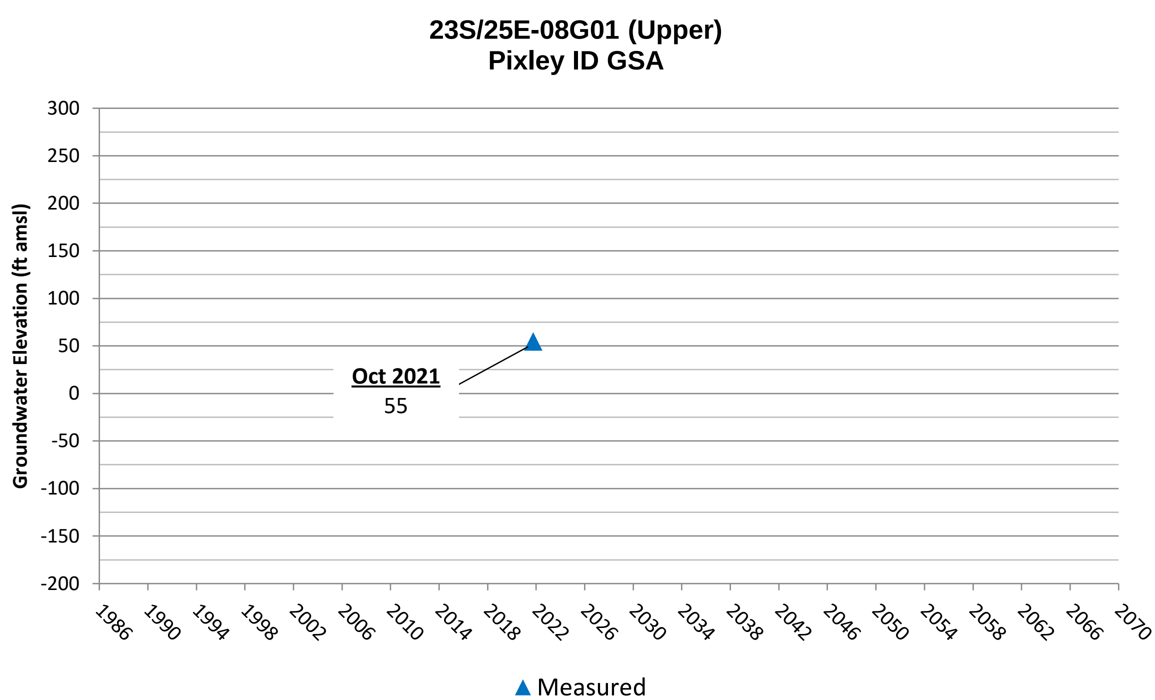
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



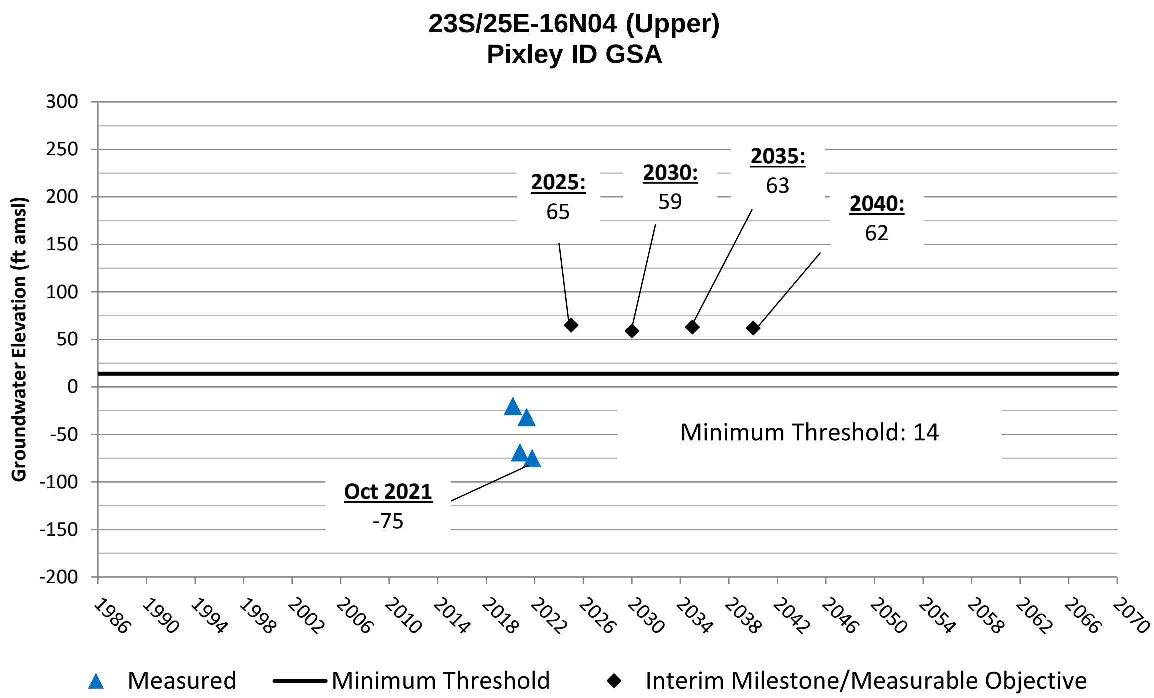


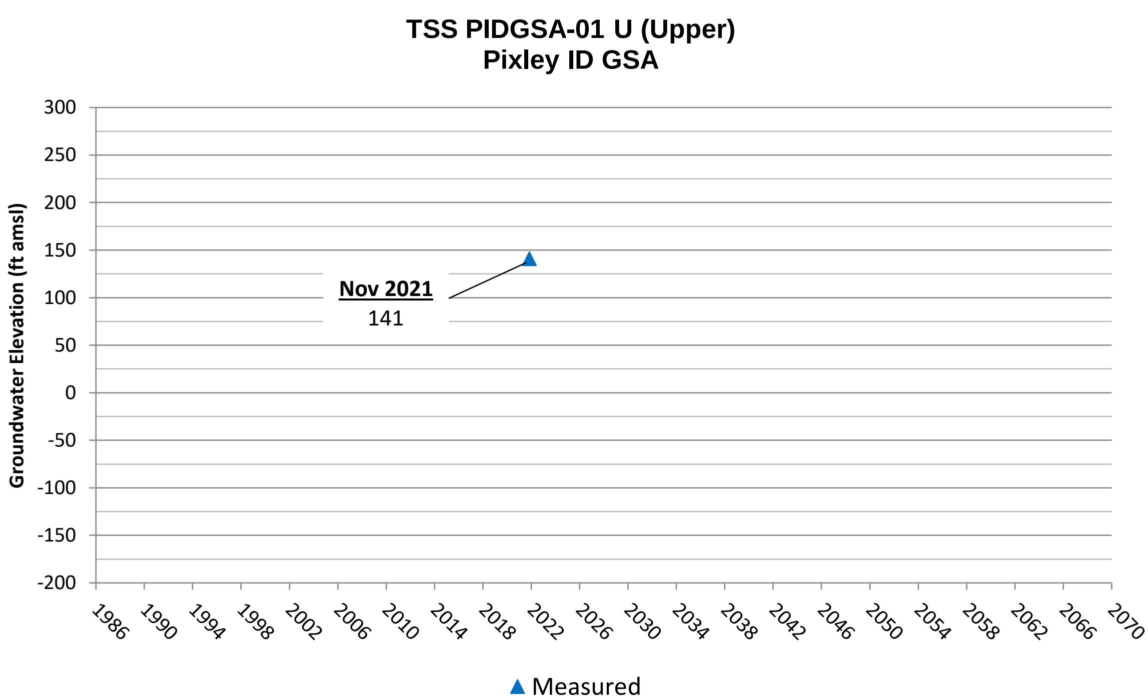
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



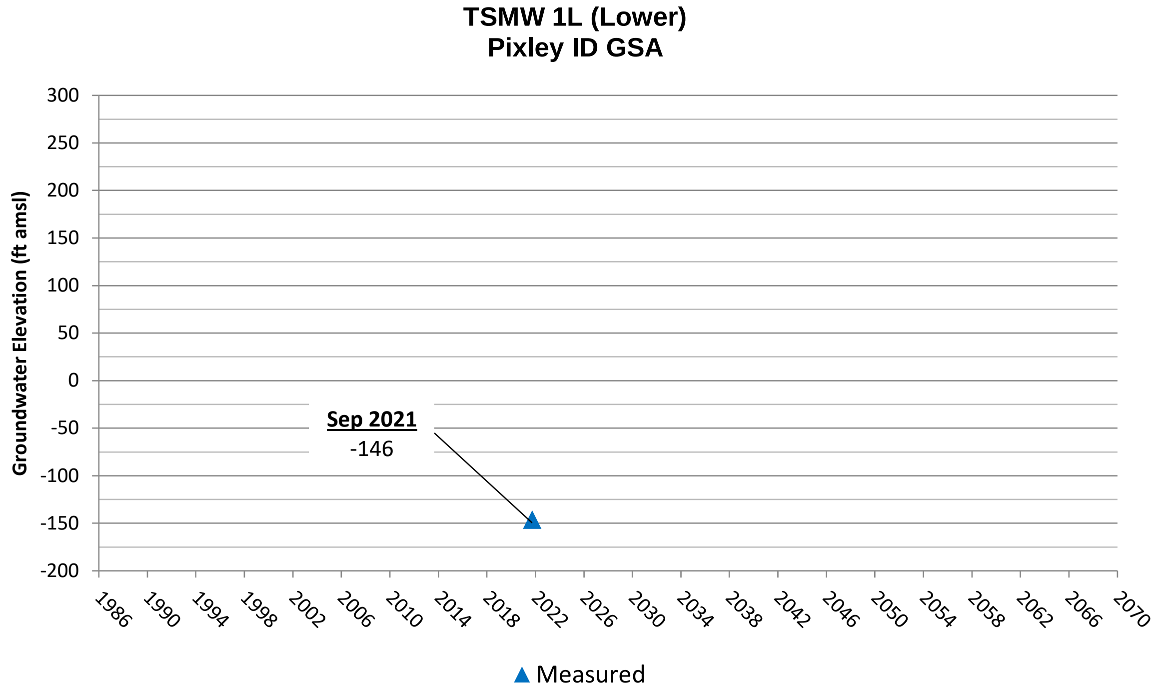


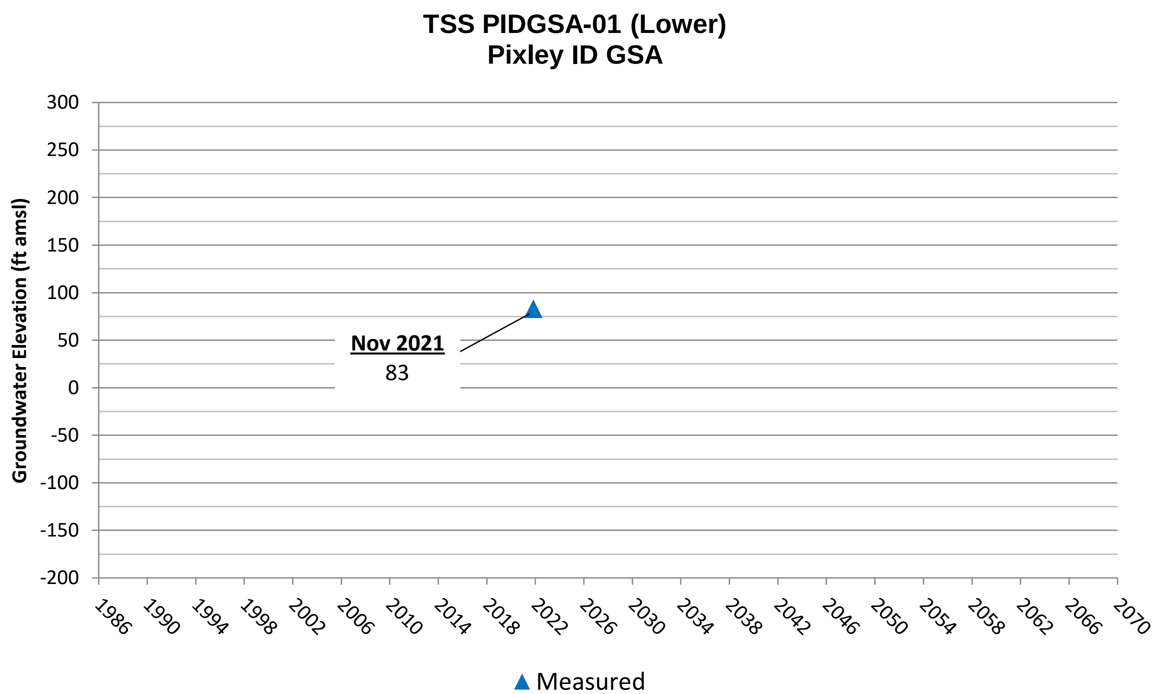
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



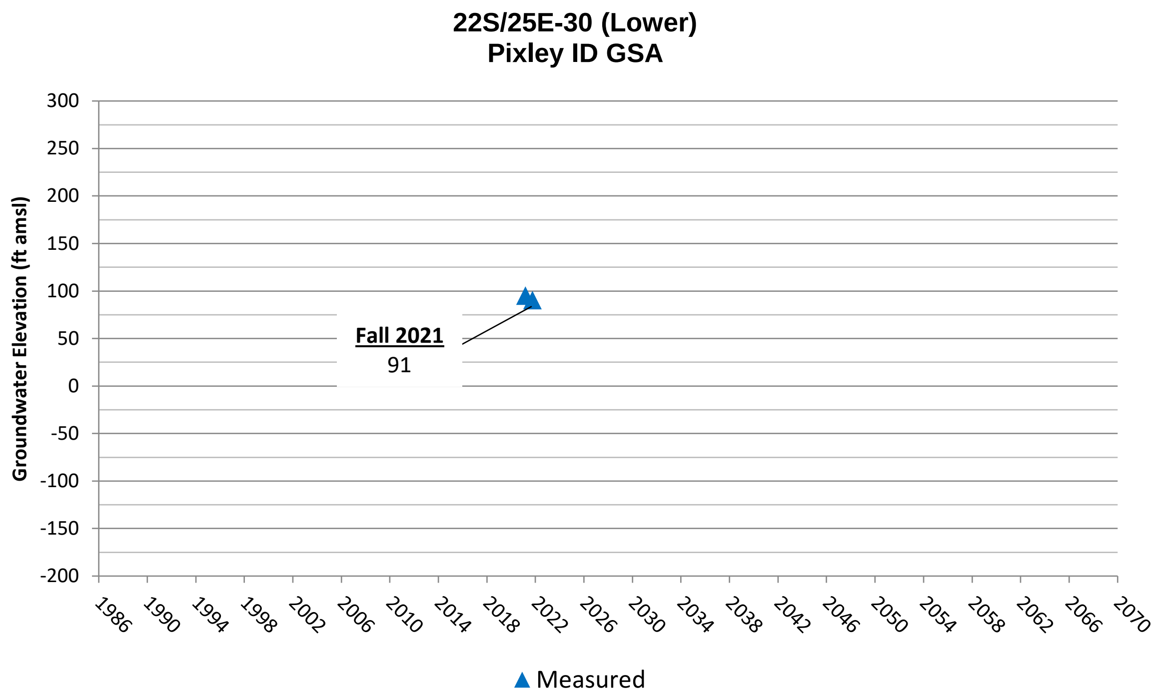


Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs





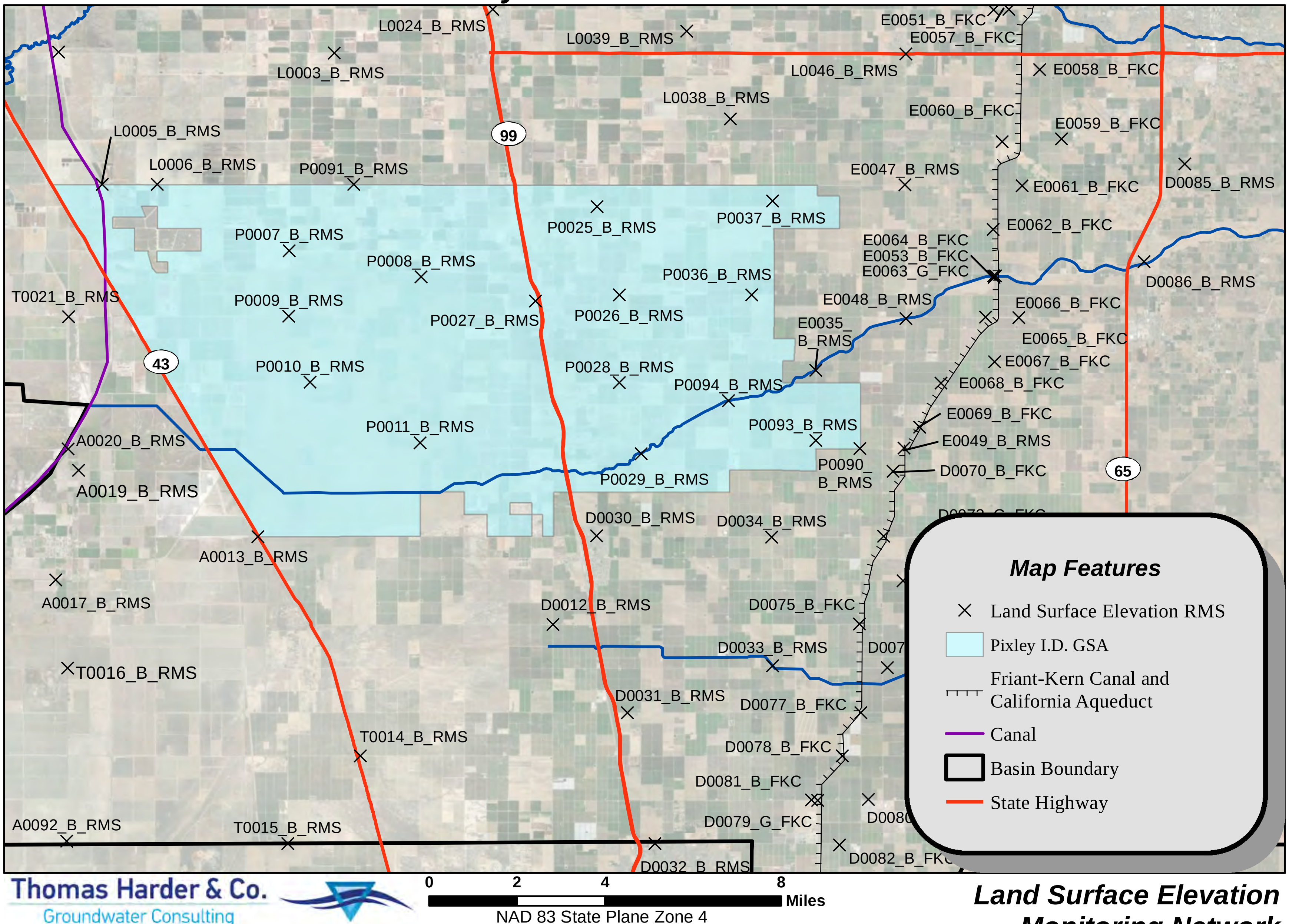
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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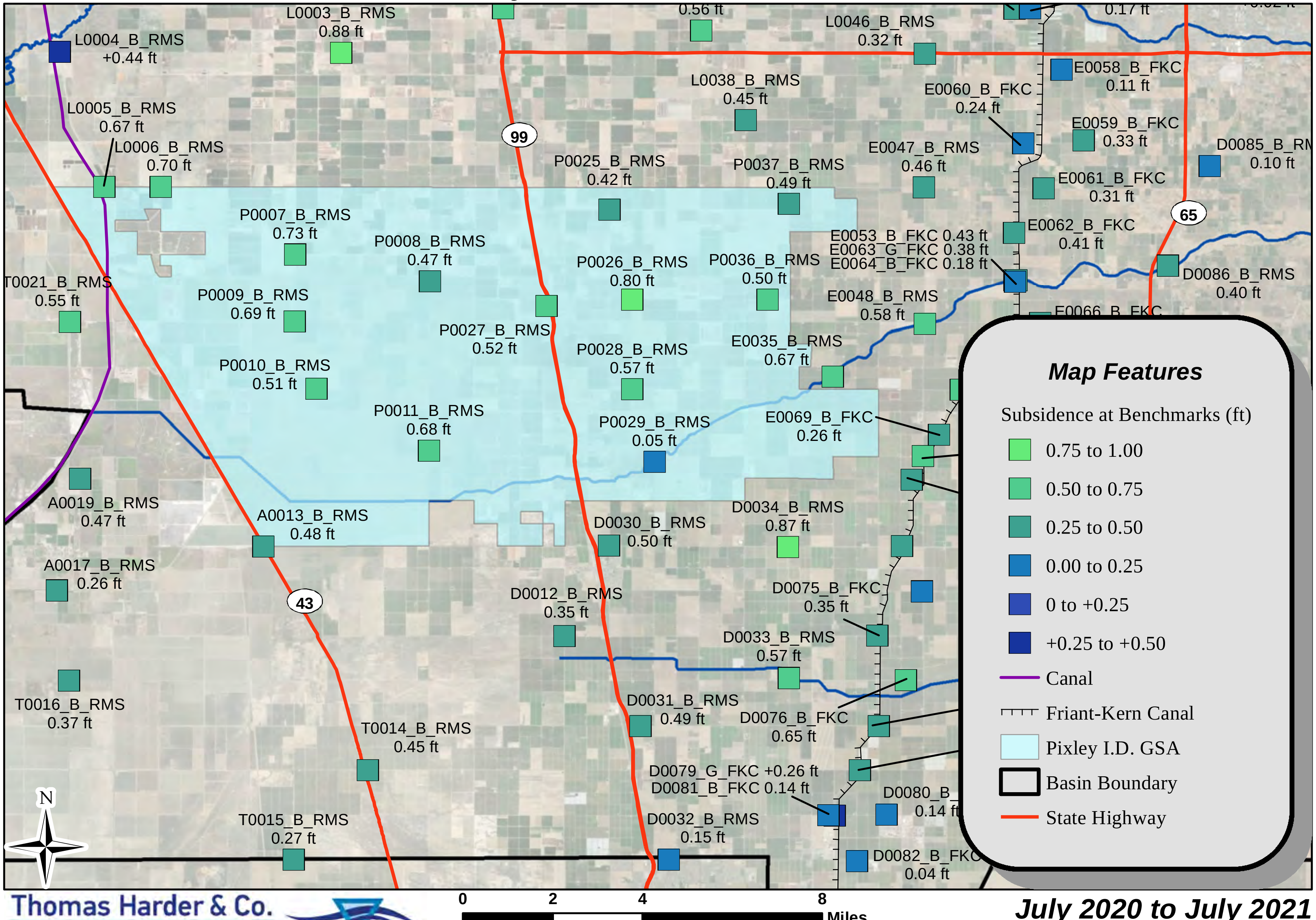
Groundwater Consulting

Land Surface Elevation Monitoring Network
Pixley I.D. GSA
Appendix D
Figure 6

Tule Subbasin Technical Advisory Committee



NAD 83 State Plane Zone 4

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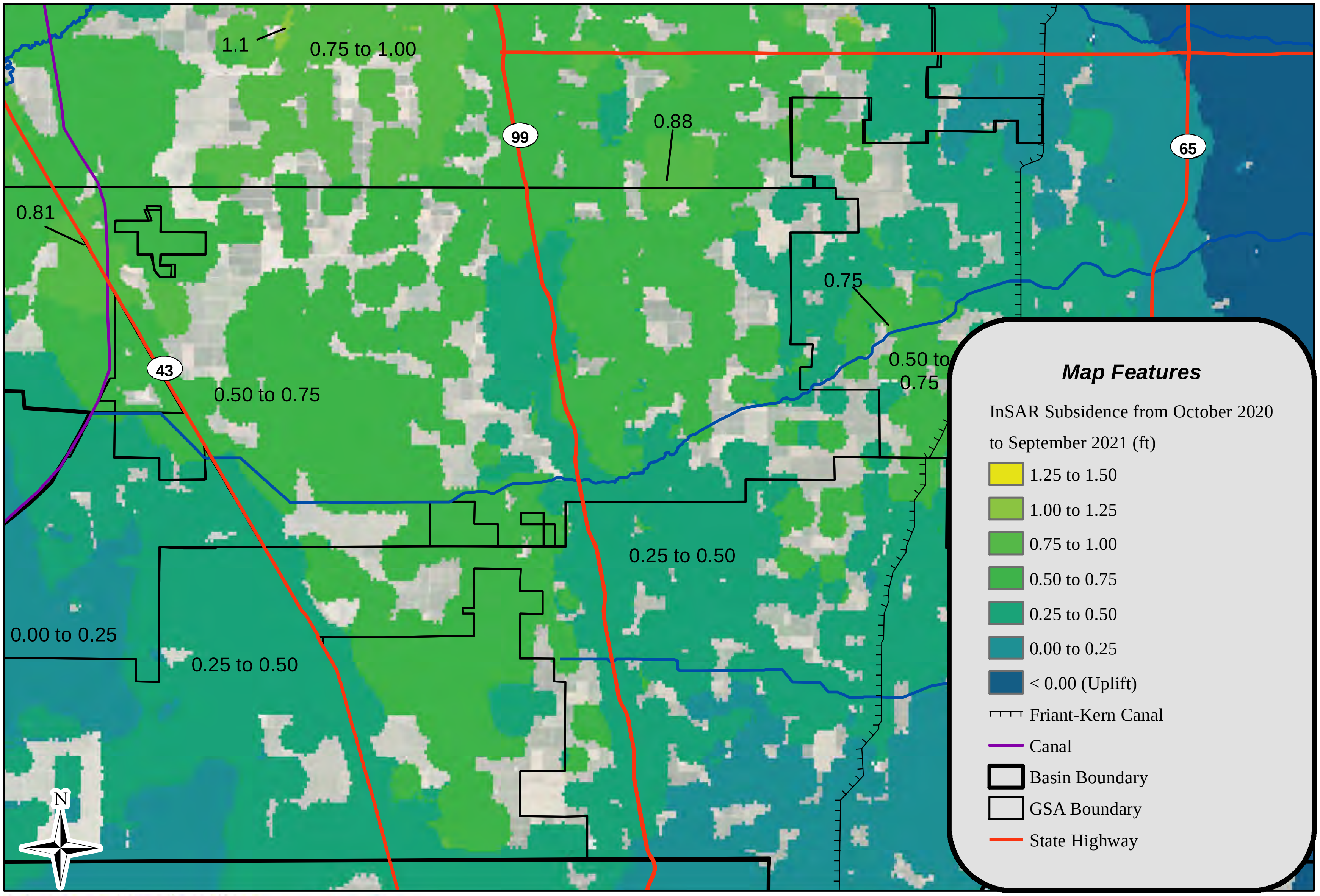
July 2020 to July 2021
Benchmarks Land Subsidence
Pixley I.D. GSA
Appendix D
Figure 7

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
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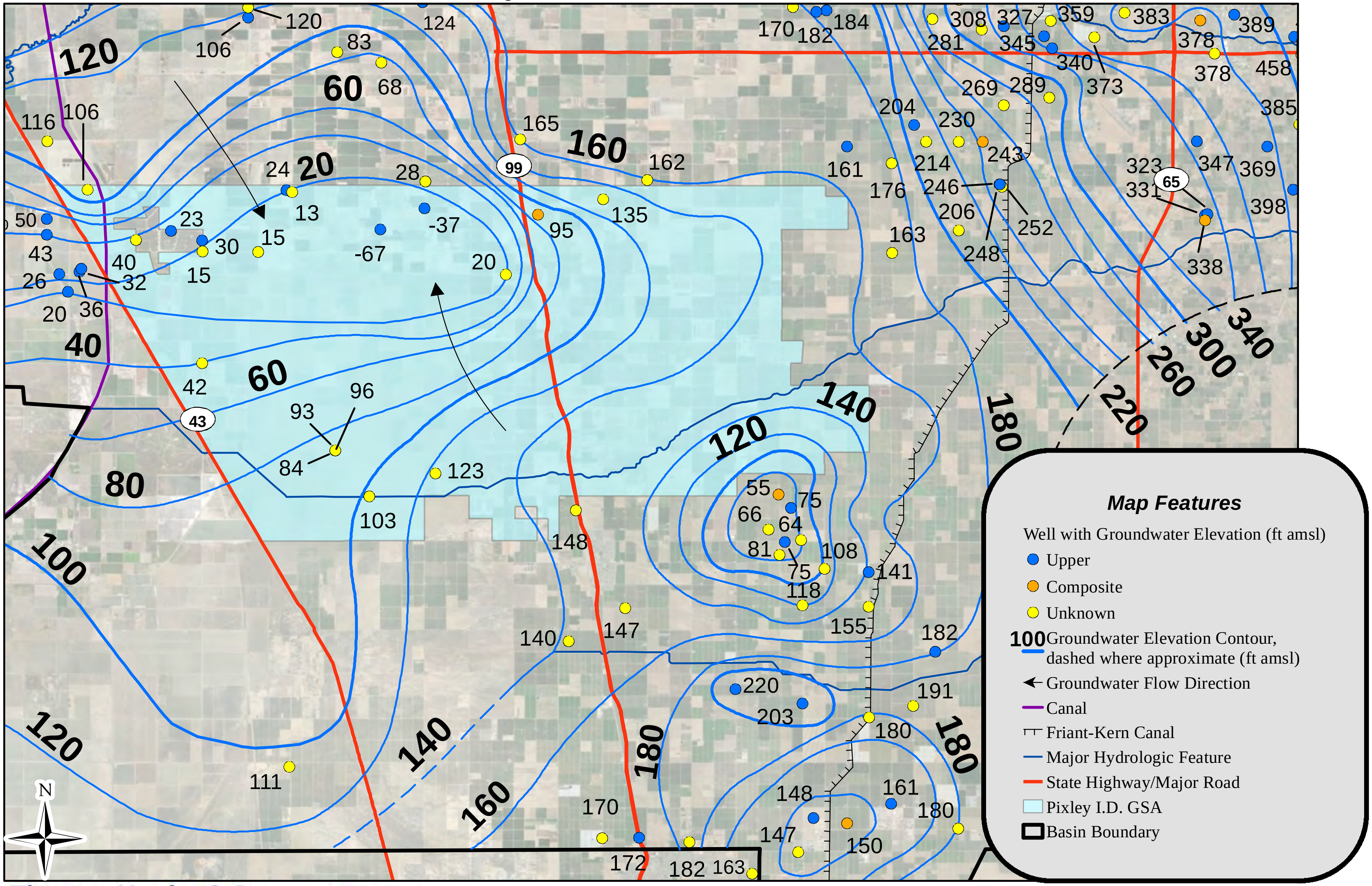
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

Land Subsidence - October 2020 to September 2021
Pixley I.D. GSA
Appendix D
Figure 8

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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Groundwater Consulting

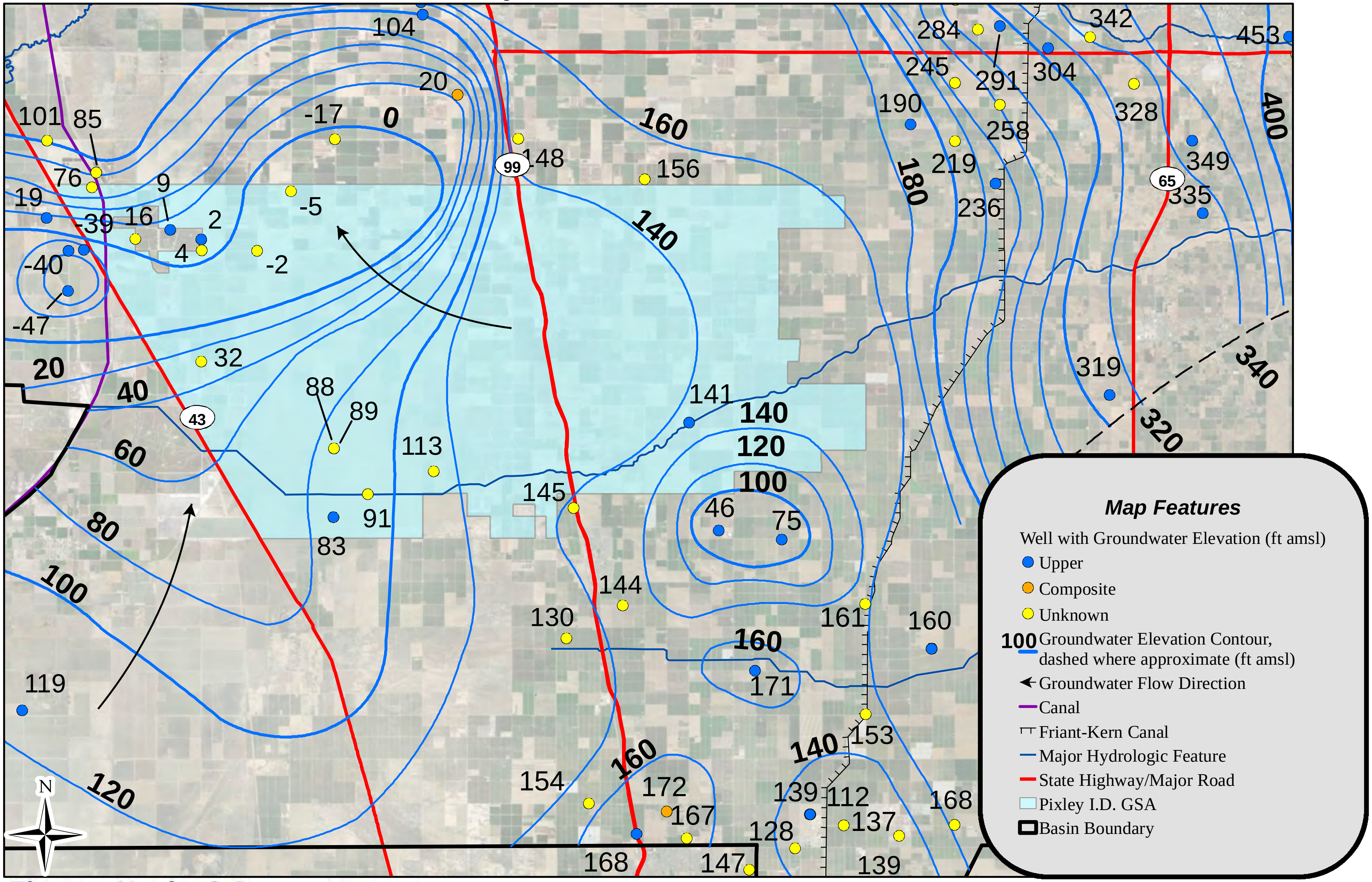
0 2 4 8 Miles

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
Pixley I.D. GSA
Appendix D
Figure 9

Tule Subbasin Technical Advisory Committee



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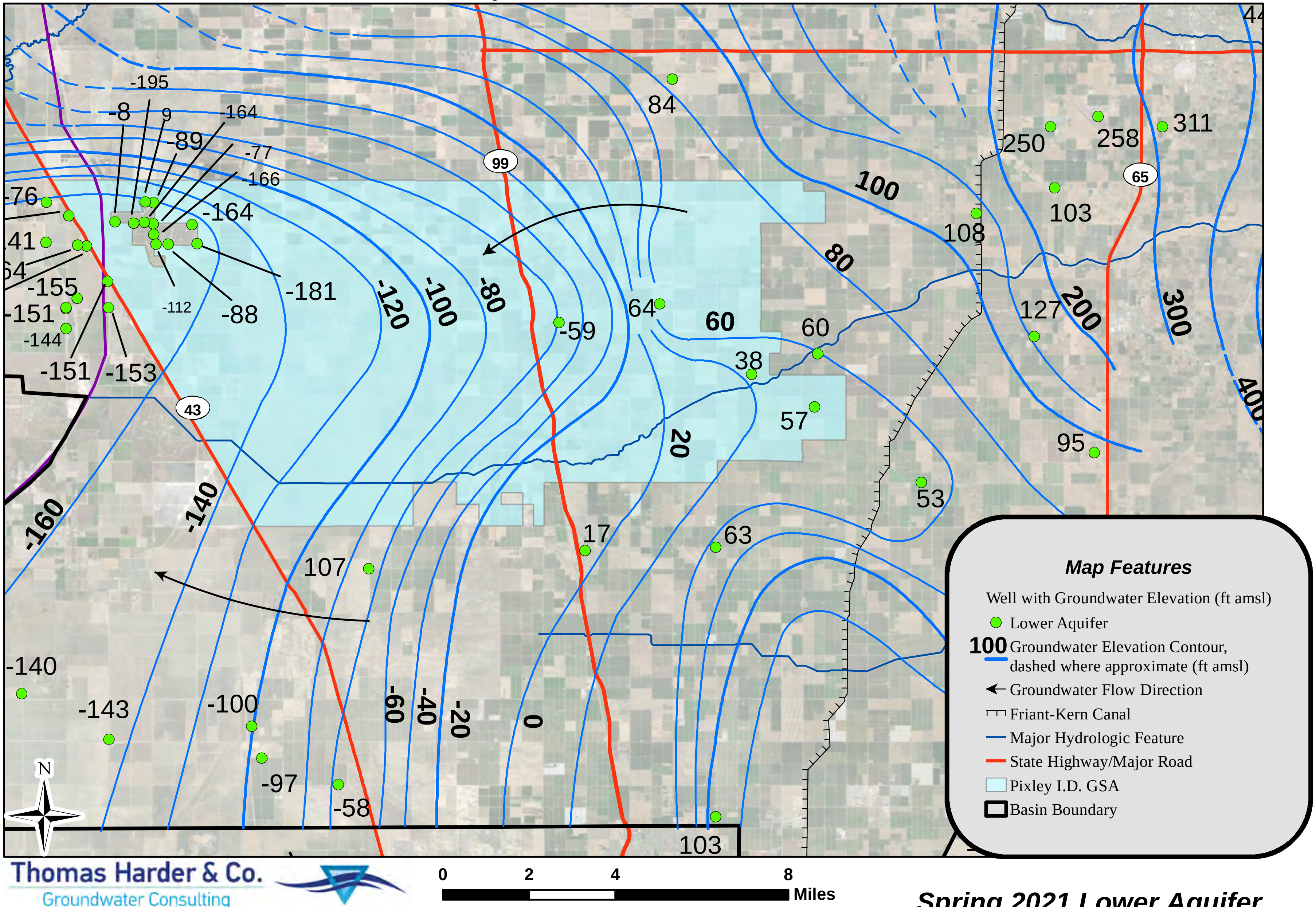
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Pixley I.D. GSA
Appendix D
Figure 10

Tule Subbasin Technical Advisory Committee



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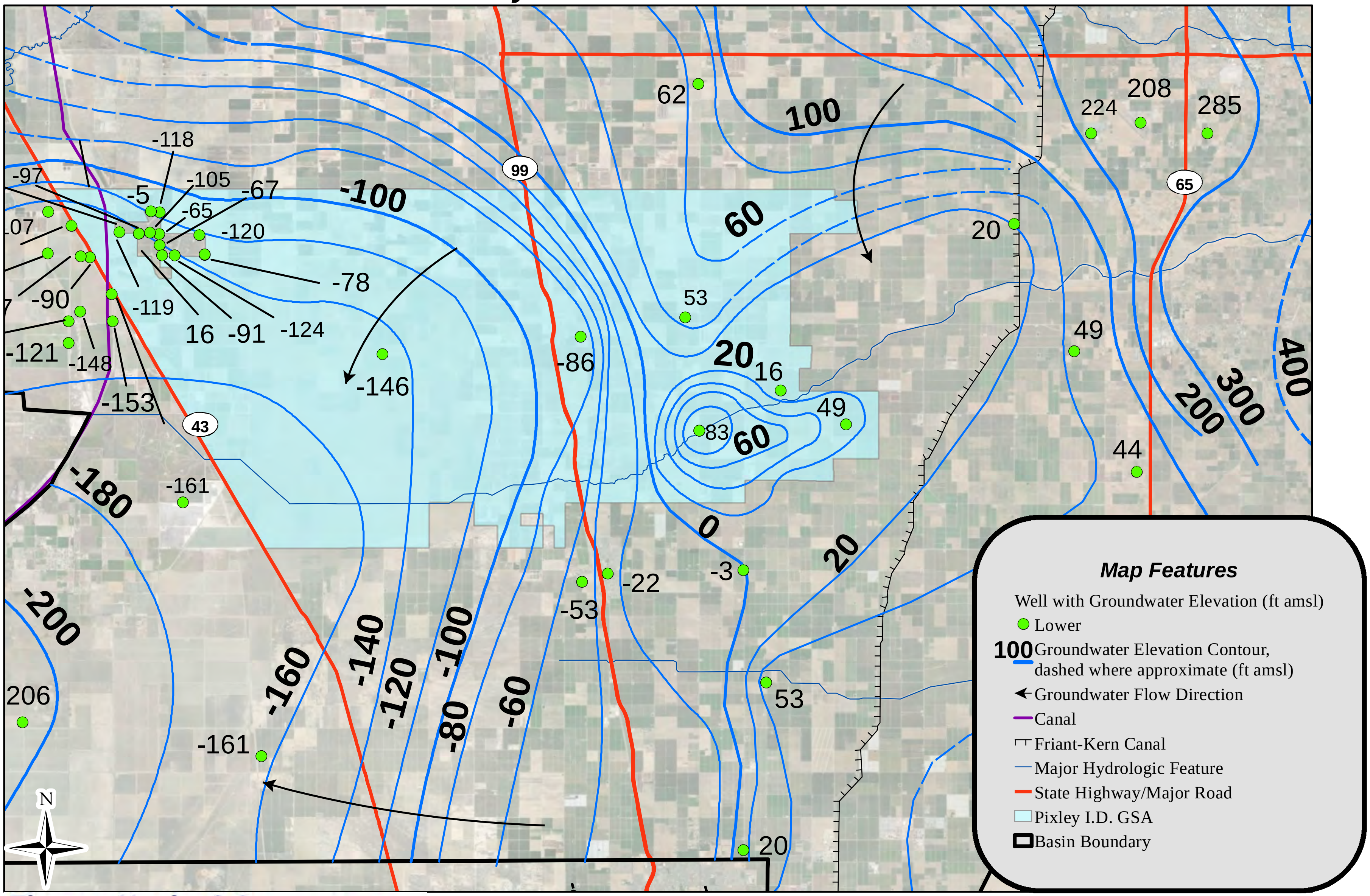
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer
Pixley I.D. GSA
Appendix D
Figure 11

2020/2021 Annual Report
March 2022

Tule Subbasin Technical Advisory Committee



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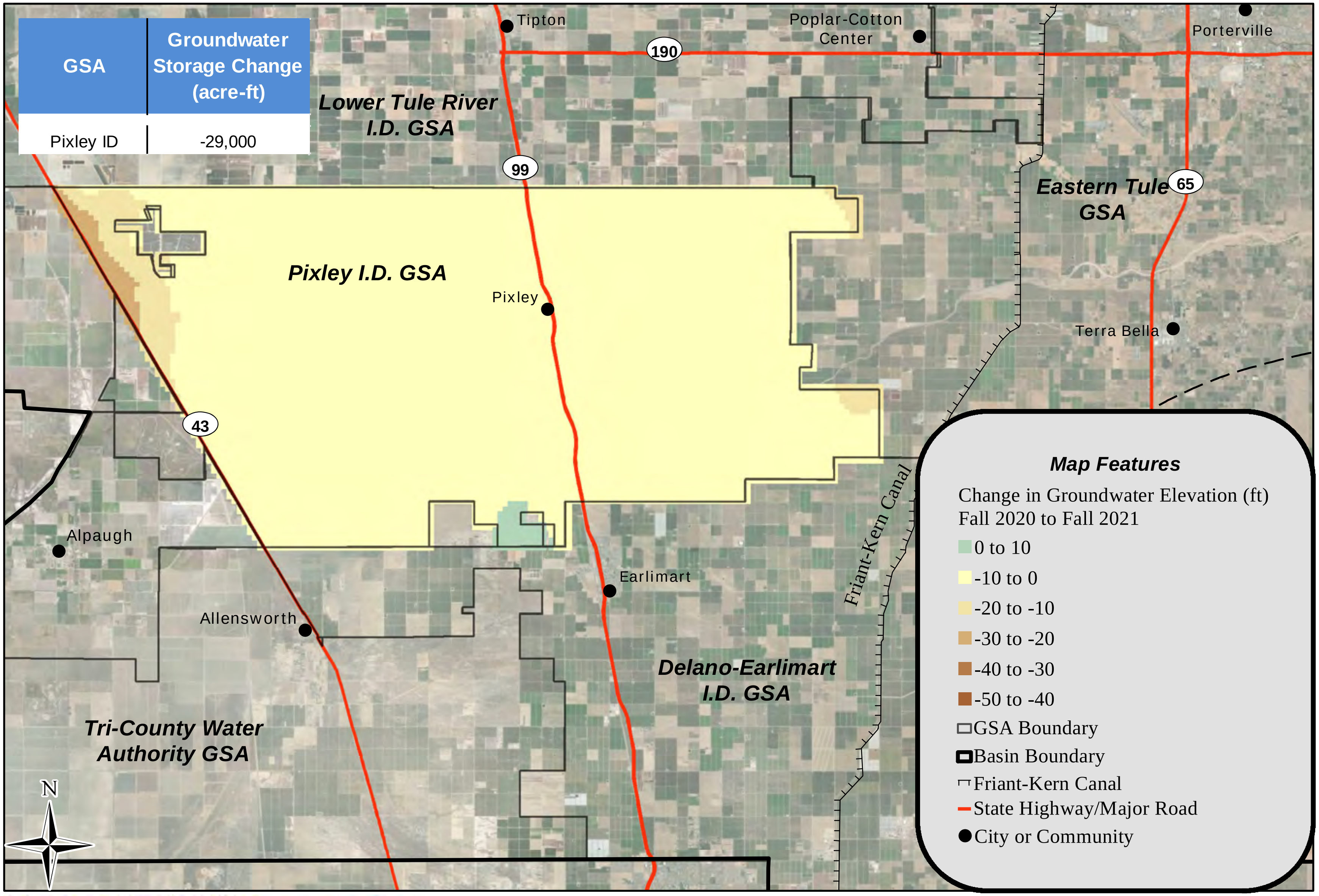
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Lower Aquifer
Pixley I.D. GSA
Appendix D
Figure 12



GSA	Groundwater Storage Change (acre-ft)
Pixley ID	-29,000

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Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - Pixley I.D. GSA

Appendix D
Figure 13

Appendix E

Tri-County Groundwater Authority GSA 2020/21 Annual Data

Tri-County Water Authority GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
TCWA GSA	North	9,100	0	17,050	26,150
	Southeast	44,000	100	0	44,100
	Total	***53,100***	***100***	***17,050***	***70,250***

Tri-County Water Authority GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
TCWA GSA	North	0	0	0	0	3,100	3,100
	Southeast	0	0	0	0	13,400	13,400
	Total	***0***	***0***	***0***	***0***	***16,500***	***16,500***

Tri-County Water Authority GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
TCWA GSA	North	26,150	3,100	29,250
	Southeast	44,100	13,400	57,500
	Total	***70,250***	***16,500***	***86,750***

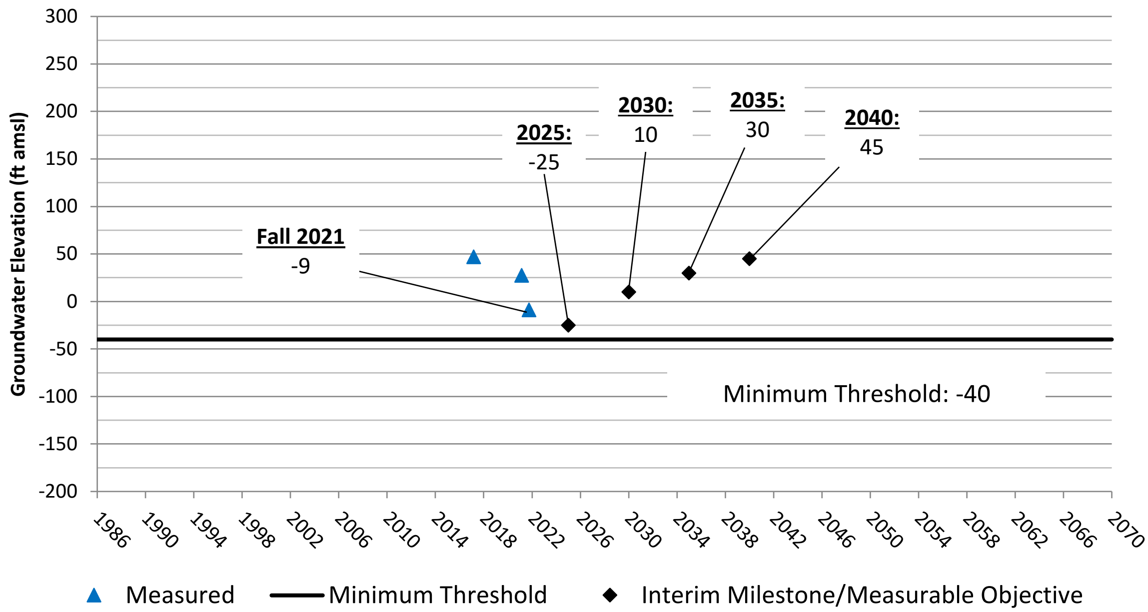
Tri-County Water Authority GSA
Land Surface Elevations at Representative Monitoring Sites

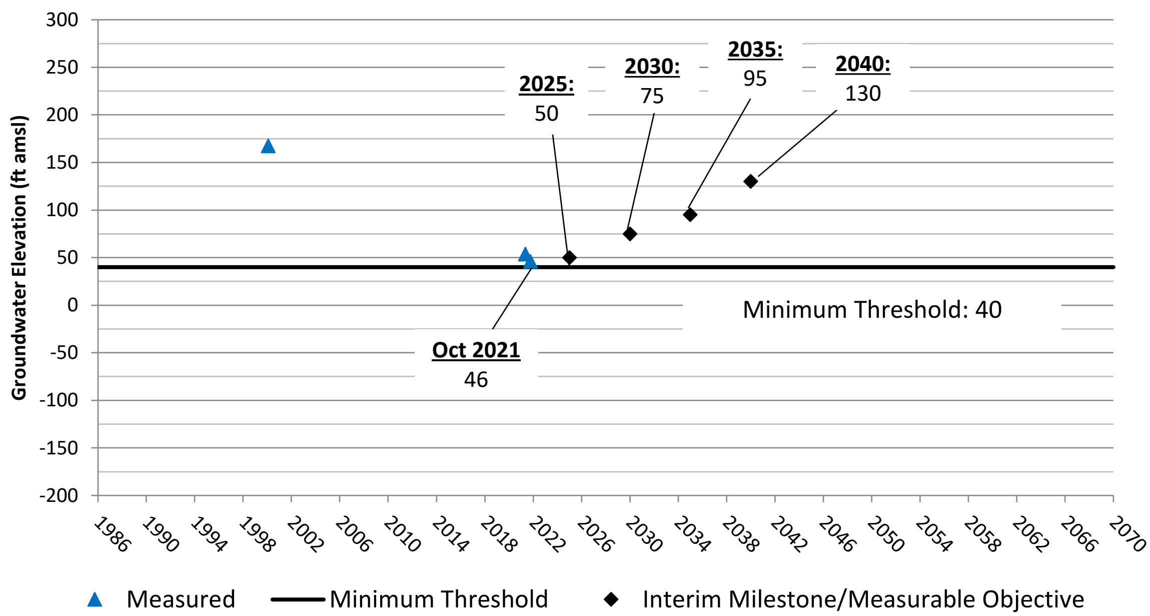
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
T0014_B_RMS	219.4	219.0	212.6	211.6
T0015_B_RMS	217.1	216.8	211.3	210.3
T0016_B_RMS	201.3	200.9	195.4	194.4
T0021_B_RMS	183.0	182.4	175.1	174.1

Note:

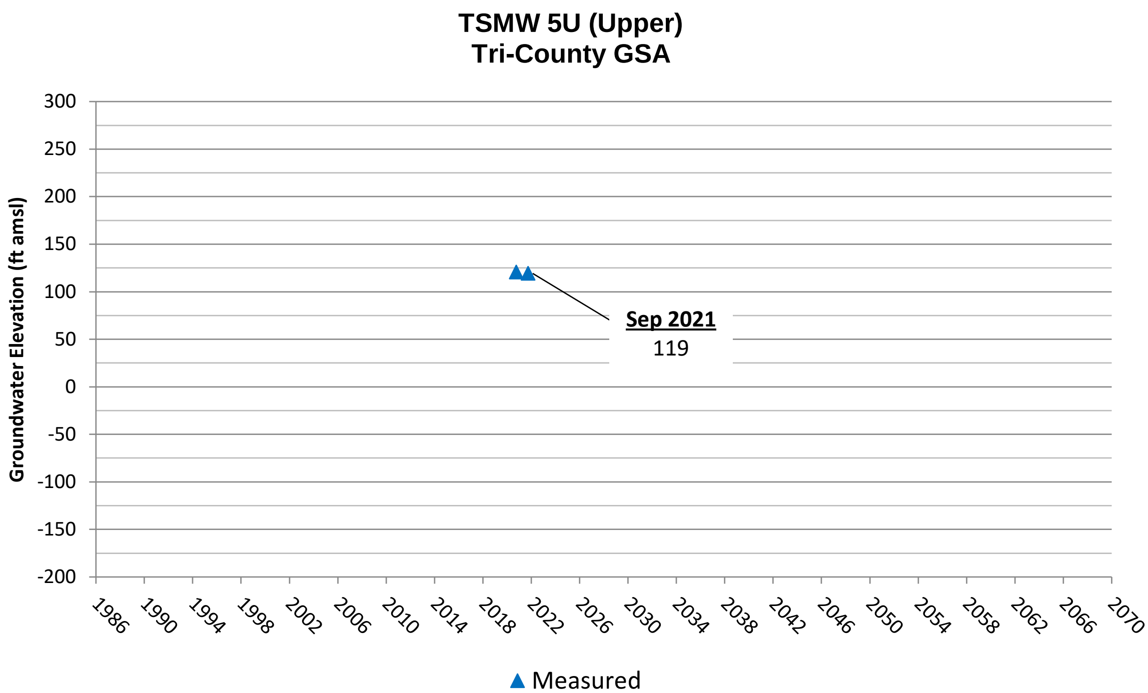
[1] Benchmarks surveyed in July and August of each year.

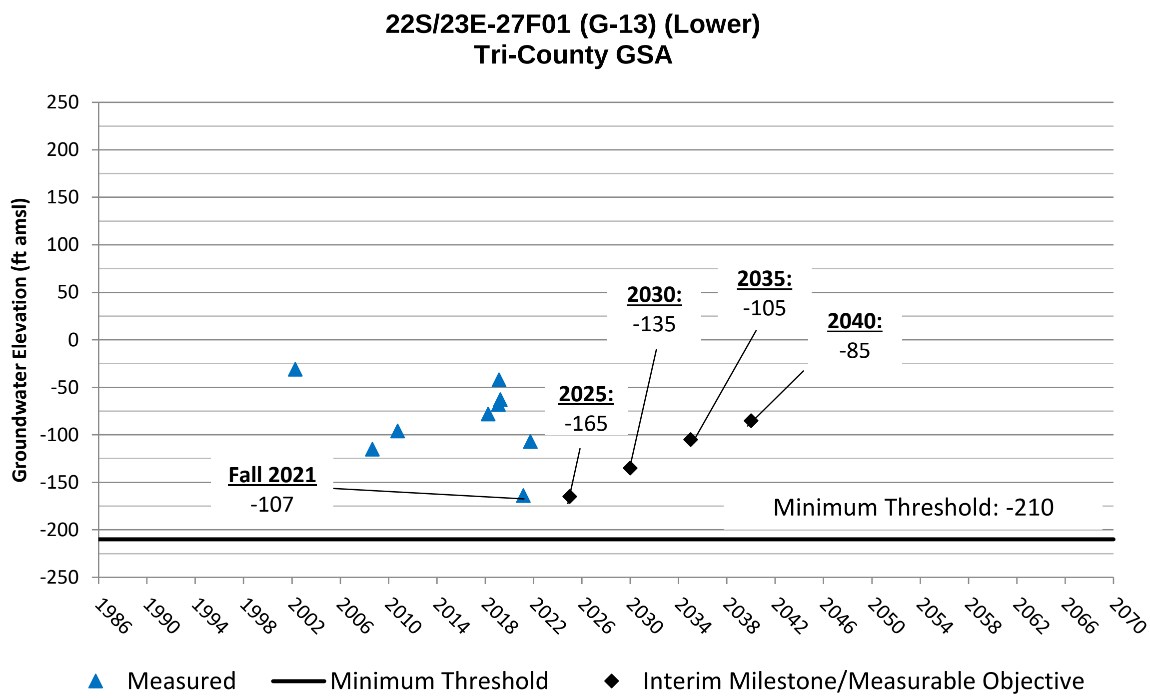
Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs



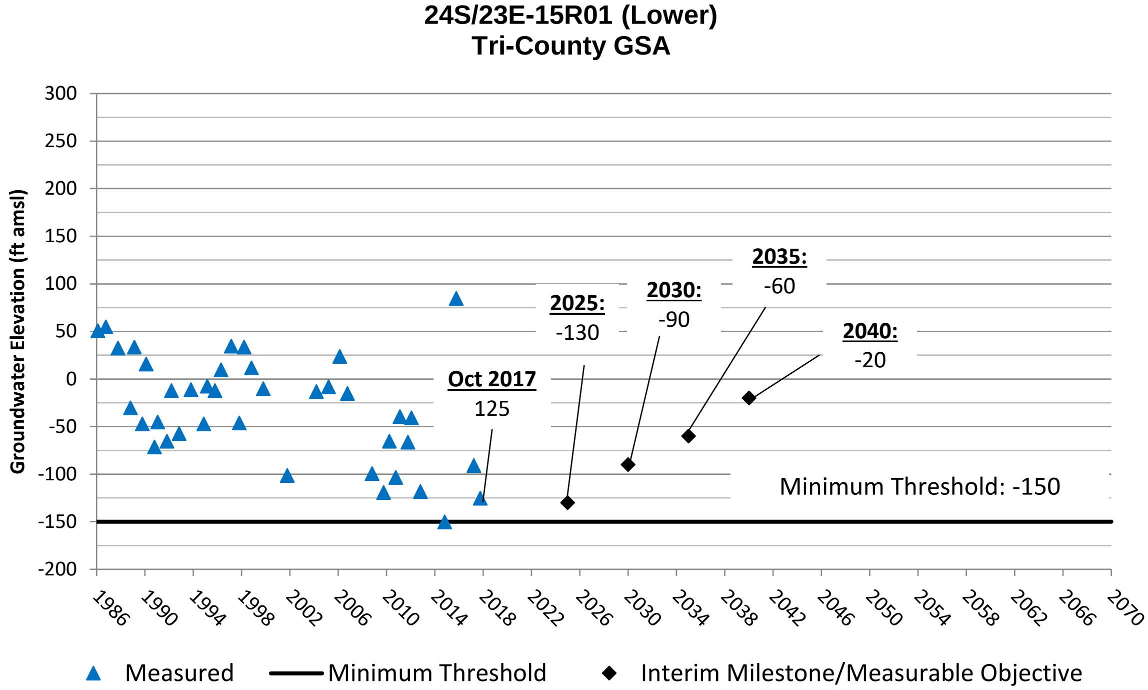


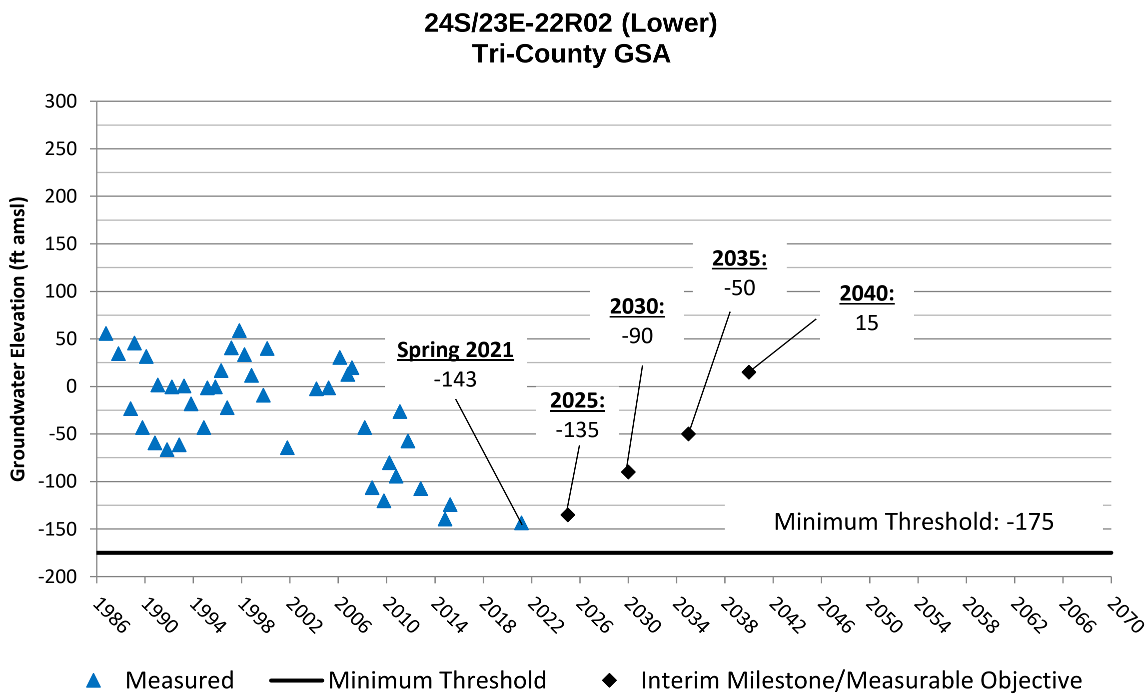
Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs



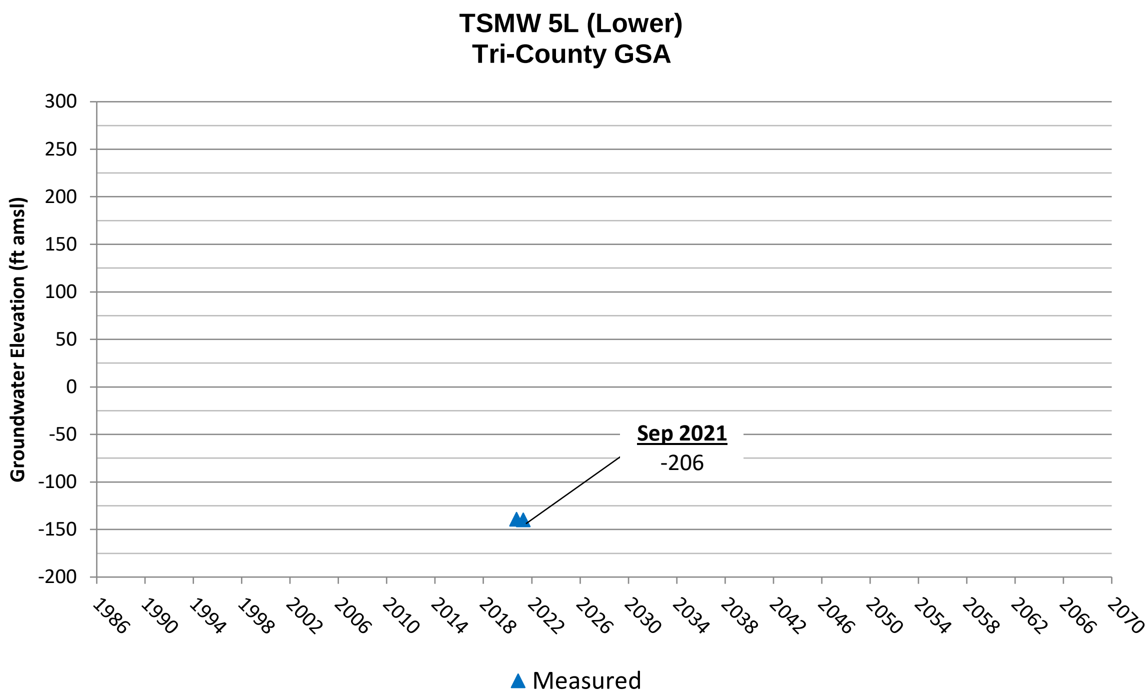


Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs

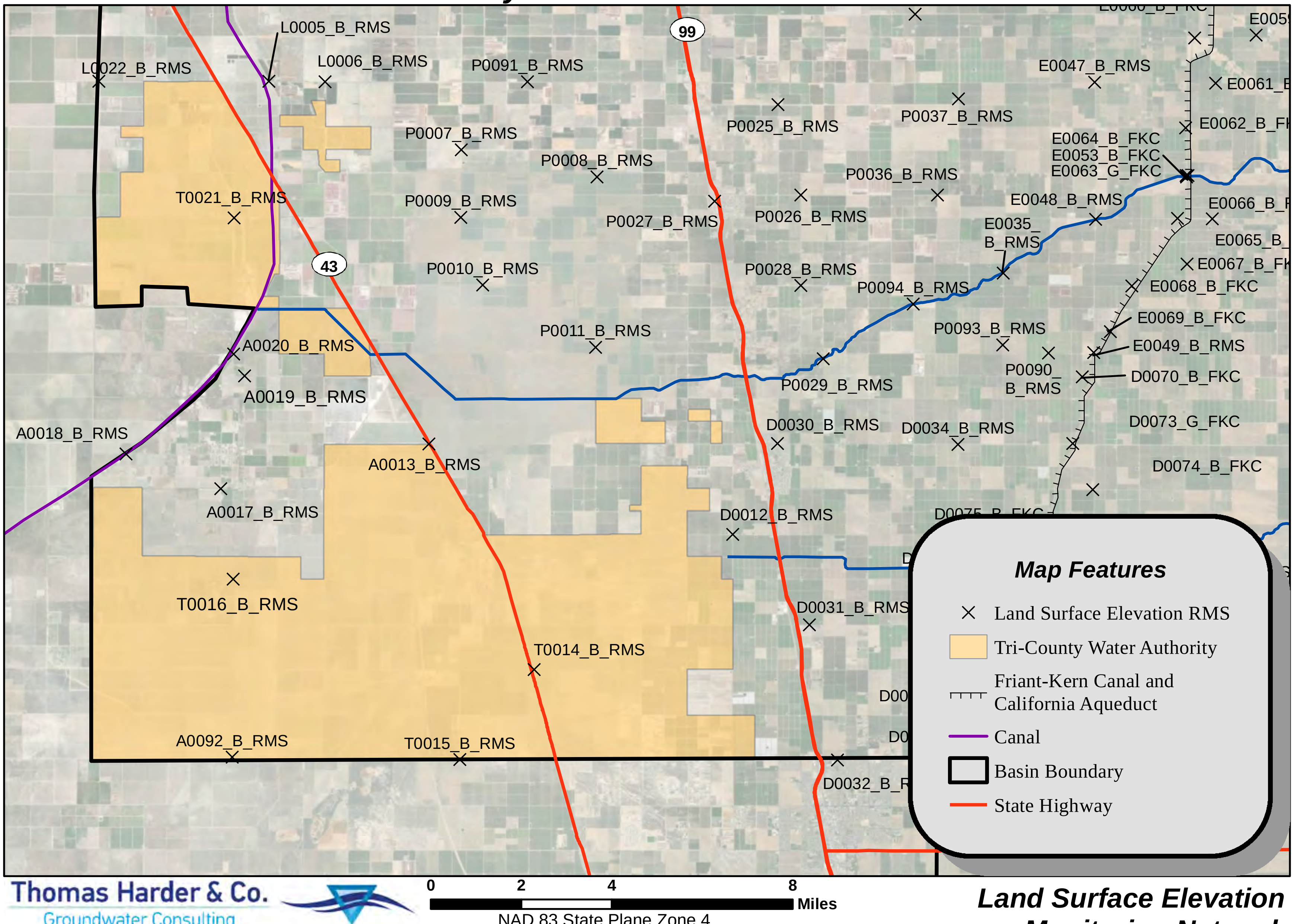




Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs



Tule Subbasin Technical Advisory Committee



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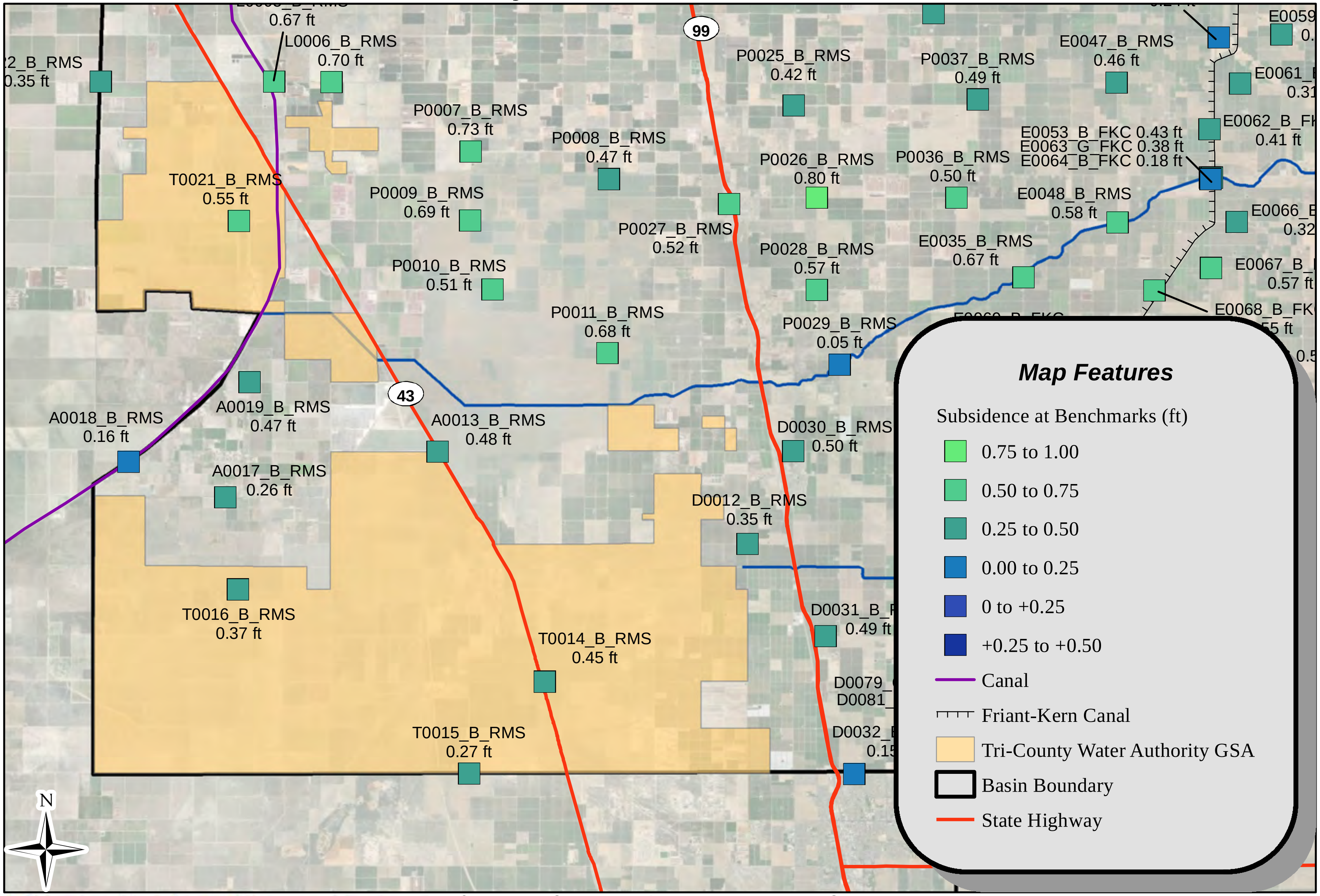
Land Surface Elevation Monitoring Network
Tri-County Water Authority GSA
Appendix E
Figure 5

Tule Subbasin Technical Advisory Committee



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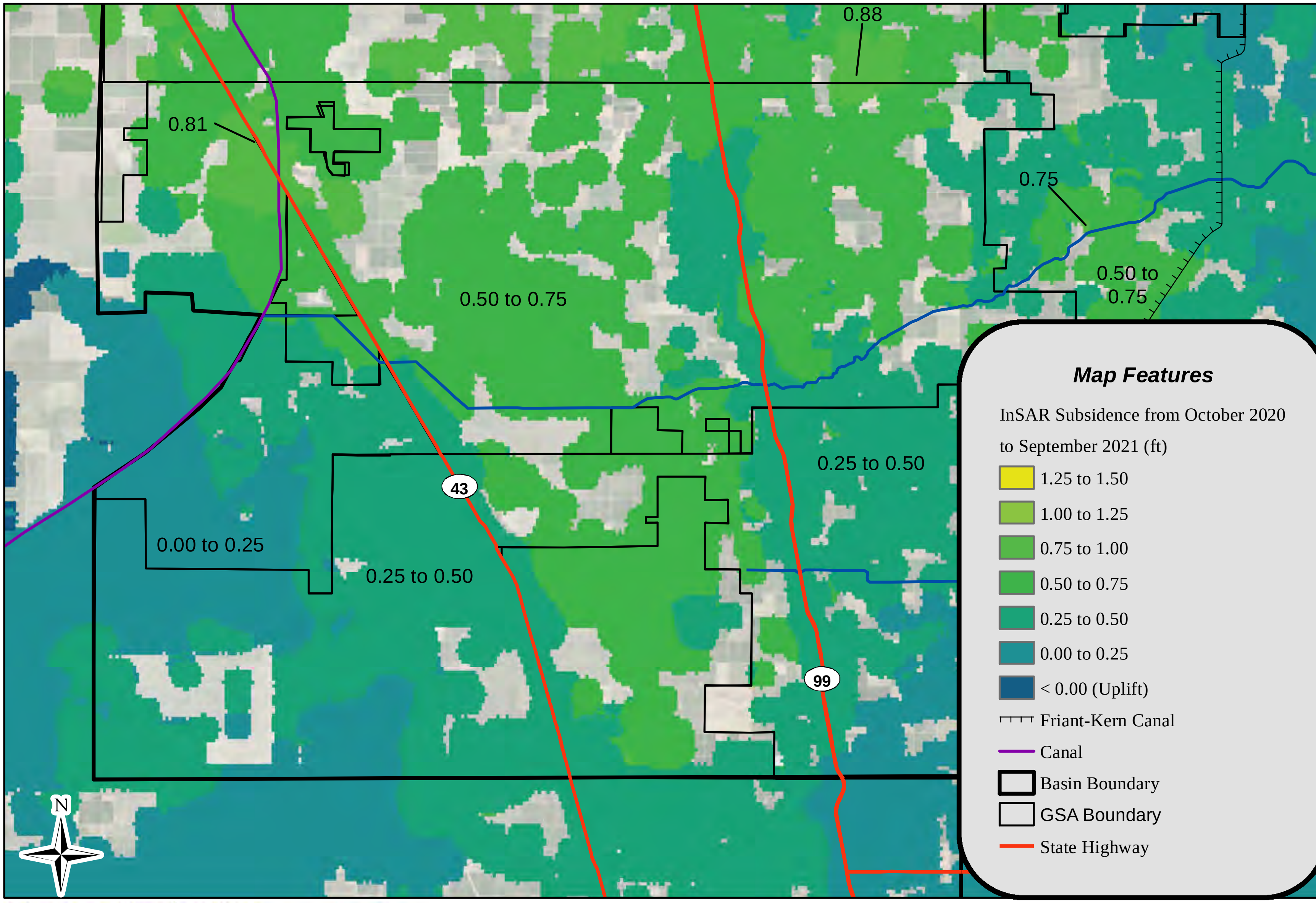
NAD 83 State Plane Zone 4

July 2020 to July 2021
Benchmarks Land Subsidence
Tri-County Water Authority GSA
Appendix E
Figure 6



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InSAR data from:
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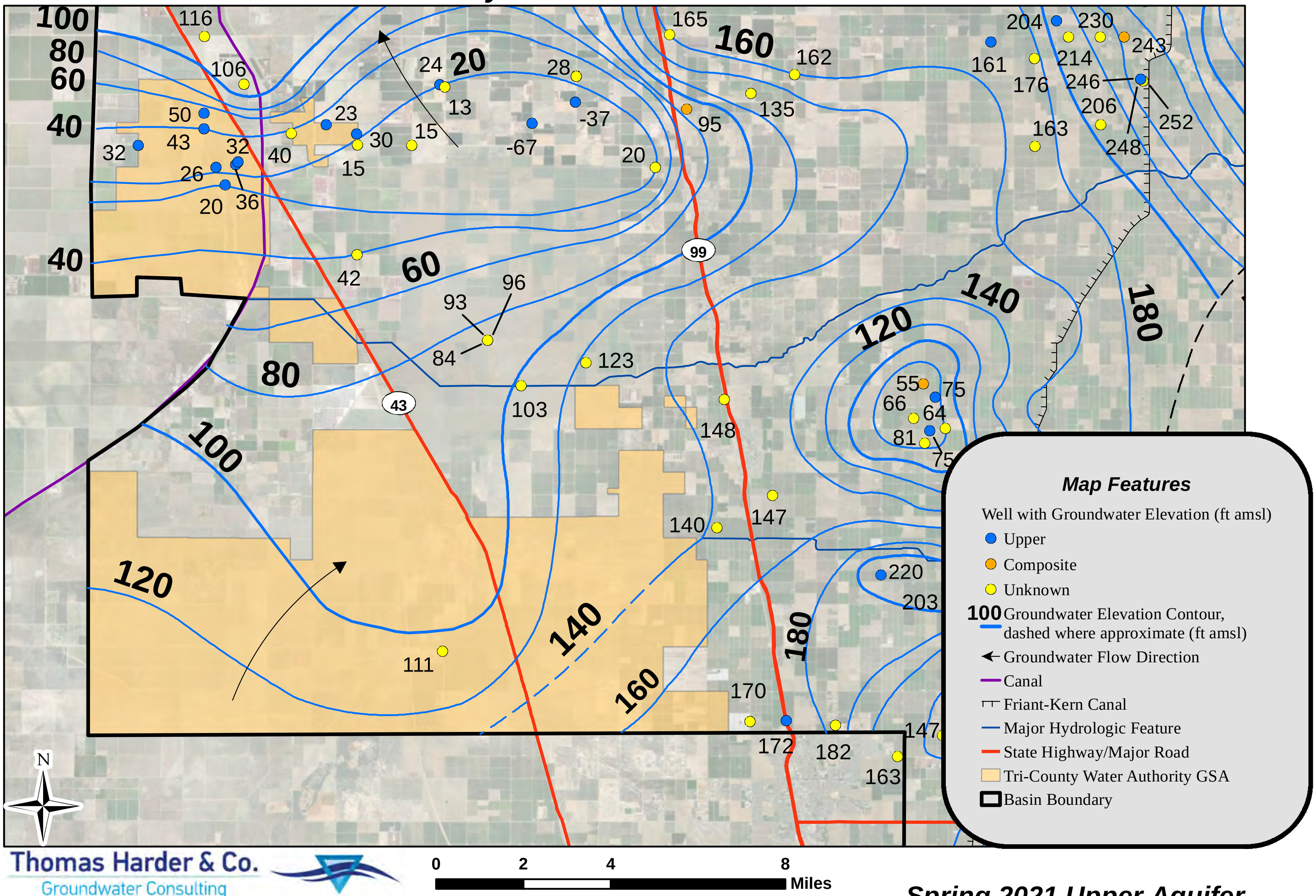
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

0 1.25 2.5 5 Miles
NAD 83 State Plane Zone 4

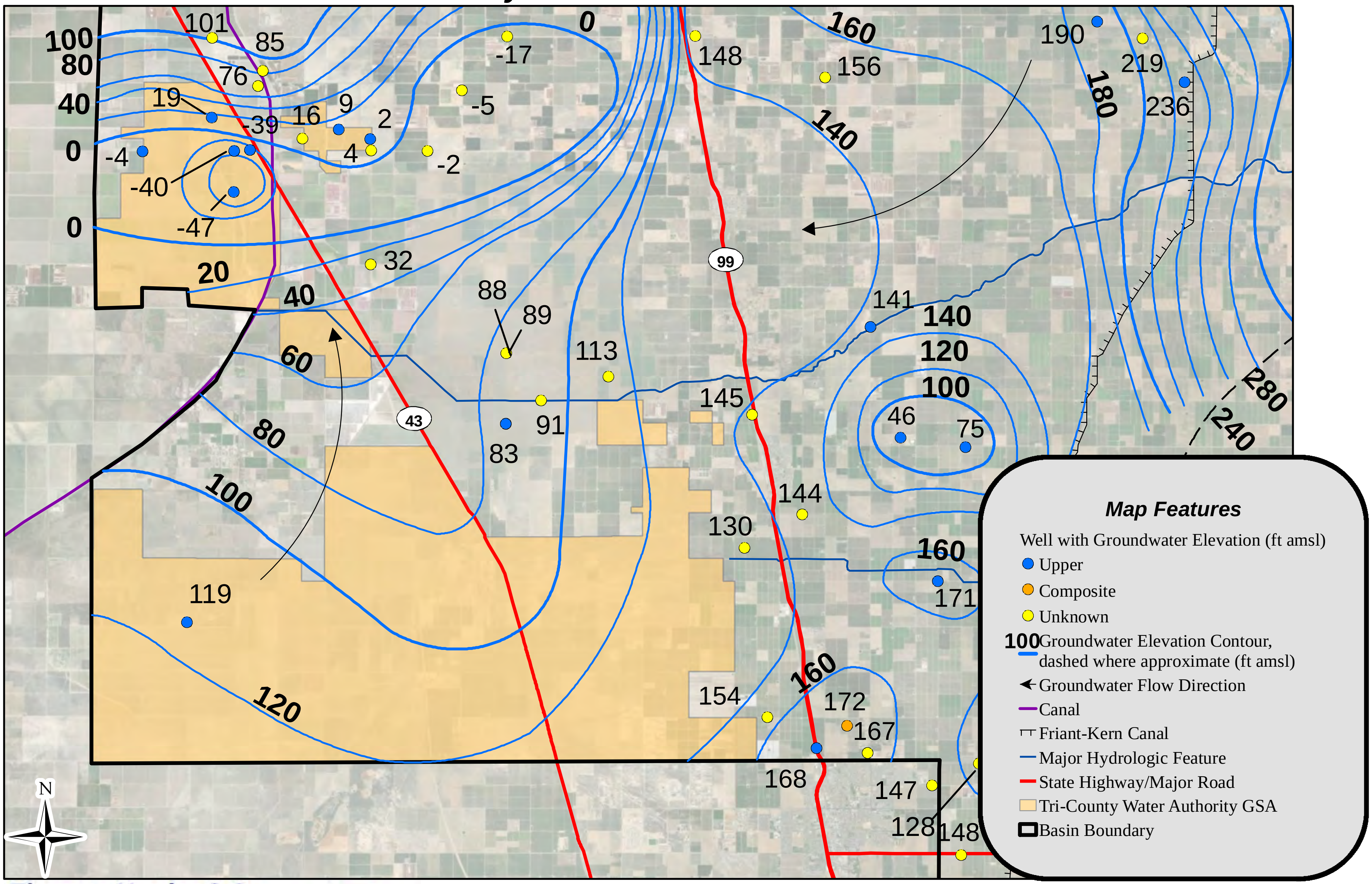
Land Subsidence - October 2020 to September 2021
Tri-County Water Authority GSA
Appendix E
Figure 7



NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 8



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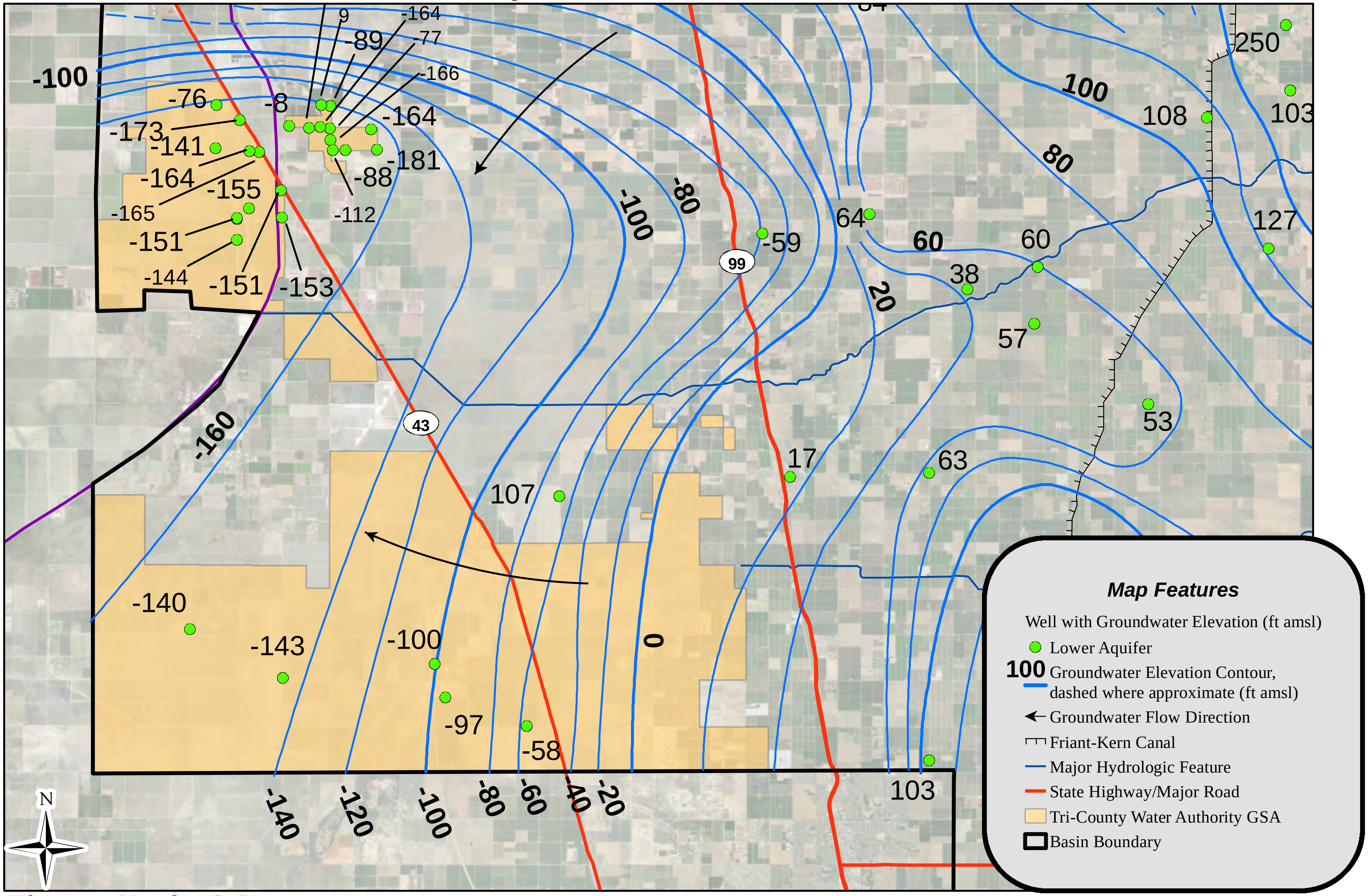
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 9

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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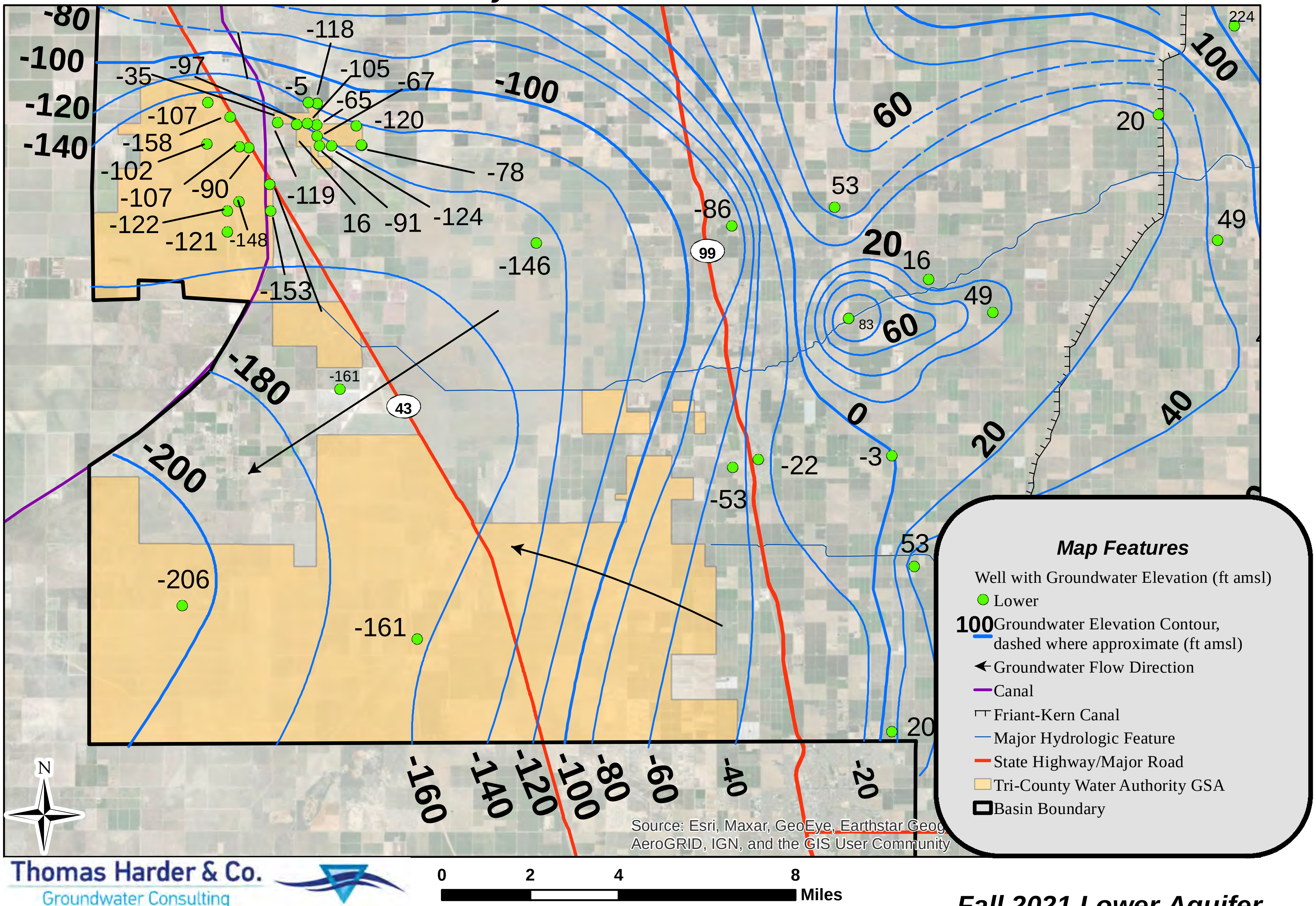
0 2 4 8 Miles

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Lower Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 10

Tule Subbasin Technical Advisory Committee



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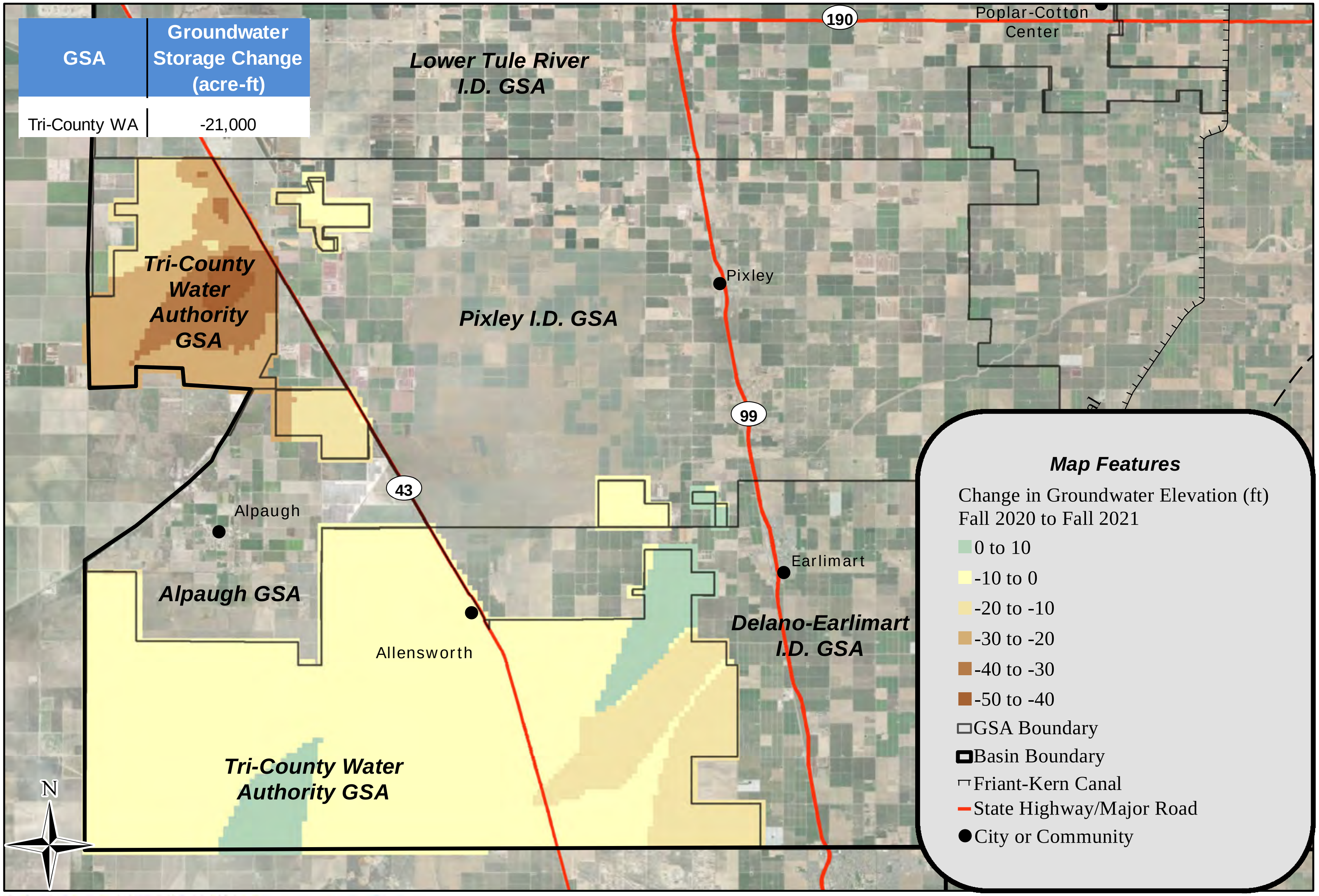
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Lower Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 11

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report
March 2022



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Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - Tri-County Water Authority GSA

Appendix E
Figure 12

Appendix F

Alpaugh Irrigation District GSA 2020/21 Annual Data

Alpaugh Irrigation District GSA
Groundwater Extraction for Water Year 2020/21

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Alpaugh ID GSA	***Total***	***20,000***	***250***	***0***	***20,250***

Alpaugh Irrigation District GSA
Surface Water Supplies for Water Year 2020/21

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Alpaugh ID GSA	***Total***	***0***	***0***	***0***	***0***	***3,700***	***3,700***

Alpaugh Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2020/21

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
Alpaugh ID GSA	***Total***	***20,250***	***3,700***	***23,950***

Alpaugh Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

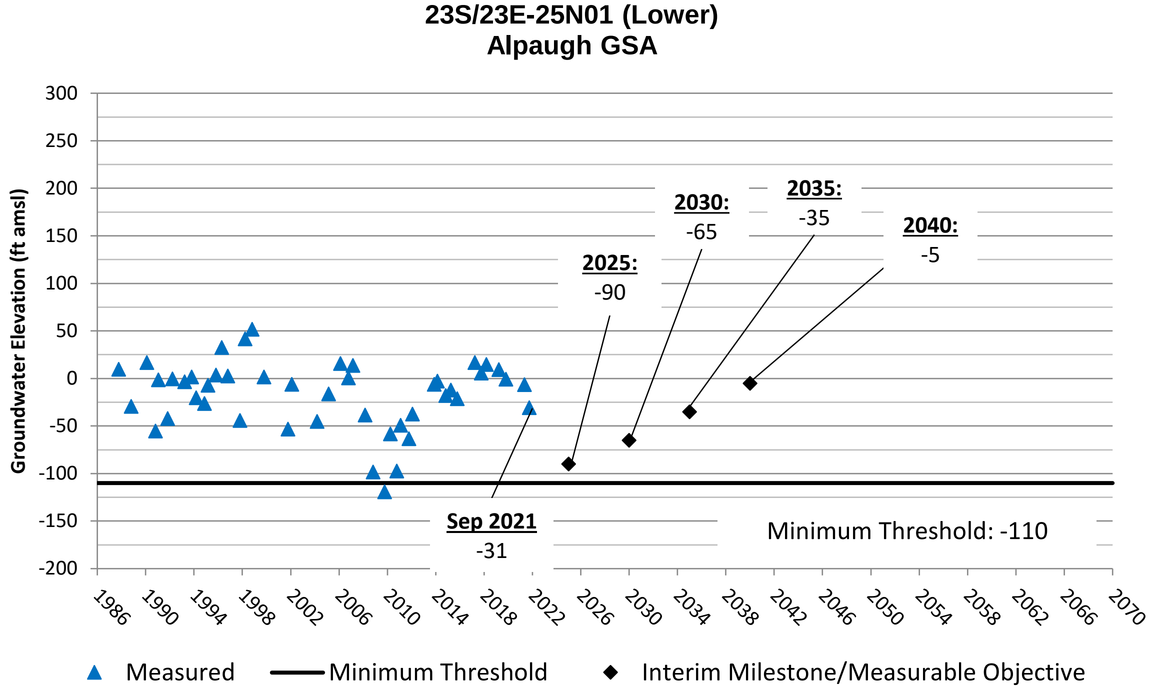
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2021	Measurable Objective	Minimum Threshold
A0013_B_RMS	196.814	196.338	189.645	187.876
A0017_B_RMS	204.396	204.137	199.110	197.996
A0018_B_RMS	196.141	195.977	192.203	191.153
A0019_B_RMS	192.326	191.857	186.921	185.921
A0020_B_RMS	195.065	191.08	189.463	188.463
A0092_B_RMS	N/A	200.37	N/A	N/A

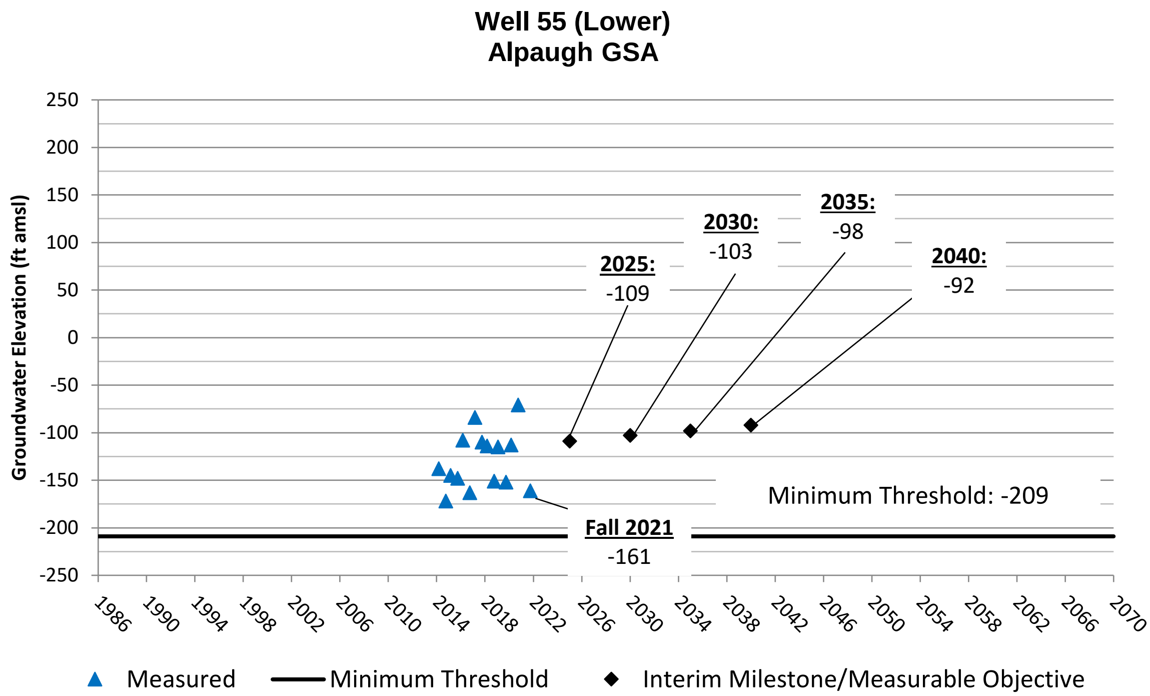
Notes:

N/A = Not available

[1] Benchmarks surveyed in July and August of each year.

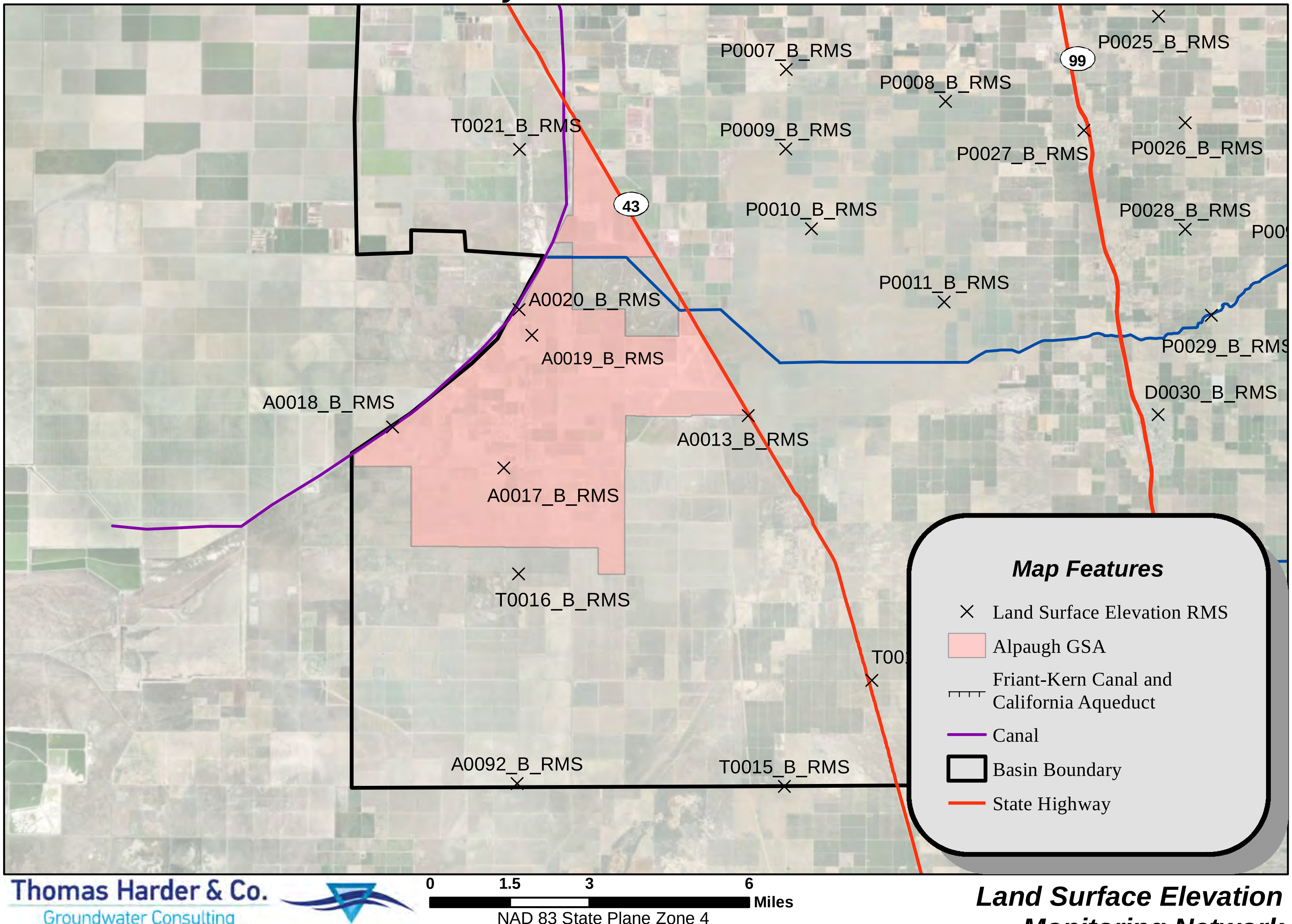
Alpaugh Irrigation District GSA
RMS Groundwater Elevation Hydrographs





2020/2021 Annual Report
March 2022

Tule Subbasin Technical Advisory Committee



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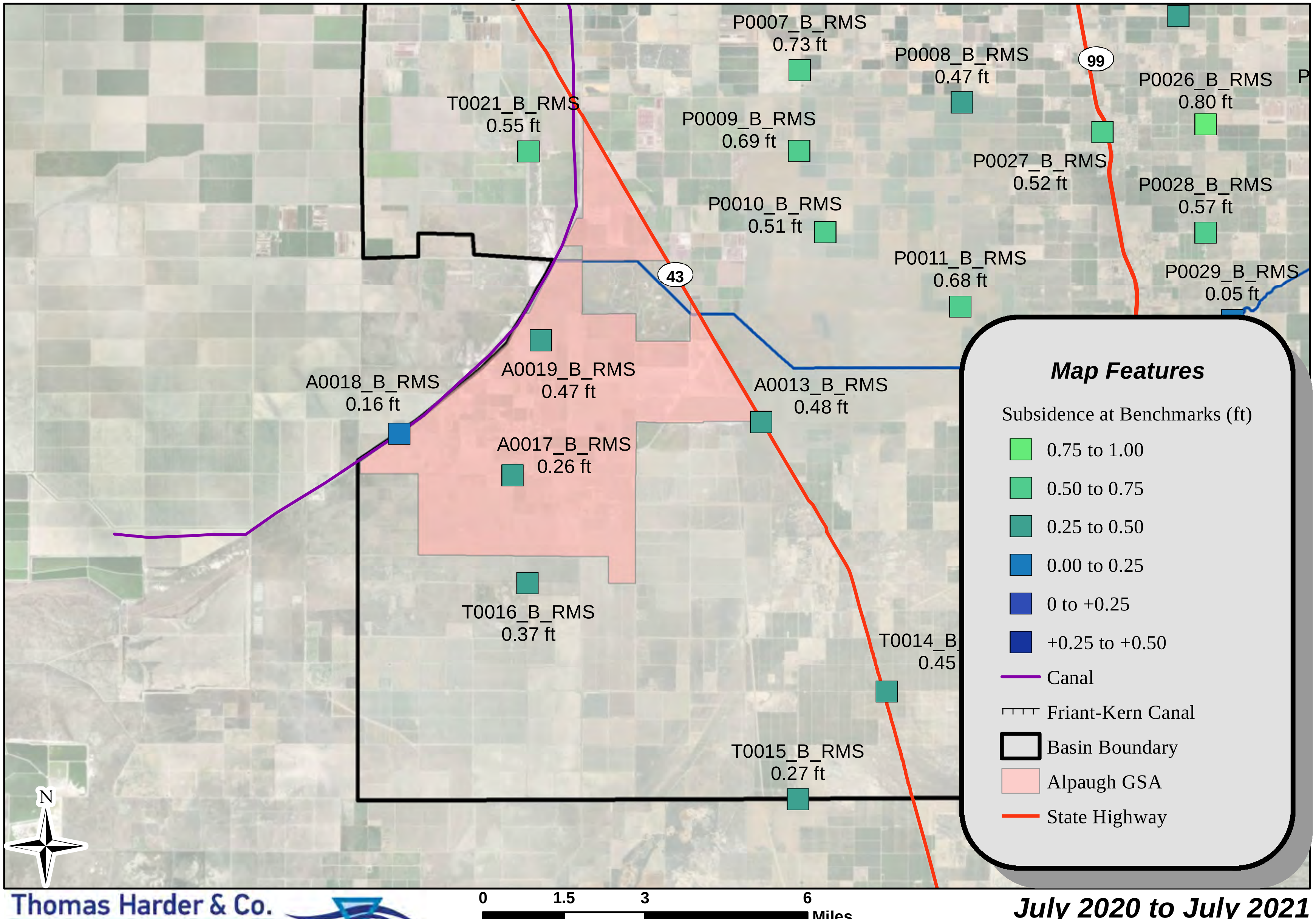
Land Surface Elevation Monitoring Network
Alpaugh GSA
Appendix F
Figure 2

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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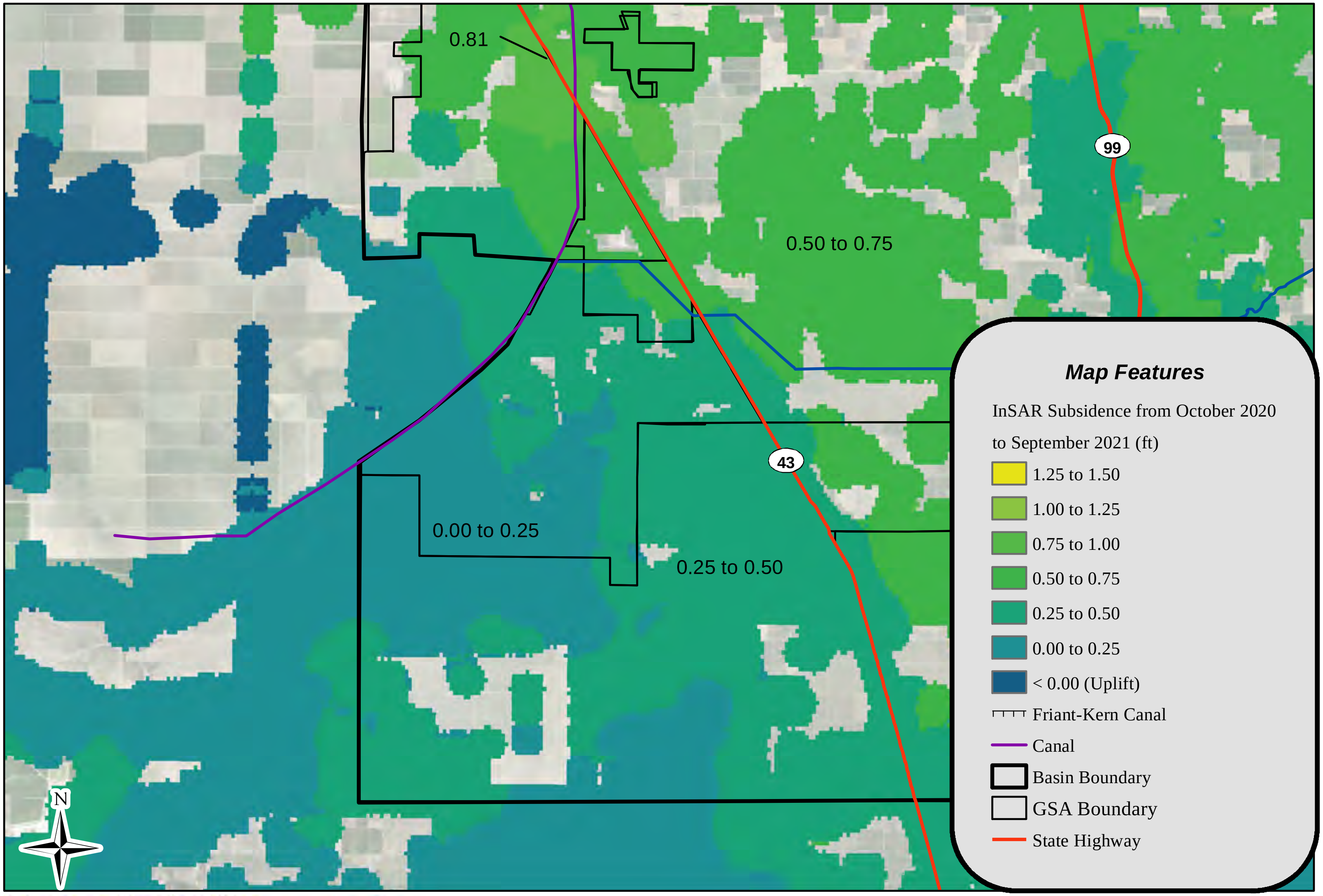
NAD 83 State Plane Zone 4

July 2020 to July 2021
Benchmarks Land Subsidence
Alpaugh I.D. GSA

Appendix F
Figure 3



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InSAR data from:
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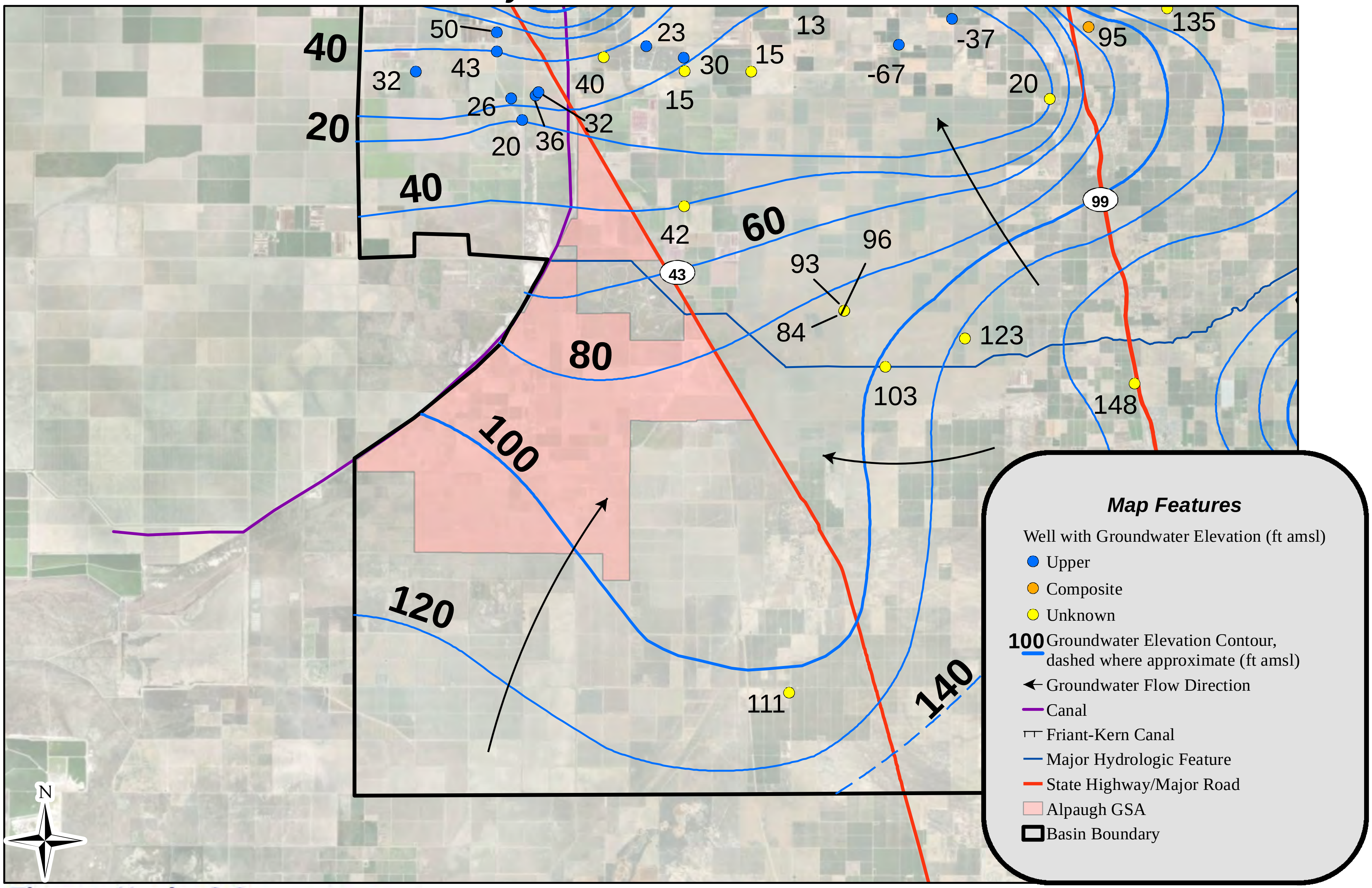
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2021_Total_Since_20150613_20211001/ImageServer

Land Subsidence - October 2020 to September 2021
Alpaugh I.D. GSA
Appendix F
Figure 4

Tule Subbasin Technical Advisory Committee



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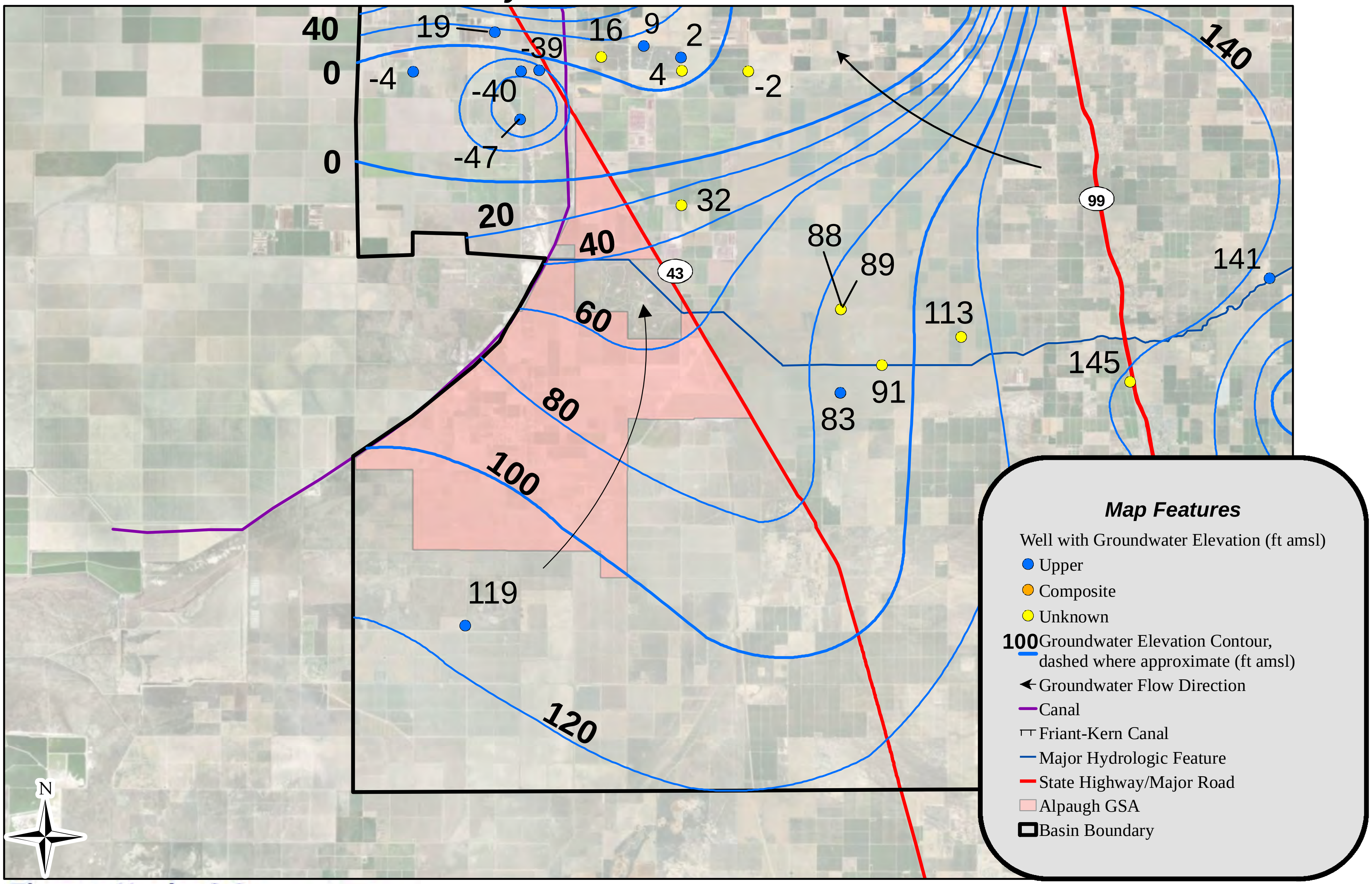
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Spring 2021 Upper Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 5

Tule Subbasin Technical Advisory Committee



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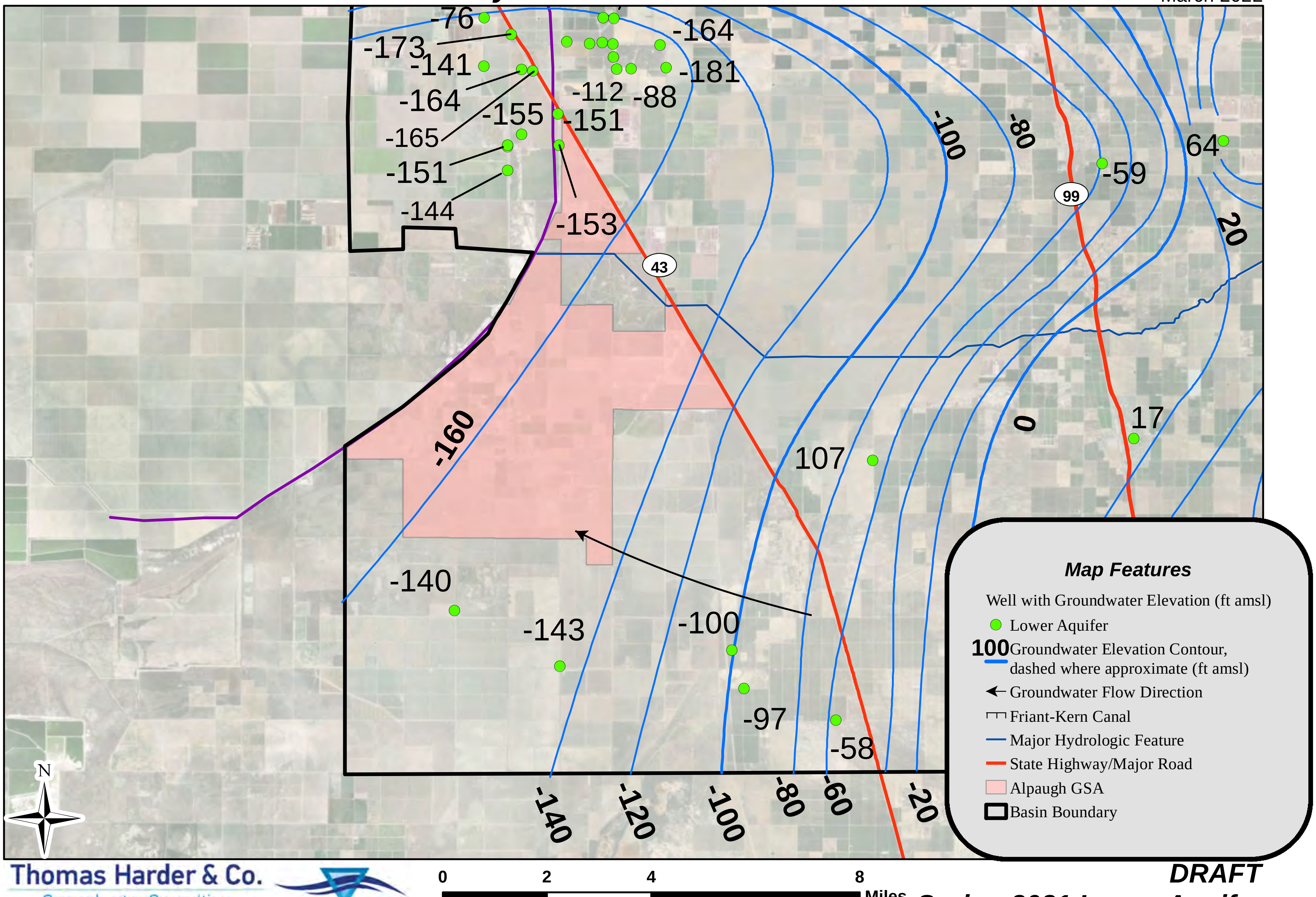
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 6



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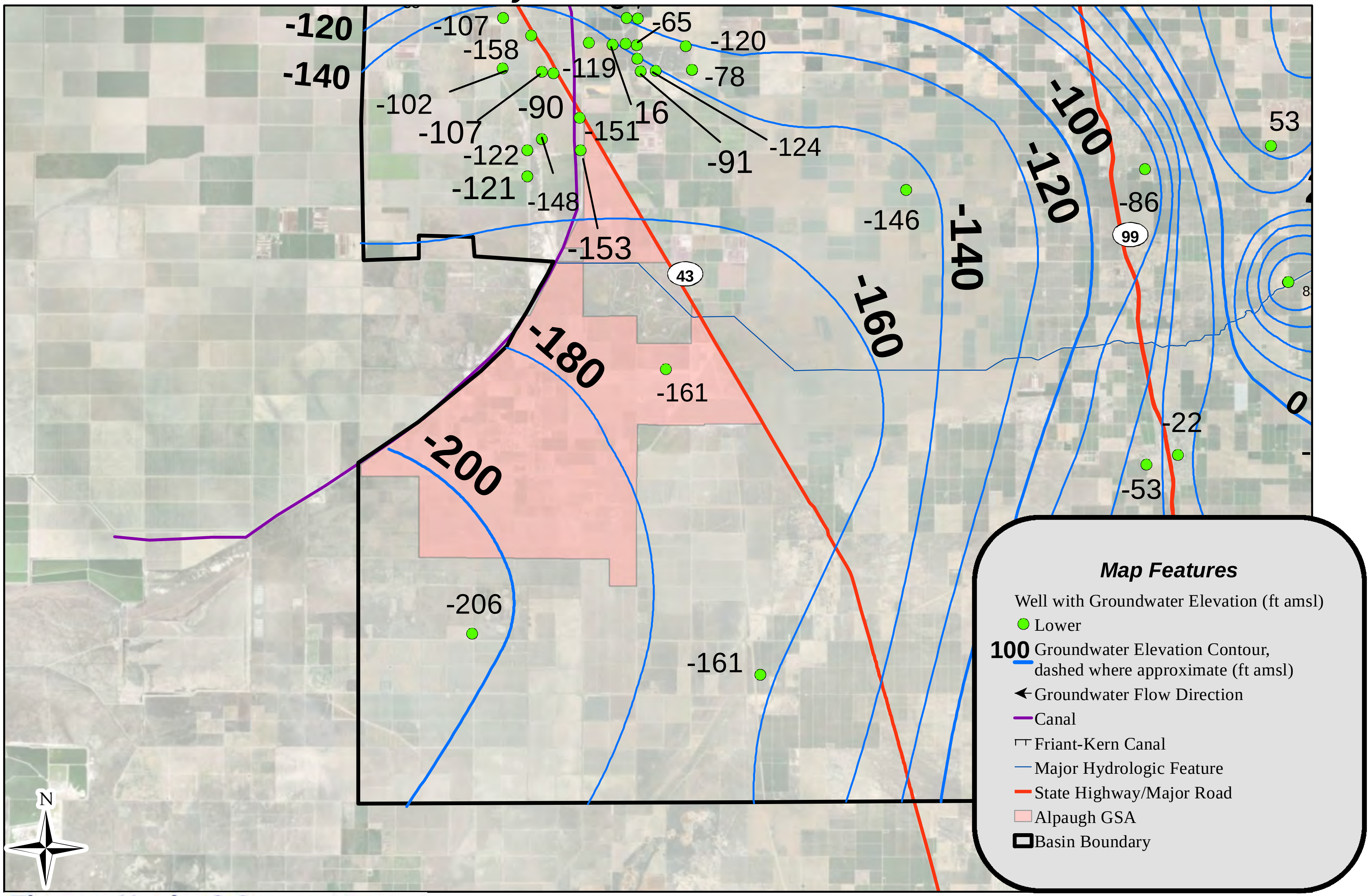
NAD 83 State Plane Zone 4
Note: All groundwater elevations are in feet above mean sea level.

DRAFT
Spring 2021 Lower Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 7

Tule Subbasin Technical Advisory Committee

2020/2021 Annual Report

March 2022



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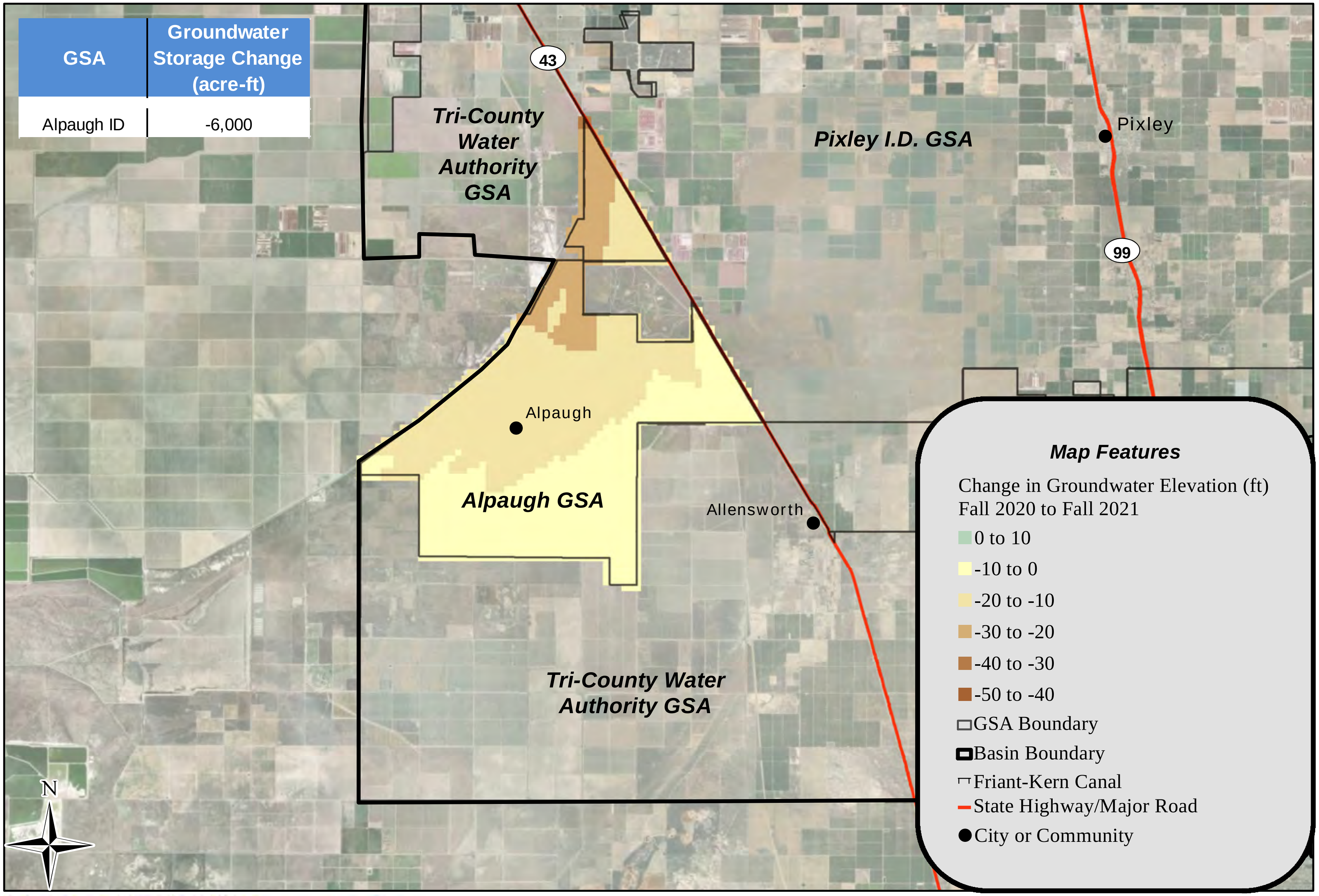
NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Fall 2021 Upper Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 8

Tule Subbasin Technical Advisory Committee

GSA	Groundwater Storage Change (acre-ft)
Alpaugh ID	-6,000



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Change in Groundwater Elevation Fall 2020 to Fall 2021
Upper Aquifer - Alpaugh I.D. GSA

Appendix F
Figure 9

ATTACHMENT 2 – PIXLEY GSA RULES AND OPERATING POLICIES

Pixley Irrigation District Groundwater Sustainability Agency

WATER MEASUREMENT & METERING

The landowners within the GSA utilize both surface water and groundwater to meet the needs of the business operations and producing agricultural products. A key component to manage the sustainability of groundwater is to measure quantitatively the total amount of water used by each landowner within the GSA. This will allow the GSA to track groundwater water usage by landowner which can then be correlated to the amounts allowed to achieve sustainability. The GSA will utilize satellite imagery to determine crop demands at the landowner level

Per the Pixley Irrigation District Surface Water Allocation Policy, adopted 8/8/19, the District has determined that imported surface water should be allocated proportionally to lands within the District on an annual basis. Since not all lands in the District are connected to the District canal system, the District policy is to accomplish such an allocation by annually allocating surface water as groundwater credits. Surface water, once actually delivered to lands with access to the District canal system and consumed by those lands through crop production would then be accounted for as a reduction against their allocated groundwater credits.

Total Crop Demand (Evapotranspiration or ET) is calculated by a third party, using NASA LAndSat satellite imagery.

Consumption, based on the ET calculations will be tracked and will be available in the following sequencing:

i. Precipitation Yield
ii. Sustainable Yield
iii. District allocated groundwater credits (per surface water allocation policy)
iv. Transitional groundwater credits**
v. Landowner developed groundwater credits**

**The sequencing of the Transitional water credits and Landowner developed groundwater credits can be switched at the landowner's discretion.

The satellite imagery used to determine the ET values, will be audited by the GSA through spot checking land use for cropping patterns and compared to available District metered data.

Pixley Irrigation District Groundwater Sustainability Agency

GROUNDWATER BANKING AT THE LANDOWNER LEVEL

Irrigation District Recharge

The irrigation district oversees and manages the surface water for the district, separate and apart for the Groundwater Sustainability Agency. The irrigation district recognizes the surface water supplied is very important to achieve groundwater sustainability and needed for the landowners to continue operations of their farms and that landowners need to be able to balance all of these resources to achieve sustainability under SGMA.

When Millerton Reservoir is in flood control operations and surface water beyond what is needed to meet irrigation demands is available, the irrigation district will maximize the use of these surface waters and divert these waters into the natural waterways, open channel canals, and district owned recharge basins. This will occur most often during above average water years when those waters cannot be stored and are released from local reservoirs. The surface water diverted and recharged into groundwater into district owned facilities is done to benefit all the landowners within the district without regard for specific credits under SGMA. Additionally, the irrigation district will continue to optimize the distribution systems to maximize the recharge of surface water while supplying surface water to landowners as efficiently as possible.

Landowner Groundwater Banking

During these periods of flood operations, and where surplus surface waters are deemed to be available by the District, landowners within the GSA can divert surface water into landowner owned designated recharge facilities for future groundwater credits as follows:

1. Water the landowner purchases from the irrigation District through regular surface water purchase procedures.

2. The District has established the following priority order of water service and related canal capacities:
    - Deliveries for irrigation demand
    - District recharge/banking for the benefit of all landowners
    - Landowner recharge/banking

When these periods occur, the landowner can bank this surface water that is recharged to groundwater under the following conditions:

1. The surface water purchased must be applied directly to a specific groundwater recharge basin that meets the minimum GSA requirements for a groundwater recharge basin. The location of the basin must be registered with the GSA to receive any credits.
    - All surface water diverted to the landowner is required to be metered per GSA metering requirements.
    - Surface water diverted will be credited to the landowner at 90% of the surface water diverted. The remaining 10% credit will remain with the GSA for the benefit of all the landowners.
    - The groundwater credits issued to the landowners will be available and carried over to subsequent years. The term of the credits will be perpetual. The groundwater credits can also be transferred, sold, or leased to other landowners based upon the GSA groundwater transfer criteria.
2. Landowners can apply surface water above irrigation demand and generate groundwater credits as follows:
    - All surface water diverted to the landowner is required to be metered per GSA metering requirements.
    - Surface water diverted will be credited to the landowner at 90% of the surface water diverted. The remaining 10% credit will remain with the GSA for the benefit of all the landowners.
    - The groundwater credits issued to the landowners will be available and carried over to subsequent years. The term of the credits will be perpetual. The groundwater credits can also be transferred, sold, or leased to other landowners based upon the GSA groundwater transfer criteria.

Pixley Irrigation District Groundwater Sustainability Agency

WATER ACCOUNTING AND WATER TRANSFERS

To effectively achieve groundwater sustainability within the GSA and the Tule Subbasin, while maintaining the agriculture operations during the implementation of SGMA, each landowner within the GSA will be provided a baseline groundwater credit. These groundwater credits act as an individual water bank account for each landowner, allowing each landowner to decide how to feasibly and economically manage their farm operation within the rules established by the GSA and the Tule Subbasin.

Water Accounting:

To adequately track, monitor, and account for the water credits within the GSA, the following water budget will be established and monitored for each landowner[1] in the GSA:

Groundwater Credit Inputs:	**Definition:**
Tule Subbasin Sustainable Yield	Common Groundwater available to all landowners within Tule Subbasin, defined under Subbasin Coordination Agreement
Precipitation Yield	Annual average precipitation in the GSA, calculated from 1991 going forward. Precipitation yield credits are not transferrable.
Districted Allocated Groundwater Credits	Allocated by the Board annually, per the Pixley Irrigation District Surface Water Allocation Policy, adopted 8/8/2019. Allocated amounts will be credited to landowners proportionally based on assessed acres.
Landowner Developed Credits	• Surface Water diverted by the landowner into a specified recharge basin, credited per criteria set forth in Policy 2: Banking at Landowner Level • Surface Water over-applied by landowner during flood operations, beyond crop demand, credited per criteria set forth in Policy 2. •

A credit or deficit for each landowner account will be accounted for on a monthly basis by the GSA.

Water Transfers:

Landowners may transfer groundwater water credits through either a direct sale or lease. The process for transferring groundwater credits is as follows:

1. Transfers within the GSA;

    - Groundwater credits will be tracked at a land-based level. Transfers of any credits accrued to the land requires the written approval of the landowner to transfer.
    - Groundwater credits can only be transferred by a landowner that has a positive balance in their groundwater budget. Deficit groundwater credit transferring is not allowed.
    - For every one acre-foot of groundwater credit a Landowner transfers out of their account, they cannot use one acre-foot of Transitional Groundwater Credit in that year. They will regain access to the restricted Transitional Pumping amounts in the next year.
    - A groundwater credit transfer is a one to one transfer within the GSA. Transfers outside the GSA are subject to the Coordination with other Tule Subbasin GSAs.
    - All groundwater credit transfers require formal notification (GSA approved transfer template) and approval of the GSA. The GSA will keep an account of all transfers within the GSA Water Accounting Program. The sale or lease terms of the groundwater credits is between landowners and not subject to disclosure.

2. Transfers to other GSAs;
    - General Provisions;
        - Groundwater credits will be tracked at a land-based level.
        - Groundwater credits can only be transferred by a landowner that has a positive balance in their groundwater budget. Deficit groundwater credit transferring is not allowed.
        - For every one acre-foot of groundwater credit a Landowner transfers out of their account, they cannot use one acre-foot of Transitional Groundwater Credit in that year. They will regain access to the restricted Transitional Pumping amounts in the next year.
        - Groundwater Credits can only be transferred and used in GSAs within the Tule Subbasin that have similar landowner-based groundwater accounting systems as the LTRID and Pixley GSAs.
        - Groundwater credits may not be transferred or used outside of the Tule Subbasin.
        - A groundwater credit transfer is a one to one transfer ratio.

- The maximum amount of groundwater transfers out of the GSA per year will be limited to 10,000 AF.
- The maximum amount of groundwater transfers accepted into the District per year will be limited to 10,000 AF.
- The annual Deadline to submit transfer requests is May 1 of each year.
- If the total transfers requested are in excess of the 10,000 AF annual limit, the transfers approved will be allocated on a per acre owned basis.
  - Example:
    - Grower A requests 6,000 AF transfer
    - Grower B requests 6,000 AF transfer
    - Grower C requests 6,000 AF transfer
    - Grower A owns 1,000 acres
    - Grower B owns 500 acres
    - Grower C owns 250 acres
    - Each landowner will be allowed to transfer 5.71 AF/AC (10,000 AF limit / 1,750 acres)

3. Administration and Approval
   a. All groundwater credit transfers require formal notification (GSA approved transfer template) and approval of the GSA. The GSA will keep an account of all transfers within the GSA Water Accounting Program. The sale or lease terms of the groundwater credits is between landowners and not subject to disclosure.
   b. There will be a $100 fee, per transfer, charged by the GSA for administration and coordination with the other GSAs.
   c. In order to avoid undesirable results and avoid localized impacts, transfers in to certain areas may be limited or restricted even further by the GSA.
      i. The Groundwater Planning Commission and Board of Directors will annually review the hydrographs at each Representative Monitoring Site in the GSA to determine such restrictions for that year.
4. Implementation of the terms of this entire policy will be reviewed and determined annually by the Groundwater Planning Commission and Board of Directors. The Board of Directors reserves the right to change terms of this policy at any time.

Pixley Irrigation District Groundwater Sustainability Agency

TRANSITIONAL GROUNDWATER CONSUMPTION

To assist landowners with the transition to implementation of the Sustainable Groundwater Management Act, groundwater use and extraction above basin wide sustainable yield will be phased based on periodic reviews of the GSP per the guidelines of SGMA.

The GSA will provide access to a water accounting program to track all water credits including District allocated groundwater credits, landowner developed groundwater credits, sustainable yield credits, precipitation yield credits, surface water allocations and transitional water consumption.

During the period of GSP implementation, transitional water credits (groundwater consumption above other available credits), may be consumed consistent with the following criteria:

1. Use will be consistent with the policies established for avoiding the undesirable effects under SGMA;
2. Transitional water will be available based on the following sequencing:
    i. Precipitation yield credits
    ii. Sustainable yield groundwater credits
    iii. District allocated groundwater credits
    iv. Transitional water credits**
    v. Landowner developed groundwater credits**

   **The sequencing of the Transitional water credits and Landowner developed groundwater credits can be switched at the landowner's discretion.

3. Transitional water credits will be available based on assessed acres and made available in 5-year blocks.
4. Transitional water credits stay with the landowner to be used on properties within the GSA and cannot be transferred to other landowners. Tier 1 transitional water allocations can be transferred to lease tenants on an annual basis.
5. An upper limit for net groundwater use, including transitional water allocations, will be established. Exceeding this limit will result in fines and reduced allocations in the next year, per Policy #8 Implementation & Enforcement of Plan Actions.
6. There will be a phased approach to the availability of groundwater for transitional water. The GSP will provide for levels of groundwater consumption that will be higher during the initial phases and decreasing over time to reach sustainable consumption levels (as required by SGMA) by 2040. The amount of Transitional water available will be determined at the beginning of each phase.
    a. The first phase of transitional water will be from 2020 through the 2025 (2 AF/Acre/year)
    b. The second phase of transitional water will be from 2026 through 2030

(1.5 AF/Acre/year)

c. The third phase of transitional water will be 2031 through 2035 (1 AF/Acre/year)
d. The final phase of transitional water will be from 2031 through 2040 (0.5 AF/Acre/year)

7. There will be a fee schedule for transitional water consumption. The fee schedule will be implemented as described below in 2020.
    i. Tier 1 of transitional water consumption is 50% of the total transitional water allocated for the period and shall be assessed a fee of $90 per acre foot starting in 2021. The price will be adjusted annually by the Board based on a formula using the change in the Friant Class 1 water rate.
    ii. Tier 2 is transitional water consumption over Tier 1, up to the total transitional water allocation and shall be charged a fee of two times the rate of tier 1 transitional water consumption.
    iii. There will be no fee applied during 2020 for the first 2 acre-feet of Transitional water consumed. Consumption over 2 acre-feet during 2020 will follow the fee schedule above.

The above fee schedule is intended to serve as both a disincentive mechanism while also relating to the cost of mitigating the impacts of use of transitional pumping allocations. The above amounts, being based on the cost of Friant Class 1 water, were based in part on an analysis of replacement water costs, and in part on the costs of groundwater production as the basis for an effective economic disincentive. Further analysis and additional justifications for the level of the fee may be considered by annually by the GSA.

8. Revenues will be used to mitigate impacts and implement projects and programs including, but not limited to:
    - Friant Kern Canal capacity correction
    - Surface water development
    - Additional recharge basin construction
    - Water conservation grants to GSA members
    - Land conservation and set-aside programs
    - Monitoring impacts and effects of groundwater pumping.
    - Other projects that may be identified by the GSA.

A specific plan of mitigation will be developed and will be based on relative levels of impacts that can be shown to be associated with transitional pumping. Additional analysis, including technical analysis of projected impacts together with costs of effective and reasonable mitigation measures, will be completed as part of GSP implementation.

Pixley Irrigation District Groundwater Sustainability Agency

LANDOWNER SURFACE WATER IMPORTED INTO THE GSA

District Landowners may participate in water exchanges or transfers outside of the GSA boundary that result in surface water being available for direct use by the landowner. Use of that water by the landowner within the GSA requires the use of Irrigation District infrastructure to divert this surface water to their land.

This surface water that is brought into the GSA by the landowner will be tracked and accounted by the GSA and applied to the landowner's water budget according to the following procedures:

1. Surface water brought into the GSA and credited to the landowner will be subject to a loss/reduction factor as determined by the Irrigation District Board of Directors.

2. Surface water brought into the GSA will be delivered to the landowner based upon canal capacity. No surface water delivery brought into the GSA will interrupt or interfere with scheduled allocations of the District surface water supplies.

3. Imported surface water may be used for groundwater recharge subject to the policies of the GSP.

Pixley Irrigation District Groundwater Sustainability Agency

DISTRICT ALLOCATED GROUNDWATER CREDITS

One of the primary purposes of the Pixley Irrigation District is to enhance the groundwater resources that underlie the District through the importation of surface water. The District overlies the Tule Subbasin Groundwater Basin, which has been defined by the State of California as being in a state of critical overdraft. Since it's formation in 1958, the District has imported as much surface water as possible to offset the use of groundwater for irrigation purposes and to replenish the aquifer through direct recharge via sinking basins, river channels and unlined canals. The District's efforts are funded through assessments and water charges paid by landowners in the District. The lack of access to a reliable surface water supply for Pixley means that providing water to landowners through both direct and in-lieu recharge in wetter years becomes a method for stabliizing access to water for the landowners of the District.

In 2014, the State of California passed the Sustainable Groundwater Management Act (SGMA), which regulates the use of groundwater in the State of California. Groundwater Sustainability Plans, under SGMA, are to be implemented by January 1, 2020. As part of the SGMA process, and consistent with the provisions of the California Water Code that are applicable to Irrigation Districts related to distribution of water resources among District lands, the District has determined that imported surface water should be allocated proportionally to lands within the District on an annual basis.

Historically, proportional distribution of the District's available surface water has presented a challenge in that not all the lands in the district have direct access to surface water. However, with the development of a GSP as required by SGMA, distribution of surface water on a District-wide proportional basis can now be accomplished by coordination with a groundwater allocation system. The approach taken in the District's Surface Water Allocation Policy is designed to provide proportional access of imported surface water to all lands in the District and not just those with access to the District's distribution system. To meet this goal, the surface water is allocated to all lands as an additional groundwater credit. Surface water actually delivered to lands with access to the canal system and consumed by those lands through crop production would then be accounted for as a debit against their groundwater credit balance.

District groundwater credit allocations will not be allocated in full to the landowners if a determination is made by the GSA Board that minimum threshold amounts identified in the GSP have not been met.

1. Allocation will occur annually on January 1 based on the prior year surface water supply received by the District.
    - Allocation will be made in the form of groundwater credits.

- The amount of the allocation will be a maximum of 90% of prior year surface water deliveries to account for evaporation and the ability to meet the goals of the Groundwater Sustainability Plan.
- The Board will address a variety of factors related to meeting the goals of the Groundwater Sustainability Plan before finalizing the allocation. As an example, if minimum thresholds of groundwater elevations have been exceeded, the leave behind factor may have to be greater and less water will be allocated.
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2. Allocations will be made to total developed, assessed acres. Non-irrigated lands will not receive an allocation.

3. Use and transfers of groundwater credits must follow the policies adopted by the GSA.

4. When surface water is made available, the District will make it available for irrigation purposes on a first come first served basis.
   - Each acre-foot of water consumed (ETc) by a landowner's crop through surface water delivered will result in an acre-foot of groundwater credit reduction from their groundwater account
   - Any water not delivered as irrigation demand, will be recharged by the District
   - Taking surface water will be on a voluntary basis
   - The price to access surface water will be set by the District and may be based on the approximate cost to pump groundwater, or other factors as deemed appropriate by the Board.

5. During flood release and unlimited uncontrolled season operations, based on the amount of water available to the District, the District may make water available to landowners for purchase by the landowner, for on-farm recharge per Policy #2.

Pixley Irrigation District Groundwater Sustainability Agency

CSD & PUD Water Use within the GSA

A community service district (CSD) is an entity formed by residents of an unincorporated area to provide a wide variety of services to its residences, particularly water and wastewater management, along with many others. A CSD may be formed and operated in accordance with the Community Services District Law (Government Code §61000-61850), which was created to provide an alternate method of providing services in unincorporated areas.

The Public Utility District Act authorizes the formation of public utility districts (PUD) and authorizes a district to acquire, construct, own, operate, and control works for supplying its inhabitants with water and other critical components for everyday life.

Within the Pixley GSA boundary are the following CSDs and PUDs ("Community):

- Teviston CSD
- Pixley PUD

Each Community entered into an MOU with the Pixley GSA to cooperate on SGMA implementation. Consistent with Section 3 of the MOU, the Community will be considered within the boundaries of the Pixley GSA and included in the Pixley Groundwater Sustainability Plan.

Consistent with Section 6 of the MOU, Pixley will identify the Community as a separate management area. As its own management area, Pixley will specifically address the minimum thresholds and measurable objectives for the Community to achieve sustainable management.

Reporting of Community Water Use

Consistent with Section 7 of the MOU, the Community will provide Pixley the following information for determining the net groundwater usage of the Community:

On a quarterly basis:

- Each Community will submit the total of groundwater pumped from Community wells.
- Each Community will submit the total of water discharged to the wastewater treatment system that is treated and diverted to percolation/evaporation ponds

Minimum Thresholds and Measurable Objectives

The following will be considered the minimum thresholds and measurable objectives required by the Community to meet the sustainability for the implementation of the Pixley GSP for the period from January 2020 to January 2026:

- The net of water pumped minus water discharged will be considered total Community water use

- The total of all treated water discharged to percolation/evaporation ponds, less 10%, will be available to the Pixley GSA for calculation and use in total Pixley GSA water balance.

- If the Community is providing any treated discharge to adjacent lands, the Community shall provide a regular accounting to the Pixley GSA that includes total volume amount discharged and APN(s) receiving the discharge.

- The water use will be reviewed through periodic updates to the GSP and will be compared to the available sustainable yield for the community and pumping limits acceptable to the GSA, as allowed under the regulatory code of SGMA.

- Community wells will include all wells used by the Community that are connected to the Community water distribution system.

- The Community and the GSA Board of Directors agree to cooperate on conditions of approval for future growth to ensure they are consistent with GSA and Community policies including pursing grant funding opportunities, outreach and joint projects for developing additional water supply for the Community.

Pixley Irrigation District Groundwater Sustainability Agency

IMPLEMENTATION & ENFORCEMENT OF PLAN ACTIONS

This Groundwater Sustainability Plan (GSP) establishes the actions, which include the policies, projects, and implementation schedule, to achieve groundwater sustainability, in accordance with the Sustainable Groundwater Management Act (SGMA).

A major element of implementationis the establishment of the accounting system, the enforcement of regulatory fees related to that system of accounting, and identification of mitigation items to be funded through those fees. Regulatory fees, and the process for establishing them, are discussed in greater depth in Policy 4 related to Transitional Pumping policies. As noted in that policy, the level and justification for fees for transitional pumping are subject to continued analysis and decision making by the GSA governing body and will be a major element of implementation of the GSP.

Regarding enforcement, for those landowners within the GSA who do not comply with the Actions of the GSP established to achieve sustainability, SGMA provides the GSA with the authority to enforce the approved actions. The Action of the GSP which are enforceable under the GSP include:

1. Failure to pay GSA assessments or groundwater consumption fees
2. Consumption of groundwater beyond the allowable limits set forth in the GSP
3. Failure to provide the GSA with required information

In the event of noncompliance by a landowner of the GSA, the following enforcement process will be implemented:

- At the time a landowner is identified as not complying with the approved Actions of the GSP, a Notice of Non-Compliance (NONC) letter will be issued to the landowner. The NONC will identify the area(s) of non-compliance and request formal response from the landowner identifying plan to get back into compliance within 30 days.

- If the landowner does not respond to the NONC letter within 30 days, a Notice of Violation (NOV) will be issued to the landowner, stating that the landowner is now in violation of the GSP implementing SGMA. The NOV will request a meeting within 15 days to discuss a plan of action to meet compliance. At the time of issuing a NOV, an administrative fine of $5 per acre fee will be assessed to that parcel(s) in violation, to be paid within 15 days.

- If a landowner has been determined to have consumed groundwater beyond the allowable limits, the landowner will receive a penalty of $1,000 per acre-foot and a reduction of groundwater credits will be applied to the landowner account. The reduction shall be the overage of consumption plus a factor of 1.5 times.

- If a landowner does not correct a NOV, a lien against the property will be filed by the GSA and the GSA will pursue action according to Water Codes Sections 25500- 26677

- If a lien has been filed against the property for outstanding balances (amounts added to assessments) from the previous year, then the landowner will not be served any surface water pursuant to Irrigation District policy.

- All fees collected will be used to for GSP implementation activities, including but not limited to, GSA administration and GSP project funding and implementation.

As with regulatory fees, all enforcement actions are subject to further refinement and definition as technical data and monitoring results are collected through the various management actions identified in the GSP.