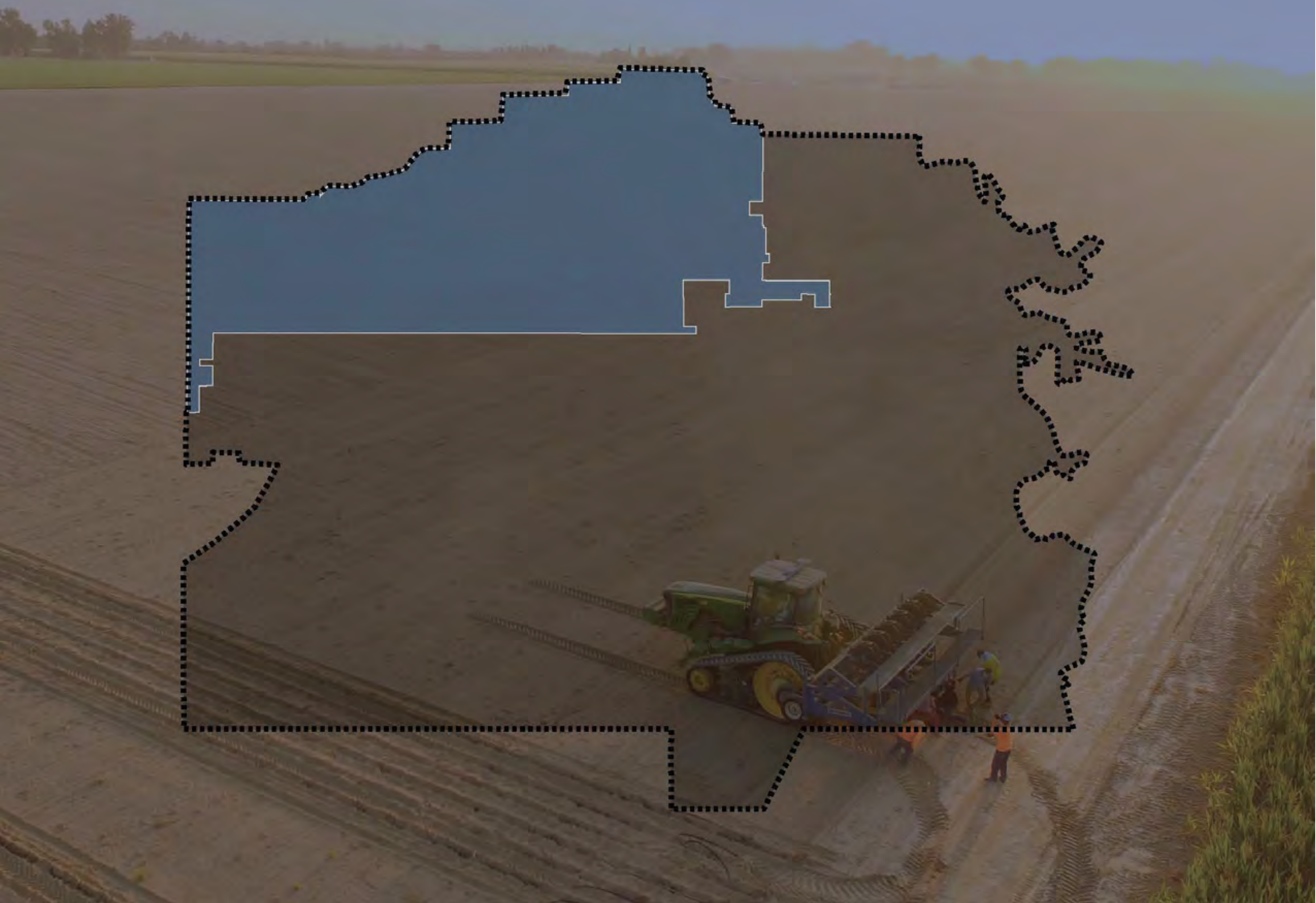
Sustainable Groundwater Management Act
Annual Report



Lower Tule River Irrigation District Groundwater Sustainability Agency

Tule Subbasin

October 2021 - September 2022

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

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
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
JPL	Jet Propulsion Laboratory

LTRID	Lower Tule River Irrigation District
LUSTs	Leaking Underground Storage Tanks
MOU	Memorandum of Understanding
MCL	Maximum Contaminant Level
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
PCSD	Poplar Community Service 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	Tipton Community Service District
Tipton CP	Tipton Community Plan
TRA	Tule River Association
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
WDL	Water Data Library
WPUD	Woodville Public Utility District

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 Subbasin's hydrogeologist, Thomas Harder and Company, has prepared an Annual Report summarizing the 2021/22 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 LTRID GSA Plan area is provided as Appendix A of the subbasin-wide annual report and will be referenced throughout this report (see Attachment 1).

This is the fourth annual report of the Lower Tule River Irrigation District Groundwater Sustainability Agency (LTRID 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, 2021 through September 30, 2022.

Sections of the LTRID 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 2021/22 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 2021/22 groundwater extractions by water use sector.

SECTION 4. SURFACE WATER USE [§356.2(b)(3)]. A description of 2021/22 surface water use by source.

SECTION 5. TOTAL WATER USE [§356.2(b)(4)]. A description of 2021/22 total groundwater extractions and surface water use.

SECTION 6. CHANGE IN GROUNDWATER STORAGE [§356.2(b)(4)]. A description of 2020/21 to 2021/22 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 2021/22 groundwater conditions compared to SMC and the GSA's progress towards implementing projects and management actions identified in the GSP.

GROUNDWATER ELEVATIONS

The GSA has identified twelve (12) wells to use as Representative Monitoring Sites (RMS), six (6) of which are perforated in the upper aquifer, five (5) are perforated in the lower aquifer, and one (1) well is perforated across both aquifers. Data collected from spring and fall 2022 is summarized in **TABLE ES-1.**

TABLE ES-1: GROUNDWATER LEVELS AT REPRESENTATIVE MONITORING SITE WELLS

Well ID	Groundwater Elevation (ft amsl)	
	Spring 2022	Fall 2022
Upper Aquifer		
21S/23E-32K01	94.60	95.04
21S/24E-35A01	106.85	108.36
21S/26E-32B02	174.47	158.48
21S/26E-34	241.40	NM[1]
22S/23E-30J01	29.95	-6.35
LTRID TSS U	186.30	179.40
Lower Aquifer		
20S/26E-32	143.39	113.19
21S/25E-36	70.99	NM[2]
22S/23E-08	-104.69	NM[2]
LTRID TSS M	111.80	99.10
LTRID TSS L	43.90	-29.90
Composite Aquifer		
22S/24E-01Q01	-35.00	6.00

1) Temporarily inaccessible / Gate locked
2) Pumping

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. Other sources of groundwater extractions included the communities of Tipton, Poplar, and Woodville, as well as groundwater pumped for exportation. Volumes of groundwater extraction by sector for the 2021/22 water year is provided in **TABLE ES-2**.

TABLE ES-2: TOTAL GROUNDWATER EXTRACTIONS

Management Area	Agricultural (AF)	Municipal (AF)	Export (AF)	Total (AF)
Agricultural MA	234,000	0	16,540	250,540
Municipal	0	1,217	0	1,217
Tulare County MOU	2,000	0	0	2,000
Total	236,000	1,217	16,540	253,757

Surface Water Use

Surface water supplies are available to the GSA as Tule River 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 2021/22 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)r	Precipitation (AF)	Total (AF)
Agricultural MA	8,842	42,214	0	54,211	105,267
Municipal	0	0	0	597	597
Tulare County MOU	0	0	0	571	571
Total	8,842	42,214	0	55,379	106,435

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 supplies, as well as municipal demands and is exported. 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	Exported	Ag[1].	Recharged[2]	
LTRID	234,000	0	16,540	72,642	32,625	355,807
Municipal	0	1,217	0	597	0	1,814
Tulare County MOU	2,000	0	0	571	0	2,571
Total	236,000	1,217	16,540	73,810	32,625	360,192

1) Includes effective precipitation
2) Recharge volumes include 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 on 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 57,000 acre-ft decrease in storage from the 2020/21 to 2021/22 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 149,425 acre-ft decline in groundwater storage from during the 2021/22 water year and is accounted for in **Table ES-5**.

Table ES-5: GSA Accounting of Groundwater Storage (October 2021 through September 2022)

October 2021 thru September 2022	LTRID	Municipal	Tulare Co. MOU		Total (AF)
Total Non-Groundwater Supply	105,267	597	571		106,435
Surface Water (streamflow, imported, recycled)	*51,056*	*0*	*0*		*51,056*
Applied Irrigation	*18,431*	*0*	*0*		*18,431*
Recharged[1]	*32,625*	*0*	*0*		*32,625*
Total Precipitation[2]	*54,211*	*597*	*571*		*55,379*
Total Consumptive Use	(252,624)	(1,217)	(2,019)		(255,860)
ETc (agricultural)	*(236,084)*	*0*	*(2,019)*		*(238,103)*
Metered (municipal, exported)	*(16,540)*	*(1,217)*	*0*		*(17,757)*
Water Balance	(147,357)	(620)	(1,448)		(149,425)

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 2021/22 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. Based on the available data for RMS well locations used to track groundwater conditions for the sustainability indicators, three RMS wells fell below their 2025 interim milestones, but were above their respective minimum thresholds.

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 actions 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
- Domestic Well Protection Projects and Management Actions

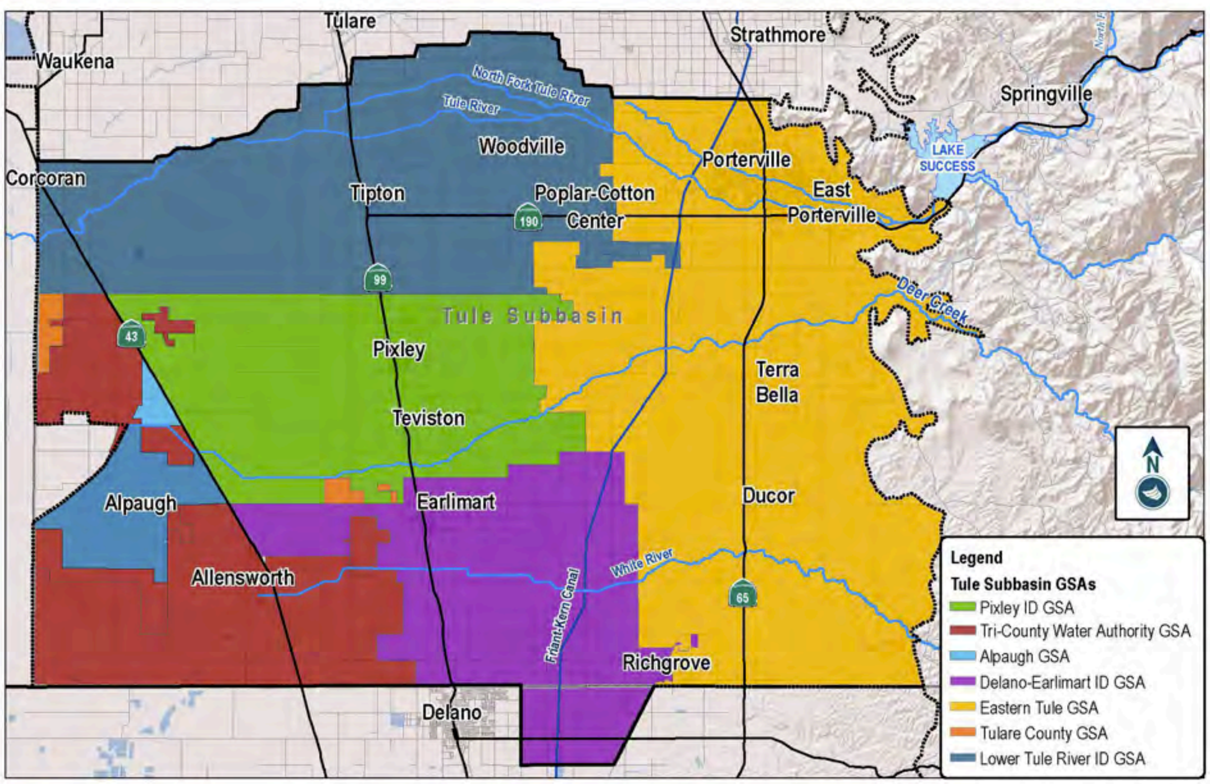
1 INTRODUCTION

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 2021/22 Annual Report, Figure 1) is completely located within Tulare County and is approximately 744 square miles (475,895 acres). 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



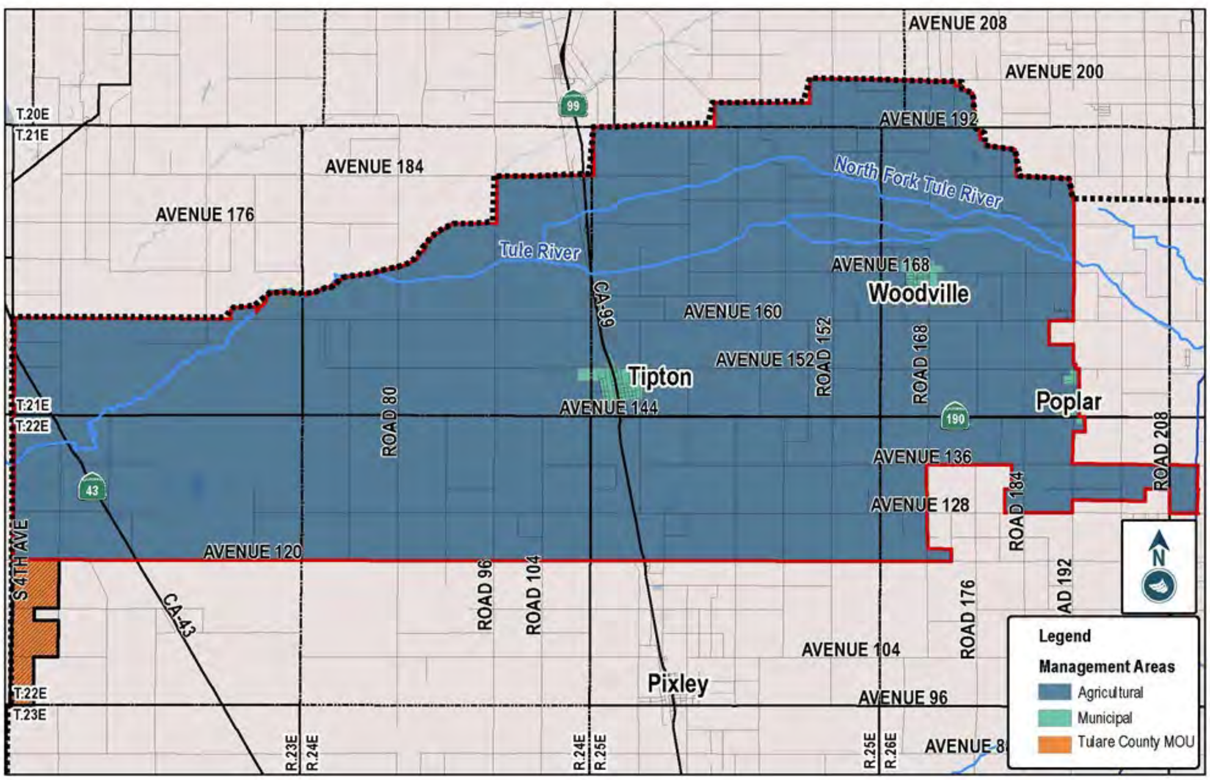
Six (6) of the seven (7) GSAs within the Tule Subbasin have developed and submitted to the CDWR independent Groundwater Sustainability Plans (GSPs) pursuant to 23 CCR §353.6. Tulare County GSA has entered into Memoranda of Understanding (MOUs) concerning coverage of territories under adjacent GSPs. As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

The LTRID GSA is located in the north-central portion of the Tule Subbasin and encompasses 105,338 acres within Tulare County. The GSA Plan area includes lands within the jurisdictional boundaries of Lower Tule River Irrigation District (LTRID), a portion of the Tulare County GSA area, and the municipalities adjacent to the District, each of which the Agency has entered into agreements providing for the management of groundwater under the LTRID GSA GSP (see **Figure 1-2**).

Figure 1-2: LTRID 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 following three (3) categories and displayed on **Figure 1-2**:

1. LTRID/ Agricultural Management Area
2. Municipal Management Area

- Tipton CSD, Woodville PUD, Poplar CSD

3. Tulare County MOU Management Area

1.3 Hydrogeological Setting

The hydrogeological of the Tule subbasin is described in Section 1.2 of the Tule Subbasin 2021/22 Annual Report (see **Attachment 1**), and a description relating to the LTRID GSA Plan area is provided below.

The GSA Plan area 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 180 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 from areas of natural recharge along Tule River in the towards a pumping depression located south of the GSA Plan area in the adjacent Pixley GSA (see **Attachment 1**, Appendix A, Figures 11, 12, 13, 14).

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.

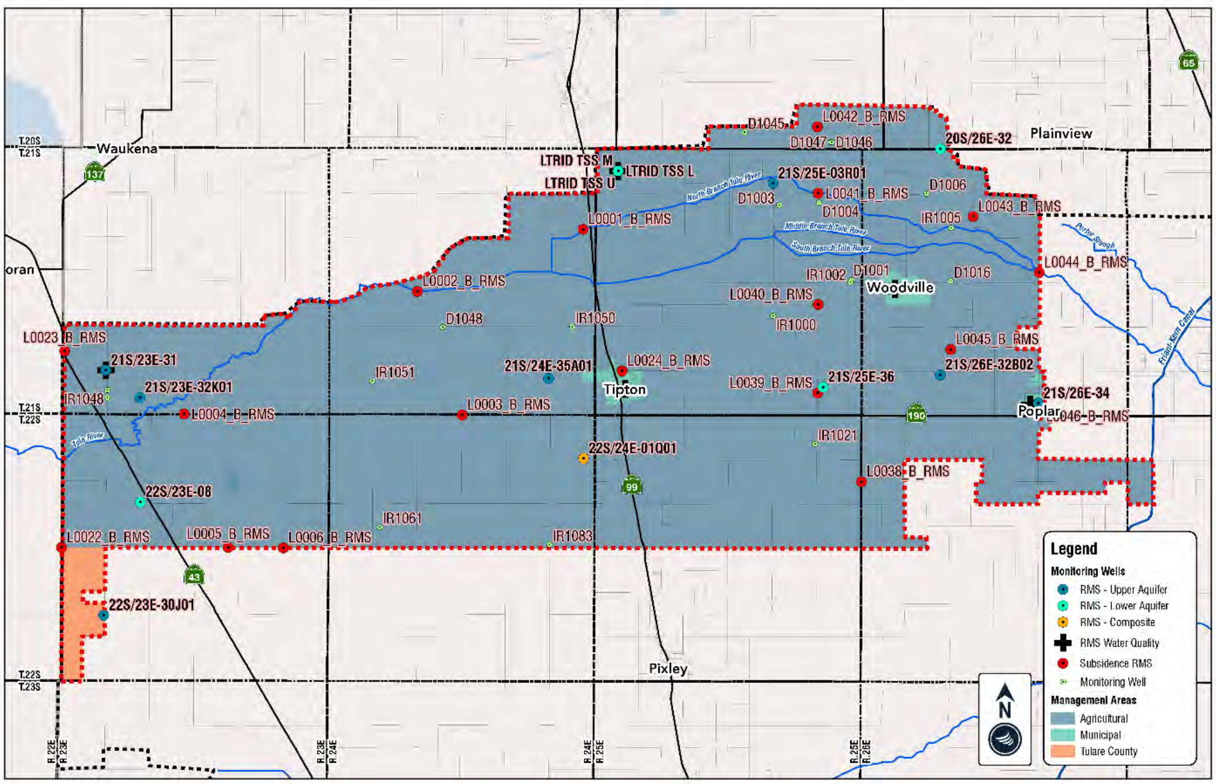
The groundwater level monitoring network for the Tule Subbasin includes monitoring features to enable collection of data from the Upper Aquifer, Lower Aquifer and Santa Margarita Formation aquifer (see **Attachment 1**, Figure 5). Groundwater levels are collected in the late winter/early spring (February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

A land surface elevation monitoring network has also been established and consists of 18 benchmarks installed in 2020 and 2021 in the GSA Plan area. Each benchmark is a representative monitoring site. The elevations of the benchmarks are surveyed annually. Land surface changed from July 2021 to July 2022 as measured at available benchmarks (see **ATTACHMENT 1**, Appendix A, Figure 7).

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 is provided in **ATTACHMENT 1**, Appendix A, Table 4, along with established measurable objectives and minimum thresholds. Land subsidence measured from InSAR data provided by the DWR from October 2021 to September 2022 is shown on Figure 10 in Appendix A of **ATTACHMENT 1**.

FIGURE 1-3: RMS MONITORING NETWORKS



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 2022 contour map(s) but was not available at the time the 2021 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 base maps 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. 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 (see **ATTACHMENT 1**) 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, **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 11 and 12 of Appendix A in the Tule Subbasin 2021/22 Annual Report displays groundwater contours for the upper aquifer in the LTRID GSA Plan area for the spring and fall of 2022, respectively (see **ERROR! REFERENCE SOURCE NOT FOUND.**).

From visual examination of the groundwater contour maps, groundwater in the upper aquifer of the GSA Plan area flows from areas of natural recharge along Tule River towards a pumping depression located south of the GSA Plan area in the adjacent Pixley GSA. 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 2022. Groundwater flow patterns in the upper aquifer did not change significantly between the spring and fall of 2022. Groundwater elevations in the upper aquifer range from 300 amsl to 20 amsl.

2.1.2 LOWER AQUIFER

Figures 13 and 14 of Appendix A in the Tule Subbasin 2021/22 Annual Report display groundwater contours maps for the lower aquifer in the LTRID GSA Plan area for the spring and fall of 2022, respectively (see **ATTACHMENT 1**).

From visual examination of the groundwater contour maps, groundwater in the lower aquifer generally follows the same flow pattern as flows in the upper aquifer, with the pumping depression being observed moving slightly west towards the LTRID GSA Plan area south/west boundary with Tri-County GSA and Alpaugh GSA. Groundwater elevations in the lower aquifer range from 200 amsl to -160 amsl

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

Groundwater level hydrographs for Representative Monitoring Site (RMS) wells in the LTRID GSA Plan area are provided in Figures 1 through 7 of Appendix A in the Tule Subbasin 2021/22 Annual Report (see **ATTACHMENT 1**).

Spring and fall 2022 groundwater levels for the RMS wells are summarized in **TABLE** 2-1.

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

Well ID	Groundwater Elevation (ft amsl)	
	Spring 2022	Fall 2022
Upper Aquifer		
21S/23E-32K01	94.60	95.04
21S/24E-35A01	106.85	108.36
21S/26E-32B02	174.47	158.48
21S/26E-34	241.40	NM[1]
22S/23E-30J01	29.95	-6.35
LTRID TSS U	186.30	179.40
Lower Aquifer		
20S/26E-32	143.39	113.19
21S/25E-36	70.99	NM[2]
22S/23E-08	-104.69	NM[2]
LTRID TSS M	111.80	99.10
LTRID TSS L	43.90	-29.90
Composite Aquifer		
22S/24E-01Q01	-35.00	6.00

1) Temporarily inaccessible / Gate locked
2) Pumping

The GSA has identified twelve (12) wells to use as Representative Monitoring Sites (RMS), six (6) of which are perforated in the upper aquifer, five (5) are perforated in the lower aquifer, and one (1) well is perforated across both aquifers.

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2022 compared to Spring 2022.

For the Lower Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2022 compared to Spring 2022.

For the Composite Aquifer monitoring Well 22S/24E-01Q01, groundwater levels showed a 41.0-ft rise between spring and fall 2022.

For RMS wells that were not monitored during WY 2021/2022, 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 are categorized by agricultural, municipal and exported. Being that the land use within the LTRID 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 native precipitation, 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 2021/22 Annual Report (see **ATTACHMENT 1**).

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

TABLE 3-1: GROUNDWATER EXTRACTION

Groundwater Extraction (acre-feet)		
2019/20 WY	2020/21 WY	2021/22 WY
226,000	283,000	236,000
Annual Δ in Groundwater Extraction:	(57,000)[1]	47,000[1]
Average Δ in Groundwater Extraction:	(5,000)[3]	

1) [226,000 acre-feet – 283,000 acre-feet]
2) [283,000 acre-feet – 236,000 acre-feet]
3) [226,000 acre-feet – 236,000 acre-feet] ÷ 2

Within the LTRID GSA Plan area, the estimated volume of groundwater pumped for agricultural purposes in the 2019/20 WY amounted to approximately 226,000 acre-feet. The estimated volume of groundwater pumped for agricultural purposes in 2020/21 WY amounted to approximately 283,000 acre-feet. During the 2021/22 WY, groundwater pumped for agricultural purposes amounted to approximately 236,000 acre-feet.

The annual rate of change in groundwater extraction for the LTRID GSA Plan area between the 2019/20 WY to 2021/22 WY was estimated to have increased by 5,000 acre-feet per year. This contrasts the consumption analysis performed by considering evapotranspiration (see **Section 7.2.1**). The GSA will continue to refine data sources and methods of analyses in order to understand this discrepancy.

3.2 MUNICIPAL

Municipal groundwater pumping metered data was provided by the communities of Tipton and Woodville. The community of Poplar municipal pumping was estimated based on population density and per capita water use as reported in Urban Water Master Plan.

Within the LTRID GSA Plan area volume of groundwater pumped for municipal purposes in 2021/22 water year amounted to approximately 1,220 acre-feet.

3.3 EXPORTED

Some of the groundwater pumping that occurs in the LTRID GSA Plan area is exported out of the Boswell/Creighton Ranch for use out of the Tule Subbasin. Total groundwater exports out of the GSA Plan area for the 2021/22 water year was 16,540 acre-feet, obtained through meter data from wells that extract the groundwater for exportation. This water is accounted for separately because the water is not applied within the subbasin and there is no associated return flow.

3.4 SUMMARY OF TOTAL GROUNDWATER EXTRACTIONS

Total groundwater extraction from the LTRID GSA Plan area for the 2021/22 water year was 253,757 acre-ft (see **Table 3-2**).

TABLE 3-2: TOTAL GROUNDWATER EXTRACTIONS

Management Area	Agricultural (AF)	Municipal (AF)	Export (AF)	Total (AF)
Agricultural MA	234,000	0	16,540	250,540
Municipal	0	1,217	0	1,217
Tulare County MOU	2,000	0	0	2,000
Total	236,000	1,217	16,540	253,757

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 LTRID GSA Plan area through the Lower Tule River Irrigation District (LTRID, District) as diverted stream flow from native Tule River downstream as a downstream rights holder and imported Central Valley Project (CVP) Friant and Shasta Division contracts.

The District delivers the surface and imported water available to them to meet crop demands for landowners within the District as a first priority of use. During time surface water supplies are available in excess of crop demands, the supplies can be diverted to 4,516 acres of recharge basins owned by the District for future landowner in-lieu pumping of groundwater. The GSA and District also promote 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 TULE RIVER STREAMFLOW

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[1]. Releases of water from Lake Success and downstream diversions are documented in Tule River Association (TRA) annual reports.

For water year 2021/22, a total of 8,842 acre-ft of water was released to the Tule River from Success Reservoir and delivered within the LTRID service area.

4.2 IMPORTED WATER

All of the water imported into the LTRID GSA Plan area is from the Central Valley Project (CVP) and delivered via the Friant-Kern Canal and later diverted into the LTRID's distribution system consisting of unlined canals for delivery to landowners and recharge basins within the District.

The total volume of imported water for the 2021/2022 water year was 42,214 acre-feet.

4.3 PRECIPITATION

Section 4.5 of the Tule Subbasin 2021/22 Annual Report describes the methodology used to estimate the precipitation for the Tule Subbasin (see **ATTACHMENT 1**).

The total volume of precipitation available in 2021/22 was based on LandIQ that was estimated to be 55,379 acre-ft.

[1] TRA, 1966

4.4 Summary of Total Surface Water Supplies

Total surface water supplied to the LTRID GSA Plan Area for the 2021/22 water year was estimated to be 106,435 acre-feet (**Table 4-1**).

Table 4-1: Total Surface Water Supply

Management Area	Stream Diversions (AF)	Imported Water (AF)	Recycled Water (AF)r	Precipitation (AF)	Total (AF)
Agricultural MA	8,842	42,214	0	54,211	105,267
Municipal	0	0	0	597	597
Tulare County MOU	0	0	0	571	571
Total	8,842	42,214	0	55,379	106,435

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 LTRID GSA Plan area during the water year 2021/22 consisted of water for meeting agricultural and municipal demand, along with groundwater exports. Agricultural demands were met through a combination of groundwater extractions, surface water deliveries and effective precipitation, while municipal and exported water was entirely from groundwater extractions. The total water use within the GSA Plan area was 360,192 acre-ft. **TABLE 5-1** describes the volumes of water use by use sector and source.

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

Management Area	Groundwater (AF)			Surface Water (AF)		Total (AF)
Source:	Ag.	Municipal	Exported	Ag[1]	Recharged[2]	
LTRID	234,000	0	16,540	72,642	32,625	355,807
Municipal	0	1,217	0	597	0	1,814
Tulare County MOU	2,000	0	0	571	0	2,571
Total	236,000	1,217	16,540	73,810	32,625	360,192

1) Includes effective precipitation to meet crop demands

2) Recharge volumes include 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 2021 and fall 2022 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 in the Upper Aquifer 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 2021 and fall 2022, groundwater in storage decreased in the Upper Aquifer by approximately 57,000 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 2021/22 water year.

A change in groundwater storage map within the GSA Plan area is displayed as Figure 15 in Appendix A of the Tule Subbasin 2021/22 Annual Report (see **ATTACHMENT 1**) using groundwater elevations as the basis for estimating groundwater change in storage.

Figure 18 of the Tule Subbasin 2021/22 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 2021/22 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 **Eq.** 6-1 to determine change in groundwater storage based on total water use (ETc, metered) and total non-groundwater supply **TABLE 6-1**: GSA Accounting of Groundwater Storage provides a summary of this accounting for the GSA.

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

TABLE 6-1: GSA ACCOUNTING OF GROUNDWATER STORAGE (OCTOBER 2021 THROUGH SEPTEMBER 2022)

October 2021 thru September 2022	LTRID	Municipal	Tulare Co. MOU	Total (AF)
Total Non-Groundwater Supply	105,267	597	571	106,435
Surface Water (streamflow, imported, recycled)	*51,056*	*0*	*0*	*51,056*
Applied Irrigation	*18,431*	*0*	*0*	*18,431*
Recharged[1]	*32,625*	*0*	*0*	*32,625*
Total Precipitation[2]	*54,211*	*597*	*571*	*55,379*
Total Consumptive Use	(252,624)	(1,217)	(2,019)	(255,860)
ETc (agricultural)	*(236,084)*	*0*	*(2,019)*	*(238,103)*
Metered (municipal, exported)	*(16,540)*	*(1,217)*	*0*	*(17,757)*
Water Balance	(147,357)	(620)	(1,448)	(149,425)

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 fall of 2021 to fall of 2022, groundwater decreased by 149,425 acre-ft.

The difference in the change in groundwater storage volumes between the GIS methodology and the GSA's accounting is approximately 92,425 acre-ft. 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 GSA's 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 2021/22 water year within the LTRID GSA Plan 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 LTRID GSA GSP to determine the GSA's progress toward successfully implementing its GSP.

With the exception of groundwater quality, the other three sustainability indicators relied on the Tule Subbasin Groundwater Flow Model (GFM) projections for establishing SMC's. By incorporating historical data, climate change, and GSA's proposed projects and management actions, the GFM predicted conditions relative to each sustainability indicators and is the basis for the established quantifiable interim milestones and measurable objectives. 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. The 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 Subbasin 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."*

Sustainable Management Criteria (SMC; measurable objectives, intermediate milestones, and minimum thresholds) have been assigned to the newly added RMS wells (see ATTACHMENT **3: Updated Sustainable Management Criteria**).

The following well(s) have been removed from the groundwater level RMS monitoring network:

- 21S/26E-32A01 – repeatedly unable to measure due to lack of access port

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.

When reviewing the SMCs and monitoring data in the following sections it is important to consider the efforts of the Tule Subbasin TAC and each of the GSAs within to develop mitigation framework and adopt mitigation plans for addressing impacts resulting from the implementation of GSPs. This is expanded on in **SECTION 7.2.7** of this report.

7.1.1 GROUNDWATER ELEVATIONS

There are twelve (12) RMS wells in the LTRID GSA (see **FIGURE 1-3**). Of these wells, seven (7) are perforated in the Upper Aquifer, five (5) are perforated in the Lower Aquifer, and one (1) is a composite well perforated in two aquifers. Hydrographs for each of the wells are provided in Appendix A of the Tule Subbasin 2021/22 Annual Report as Figures 1 through 7 (see **ATTACHMENT 1**). Available groundwater level data for RMS wells from spring and fall 2022 are summarized in **TABLE 7-1** and is the basis for comparing the measured data in RMS well to sustainable management criteria in Section 3 of the LTRID GSA GSP.

TABLE 7-1: RMS WELL GROUNDWATER ELEVATION DATA

Well ID	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
21S/23E-32K01	95.23	95.04	54	13
21S/24E-35A01	106.85	108.36	68	53
21S/26E-32B02	174.47	158.48	113	103
21S/26E-34	241.40	NM[1]	261	231
22S/23E-30J01	29.95	-6.35	-61	-71
LTRID TSS U	186.30	179.40	129	101
Lower Aquifer				
20S/26E-32	143.39	113.19	79	36
21S/25E-36	70.91	NM[2]	49	1
22S/23E-08	-104.69	NM[2]	-195	-224
LTRID TSS M	111.80	99.10	62	28
LTRID TSS L	43.90	-29.90	-67	-101
Composite Aquifer				
22S/24E-01Q01	-35.00	6.00	-85	-143

1) Temporarily inaccessible / Gate locked
2) Pumping

For the Upper Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2022 compared to Spring 2022. All measured groundwater levels in Upper Aquifer wells were above their respective measurable objectives and minimum thresholds.

For the Lower Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in Fall 2022 compared to Spring 2022. 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 --35.0 ft amsl to 6.0 ft amsl between spring and fall 2022. Both groundwater levels are above the measurable objective and minimum threshold for this well.

7.1.2 GROUNDWATER STORAGE

Groundwater storage in 2020/21 WY was estimated according to the equation and methodology described in Section 6 of the Tule Subbasin 2021/22 Annual Report using available groundwater elevation data (see **ATTACHMENT 1**). Based on this estimation, approximately 62.206 million acre-feet of groundwater was stored within the aquifers beneath the LTRID GSA Plan area. Applying the loss of groundwater storage volume previously mentioned in **SECTION 1: GROUNDWATER STORAGE** of 57,000 acre-feet occurring between 2020/21 WY and 2021/22 WY, the volume of groundwater storage beneath the LTRID GSA Plan area amounts to approximately 62.149 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 LTRID GSA Plan area were identified in Tables 3-3 and 3-8, respectively, in Section 3 of the LTRID GSA GSP. **TABLE** 2-1 provides a comparison of the 2022 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	2021/22 WY	2025 Interim Milestone	Measurable Objective	Minimum Threshold
62.342	62.288	62.206	62.149	60.59	59	58.1
Annual Δ in Storage:	0.054[1]	0.082[2]	0.057[3]	*0.3504[5]*	*0.1671[6]*	*0.2121[7]*
Average Δ in Storage:	0.0643[4]					

Notes:
1) [62.342 million AF – 62.288 million AF]
2) [62.288 million AF – 62.206 million AF]
3) [62.206 million AF – 62.149 million AF]
4) [62.342 million AF – 62.149 million AF] ÷ 3 years
5) [62.342 million AF –60.590 million AF] ÷ 5 years
6) [62.342 million AF – 59.000 million AF] ÷ 20 years
7) [62.342 million AF – 58.100 million AF] ÷ 20 years

The volume of groundwater storage in 2022 remains greater than the established 2025 interim milestone, measurable objective and minimum threshold volumes for the LTRID GSA Plan area. The average annual rate of decline in groundwater storage for LTRID GSA Plan area between 2019/20 WY to 2021/22 WY amounts to 64,300 acre-feet per year. Whereas the average annual rate of decline for groundwater storage between 2019/20 WY and the established 2025-interim milestone is 350,400 acre-feet per year, making the experienced change in groundwater storage annual average rate of decline less than the acceptable rate for achieving the 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 overlying land uses and users of the groundwater.

Additional information on the revised process for establishing Interim Milestones, Measurable Objectives, and Minimum Thresholds can be referenced in the revised Tule Subbasin Coordination Agreement's Attachment 5 and the updated GSP, submitted Summer 2022.

Interim Milestones/Measurable Objective

There are four (4) water quality RMS wells within the LTRID GSA Plan area. Additionally, the GSA will analyze water quality data from the communities of Tipton, Poplar, and Woodville municipal wells for monitoring water quality conditions throughout the implementation of its GSP. The basis for setting SMC's at each RMS location as described in the LTRID GSA GSP is outlined below:

The interim milestones and measurable objective for the Groundwater Quality Sustainability Indicator have been quantified using the following available data:

- Utilizing historical groundwater quality data from the existing RMS wells which are monitored under separate groundwater quality regulatory programs, such as those wells monitored under the California Regional Water Quality Control Board Irrigated Lands Regulatory Program, CV-Salts Nitrate Control Program, and those associated with Public Water Systems; and
- Other relevant information discussed in the Tule Subbasin Setting.

The following three (3) steps detail the process for setting interim milestones and the measurable objective at individual RMS related to Groundwater Quality:

Step 1:

Locate the RMS defined in the Tule Subbasin Monitoring Plan, identify which portion of the aquifer it represents, and the associated Constituents of Concern (COC) to be monitored at the RMS based on beneficial uses and users of groundwater represented by the RMS well (Agricultural, Drinking Water) as described below:

Drinking Water: The RMS well is within an urban MA or 1-mile of a public water system**.**

Agricultural: Greater than 50% of the pumping within the representative area is determined to be agricultural and there are no public water systems within a 1-mile radius.

Agricultural or drinking water constituents of concerns will be evaluated based on the established Maximum Contaminate Level (MCL) or Water Quality Objectives (WQO) by the responsible regulatory agency. In the case of drinking water, the following title 22 constituents will be monitored and for agricultural the following Basin Plan Water Quality Objective (WQO) COC as identified in **Table 7-3**: Constituents of Concern by Beneficial Uses and Users**.**

TABLE 7-3: CONSTITUENTS OF CONCERN BY BENEFICIAL USES AND USERS

Drinking Water	Agricultural
Arsenic	Nitrogen as N
Nitrate as N	Chloride
Hexavalent Chromium	Sodium
Dibromochloropropane (DBCP)	Total Dissolved Solids
1,2,3-Trichloropropane (TCP)	
Tetrachloroethene (PCE)	
Chloride	
Total Dissolved Solids	
Perchlorate	

Step 2:

Establish measurable objectives and interim milestones at each groundwater quality RMS well based on 75% of the regulatory limits set as part of the responsible regulatory programs that are applicable to the identified beneficial uses and users of groundwater represented by the RMS well as shown in **Table 7-4**.

Table 7-4: Interim Milestones & Measurable Objectives for Groundwater Quality

Constituent	Units	Interim Milestone & Measurable Objective	
		75% Drinking Water Limits (MCL/SMCL)	75% Agricultural Water Quality Objective (WQOs)
Arsenic	ppb	7.5	N/A
Nitrate as N	ppm	7.5	N/A
Hexavalent Chromium	ppb	7.5	N/A
Dibromochloropropane (DBCP)	ppb	0.15	N/A
1,2,3-Trichloropropane (TCP)	ppt	3.75	N/A
Tetrachloroethene (PCE)	ppb	3.75	N/A
Chloride	ppm	375	79.5
Sodium	ppm	N/A	51.75
Total Dissolved Solids	ppm	750	337.5
Perchlorate	ppb	4.5	N/A

Step 3:

Evaluate historical groundwater quality data for instances where SMCs established at RMS wells have been historically exceeded not as a result of implementation of a GSP. In those instances, SMCs will not be set at the MCLs or WQOs, but rather the pre-SGMA implementation concentration. These RMS wells closely monitored to evaluate if further degradation is occurring at the RMS site as a result of GSP implementation into the future.

Under the terms of the cooperative agreements with the PUD/CSDs, those agencies have an ongoing opportunity to propose minimum thresholds for additional constituents and determine whether additional changes to the monitoring network should be made to address water quality issues. The GSA will consider such proposals when made.

In addition, the GSA will seek to collect data from the public water systems as part of monitoring efforts. The collected data will reflect what these public water systems report to existing regulatory agencies to determine if existing regulatory requirements are being met and to determine if specific management actions would be warranted by the GSA under its authority to manage groundwater. The GSA will be monitoring and coordinating these items to determine if groundwater pumping activities are contributing to undesirable effects related to degraded water quality.

For Municipal management areas water quality data gathered from Consumer Confidence Reports will be utilized rather than quality reading taken from individual wells.

(Note that Point Source/Non-Point Source Discharges unrelated to groundwater recharge are not monitored under this Plan or regulated by the Agency).

The GSA acknowledges a gap in data related to individual domestic well water locations, elevations and water quality. The GSA will address this gap in coordination with Tulare County and other water quality regulatory programs and agencies that are being coordinated with this GSP, such as the Tule Basin Management Zone. Although the GSA cannot assume responsibility for failure of individual wells, the GSA may consider additional management actions beyond those identified in Section 5 of the revised GSP if specific data is developed that identifies domestic wells that go dry due to the lowering of groundwater levels during plan implementation. Any such action should be in coordination with Tulare County, including the potential for the continuation by the County of existing programs for drought mitigation assistance implemented during the last major drought.

Minimum Thresholds

The following three (3) steps detail the process for setting minimum threshold values at individual RMS wells related to Groundwater Quality:

Step 1:

Locate the RMS defined in the Tule Subbasin Monitoring Plan, identify which portion of the aquifer it represents, and the associated Constituents of Concern (COC) to be monitored at the RMS based on beneficial uses and users of groundwater represented by the RMS well (Agricultural, Drinking Water) as described below:

Drinking Water: The RMS well is within an urban MA or 1-mile of a public water system.

Agricultural: Greater than 50% of the pumping within the representative area is determined to be agricultural and there are no public water systems within a 1-mile radius.

Agricultural or drinking water constituents of concerns will be evaluated based on the established Maximum Contaminate Level (MCL) or Water Quality Objectives (WQO) by the responsible regulatory agency. In the case of drinking water, the following title 22 constituents will be monitored and for agricultural the following Basin Plan Water Quality Objective (WQO) COC as previously identified in **Table 7-3**: Constituents of Concern by Beneficial Uses and Users.

Establish minimum thresholds at each groundwater quality RMS well based on the regulatory limits set as part of the responsible regulatory programs that are applicable to the identified beneficial uses and users of groundwater represented by the RMS well as shown in **Table 7-5**.

Table 7-5: Minimum Thresholds for Groundwater Quality

Constituent	Units	Minimum Thresholds	
		Drinking Water Limits (MCL/SMCL)	Agricultural Water Quality Objective (WQOs)
Arsenic	ppb	10	N/A
Nitrate as N	mg/L	10	N/A
Hexavalent Chromium	ppb	10	N/A
Dibromochloropropane (DBCP)	ppb	0.20	N/A
1,2,3-Trichloropropane (TCP)	ppt	5	N/A
Tetrachloroethene (PCE)	ppb	5	N/A
Chloride	ppm	500	500
Sodium	ppm	N/A	69
Total Dissolved Solids	ppm	1,000	450
Perchlorate	ppb	6	N/A

Step 3:

Evaluate historical groundwater quality data for instances where SMCs established at RMS wells have been historically exceeded not as a result of implementation of a GSP. In those instances, SMCs will not be set at the MCLs or WQOs, but rather the pre-SGMA implementation concentration. These RMS wells closely monitored to evaluate if further degradation is occurring at the RMS site as a result of GSP implementation into the future.

(Note that Point Source/Non-Point Source Discharges unrelated to groundwater recharge are not monitored under this Plan or regulated by the Agency and may trigger a minimum threshold).

Results at each RMS during the 2022 WY can be found in **Table 7-6** and **Table 7-7**.

TABLE 7-6: RMS WATER QUALITY DATA- AG DESIGNATED WELLS

Constituent	Results		
	2022[1]	Measurable Objective	Minimum Threshold
RMS Well: 20S/26E-32 (E0090245)			
Chloride (ppm)	NM	375	500
Sodium (ppm)	NM	51.75	69
TDS (ppm)	133.45	338	450
RMS Well: 21S/26E-32B02 (E049930)			
Chloride (ppm)	NM	375	500
Sodium (ppm)	NM	51.75	69
TDS (ppm)	231.1	443	450
RMS Well: 21S/23E-31 (E0047650)			
Chloride (ppm)	NM	375	500
Sodium (ppm)	NM	51.75	69
TDS (ppm)	461.0	443	590

1) ND – none detected; NM – not measured/tested

Wells 20S/26E-32 and 21S/26E32B02 were below their respective measurable objectives for TDS. Well 21S/23E-31 exceeded its measurable objective for TDS, however is below the established Minimum Threshold.

The GSA did not test for Chloride or Sodium during this water year. This can be attributed to the fact that revised parameters regarding water quality objectives and well designations were established after monitoring had taken place. LTRID GSA will ensure that the additional constituents will be tested for in the upcoming water year.

TABLE 7-7: RMS WATER QUALITY DATA- MIXED/DRINKING WATER DESIGNATED WELLS

Constituent	Results		
	2022[1]	Measurable Objective	Minimum Threshold
RMS Well: Tipton CSD CCR – Drinking			
Arsenic (*ppb*)	7.18	7.5	10
Nitrate as N (*mg/L*)	6.55	7.5	10
Hexavalent Chromium (*ppb*)	ND	7.5	10
Dibromochloropropane (DBCP) (*ppb*)	ND	0.15	0.20
1,2,3-Trichloropropane (TCP) (*ppt*)	ND	3.75	5
Tetrachloroethene (PCE) (*ppb*)	NM	3.75	5
Chloride (*ppm*)	16.00	375	500
Total Dissolved Solids (*ppm*)	180.00	750	1,000
Perchlorate (*ppb*)	ND	4.5	6
RMS Well: Poplar CSD CCR – Drinking			
Arsenic (*ppb*)	ND	7.5	10
Nitrate as N (*mg/L*)	6.79	7.5	10
Hexavalent Chromium (*ppb*)	ND	7.5	10
Dibromochloropropane (DBCP) (*ppb*)	ND	0.15	0.20
1,2,3-Trichloropropane (TCP) (*ppt*)	ND	3.75	5
Tetrachloroethene (PCE) (*ppb*)	NM	3.75	5
Chloride (*ppm*)	10.20	375	500
Total Dissolved Solids (*ppm*)	300.00	750	1,000
Perchlorate (*ppb*)	ND	4.5	6
RMS Well: Woodville PUD CCR – Drinking			
Arsenic (*ppb*)	ND	7.5	10
Nitrate as N (*mg/L*)	11.67	7.5	10
Hexavalent Chromium (*ppb*)	ND	7.5	10
Dibromochloropropane (DBCP) (*ppb*)	ND	0.15	0.20
1,2,3-Trichloropropane (TCP) (*ppt*)	ND	3.75	5
Tetrachloroethene (PCE) (*ppb*)	NM	3.75	5
Chloride (*ppm*)	19.00	375	500
Total Dissolved Solids (*ppm*)	630.00	750	1,000
Perchlorate (*ppb*)	ND	4.5	6
RMS Well: LTRID TSS L – Mixed			
Arsenic (*ppb*)	NM	7.5	10
Nitrate as N (*mg/L*)	NM	7.5	10
Hexavalent Chromium (*ppb*)	NM	7.5	10
Dibromochloropropane (DBCP) (*ppb*)	NM	0.15	0.20
1,2,3-Trichloropropane (TCP) (*ppt*)	NM	3.75	5
Tetrachloroethene (PCE) (*ppb*)	NM	3.75	5

Chloride (*ppm*)	NM	375	500
Total Dissolved Solids (*ppm*)	NM	750	1,000
Perchlorate (*ppb*)	NM	4.5	6

1) ND – none detected; NM – not measured/tested

Woodville PUD was the only community where Nitrate as N exceeded its established Minimum Threshold. The GSA will continue to evaluate groundwater quality as it relates to the Woodville PUD wells to determine if the increase in nitrate contamination is a result of lowering of groundwater levels. The Woodville PUD is a focus of potential projects to assist with groundwater recharge; 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 2021/22 Annual Report, RMS for subsidence were proposed and arbitrary locations were identified until RMS subsidence benchmarks 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 LTRID 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.

Eighteen (18) subsidence RMS benchmarks were constructed in 2020 within the LTRID GSA Plan area. Elevations taken during the summer of 2022 are compared to baseline 2020 elevations at each of the RMS benchmarks are compared to the established 2025-interim milestones, measurable objectives, and minimum thresholds in **TABLE 7-8** and **TABLE 7-9**.

TABLE 7-8: RATE OF SUBSIDENCE

RMS Benchmark ID	Baseline Year	Ground Surface Elevation (ft amsl)		
		Baseline Measurement	2022	Rate (ft/year)[1]
L0001_B_RMS	2020	252.975	251.44	0.77
L0002_B_RMS	2020	228.884	226.81	1.03
L0003_B_RMS	2020	228.690	226.77	0.96
L0004_B_RMS	2020	197.263	195.78	0.74
L0005_B_RMS	2020	190.245	188.49	0.88
L0006_B_RMS	2020	192.263	189.97	1.15
L0022_B_RMS	2020	180.046	178.35	0.85
L0023_B_RMS	2020	190.843	189.39	0.73
L0024_B_RMS	2020	254.855	253.41	0.72
L0038_B_RMS	2020	321.584	320.52	0.53
L0039_B_RMS	2020	307.480	306.03	0.72
L0040_B_RMS	2020	308.990	307.87	0.56
L0041_B_RMS	2020	307.3480	306.17	0.59
L0042_B_RMS	2020	306.541	305.03	0.75
L0043_B_RMS	2020	348.618	348.46	0.08
L0044_B_RMS	2020	370.560	370.30	0.13
L0045_B_RMS	2020	346.292	345.31	0.49
L0046_B_RMS	2020	371.003	364.85	3.08

Notes:

1) Negative value indicates increase in ground surface elevation

TABLE 7-9: RMS SUBSIDENCE DATA

RMS Benchmark ID	Ground Surface Elevation (ft amsl)			
	2022	2025 Interim Milestone	Measurable Objective	Minimum Threshold
L0001_B_RMS	251.44	250	239	238
L0002_B_RMS	226.81	228	222	221
L0003_B_RMS	226.77	228	223	222
L0004_B_RMS	195.78	197	193	193
L0005_B_RMS	188.49	189	182	183
L0006_B_RMS	189.97	191	184	184
L0022_B_RMS	178.35	177	172	172
L0023_B_RMS	189.39	190	187	187
L0024_B_RMS	253.41	254	251	249
L0038_B_RMS	320.52	321	320	318
L0039_B_RMS	306.03	307	305	303
L0040_B_RMS	307.87	308	305	304
L0041_B_RMS	306.17	307	304	302
L0042_B_RMS	305.03	306	303	301
L0043_B_RMS	348.46	348	347	346
L0044_B_RMS	370.30	371	370	369
L0045_B_RMS	345.31	346	344	343
L0046_B_RMS	364.85	371	370	369

From review of the 2022 subsidence monitoring data in **TABLE 7-9** fifteen (15) of the benchmarks exceeded the 2025 interim milestone (L0002, L0003, L0004, L0005, L0006, L0023, L0024, L0038, L0039, L0040, L0041, L0042, L0044, L0045, L0046) 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 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 - LTRID 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
7. Domestic Well Protection Projects and Management Actions

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 LTRID GSA began implementing the "Agency Groundwater Accounting Action", as described in Section 5.2.1 of the LTRID 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 GSA's 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 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 0.76 acre-feet per acre based on the 27-year average for 2022.

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. The GSA has added the additional monitoring to address lack of data available. As a part of implementation, collection of the available data within the 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.

<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 7-10**), was adopted by the GSA governing board to gradually reduce groundwater consumption to sustainable levels by 2040.

TABLE 7-10: RAMP DOWN SCHEDULE

Groundwater Consumptive Use Allowed Above Sustainable Yield (AF)			
2021-2025	**2026-2030**	**2031-2035**	**2035-2040**
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 consumption 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 also identified potential management actions to not cause an undesirable result resulting from subsidence to key infrastructure such as the Friant Kern Canal (FKC), 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 was updated in 2020 by TH&Co. 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 LTRIDGSA.

The subsidence along the FKC continues to be evaluated with more specific analysis within the neighboring Eastern Tule GSA. As this further analysis continues to identify the causes of subsidence along the FKC and relative impacts from LTRIDGSA, adaptive updates to management actions as outlined in the GSP will take place, while monitoring continues and tracking transitional pumping.

The Tule Subbasin and LTRID GSA account for groundwater extraction data within the GSA through the use of crop evapotranspiration (ET). ET is estimated through the use of remote sensing data from Landsat satellites, Section 3.1 of the Tule Subbasin 2021/22 Annual Report describes the methodology used to estimate ET for the Tule Subbasin (see **ATTACHMENT 1)**.

Evapotranspiration (acre-feet)			
Management Area	**2019/20 WY**	**2020/21 WY**	**2021/22 WY**
Agricultural MA	258,796	249,464	236,084
Municipal MA	1,893	1,270	1,253
Tulare County MOU MA	2,848	1,987	2,019
TOTAL (acre-feet)	263,537	252,721	239,356
	Annual Δ in ET:	10,816[1]	13,365[2]
	Average Δ in ET:	12,091[3]	

Notes:
1) [263,537 acre-feet – 252,721 acre-feet]
2) [252,721 acre-feet – 236,048 acre-feet]
3) [263,537 acre-feet – 236,048 acre-feet] ÷ 2 years

Within The LTRID GSA Plan area, estimated amount of ET accounted for the 2019/20 WY amounted to 263,537 acre-feet. During the 2020/21 WY the estimated amount of ET occurring within the LTRID GSA Plan area amounted to 252,721 acre-feet. Within the LTRID GSA Plan area estimated amount of ET accounted for the 2021/22 WY amounted to 236,084 acre-feet.

The average annual rate of decline in evapotranspiration for LTRID GSA Plan area between 2019/20 WY to 2021/22 WY amounts to 12,091 acre-feet per year. This annual reduction is the direct result of the implementation of the GSA's policies implementing allocations and tracking of groundwater use, as well as fallowing programs as described in **Section 7.2.5** of this report.

Water accounting

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.

Develop policy for crediting groundwater recharge and banking activities

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 (see **ATTACHMENT 2**). The policy incentivizes landowners to use 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.

Develop policy for transferring groundwater credits

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.

Adjustment of policies for groundwater allocations and transfers

Status: *ongoing-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.

Create revenue for financing GSA operation, mitigation, monitoring, and projects

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**.

Develop policy for enforcement to ensure compliance with rules established to achieve sustainability.

Status: *complete, subject to future refinement*

The governing board to the LTRID 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 LTRID GSA GSP and has been a joint implementation between the LTRID and the landowners within the District.

Modify existing key water control structures

Annually the district performs maintenance on the distribution systems when the system is not in use. This includes nature water way and district owned channels routine maintenance. Additionally, the district has received grant funding to install meters at all recharge facilities to more accurately track volumes of surface water diverted for recharge activities. This project was completed in 2020.

Modify existing District recharge basins

As previously mentioned, the district received a grant for purchasing and installed meters at all recharge facilities during the year 2020.

Expand Supervisory Control and Data Acquisition (SCADA) system

Status: *on-going*

As part of the Groundwater Accounting Action, the LTRID 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 meters being installed at the recharge facilities is a component of the Districts expansion of the SCADA system.

Replace open channel canals with pipeline distribution systems

Status: *in-progress*

Since 2016, the District has successfully obtained WaterSMART and Department of Water Resources grants to install the Riparian Pipeline for replacing open channel distribution system with a pipeline distribution system. The first phase of the project was completed in 2019 and the second phase was completed in 2021. Prior to installation of the pipeline, approximately 5,750 acres within LTRID was served surface water though existing open the channels of the Tule River resulting in significant channel loss. The pipeline project relocated the distribution system from the Tule River channel to a pipeline distribution system and enhances in-lieu recharge for water that was previously lost to seepage. The project also expanded the District's ability to deliver surface water to lands that previously did not have direct access. With the completion of this project, nearly all of the lands within the District now have access to surface water.

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.

Maintain existing pipeline distribution systems

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.

Upgrade on-farm irrigation distribution systems

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 LTRID GSA GSP and include additional supplies made available through the Success Reservoir Enlargement Project (SREP), surface water infrastructure development, and delivery or increased deliveries of Central Valley Project (CVP) contracts. Progress towards implementing these projects is summarized below.

Success Reservoir Enlargement Project

Status: *on-going*

During the water year 2019, the Success Reservoir Enlargement Project made significant progress in moving forward with design. The Army Corps of Engineers completed Phase 1 Construction documents to relocate a road and complete the initial blasting and demolition. Phase 1 construction began in 2020 and is expected to be complete in 2021. The Army Corps. Of Engineers is currently finalizing bid documents for Phase 2 and will be sending them out soon. Phase 2 construction contracts are expected to be awarded and construction beginning in 2022. Additionally, the process to acquire the additional property due to the raised spillway is underway. The project will provide additional flexibility in management of the Tule River water, particularly during the Spring and Summer water runs. The project is on schedule to be completed in 2024.

Surface water infrastructure development

Status: *on-going*

The Riparian Pipeline Project previously described also applies to the surface water infrastructure development component of the surface water development project.

Delivery of CVP Shasta Division Contract

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. During 2022 the District entered into a long term exchange agreement to ensure the delivery of this water into the District.

Additional deliveries of CVP Friant Division Contract

Status: *on-going*

As the District and landowners continue to develop more land for groundwater recharge capability, it will allow the district to increase deliveries of CVP Friant Division Contract supplies during wet years.

7.2.4 Managed Aquifer Recharge and Banking

Managed aquifer recharge and banking projects are discussed in Section 5.2.4 of the LTRID GSA GSP and in **Section 7.2.1** of this report and consists of both expansion of the LTRID 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 4 in **Attachment 2**.

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

Expansion of District recharge basins

Status: *on-going*

The District currently owns and operates over 4,500 acres of recharge basins for conjunctively manage water resources. Since adoption of the GSP, the District has not developed additional acreage of recharge facilities but continues to assess potential opportunities for doing so in the future. In 2022, the District applied for a grant that will expand the District's recharge capabilities near the Disadvantaged Communities of Woodville and Tipton.

Development of landowner recharge basins

Status: *on-going*

Since adoption of the *Groundwater Banking at the Landowner Level* policy, 640 acres of recharge basins have been developed by landowners within the LTRID. As a result, the District is able to increase its capacity for taking on surface water when available in short windows of time.

7.2.5 Agriculture Land Retirement Projects

Agriculture land retirement projects are discussed in Section 5.2.5 of the LTRID GSA GSP and consists of the LTRID 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. Some lands within the district have been converted from crop production to use as recharge basins by landowners, resulting in the 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 LTRIDGSA was also a funding contributor of the Tule Basin Land & Water Conservation Trust in 2020. 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. 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 also interface with the Watershed Coordinator described in Section 7.2.6 regarding the plans outlined in the Tule Subbasin GSPs.

During 2021-2022, 3,856 acres of land were fallowed for the entire year, 3,122 acres were fallowed from October through May and 3,173 acres were fallowed from June – September, under the GSA's land fallowing policy and the Tule Basin Land & Water Conservation Trust pilot land fallowing project.

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 LTRID 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 Woodville and Tipton. Staff is working with local landowners to develop the recharge capabilities in and around these areas.

During 2022 the District developed Surface Water Delivery Operational Guidelines. The document outlines guidelines on handling surface water deliveries based on the amount of surface water supply available. Using these guidelines and with a limited surface water supply available in 2022, the District focused all of the deliveries of surface water during the summer water run to a 1 mile radius of the communities of Tipton, Poplar and Woodville. The result was, direct groundwater recharge and in-lieu groundwater recharge of approximately 8,300 acre-feet in and around those communities. This was done to help protect groundwater elevations in those areas.

The LTRID 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, which have established governance structures. Post adoption, the LTRIDGSA has continued working with these agencies.

The Lower Tule River Irrigation District entered into a cooperative Memorandum of Understanding (MOU) with the Poplar Community Services District, the Woodville Public Utility District and the Tipton Community Services District. Under the MOU, Lower Tule agreed to cooperate with the PUD and CSDs on the development of the Groundwater Sustainability Plans for the region. The PUD and CSDs were included in the Lower Tule River Irrigation District 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 CSDs in the SGMA process using the resources and coordination of the LTRIDGSA. The PUD and CSDs named a representative to the Planning Commission. The LTRIDGSA 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 LTRIDGSA is cooperating with the Pixley Irrigation District GSA which submitted for and was awarded a grant through 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. 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 LTRID GSA and the communities of Poplar, Woodville and Tipton.

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.
8. Working with willing landowners, identify potential agricultural lands coming out of production to meet groundwater sustainability goals.
9. Coordinate on-farm recharge with landowners. Collaborate with Fresno State, UC Davis and Sustainable Conservation on monitoring and evaluation of effects of recharge.

7.2.7 Domestic Well Protection Projects and Management Actions

As part of revisions to the Tule Subbasin Groundwater Sustainability Plans (GSPs) and Coordination Agreement approved by the Groundwater Sustainability Agencies (GSAs) within the Tule Subbasin, the GSAs each agreed to develop mitigation plans to address significant and unreasonable impacts to beneficial uses of groundwater during the sustainability transition period between 2020 and 2040. The revised Tule Subbasin Coordination Agreement submitted in July 2022 included a Mitigation Program Framework as Attachment 7, which outlined the general standards that each GSA would commit to in developing their respective Mitigation Programs. The GSAs further committed to completing the mitigation claims process for domestic and municipal wells by December 31, 2022 and all other aspects of the Mitigation Programs by June 30, 2023.

In December 2022, the GSA adopted a Groundwater Sustainability Plan Impact Mitigation Plan (see **Attachment 4**). The Mitigation Program allows for domestic, industrial, municipal, and certain agricultural well owners adversely affected by groundwater level impacts to file a claim with the GSA in which the well is located. The plan describes the process for filing a claim, assessment and evaluation of filed claims, and potential mitigation measures for accepted claims .

8 REFERENCES

California Department of Water Resources. n.d. "Sustainable Groundwater Management Act." *2016.*

Irrigation Training and Research Center. 2019. *California Irrigation Management Information System.* California Polytechnic University.

Lower Tule River Irrigation District Groundwater Sustainability Agency. 2020. "Groundwater Sustainability Plan."

National Aeronautics and Space Administration, Jet Propulsion Laboratory. 2019. *Interferometric Synthetic Aperture Radar.*

Thomas Harder and Company. 2022. "Tule Subbasin 2021/22 Annual Report."

Tule Baisn Water Quality Coalition (TBWQC). 2017. "Groundwater Quality Trend Monitoring Workplan Addendum."

Tule River Association. 2019. "Annual Report."

Tule River Association. 1966. "Tule RIver Diversion Schedule and Storage Agreement."

United States Enviromental Protection Agency. 2020. *Safe Drinking Water Information System - Woodville PUD.* https://sdwis.waterboards.ca.gov/PDWW/JSP/MonitoringResults.jsp?tinwsys_is_number=5954&tinwsys_st_code=CA&counter=0.

United States Environmental Protection Agency. 2020. *Safe Drinking Water Information System - Tipton CSD.* https://sdwis.waterboards.ca.gov/PDWW/JSP/MonitoringResults.jsp?tinwsys_is_number=5944&tinwsys_st_code=CA&counter=0.

United States Environmnetal Protection Agency. 2020. *Safe Drinking Water Information Center - Poplar CSD.* https://sdwis.waterboards.ca.gov/PDWW/JSP/MonitoringResults.jsp?tinwsys_is_number=5955&tinwsys_st_code=CA&counter=0.

United States of the Interior - Bureau of Reclamation. 2018 and 2019. "Central Valley Operations."

ATTACHMENT 1 - TULE SUBBASIN 2021/2022 ANNUAL REPORT

Tule Subbasin 2021/22 Annual Report

March 2023

Prepared for

Tule Subbasin Technical Advisory Committee

Prepared by

Thomas Harder, P.G., C.HG.
Principal Hydrogeologist

CERTIFIED HYDROGEOLOGIST • STATE OF CALIFORNIA •
THOMAS E. HARDER
No: 588

Thomas Harder & Co.
Groundwater Consulting

Table of Contents

Tables

Figures

Appendices

Executive Summary

This is the fourth 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, 2021 through September 30, 2022.

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 2022. 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 2022.

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 2021/22 water year relative to the 2020/21 water year. The magnitude of groundwater level decline in 2021/22 was less than 2020/21 due to lower groundwater pumping and higher surface water deliveries.

Groundwater Extractions

Total groundwater extraction from the Tule Subbasin for water year 2021/22 was 725,390 acre-ft, as summarized by water use sector in the following table:

Table ES-1
Tule Subbasin Groundwater Extraction for Water Year 2021/22

	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Agricultural MA	234,000	0	16,540	250,540
Municipal MA	0	1,220	0	1,220
Tulare County MOU MA	2,000	0	0	2,000
LTRID GSA	236,000	1,220	16,540	253,760
Greater Tule MA	125,000	0	0	125,000
Porterville Community MA	0	10,670	0	10,670
Ducor Community MA	0	200	0	200
Terra Bella Community MA	0	0	0	0
Kern-Tulare WD MA	7,000	0	0	7,000
ETGSA	132,000	10,870	0	142,870
DEID MA	76,000	0	0	76,000
Western MA	15,000	0	0	15,000
Richgrove CSD MA	0	870	0	870
Earlimart PUD MA	0	2,930	0	2,930
DEID GSA	91,000	3,800	0	94,800
Pixley ID MA	137,000	0	0	137,000
Pixley PUD MA	0	560	0	560
Teviston CSD MA	0	100	0	100
Pixley GSA	137,000	660	0	137,660
North MA	10,300	0	23,650	33,950
Southeast MA	45,000	100	0	45,100
TCWA GSA	55,300	100	23,650	79,050
Alpaugh GSA	17,000	250	0	17,250
Totals	**668,300**	**16,900**	**40,190**	**725,390**

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 2021/22 was 470,410 acre-ft as summarized by water use sector in the following table:

Table ES-2
Tule Subbasin Surface Water Supplies for Water Year 2021/22

	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Agricultural MA	8,800	42,200	0	0	54,200	105,200
Municipal MA	0	0	0	0	600	600
Tulare County MOU MA	0	0	0	0	600	600
LTRID GSA	8,800	42,200	0	0	55,400	106,400
Greater Tule MA	12,600	45,000	0	0	88,000	145,600
Porterville Community MA	870	0	4,810	0	11,700	17,380
Ducor Community MA	0	0	0	0	200	200
Terra Bella Community MA	0	1,630	0	0	1,300	2,930
Kern-Tulare WD MA	0	8,370	0	1,100	5,300	14,770
ETGSA	13,470	55,000	4,810	1,100	106,500	180,880
DEID MA	0	73,000	0	0	30,100	103,100
Western MA	0	0	0	0	3,400	3,400
Richgrove CSD MA	0	0	0	0	200	200
Earlimart PUD MA	0	0	0	0	500	500
DEID GSA	0	73,000	0	0	34,200	107,200
Pixley ID MA	0	8,000	0	0	33,600	41,600
Pixley PUD MA	0	0	230	0	1,100	1,330
Teviston CSD MA	0	0	0	0	700	700
Pixley GSA	0	8,000	230	0	35,400	43,630
North MA	0	0	0	0	5,000	5,000
Southeast MA	0	0	0	0	21,400	21,400
TCWA GSA	0	0	0	0	26,400	26,400
Alpaugh GSA	0	0	0	0	5,900	5,900
Totals	**22,270**	**178,200**	**5,040**	**1,100**	**263,800**	**470,410**

Note: All values are in acre-ft.

Total Water Use

Total water use in the Tule Subbasin for water year 2021/22, including both groundwater extractions and surface water supplies, was 1,195,800 acre-ft as shown in the following table:

Table ES-3

Tule Subbasin Total Water Use for Water Year 2021/22

	Groundwater Extraction	Surface Water Supplies	Total
Agricultural MA	250,540	105,200	355,740
Municipal MA	1,220	600	1,820
Tulare County MOU MA	2,000	600	2,600
LTRID GSA	253,760	106,400	360,160
Greater Tule MA	125,000	145,600	270,600
Porterville Community MA	10,670	17,380	28,050
Ducor Community MA	200	200	400
Terra Bella Community MA	0	2,930	2,930
Kern-Tulare WD MA	7,000	14,770	21,770
ETGSA	142,870	180,880	323,750
DEID MA	76,000	103,100	179,100
Western MA	15,000	3,400	18,400
Richgrove CSD MA	870	200	1,070
Earlimart PUD MA	2,930	500	3,430
DEID GSA	94,800	107,200	202,000
Pixley ID MA	137,000	41,600	178,600
Pixley PUD MA	560	1,330	1,890
Teviston CSD MA	100	700	800
Pixley GSA	137,660	43,630	181,290
North MA	33,950	5,000	38,950
Southeast MA	45,100	21,400	66,500
TCWA GSA	79,050	26,400	105,450
Alpaugh GSA	17,250	5,900	23,150
Totals	**725,390**	**470,410**	**1,195,800**

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 2021 and fall 2022, groundwater in storage decreased by approximately 167,000 acre-ft in the Upper Aquifer and decreased by approximately 177,000 acre-ft in the Lower Aquifer.

Since 2015/16, the volume of groundwater in storage in the Tule Subbasin Upper Aquifer has decreased by approximately 114,000 acre-ft. Groundwater in storage in the Lower Aquifer has decreased by approximately 856,000 acre-ft.

1. Introduction

This is the fourth 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, 2021 through September 30, 2022.

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 (TAC) 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 (RMS) 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 currently consists of 65 benchmarks installed by the Tule Subbasin TAC between 2020 and 2022, 17 existing benchmarks installed by the Friant Water Authority, and 37 benchmarks installed in 2022 by ETGSA. Additional benchmarks may be added as needed. Ninety-five benchmarks within the network have been designated as a representative monitoring site (RMS). The elevations of the benchmarks are surveyed annually, at a minimum. Land surface change from July 2021 to July 2022 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 2021 to September 2022 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 2021/22 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 2022 contour map(s) but was not available at the time the 2021 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 2022. Groundwater flow patterns in the Upper Aquifer did not change significantly between the spring and fall of 2022.

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 southwestern and western portions of the subbasin (see Figures 11 and 12). Lower Aquifer pumping depressions are observed in the Tri-County GSA and Alpaugh GSA areas. The same groundwater level conditions and flow patterns were observed from Lower Aquifer contour maps generated from both the spring and fall of 2022.

[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 2022 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 July 2022. 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."*

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 14 RMS wells in the LTRID GSA (see Figure 5). Of these wells, eight 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 2022 are summarized in the following table:

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

Table 1
Lower Tule River Irrigation District GSA
2021/22 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/23E-30J01	30.2	-6.1	-61	-71
21S/23E-32K01	95.7	95.5	54	13
21S/24E-35A01	107.9	109.4	68	53
21S/25E-03R01	N/A[1]	N/A	92	58
21S/26E-32B02	174.9	158.9	13	103
21S/26E-34	242.4	N/A	261	231
LTRID TSS U	187.3	180.4	129	101
Lower Aquifer				
20S/26E-32	144.4	114.2	79	36
21S/25E-36	73.9	N/A	49	1
22S/23E-08	-102.7	N/A	-195	-224
LTRID TSS M	112.8	100.1	62	28
LTRID TSS L	44.9	-28.9	-67	-101
Composite Aquifer				
22S/24E-01Q01	-33.5	7.5	-85	-143

[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 2022 compared to spring 2022. All measured groundwater levels in Upper Aquifer monitoring wells except Well 21S/26E-34 were above their respective measurable objectives and minimum thresholds. The spring 2022 groundwater level in Well 21S/26E-34 was below the measurable objective but above the minimum threshold for this well.

For the Lower Aquifer monitoring wells from which groundwater levels could be obtained, groundwater levels were generally lower in fall 2022 compared to spring 2022. All measured groundwater levels in Lower Aquifer monitoring wells were above their respective measurable objectives and minimum thresholds.

For the Composite Aquifer monitoring Well 22S/24E-01Q01, groundwater levels in the well showed a 41.0-ft drop between spring and fall 2022. Both groundwater levels were above the measurable objective and minimum threshold for this well.

2.1.2. Eastern Tule GSA

There are nine RMS wells in the ETGSA (see Figure 5). Of these wells, three are perforated in the Upper Aquifer, two are perforated in the Lower Aquifer, three are perforated in the Santa Margarita Formation, and one 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 2022 are summarized in the following table:

Table 2
Eastern Tule GSA
2021/22 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
C-1	361.4	348.4	353	314
R-11	330.7	326.7	357	281
22S/26E-13R01	241.5	237.6	228	199
Lower Aquifer				
22S/26E-24	95.0	19.4	46	-18
TSMW 6L	210.8	201.4	187	144
Santa Margarita Formation				
23S/27E-27	-19.5	-11.3	54	-30
24S/27E-32M01	20.6	-60.3	-31	-107
TSMW 6SM	24.4	-56.5	-13	-92
Composite Aquifer				
C-16	242.0	156.0	124	61

For the Upper Aquifer monitoring wells, groundwater levels showed slight declines between spring and fall 2022. All measured groundwater levels in Well 22S/26E-13R01 were above the measurable objective and minimum threshold for this well. All measured groundwater levels in Well C-1 were above the measurable objective and minimum threshold for this well, except for the fall 2022 groundwater level that was below the measurable objective for this well. All measured groundwater levels in Well R-11 were below the measurable objective but above the minimum threshold for this well.

For the Lower Aquifer monitoring wells, groundwater levels were lower in fall 2022 compared to spring 2022. In Well 22S/26E-24, the fall 2022 groundwater level dropped below the respective measurable objective. Otherwise, all measured groundwater levels in Lower Aquifer monitoring wells were above their respective measurable objectives and minimum thresholds.

For the Santa Margarita Formation monitoring wells, groundwater levels generally dropped noticeably between spring and fall 2022 and likely represent seasonal pumping influence in this confined aquifer. All measured spring 2022 groundwater levels were above the respective measurable objectives and minimum thresholds, except for the groundwater level at Well 23S/27E-27 that fell below the respective measurable objective. All measured fall 2022 groundwater levels were below the respective measurable objectives but above the respective minimum thresholds.

For the Composite Aquifer monitoring Well C-16, groundwater levels in the well showed a 86.0-ft drop between spring and fall 2022. Both groundwater levels were above the measurable objective and minimum threshold for this well.

2.1.3. Delano-Earlimart GSA

There are 11 RMS wells in the DEID GSA (see Figure 5). Of these wells, six are perforated in the Upper Aquifer, three 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. It is noted that the DEID GSA has adjusted their minimum thresholds in response to CDWR comments to Tule Subbasin draft GSPs. The updated minimum thresholds are reflected in Table 3. 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
2021/22 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
23S/26E-29D01	63.5	68.2	74	54
24S/25E-35H01	169.0	164.9	165	149
24S/26E-04P01	100.7	82.7	158	61
24S/26E-11	173.8	162.5	189	106
24S/26E-32G01	138.4	156.3	146	83
M19-U	182.0	170.0	255	196
Lower Aquifer				
24S/24E-03A01	105.5	103.1	198	143
25S/26E-9C01	109.8	61.9	84	66
M19 -L	100.0	65.0	165	92
Composite Aquifer				
23S/25E-27	15.6	8.4	102	13
24S/27E-31	107.7	N/A[1]	166	117

[1]N/A = Not Available

For the Upper Aquifer monitoring wells, groundwater levels were generally lower in fall 2022 compared to spring 2022. Both spring and fall groundwater levels in Wells 23S/26E-29D01, 24S/26E-04P01, 24S/26E-11, and M19-U were below their respective measurable objectives. In Well 24S/25E-35H01, the fall 2022 groundwater level was below the updated measurable objective, and in Well 24S/26E-32G01, the spring 2022 groundwater level was below its updated measurable objective. Both spring and fall 2022 groundwater levels measured in M19-U were below the updated minimum threshold for this well.

For the Lower Aquifer monitoring wells, groundwater levels were generally lower in fall 2022 compared to spring 2022. In Well 24S/24E-03A01, both spring and fall 2022 groundwater levels were below the measurable objective and minimum threshold. In Well 25S/26E-9C01, the fall 2022 groundwater level was below the measurable objective and minimum threshold. In Well M19-L, groundwater levels were below the measurable objective, and the fall 2022 groundwater level was below the minimum threshold for this well.

For the Composite Aquifer monitoring wells, comparative data for spring and fall 2022 were only available for Well 23S/25E-27, which showed a 7.2-ft drop over that time. In this well, groundwater levels were below the measurable objective, and the fall 2022 groundwater level was below the minimum threshold. In Well 24S/27E-31, the spring 2022 groundwater level was below the minimum threshold and measurable objective for this well.

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 2022 are summarized in the following table:

Table 4
Pixley Irrigation District GSA
2021/22 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/24E-23J01	-28.8	-37.5	-54	-112
23S/24E-28J02	78.7	84.0	26	15
22S/25E-25N01	17.6	2.3	-9	-51
23S/25E-08G01	54.7	49.1	31	-10

23S/25E-16N04	-35.5[1]	-85.0	62	14
PIDGSA-01 U	146.5	119.6	99	77
Lower Aquifer				
TSMW 1L	-98.2	-169.7	-161	-237
PIDGSA-01 L	95.9	65.0	60	-2
Composite Aquifer				
22S/25E-30	79.8	78.9	65	7

[1]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, groundwater levels were generally lower in fall 2022 compared to spring 2022. Groundwater levels in Well 23S/25E-16N04 were below the measurable objective and minimum threshold, but groundwater levels were below the reported total depth of the well and are considered suspect and subject to further investigation. All other measured groundwater levels were above their respective measurable objectives and minimum thresholds.

For the Lower Aquifer monitoring wells, groundwater levels in Well TSMW 1L showed a 71.5-ft drop between spring and fall 2022 and the fall 2022 groundwater level was below the measurable objective for this well. Groundwater levels in Well PIDGSA-01 L showed a 30.9-ft drop between spring and fall 2022. Both spring and fall 2022 groundwater levels in this well were above the measurable objective and minimum threshold for this well.

For the Composite Aquifer monitoring Well 22S/25E-30, groundwater levels in the well showed a 0.9-ft drop between spring and fall 2022. Both spring and fall 2022 groundwater levels were above the measurable objective and minimum threshold for this well.

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 2022 are summarized in the following table:

Table 5
Tri-County Water Authority GSA
2021/22 Groundwater Levels at Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Upper Aquifer				
22S/23E-25C01 (E20)	-5.0	-17.0	-41	-102
24S/23E-22E01	52.0	60.8	42	19
TSMW 5U	140.0	113.1	N/A[1]	N/A
Lower Aquifer				
22S/23E-27F01 (G-13)	-162.0	-123.0	-80	-210
24S/23E-22R02	N/A	N/A	-10	-175
TSMW 5L	-155.2	-218.1	N/A	N/A
24S/23E-15R01	-148.7	N/A	-15	-150

[1]N/A = Not Available

For the Upper Aquifer monitoring wells, groundwater levels were generally lower in fall 2022 compared to spring 2022. All measured groundwater levels were above their respective measurable objectives and minimum thresholds.

Of the Lower Aquifer monitoring wells, spring and fall 2022 groundwater levels were available for Well 22S/23E-27F01 (G-13) and TSMW 5L. Groundwater levels in Well 22S/23E-27F01 (G-13) increased between spring 2022 and fall 2022, while groundwater levels in TSMW 5L declined between spring and fall 2022. Groundwater levels in Well 22S/23E-27F01 (G-13) were below the respective measurable objective but above the minimum threshold. In Well 24S/23E-15R01, the spring 2022 groundwater level was below the measurable objective but remained 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 2022 is summarized in the following table:

Table 6

Alpaugh Irrigation District GSA
2021/22 Groundwater Levels at the Representative Monitoring Site Wells

Well	Groundwater Elevation (ft amsl)			
	Spring 2022	Fall 2022	Measurable Objective	Minimum Threshold
Lower Aquifer				
23S/23E-25N01	-6.2	N/A[1]	-5	-110
Well 55	-137.9	-198.2	-92	-209

[1]N/A = Not Available

For the Lower Aquifer monitoring wells, comparative data for spring and fall 2022 were only available for Well 55. Groundwater levels in Well 55 showed a 60.3-ft drop between spring and fall 2022. The groundwater levels in both wells were below their respective measurable objectives but above the minimum thresholds. The spring 2022 groundwater level in 23S/23E-25N01 was below its measurable objective.

3. Groundwater Extraction for Water Year 2021/2022 §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 2021/22 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 2021/22 agricultural groundwater production for each of the six GSAs is summarized in Table 7. Total agricultural groundwater production for the Tule Subbasin in 2021/22 was approximately 668,300 acre-ft.

Table 7
Tule Subbasin Groundwater Extraction for Water Year 2021/22

	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Agricultural MA	234,000	0	16,540	250,540
Municipal MA	0	1,220	0	1,220
Tulare County MOU MA	2,000	0	0	2,000
LTRID GSA	236,000	1,220	16,540	253,760
Greater Tule MA	125,000	0	0	125,000
Porterville Community MA	0	10,670	0	10,670
Ducor Community MA	0	200	0	200
Terra Bella Community MA	0	0	0	0
Kern-Tulare WD MA	7,000	0	0	7,000
ETGSA	132,000	10,870	0	142,870
DEID MA	76,000	0	0	76,000
Western MA	15,000	0	0	15,000
Richgrove CSD MA	0	870	0	870
Earlimart PUD MA	0	2,930	0	2,930
DEID GSA	91,000	3,800	0	94,800
Pixley ID MA	137,000	0	0	137,000
Pixley PUD MA	0	560	0	560
Teviston CSD MA	0	100	0	100
Pixley GSA	137,000	660	0	137,660
North MA	10,300	0	23,650	33,950
Southeast MA	45,000	100	0	45,100
TCWA GSA	55,300	100	23,650	79,050
Alpaugh GSA	17,000	250	0	17,250
Totals	**668,300**	**16,900**	**40,190**	**725,390**

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 2021/22 water year was approximately 16,900 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 2021/22 water year was 40,190 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 2021/22 was 725,390 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 2021/2022 §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 2021/2022, 34,389 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 2021/22, 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 2021/22. Total stream diversions in the Tule Subbasin for 2021/22 totaled 22,270 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 2021/22

	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Agricultural MA	8,800	42,200	0	0	54,200	105,200
Municipal MA	0	0	0	0	600	600
Tulare County MOU MA	0	0	0	0	600	600
LTRID GSA	8,800	42,200	0	0	55,400	106,400
Greater Tule MA	12,600	45,000	0	0	88,000	145,600
Porterville Community MA	870	0	4,810	0	11,700	17,380
Ducor Community MA	0	0	0	0	200	200
Terra Bella Community MA	0	1,630	0	0	1,300	2,930
Kern-Tulare WD MA	0	8,370	0	1,100	5,300	14,770
ETGSA	13,470	55,000	4,810	1,100	106,500	180,880
DEID MA	0	73,000	0	0	30,100	103,100
Western MA	0	0	0	0	3,400	3,400
Richgrove CSD MA	0	0	0	0	200	200
Earlimart PUD MA	0	0	0	0	500	500
DEID GSA	0	73,000	0	0	34,200	107,200
Pixley ID MA	0	8,000	0	0	33,600	41,600
Pixley PUD MA	0	0	230	0	1,100	1,330
Teviston CSD MA	0	0	0	0	700	700
Pixley GSA	0	8,000	230	0	35,400	43,630
North MA	0	0	0	0	5,000	5,000
Southeast MA	0	0	0	0	21,400	21,400
TCWA GSA	0	0	0	0	26,400	26,400
Alpaugh GSA	0	0	0	0	5,900	5,900
Totals	**22,270**	**178,200**	**5,040**	**1,100**	**263,800**	**470,410**

Note: All values are in acre-ft.

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 2021/22 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 2021/22 totaled 178,200 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 2021/22 totaled 5,040 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 2021/22 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 2021/22 precipitation data reported for the Porterville precipitation station. An isohyetal map showing the estimated 2021/22 precipitation distribution across the subbasin is shown on Figure 14. Total precipitation at the Porterville precipitation station for water year 2021/22 was 7.5 inches, which is less than the average precipitation for the area (see Figure 14). 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 2021/22 was estimated to be approximately 263,800 acre-ft.

4.6 Total Surface Water Use

Total surface water available for use within the Tule Subbasin for water year 2021/22 was approximately 470,410 acre-ft (see Table 8).

5. Total Water Use for Water Year 2021/2022 §356.2 (b)(4)

Total water use in the Tule Subbasin for water year 2021/22, including both groundwater extractions and surface water supplies, was 1,195,800 acre-ft (see Table 9).

Table 9
Tule Subbasin Total Water Use for Water Year 2021/22

	Groundwater Extraction	Surface Water Supplies	Total
Agricultural MA	250,540	105,200	355,740
Municipal MA	1,220	600	1,820
Tulare County MOU MA	2,000	600	2,600
LTRID GSA	253,760	106,400	360,160
Greater Tule MA	125,000	145,600	270,600
Porterville Community MA	10,670	17,380	28,050
Ducor Community MA	200	200	400
Terra Bella Community MA	0	2,930	2,930
Kern-Tulare WD MA	7,000	14,770	21,770
ETGSA	142,870	180,880	323,750
DEID MA	76,000	103,100	179,100
Western MA	15,000	3,400	18,400
Richgrove CSD MA	870	200	1,070
Earlimart PUD MA	2,930	500	3,430
DEID GSA	94,800	107,200	202,000
Pixley ID MA	137,000	41,600	178,600
Pixley PUD MA	560	1,330	1,890
Teviston CSD MA	100	700	800
Pixley GSA	137,660	43,630	181,290
North MA	33,950	5,000	38,950
Southeast MA	45,100	21,400	66,500
TCWA GSA	79,050	26,400	105,450
Alpaugh GSA	17,250	5,900	23,150
Totals	**725,390**	**470,410**	**1,195,800**

Note: All values are in acre-ft.

6. Change in Groundwater in Storage §356.2 (b) (5) A and B

6.1 Change in Upper Aquifer Storage

For this annual report, the change in groundwater in storage for the Tule Subbasin was estimated for the time period between fall 2021 and fall 2022. The change in storage for the Upper Aquifer 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 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.

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 2021 and fall 2022 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 2021 and fall 2022, groundwater in storage decreased by approximately 167,000 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 2021/22 water year.

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

Since 2015/16, the volume of groundwater in storage in the Tule Subbasin Upper Aquifer has decreased by approximately 114,000 acre-ft (see Figure 18).

6.2 Change in Lower Aquifer Storage

As the majority of the Lower Aquifer in the Tule Subbasin is under confined conditions, the change in storage associated with groundwater level changes is a function of the compressibility of the sediments and, to a lesser degree, the compressibility of water. The change in storage for a confined aquifer is typically expected to be low compared to changes in storage for an unconfined aquifer assuming similar changes in groundwater elevations. Within a limited range of groundwater level fluctuation, the compressed aquitard can accept water back into its structure when groundwater levels rise resulting in elastic rebound (i.e., which is considered a positive change in storage). However, if groundwater levels are maintained at low elevations for long enough periods of time (e.g., due to groundwater pumping), the compression of aquitards becomes permanent.

In the Tule Subbasin, prolonged lowering of groundwater levels has resulted in notable subsidence at the land surface, which reflects significant compression of low permeability interbeds (hereafter referred to as aquitards) within the Lower Aquifer. This compression, which expels water from these aquitards, is considered a negative change in storage.

For this annual report, the change in storage for the Lower Aquifer was equated to the volume of water associated with compression of aquitards between fall 2021 and fall 2022. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The change in storage of the Lower Aquifer was estimated based on the following equation:

$$V_w = A\Delta b$$

Where:

V_w	=	the volume of water released from (or taken into) storage (acre-ft).
A	=	the surface area of the aquifer within the Tule Subbasin/GSA (acres).
Δb	=	the change in aquitard thickness (i.e., subsidence) (feet).

The areal distribution of land subsidence between fall 2021 and fall 2022 was based on InSAR data (see Figure 8). Because the InSAR data is not layer-specific but, rather, reflects compression that occurs in all layers in the Tule Subbasin, the change in storage of the Lower Aquifer using these data is likely an overestimate. That is, it was assumed that the water released is from the Lower Aquifer and the clay interbeds within the confining layer between the Upper and Lower Aquifers (i.e., the Corcoran Clay; see Figure 4). As more information becomes available regarding the vertical distribution of compaction in the Tule Subbasin, the storage change estimates of the Lower Aquifer will be refined.

Lower Aquifer change in storage calculations were made using a Geographic Information System (GIS) map of the Tule Subbasin discretized into 1,000-foot by 1,000-foot grid cells to allow for spatial representation of land subsidence. The change in aquitard storage was estimated for each grid cell by multiplying the InSAR land subsidence by the area of the cell. Total storage change within each GSA's boundaries was estimated by adding the cell by cell change in land elevation (see Figure 17). Areas with no InSAR data were assigned zero change in storage, likely resulting in an underestimate of storage change. Results of the analysis showed that the volume of water associated with compression of aquitards in all layers between fall 2021 and fall 2022 for the Tule Subbasin was approximately -177,000 acre-ft (see Figure 17). This volume is assumed herein to be the change in storage of the Lower Aquifer.

6.3 Cumulative Change in Tule Subbasin Aquifer Storage

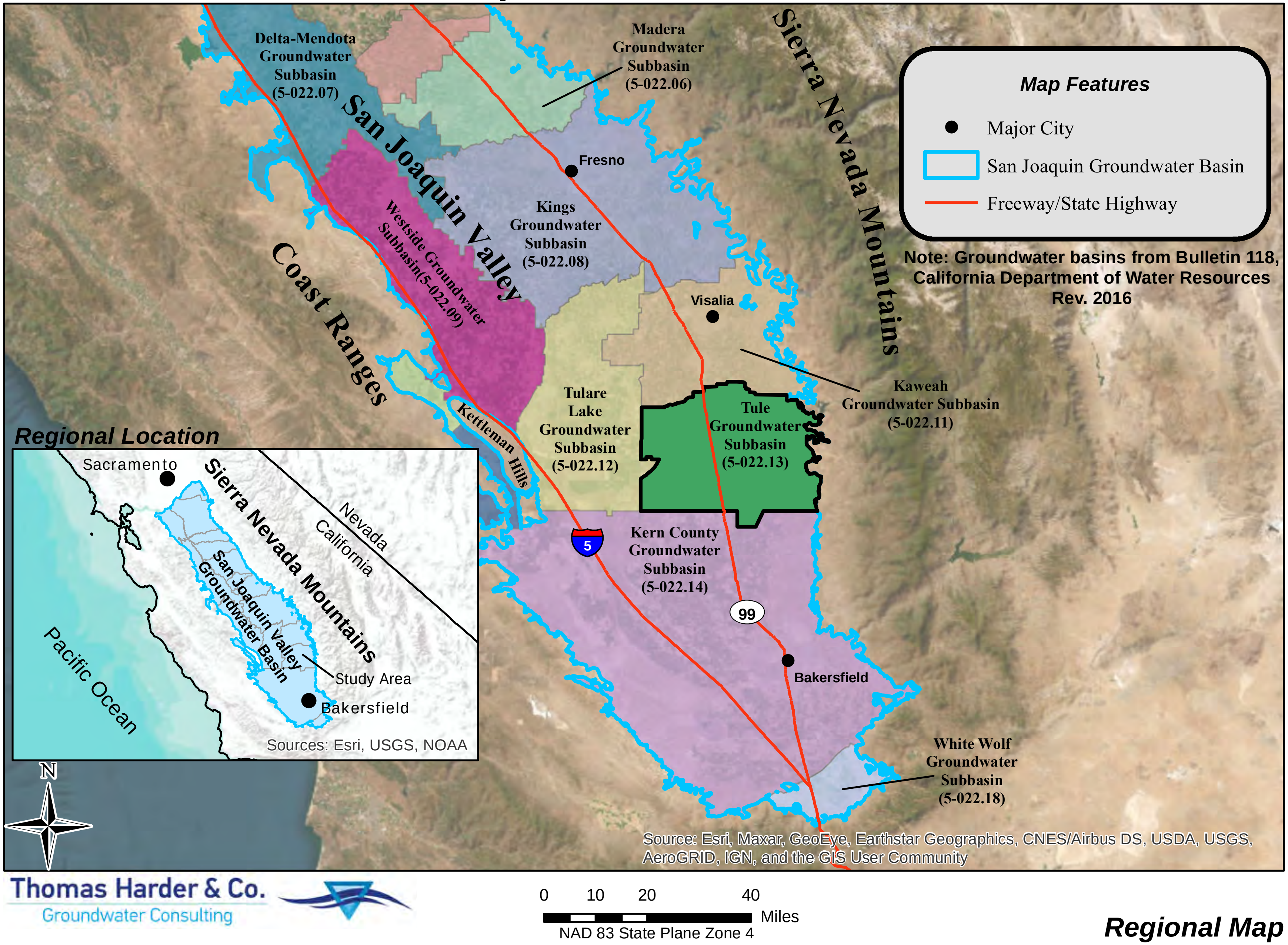
Cumulative change in storage in the Tule Subbasin since water year 1986/87 is shown along with groundwater pumping on Figure 18. The center graph on Figure 18 shows the annual change in aquifer storage by aquifer (Upper and Lower). Aquifer storage change for both Upper and Lower Aquifers prior to water year 2019/20 was estimated using the calibrated groundwater flow model of the Tule Subbasin. Upper and Lower aquifer storage from 2019/20 through 2021/22 was estimated as described in Sections 6.1 and 6.2, respectively.

As shown on Figure 18, cumulative change in storage in both the Upper and Lower Aquifers from 1986/87 through 2021/22 was approximately -7,650,000 acre-ft. Since the 2015/16 water year, the cumulative change in storage has been approximately -16,000 acre-ft in the Upper Aquifer and approximately -856,000 acre-ft in the Lower Aquifer. Positive changes in aquifer storage are generally associated with above-normal precipitation years when surface water supplies are available and groundwater pumping is lower.

Figures

2021/2022 Annual Report
March 2023

Tule Subbasin Technical Advisory Committee

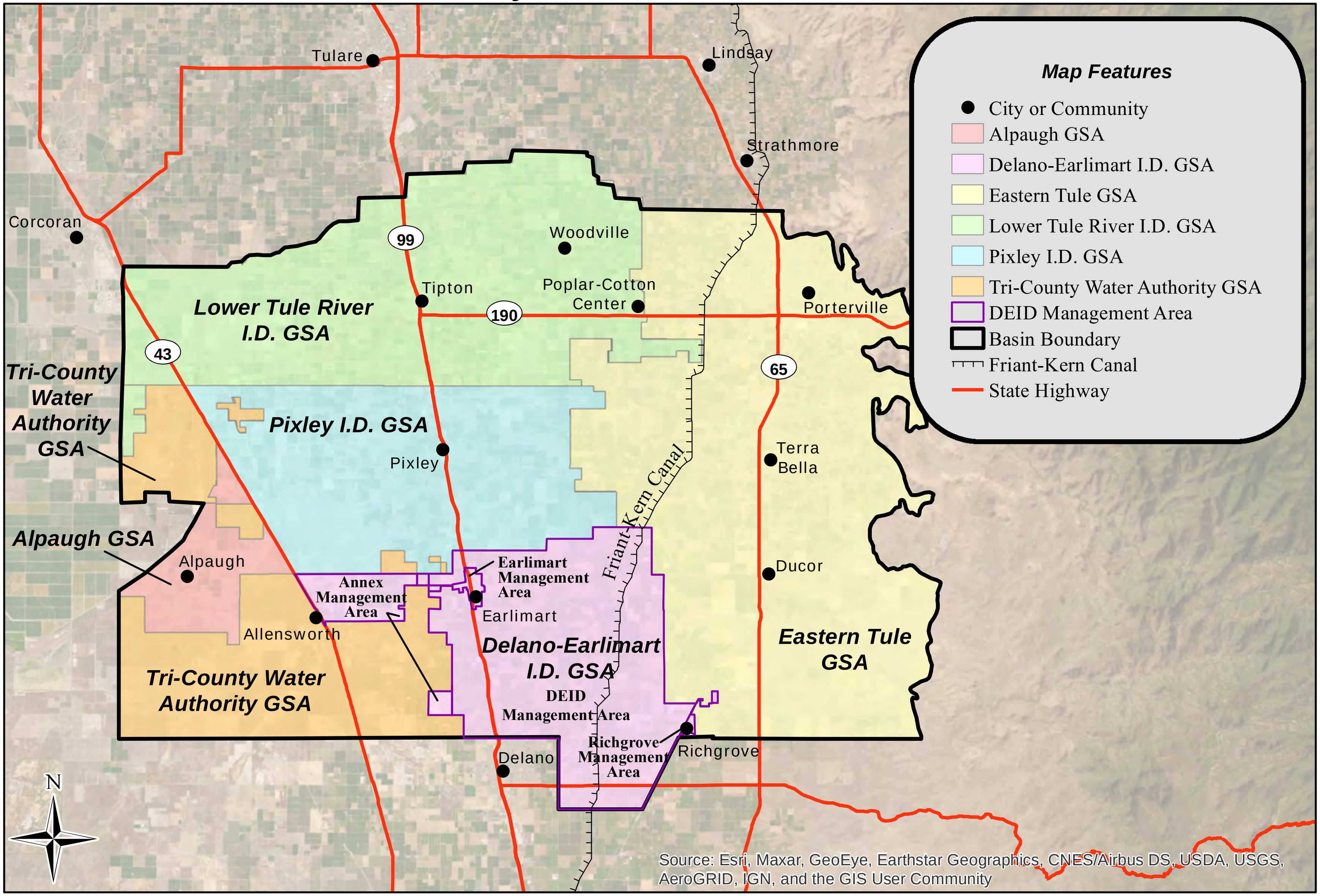


Thomas Harder & Co.
Groundwater Consulting

Regional Map
Figure 1

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

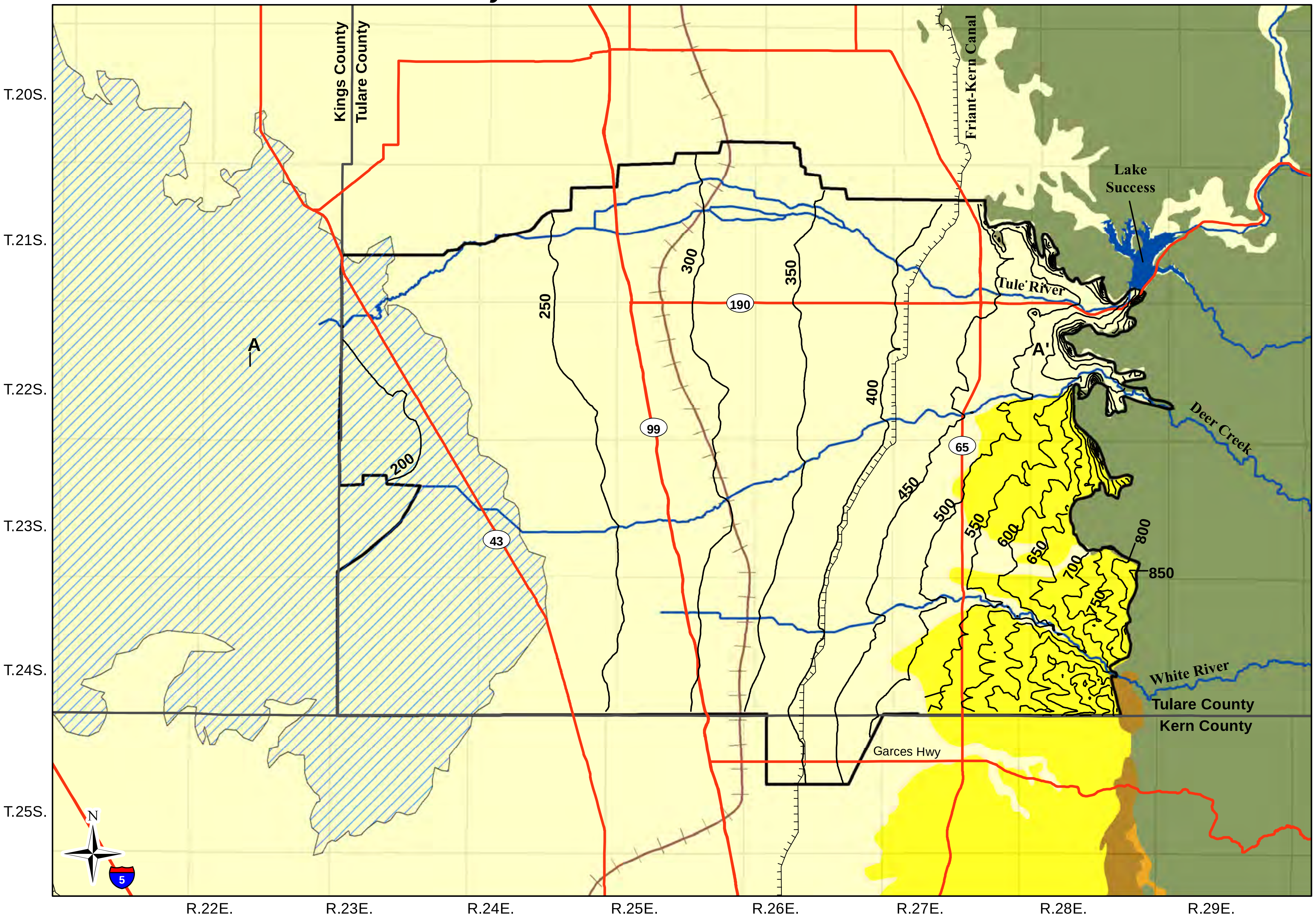
0 2.5 5 10 Miles
NAD 83 State Plane Zone 4

GSA Boundaries
Figure 2

Tule Subbasin Technical Advisory Committee

March 2023

2021/2022 Annual Report



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

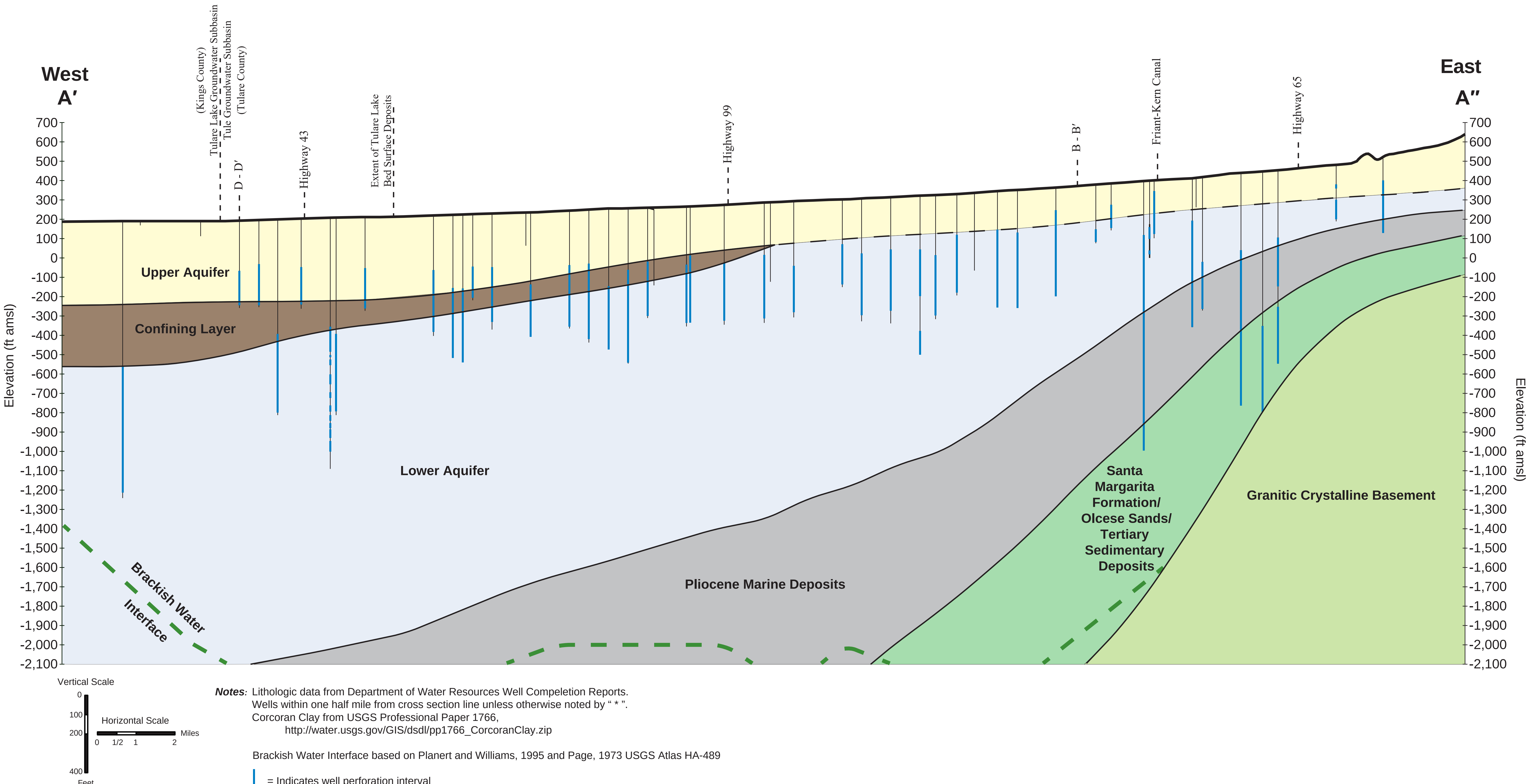
Thomas Harder & Co.
Groundwater Consulting

0 3 6 12 Miles

NAD 83 State Plane Zone 4

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

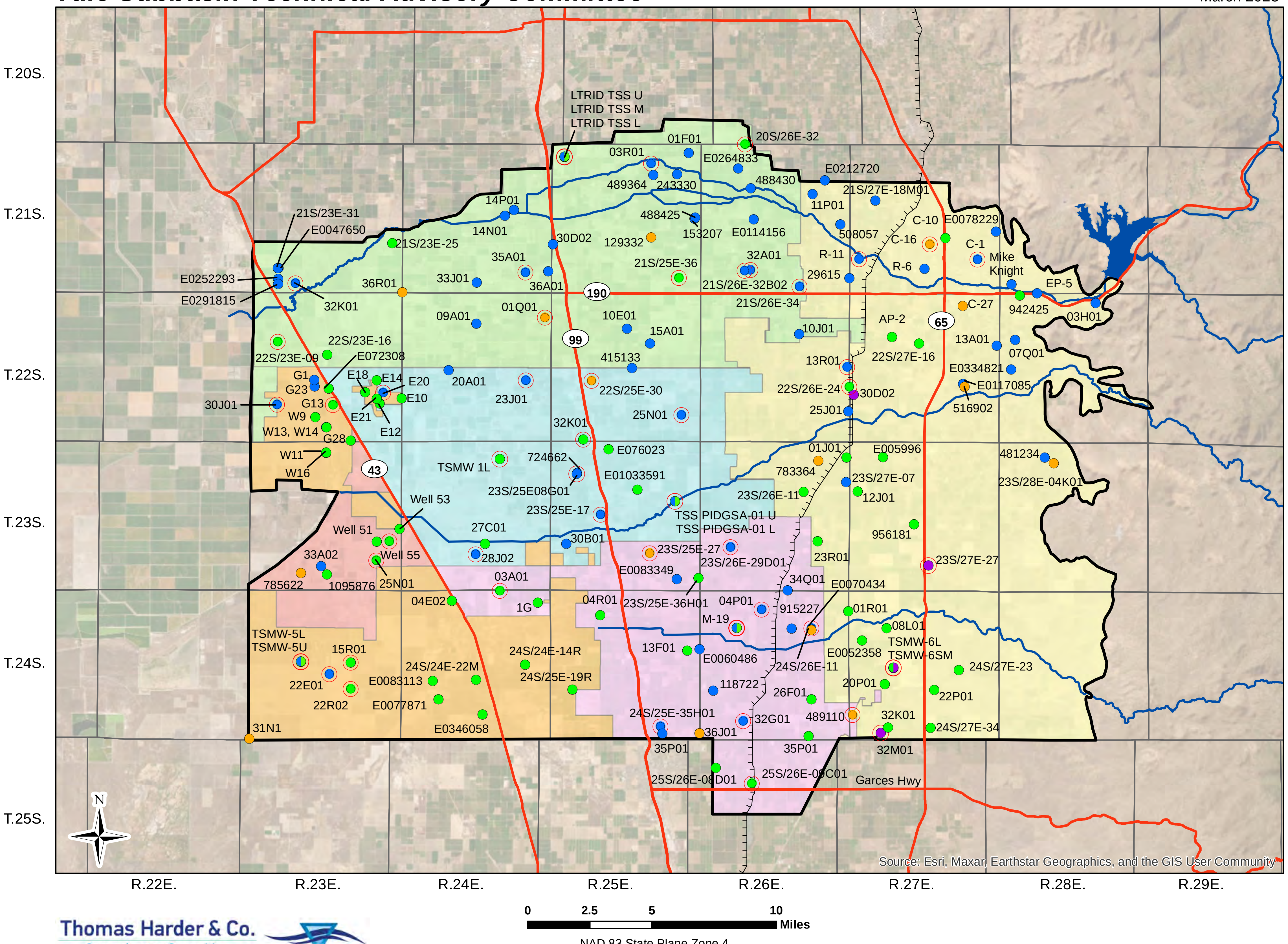
Hydrogeologic Cross Section A′-A″
Tule Groundwater Subbasin
Figure 4

Thomas Harder & Co.
Groundwater Consulting

Tule Subbasin Technical Advisory Committee

March 2023

2021/2022 Annual Report



Map Features

- Upper Aquifer RMS Well
- Upper Aquifer Well
- Lower Aquier RMS Well
- Lower Aquifer Well
- Composite Aquifer RMS Well
- Composite Aquifer Well
- Santa Margarita RMS Well
- Santa Margarita 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
- Friant-Kern Canal
- State Highway
- Major Hydrologic Feature

Thomas Harder & Co.
Groundwater Consulting

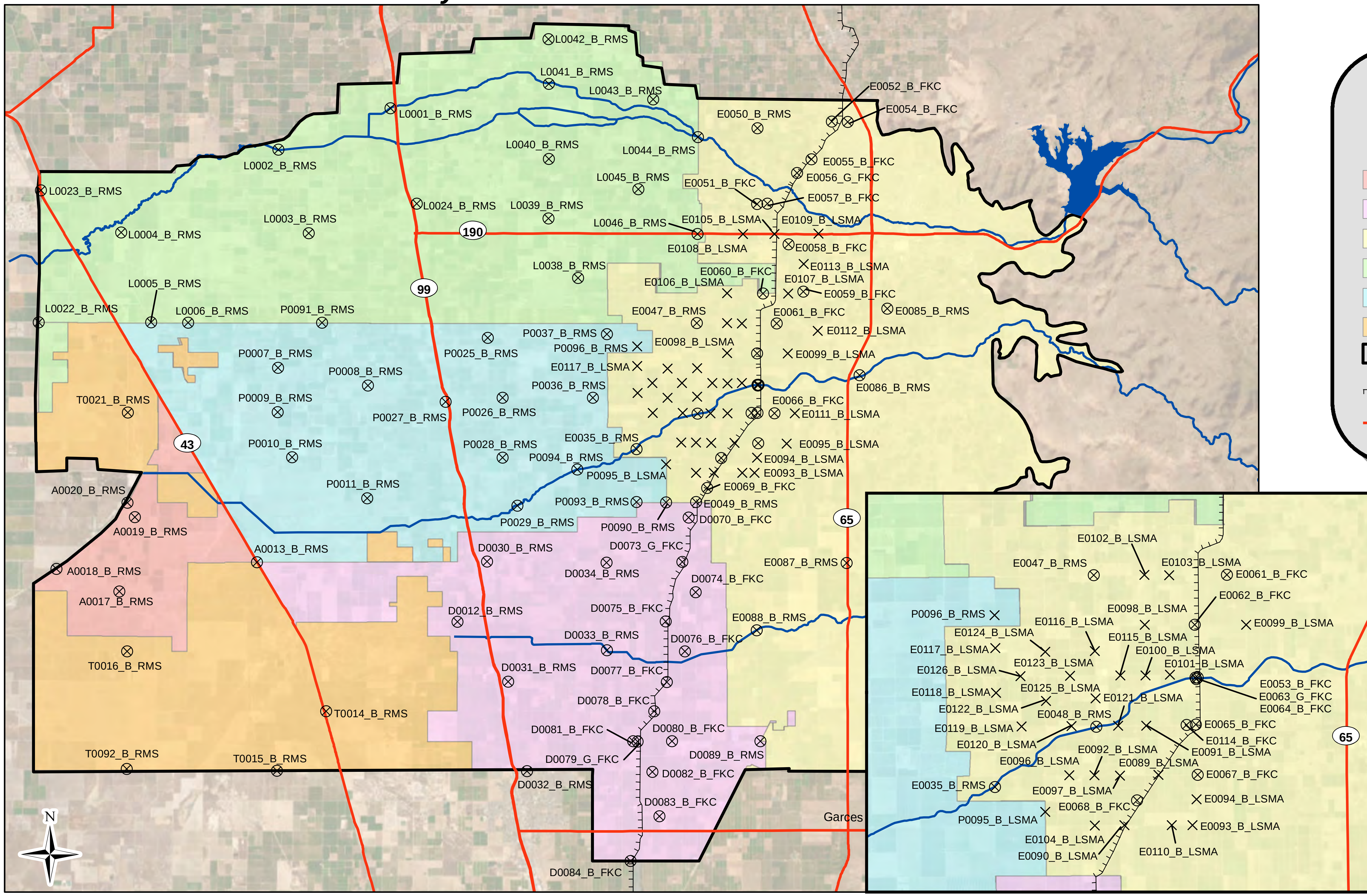
Groundwater Level Monitoring Network

Figure 5

Tule Subbasin Technical Advisory Committee

March 2023

2021/2022 Annual Report



Map Features

- Land Surface Elevation Benchmark RMS
- Land Surface Elevation Benchmark
- 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
- Friant-Kern Canal and California Aqueduct
- State Highway

Thomas Harder & Co.
Groundwater Consulting

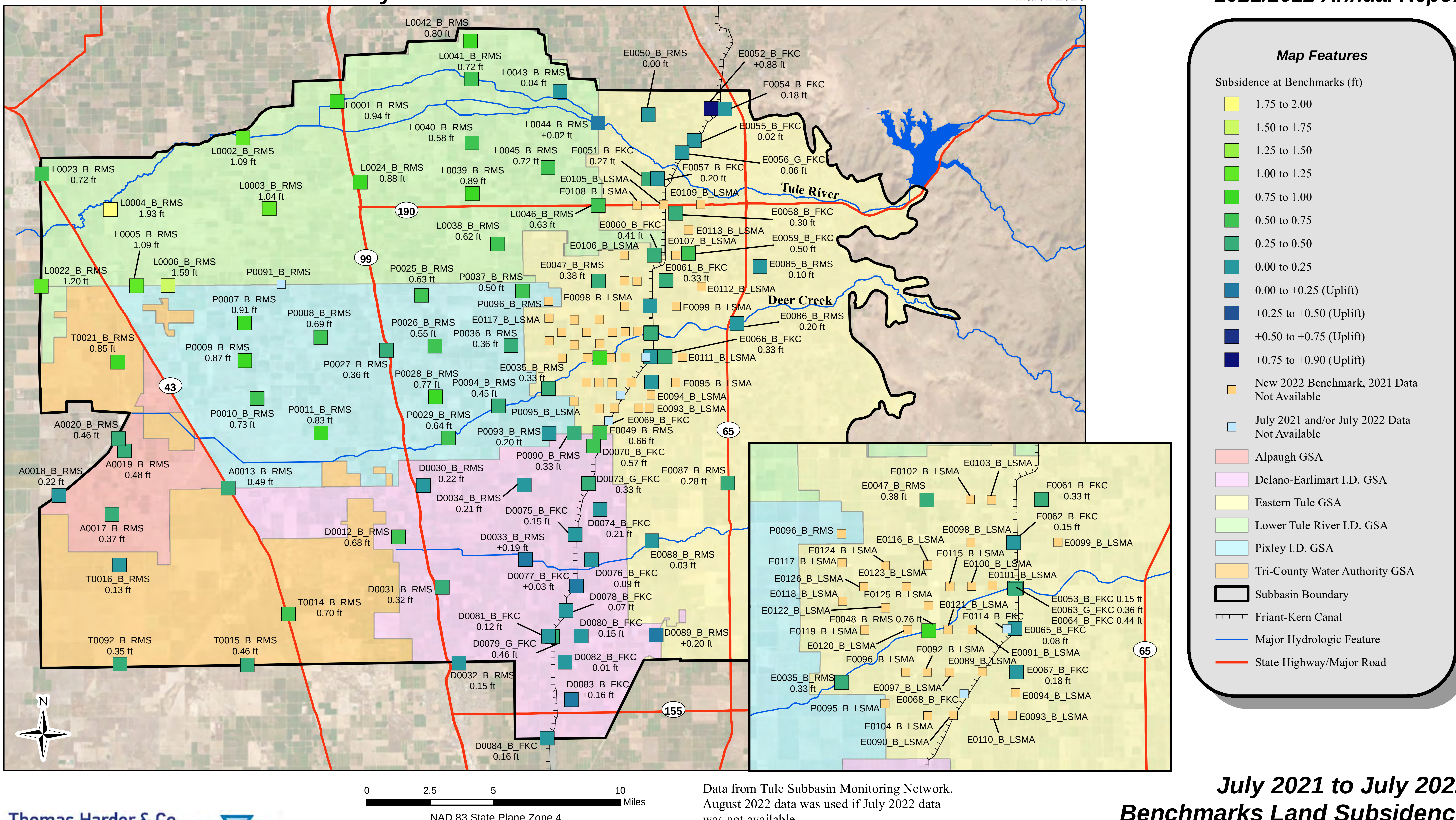
Land Surface Elevation Monitoring Network

Figure 6

Tule Subbasin Technical Advisory Committee

March 2023

2021/2022 Annual Report

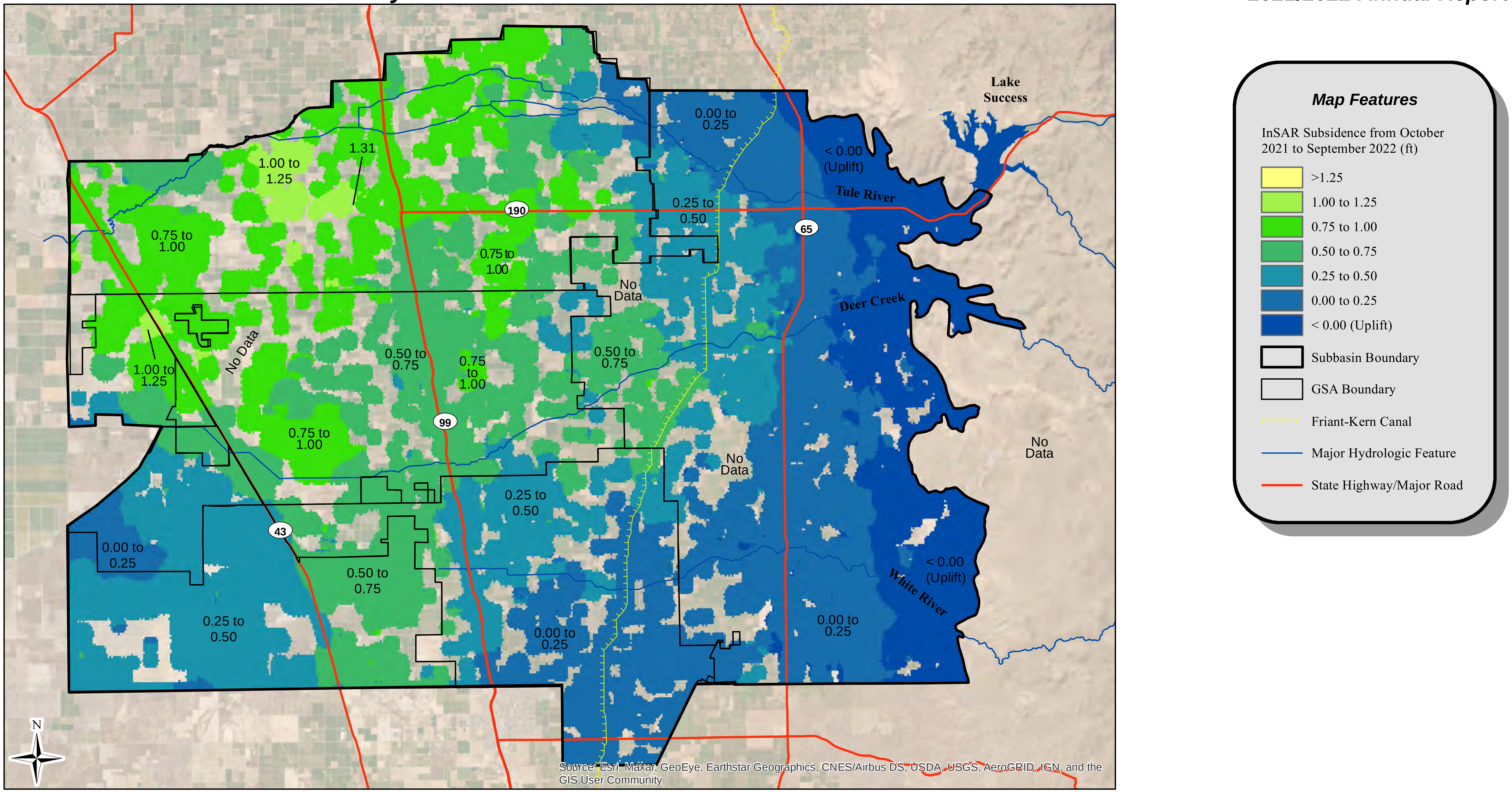


Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Thomas Harder & Co. Groundwater Consulting

July 2021 to July 2022 Benchmarks Land Subsidence

Figure 7

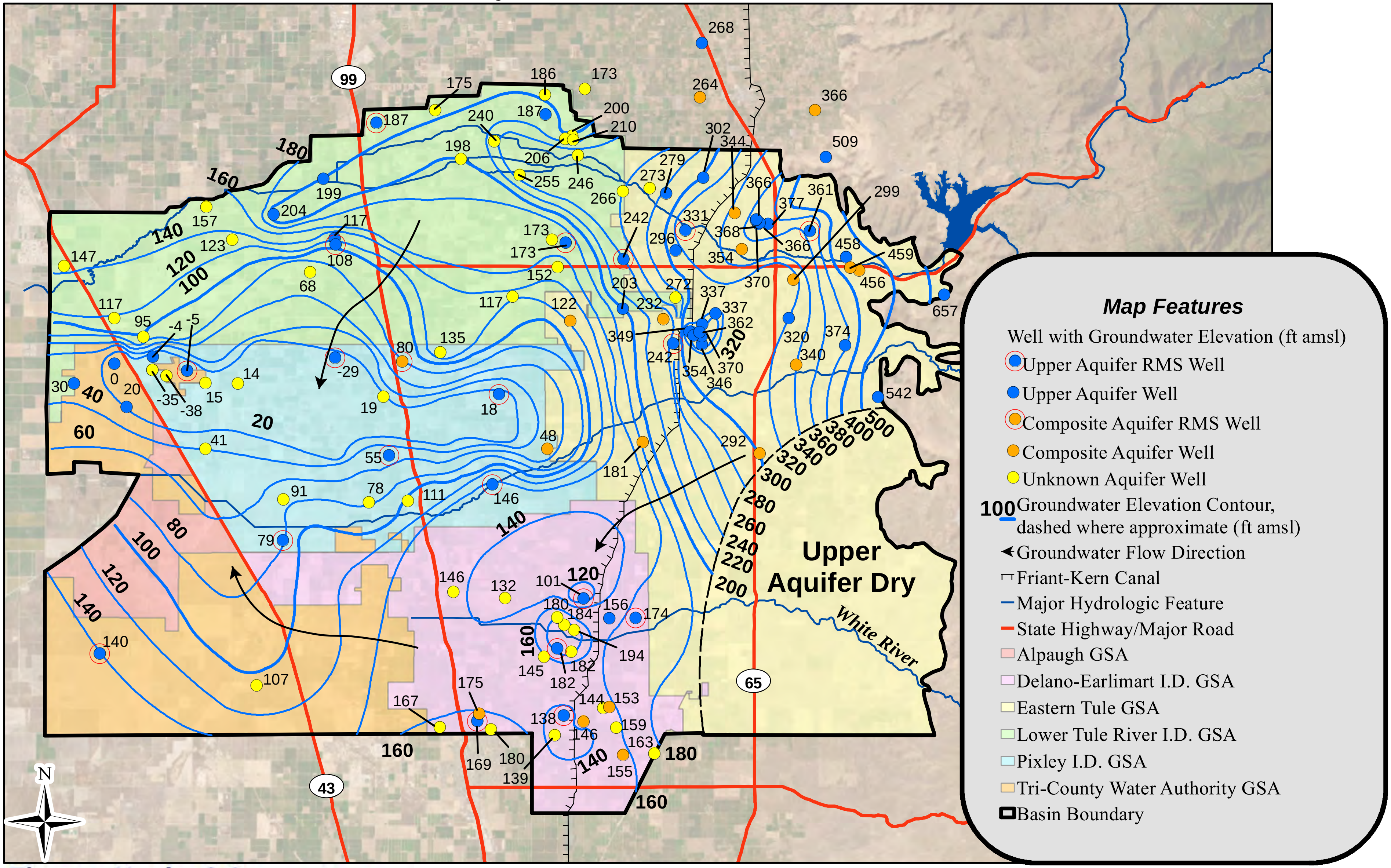


InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Thomas Harder & Co.
Groundwater Consulting

October 2021 to September 2022 InSAR Land Subsidence

Figure 8



Thomas Harder & Co.
Groundwater Consulting

0 2.5 5 10 Miles

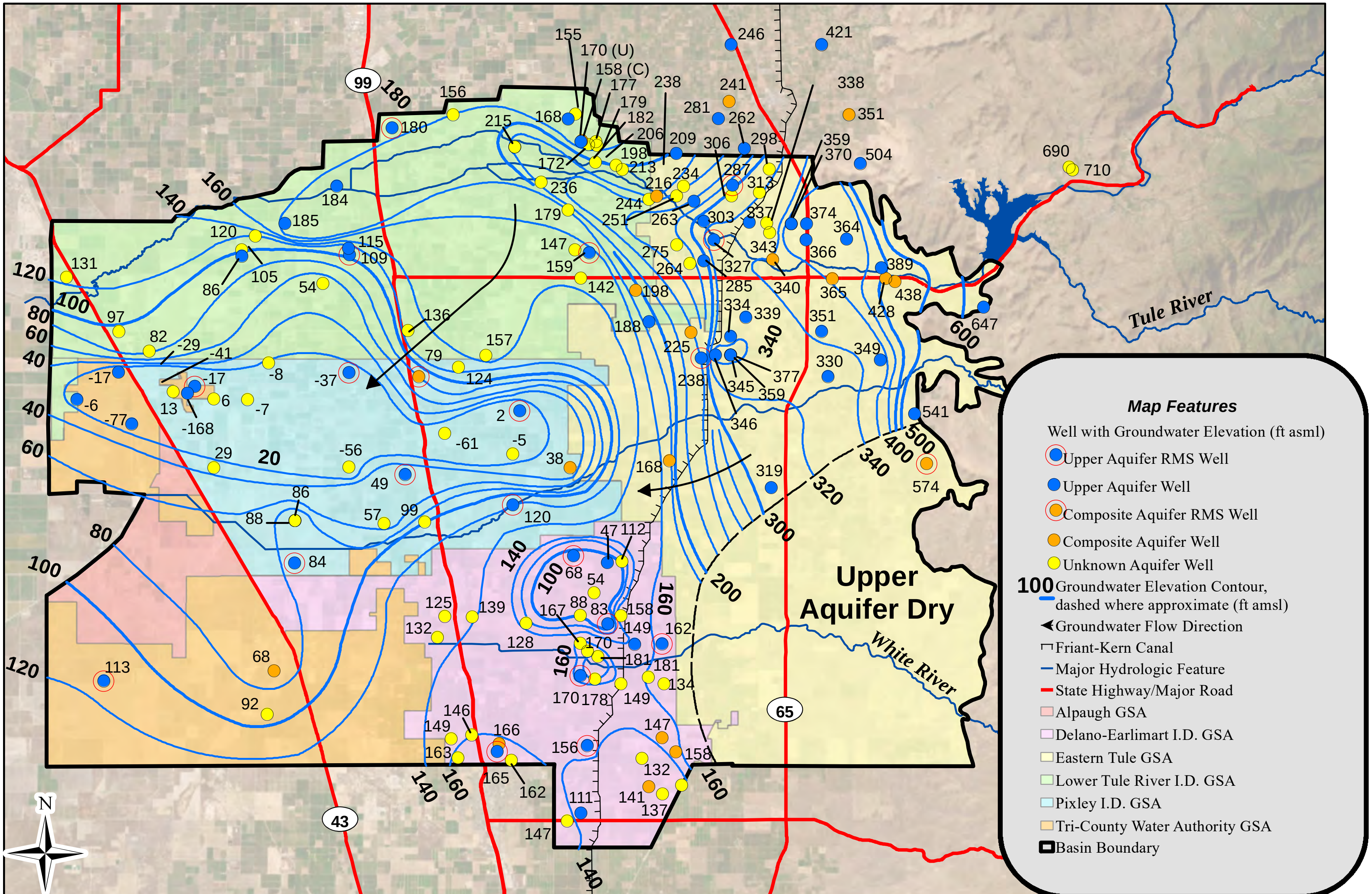
NAD 83 State Plane Zone 4

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

Spring 2022 Upper Aquifer Groundwater Elevation Contours

Figure 9

Tule Subbasin Technical Advisory Committee



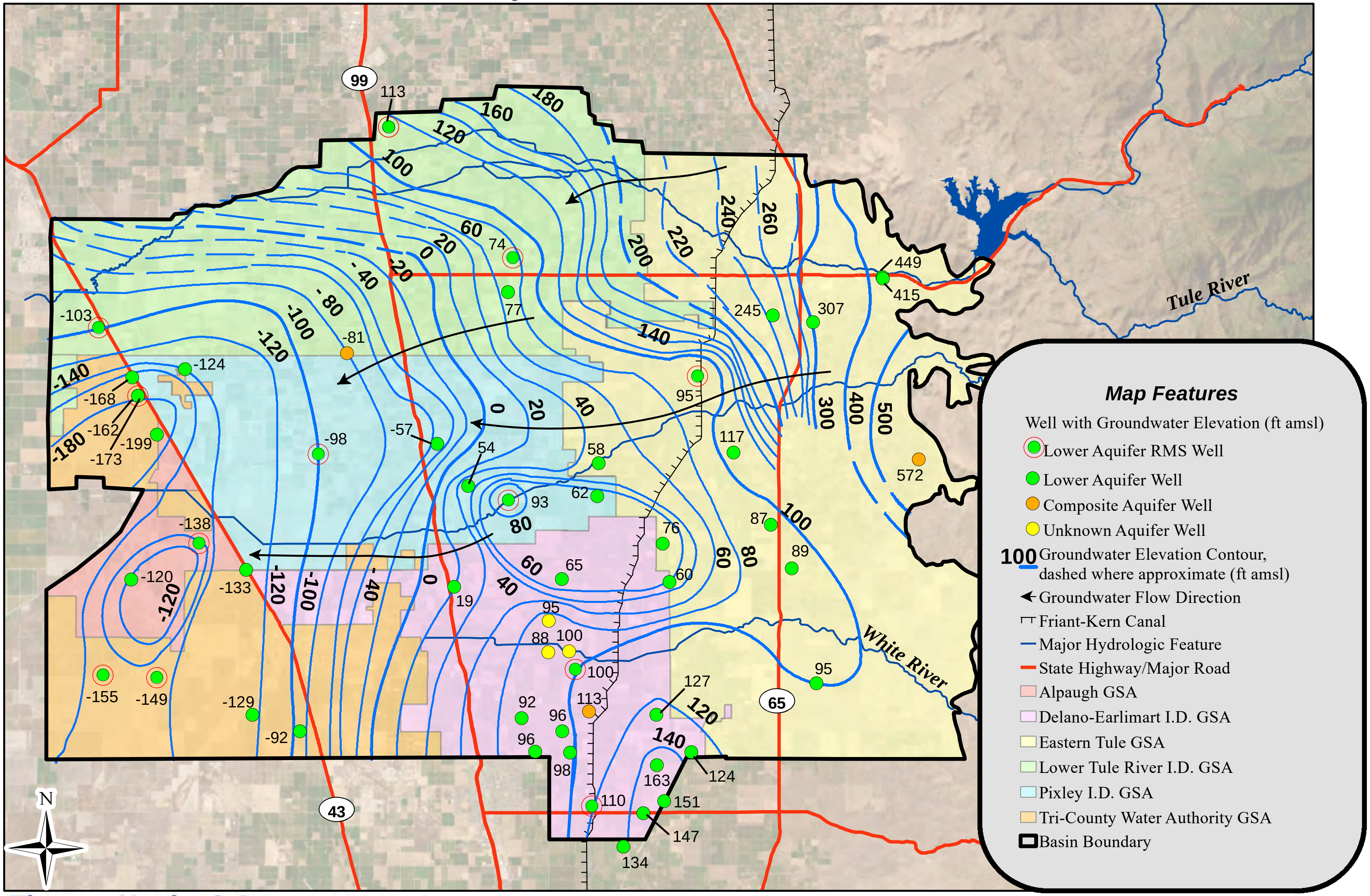
Thomas Harder & Co.
Groundwater Consulting

0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

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

Fall 2022 Upper Aquifer Groundwater Elevation Contours
Figure 10



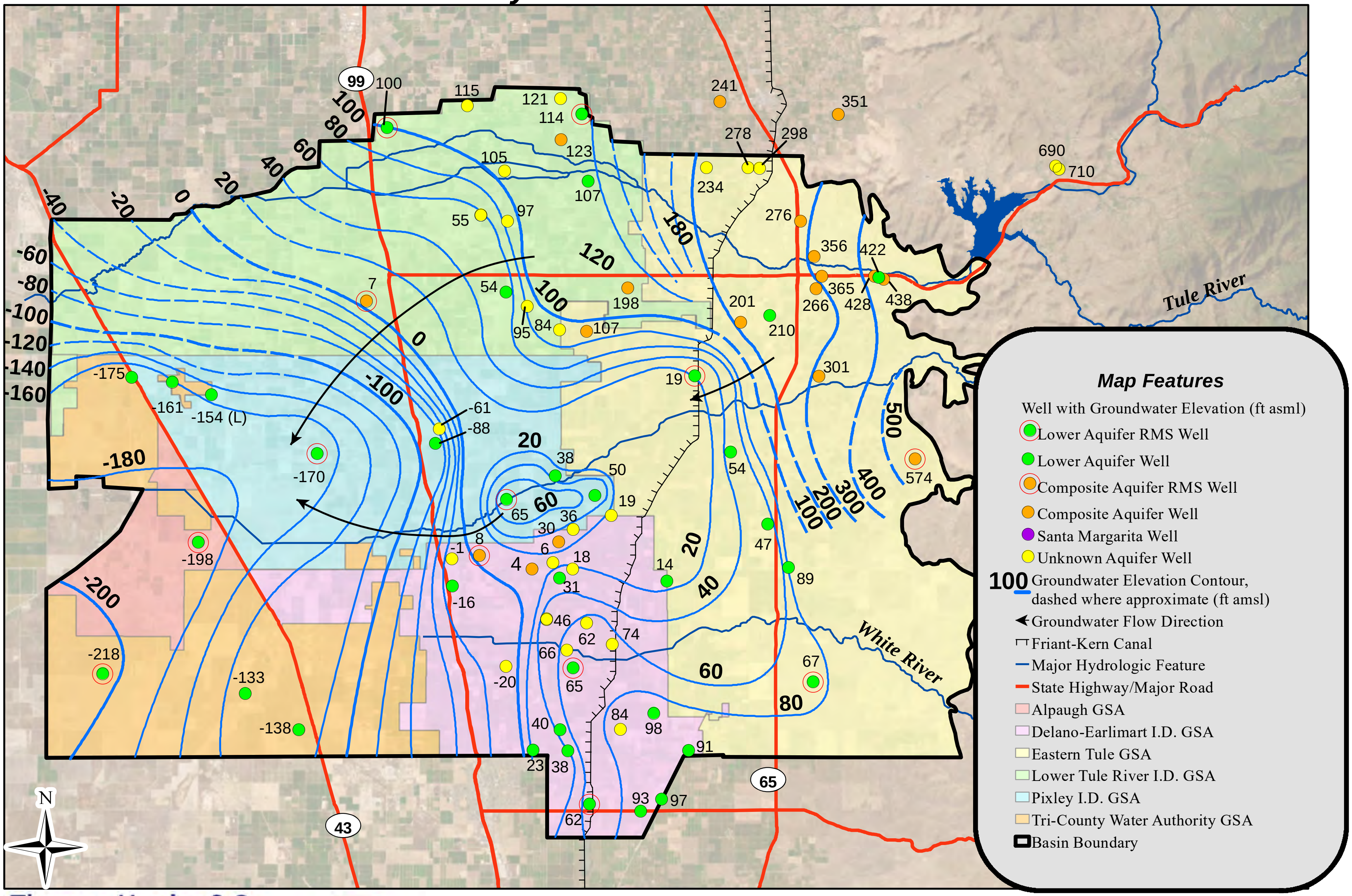
0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

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

Thomas Harder & Co.
Groundwater Consulting

Spring 2022 Lower Aquifer Groundwater Elevation Contours
Figure 11



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.

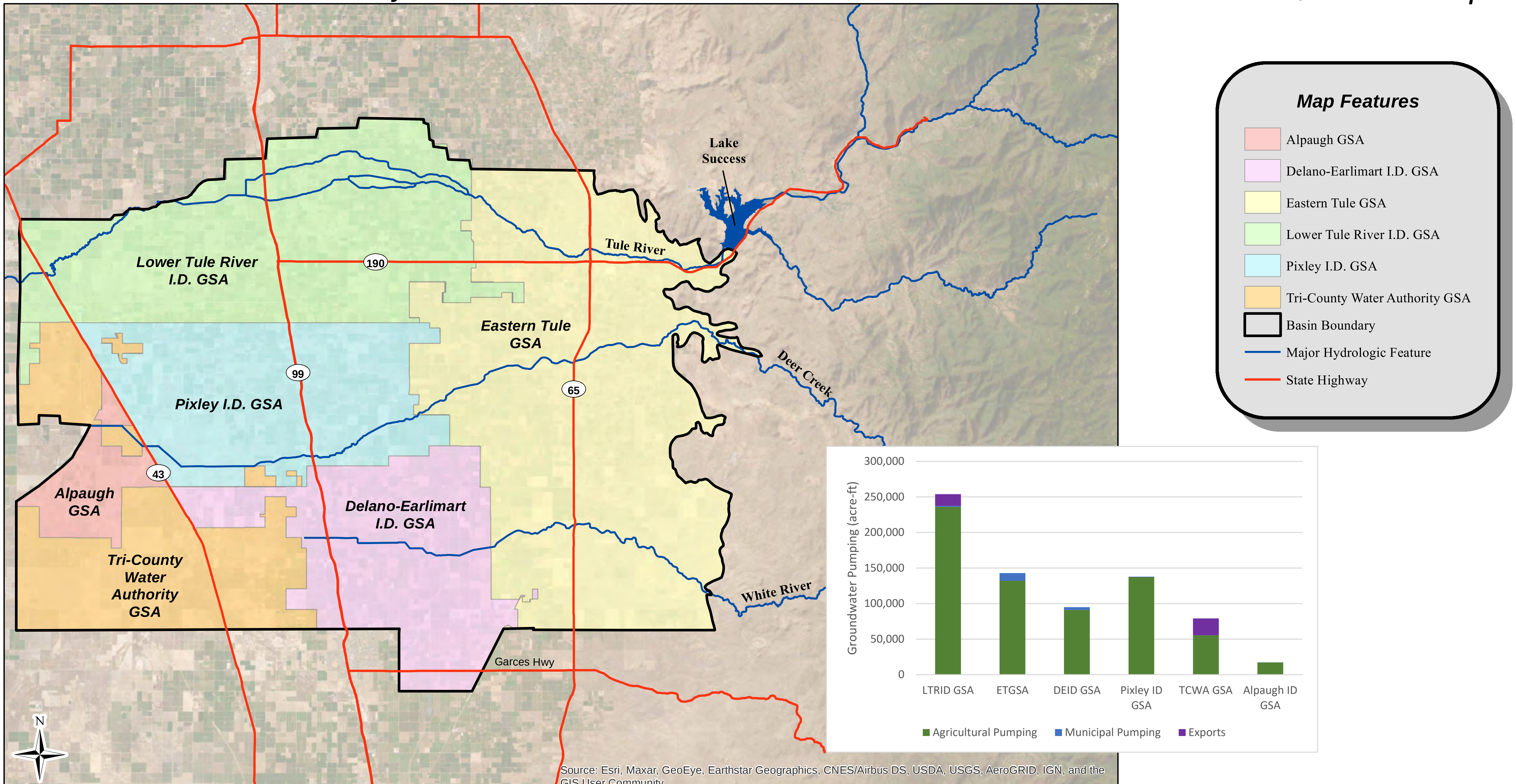
Fall 2022 Lower Aquifer Groundwater Elevation Contours

Figure 12

Tule Subbasin Technical Advisory Committee

March 2023

2021/2022 Annual Report



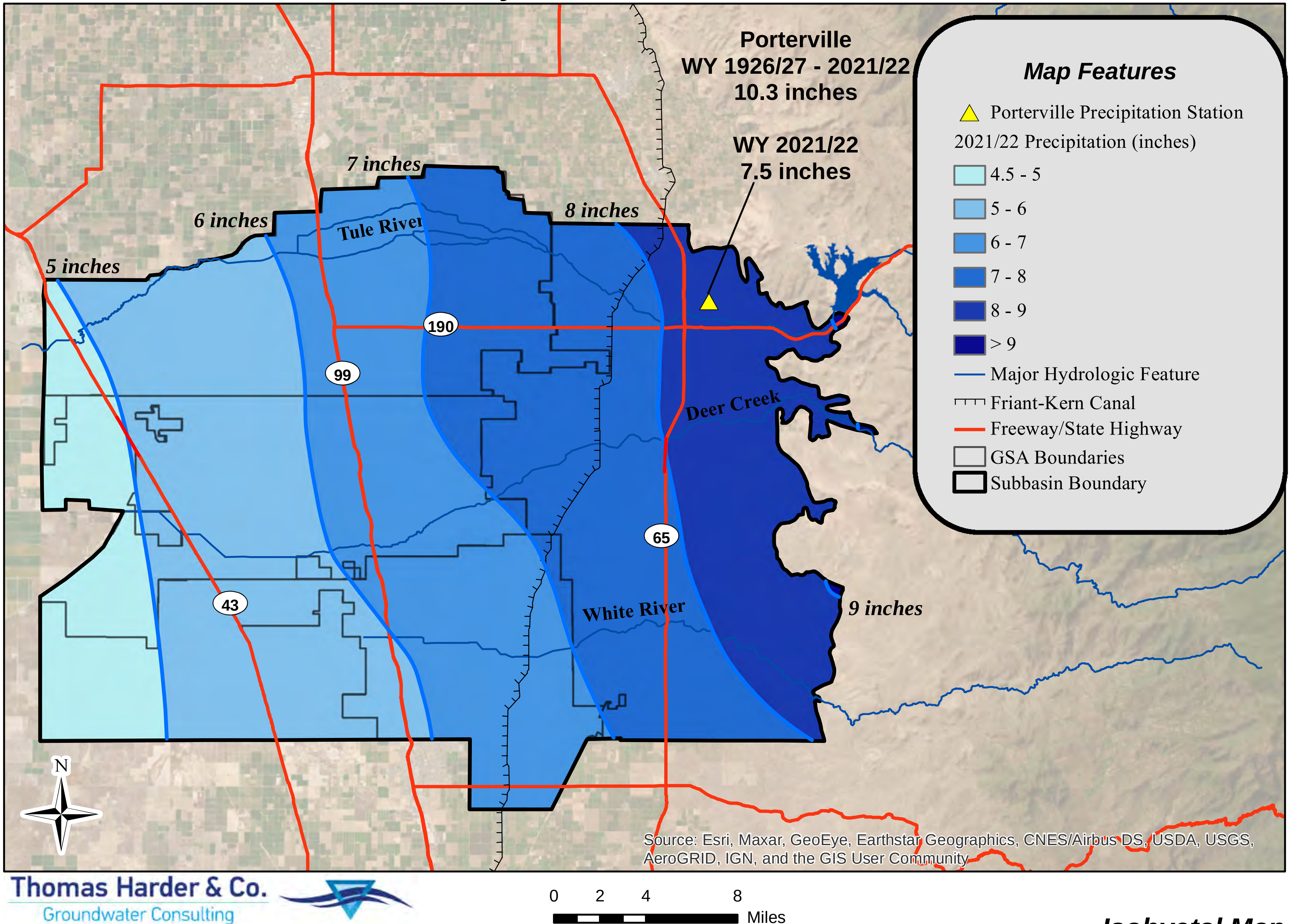
Thomas Harder & Co.
Groundwater Consulting

0 3 6 12 Miles

NAD 83 State Plane Zone 4

Groundwater Pumping

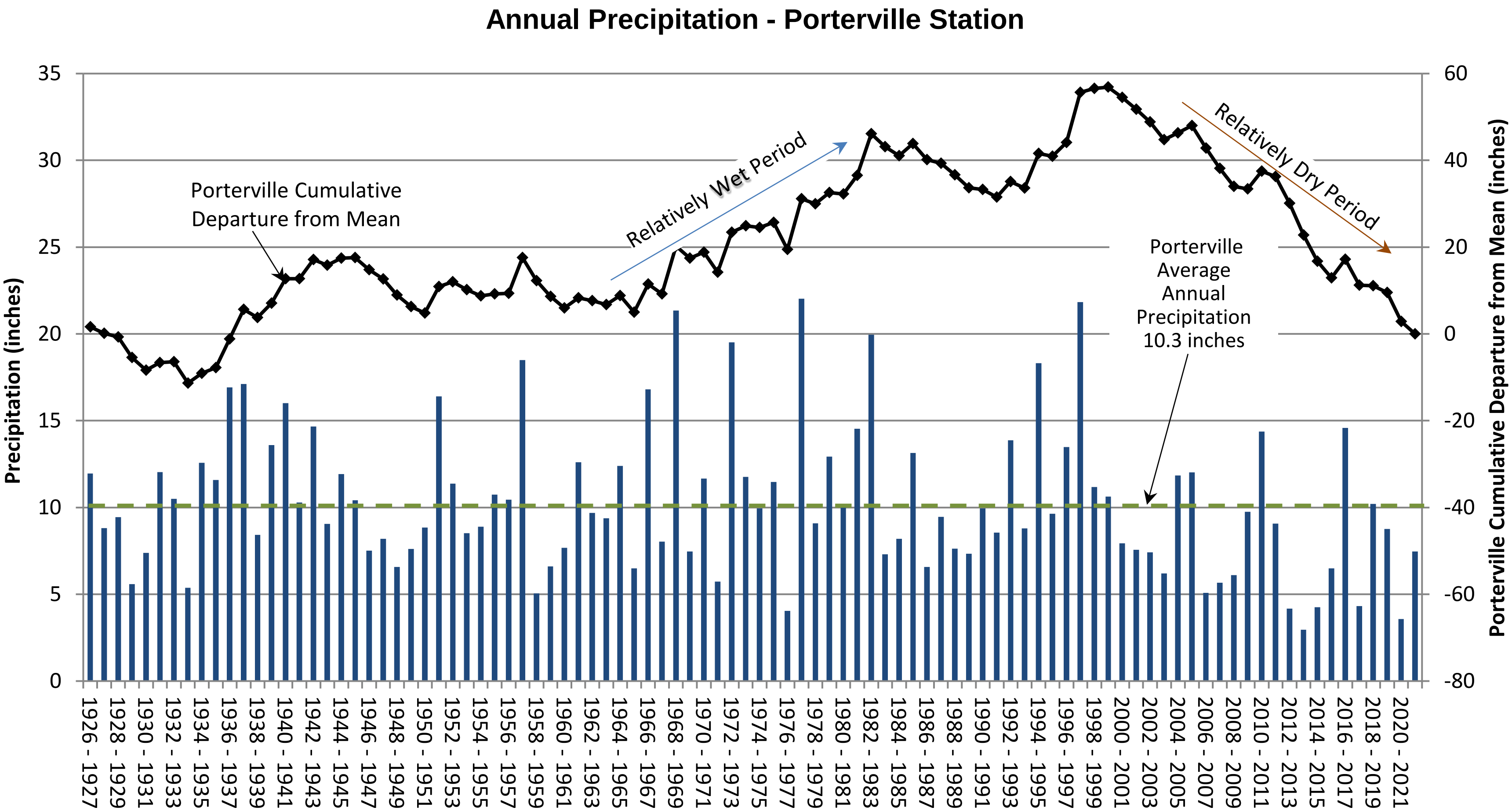
Figure 13



Thomas Harder & Co.
Groundwater Consulting

Note: Isohyetal data from LandIQ.
Porterville Precipitation Station Data
from WRCC and CIMIS (see Figure 15).

Isohyetal Map
Figure 14

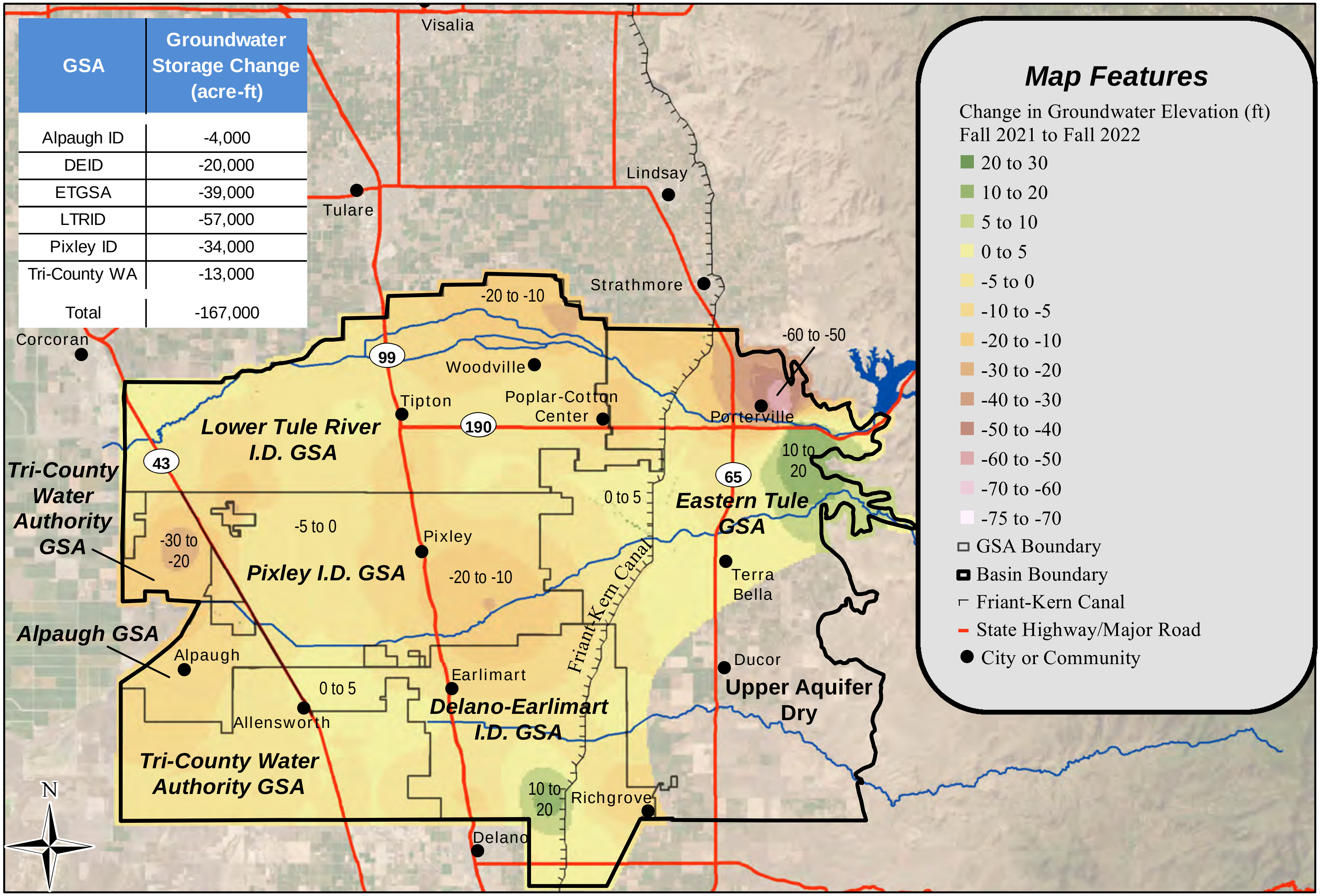


Notes:

Data in water years (October 1 to September 30).

Data from Western Regional Climate Center (1926-2001) and California Irrigation Management Information System (2002-2022).

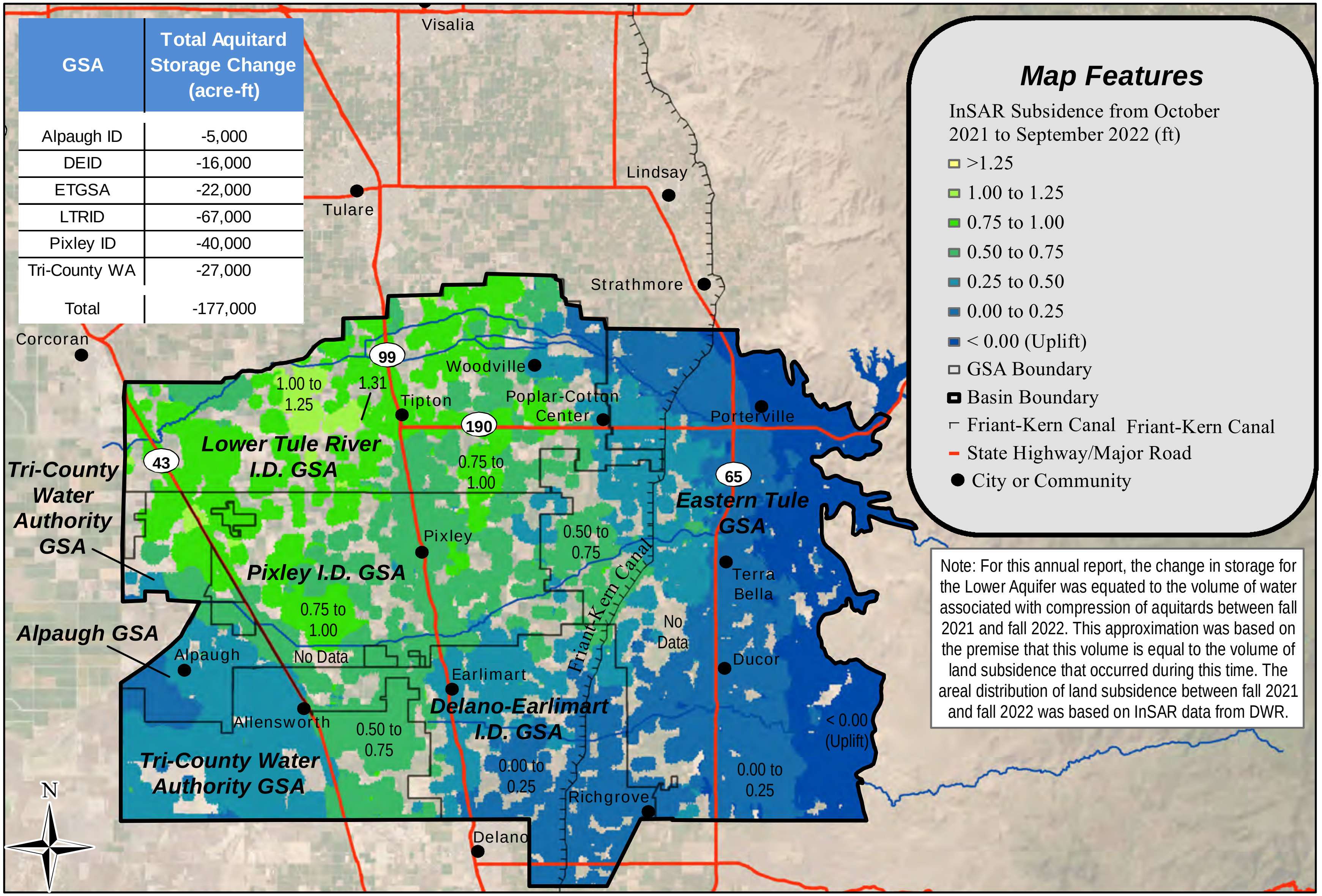
GSA	Groundwater Storage Change (acre-ft)
Alpaugh ID	-4,000
DEID	-20,000
ETGSA	-39,000
LTRID	-57,000
Pixley ID	-34,000
Tri-County WA	-13,000
Total	-167,000



Thomas Harder & Co.
Groundwater Consulting

0 2.5 5 10 Miles
NAD 83 State Plane Zone 4

Change in Groundwater Elevation
Upper Aquifer - Fall 2021 to Fall 2022
Figure 16



GSA	Total Aquitard Storage Change (acre-ft)
Alpaugh ID	-5,000
DEID	-16,000
ETGSA	-22,000
LTRID	-67,000
Pixley ID	-40,000
Tri-County WA	-27,000
Total	-177,000

0 2.5 5 10 Miles
NAD 83 State Plane Zone 4

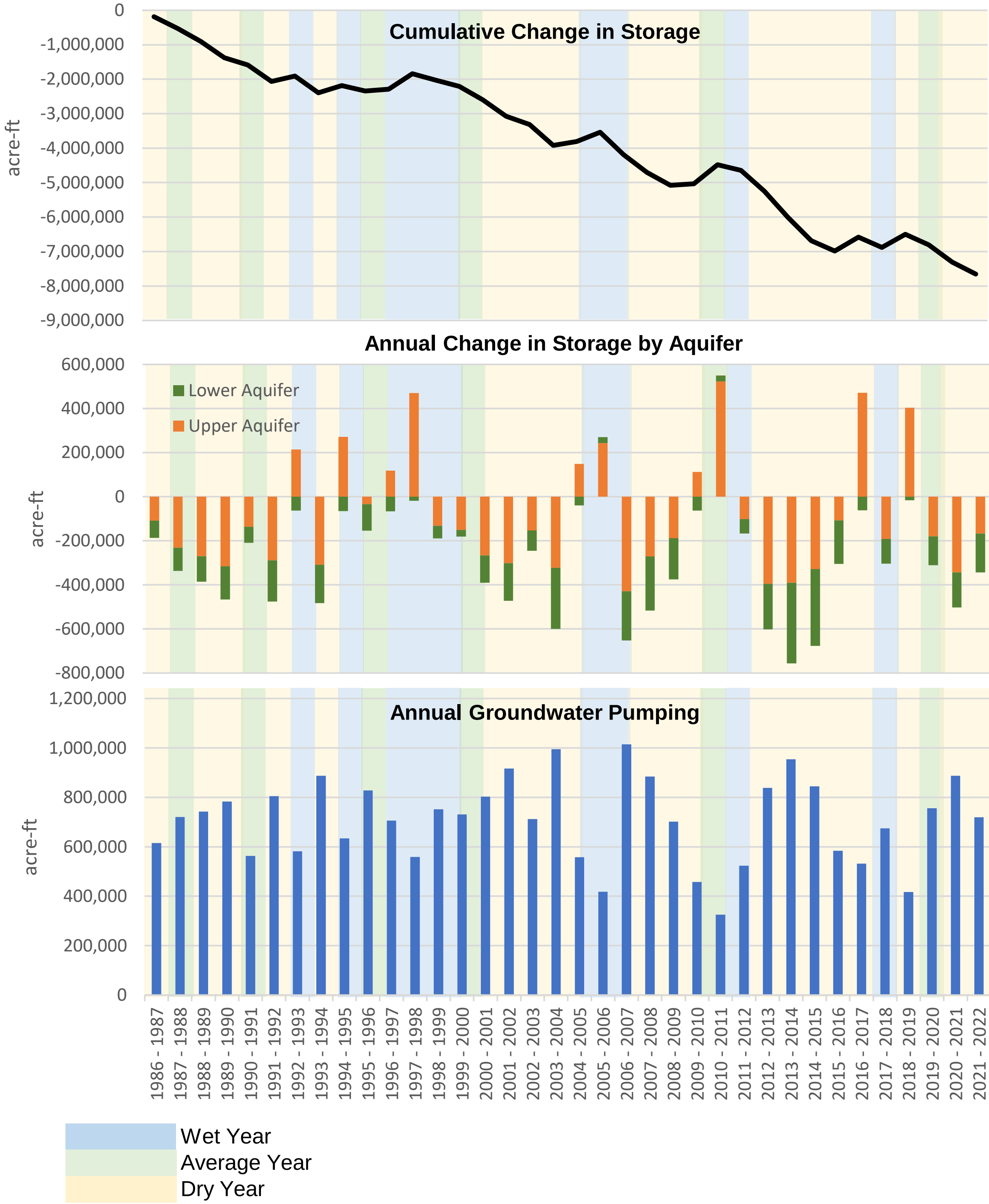
Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Change in Lower Aquifer Storage As Estimated from Land Subsidence Fall 2021 to Fall 2022

Figure 17

Tule Subbasin Groundwater Use and Change in Storage 1986/87 to 2021/22



Thomas Harder & Co.
Groundwater Consulting

Appendix A

Lower Tule River Irrigation District GSA 2021/22 Annual Data

Lower Tule River Irrigation District GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
LTRID GSA	Agricultural	234,000	0	16,540	250,540
	Municipal	0	1,220	0	1,220
	Tulare County MOU	2,000	0	0	2,000
	Total	***236,000***	***1,220***	***16,540***	***253,760***

Lower Tule River Irrigation District GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
LTRID GSA	Agricultural	8,800	42,200	0	0	54,200	105,200
	Municipal	0	0	0	0	600	600
	Tulare County MOU	0	0	0	0	600	600
	Total	***8,800***	***42,200***	***0***	***0***	***55,400***	***106,400***

Lower Tule River Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
LTRID GSA	Agricultural	250,540	105,200	355,740
	Municipal	1,220	600	1,820
	Tulare County MOU	2,000	600	2,600
	Total	***253,760***	***106,400***	***360,160***

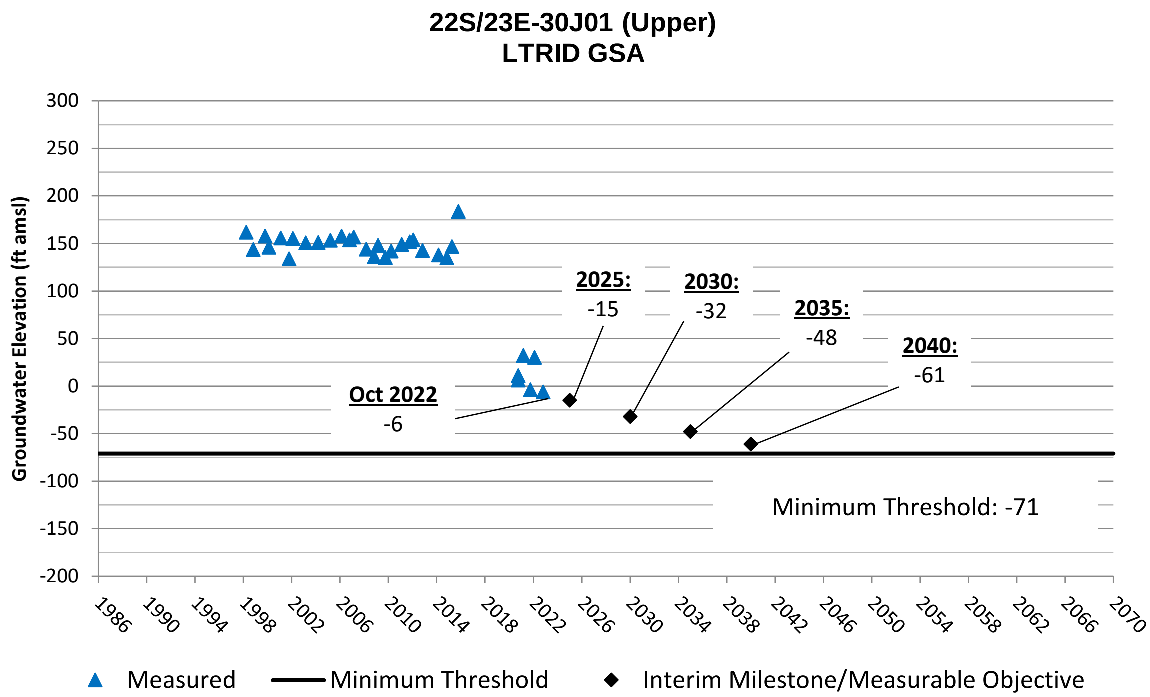
Lower Tule River Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

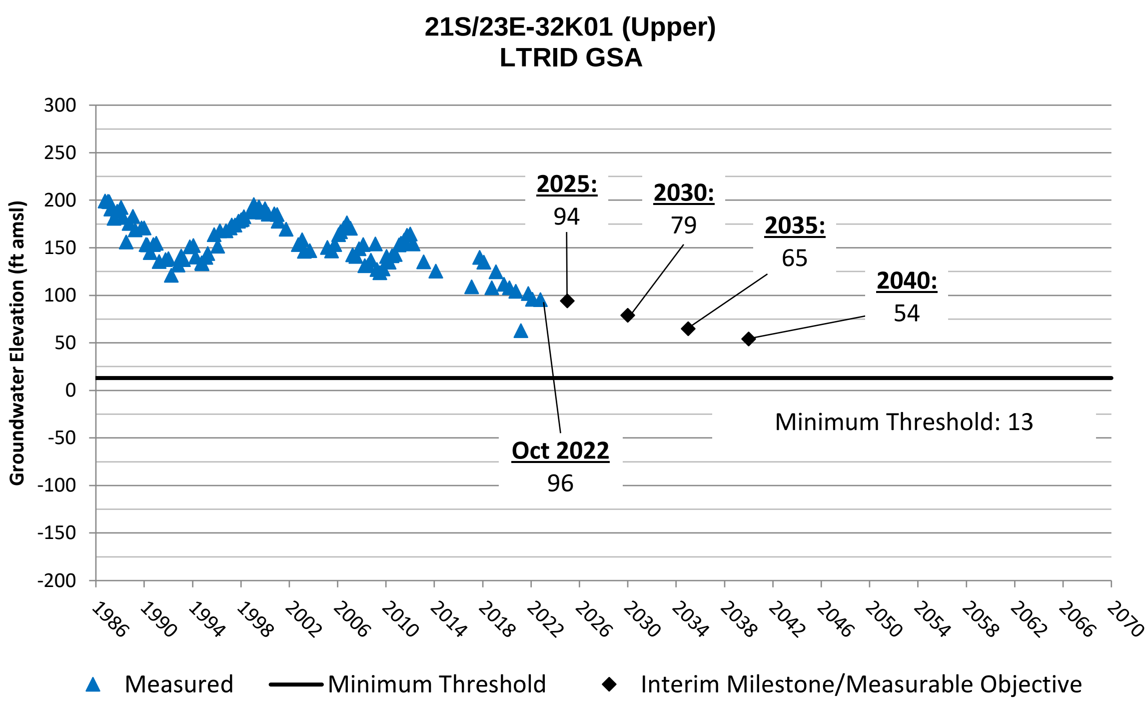
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
L0001_B_RMS	253.0	251.4	238.7	237.8
L0002_B_RMS	228.9	226.8	222.2	220.8
L0003_B_RMS	228.7	226.8	223.5	221.5
L0004_B_RMS	197.3	195.8	193.1	192.1
L0005_B_RMS	190.2	188.5	182.5	181.5
L0006_B_RMS	192.3	190.0	184.5	183.5
L0022_B_RMS	180.0	178.5	170.3	169.3
L0023_B_RMS	190.8	189.4	185.1	184.1
L0024_B_RMS	254.9	253.4	249.8	248.8
L0038_B_RMS	321.6	320.5	319.5	318.1
L0039_B_RMS	307.5	306.0	304.4	303.3
L0040_B_RMS	309.0	307.9	304.4	303.4
L0041_B_RMS	307.3	306.2	302.8	301.8
L0042_B_RMS	306.5	305.0	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	345.3	343.7	342.6
L0046_B_RMS	371.0	370.1	370.0	369.0

Note:

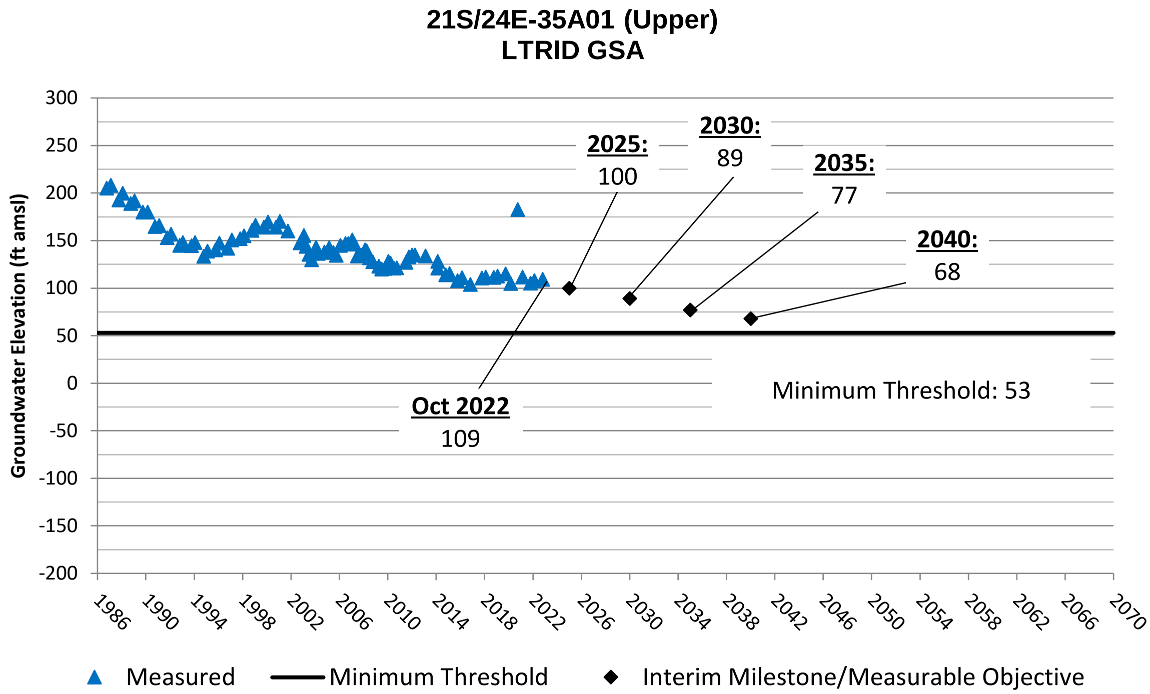
[1] Benchmarks surveyed in July and August of each year.

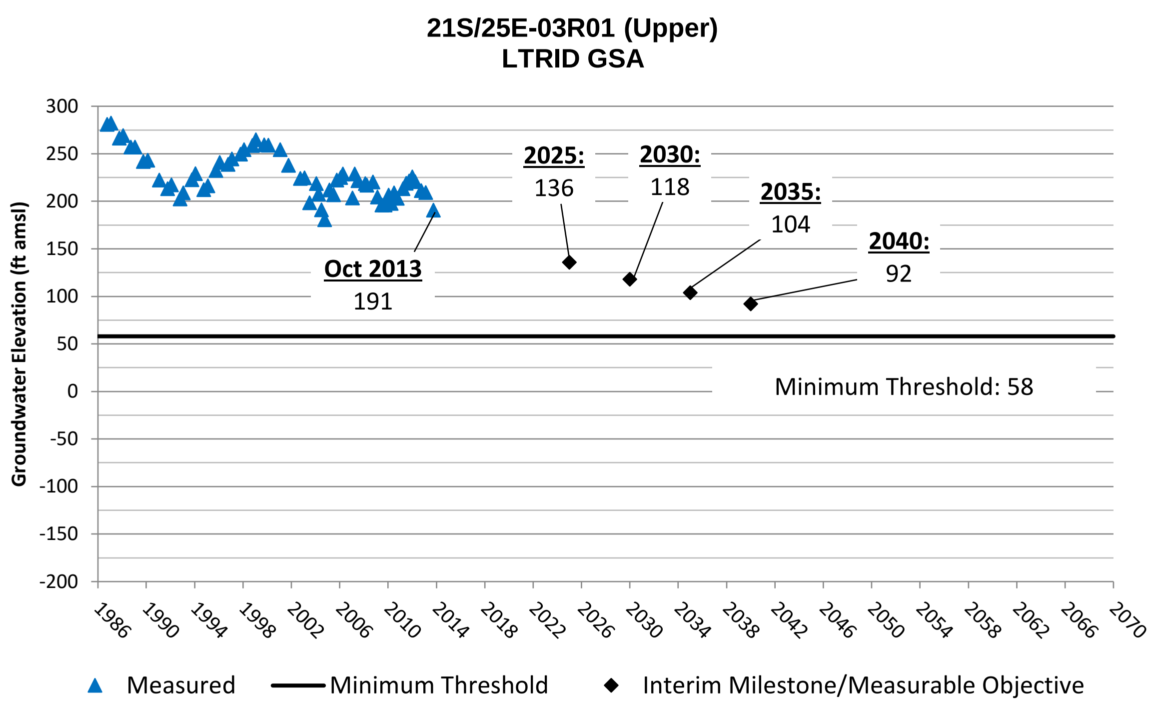
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



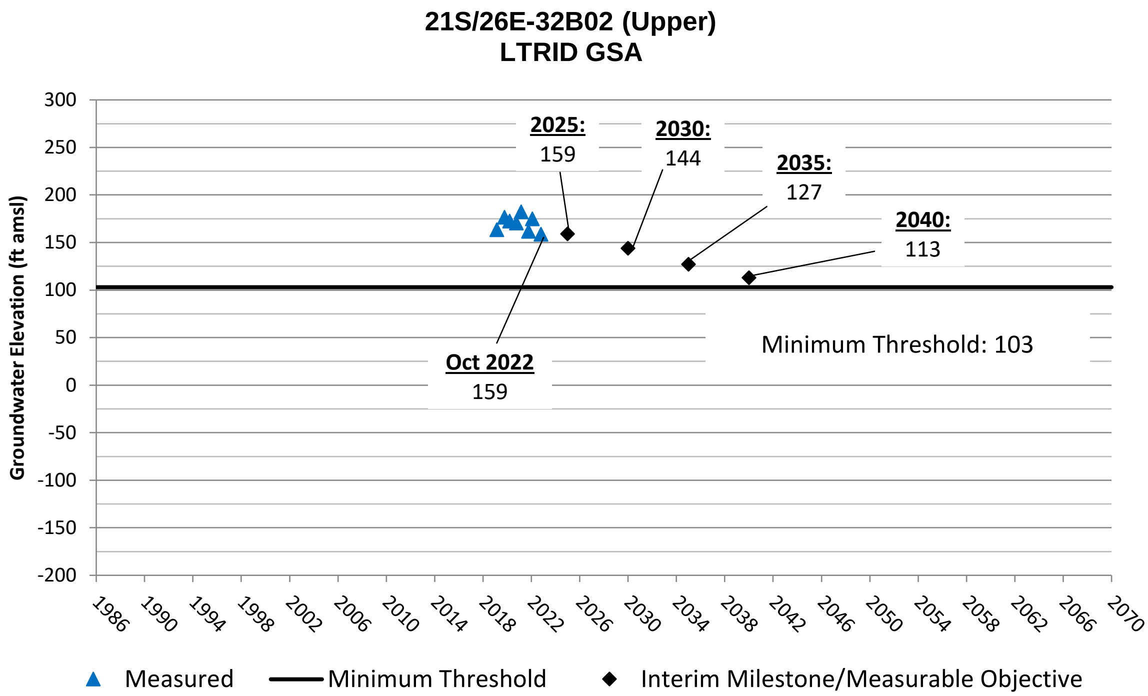


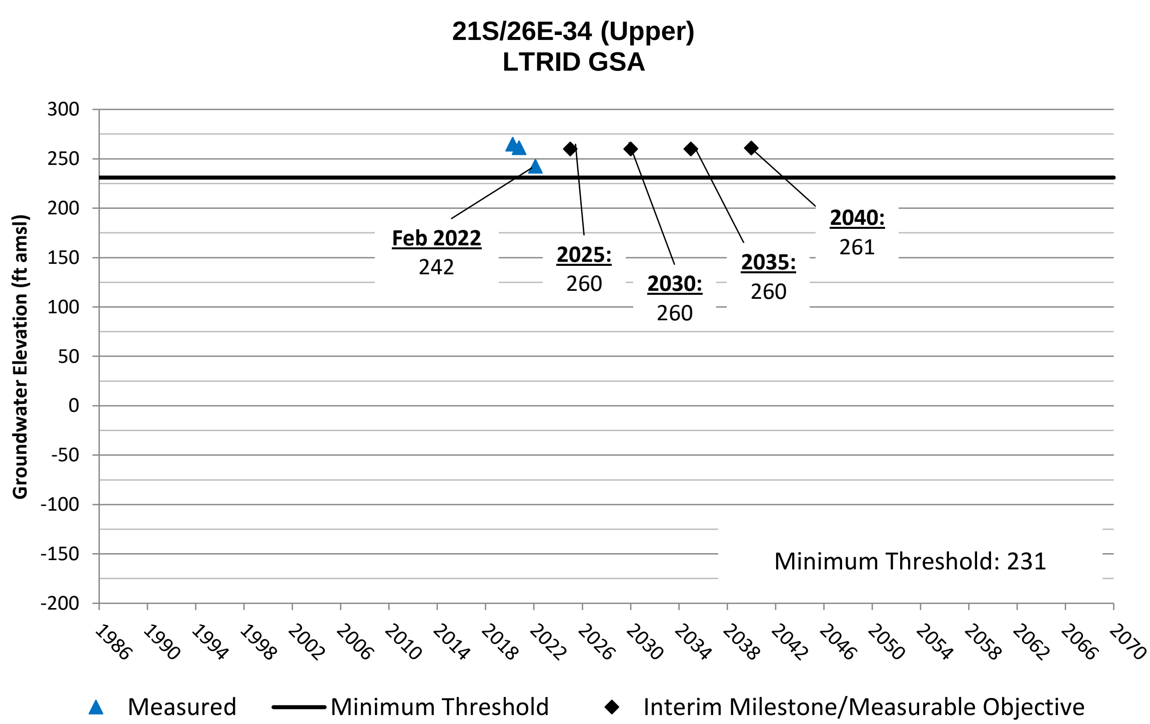
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



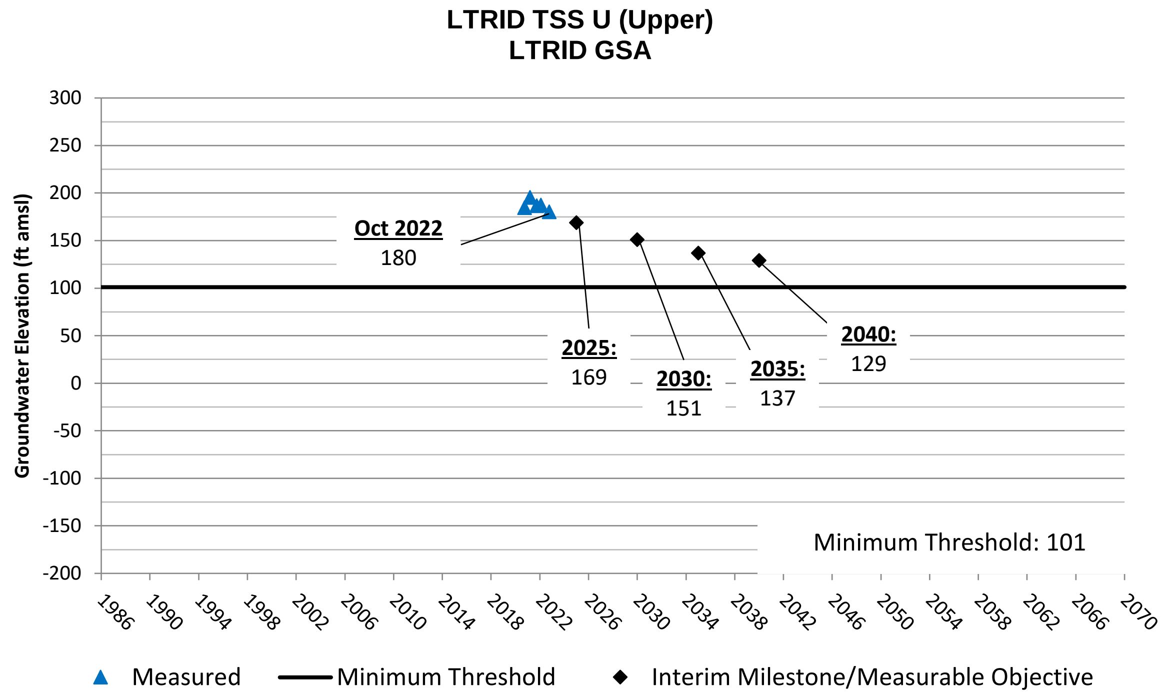


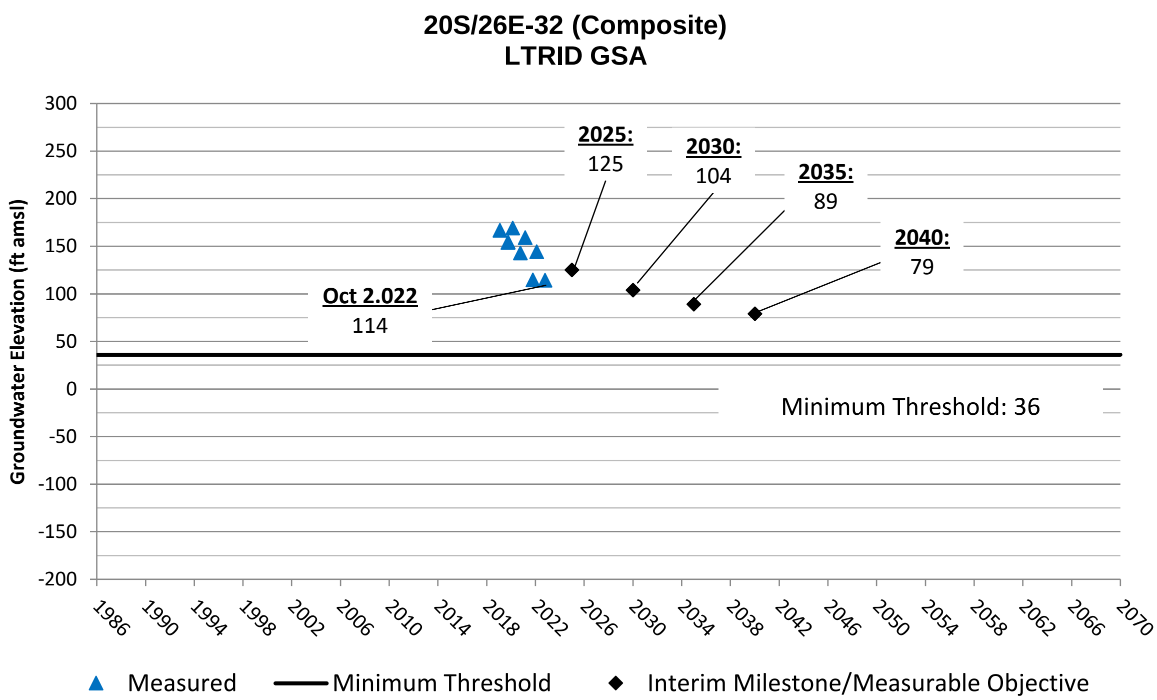
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



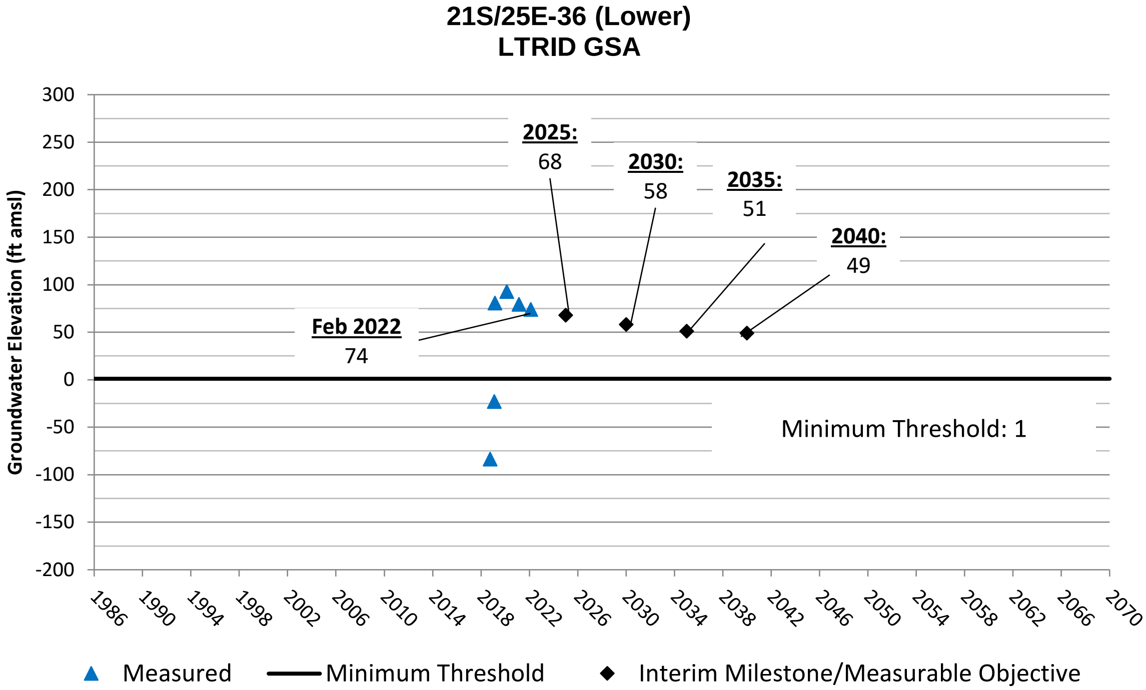


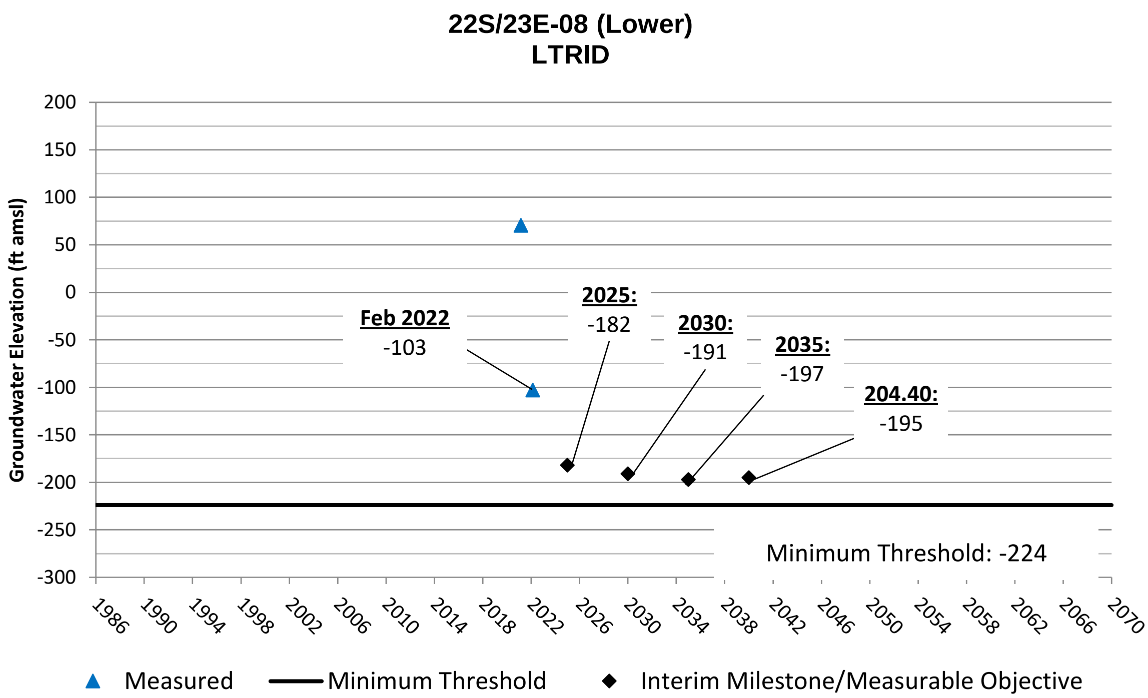
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



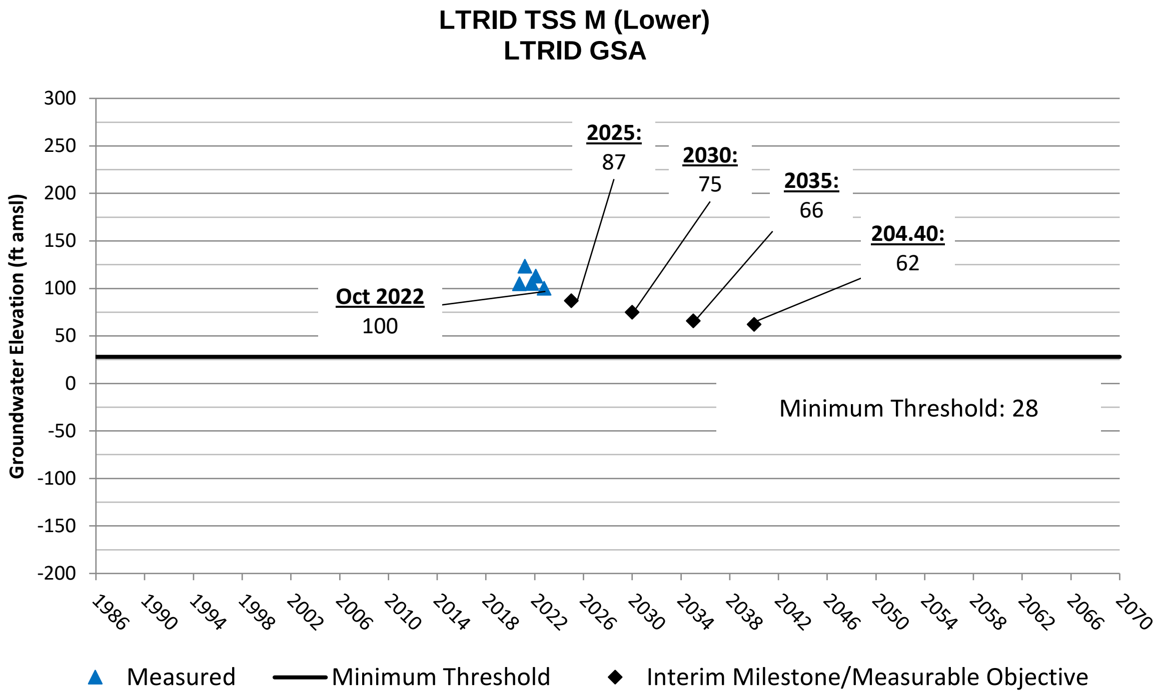


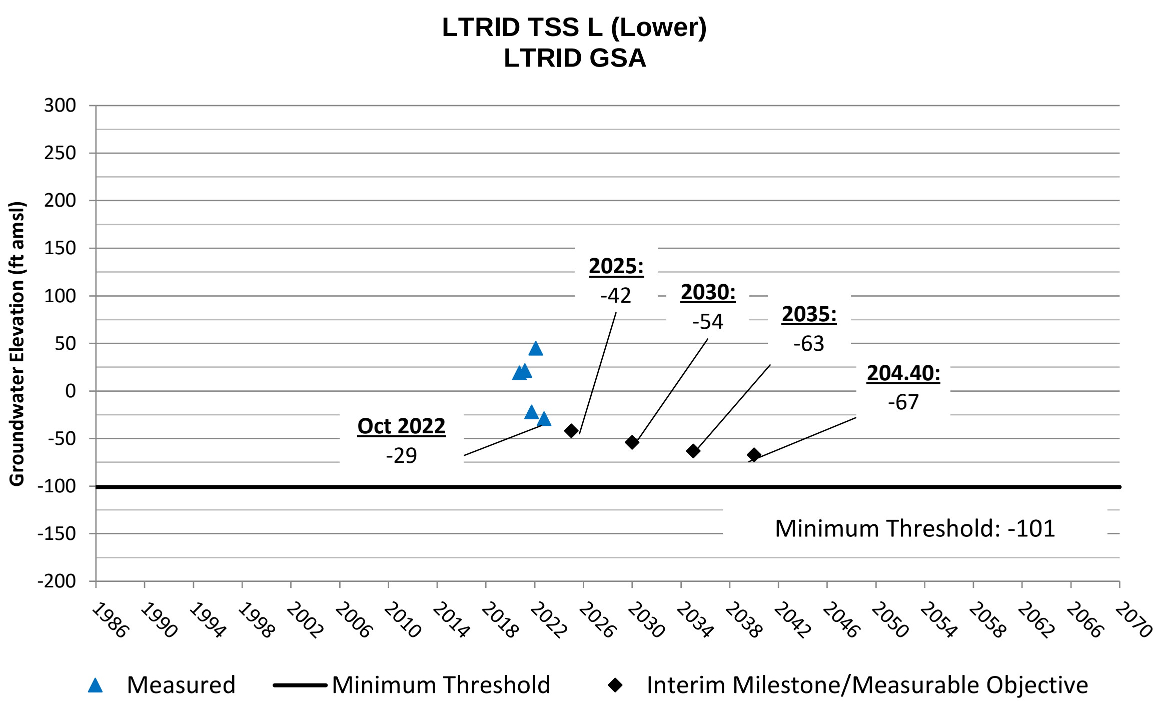
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



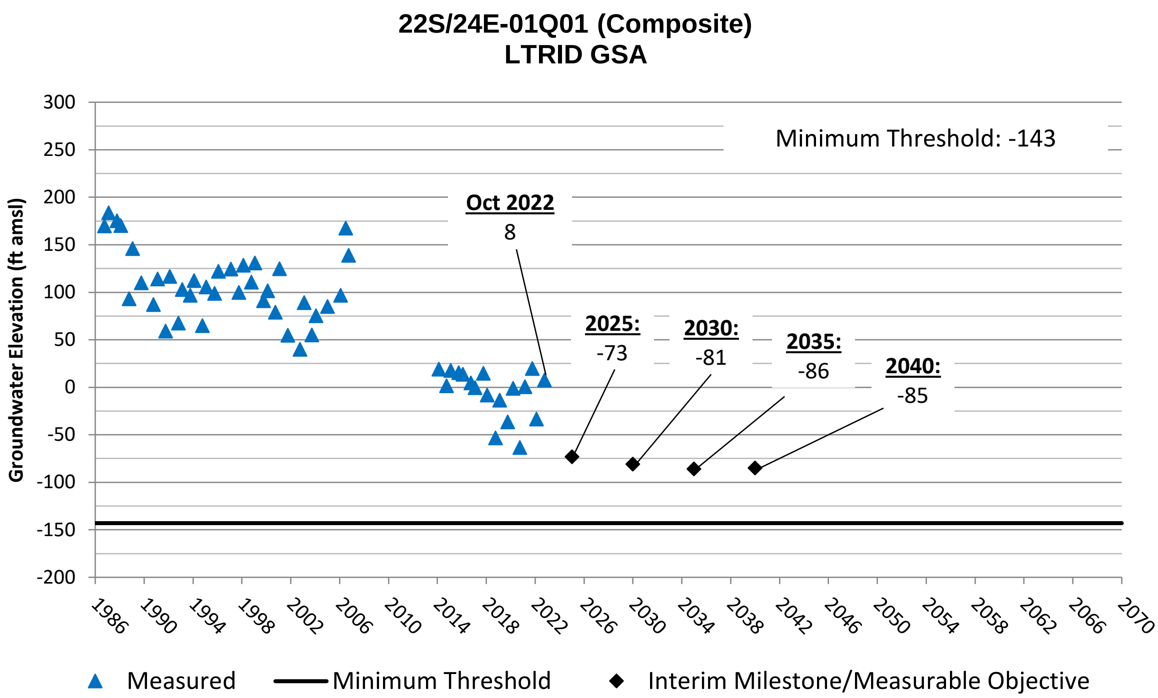


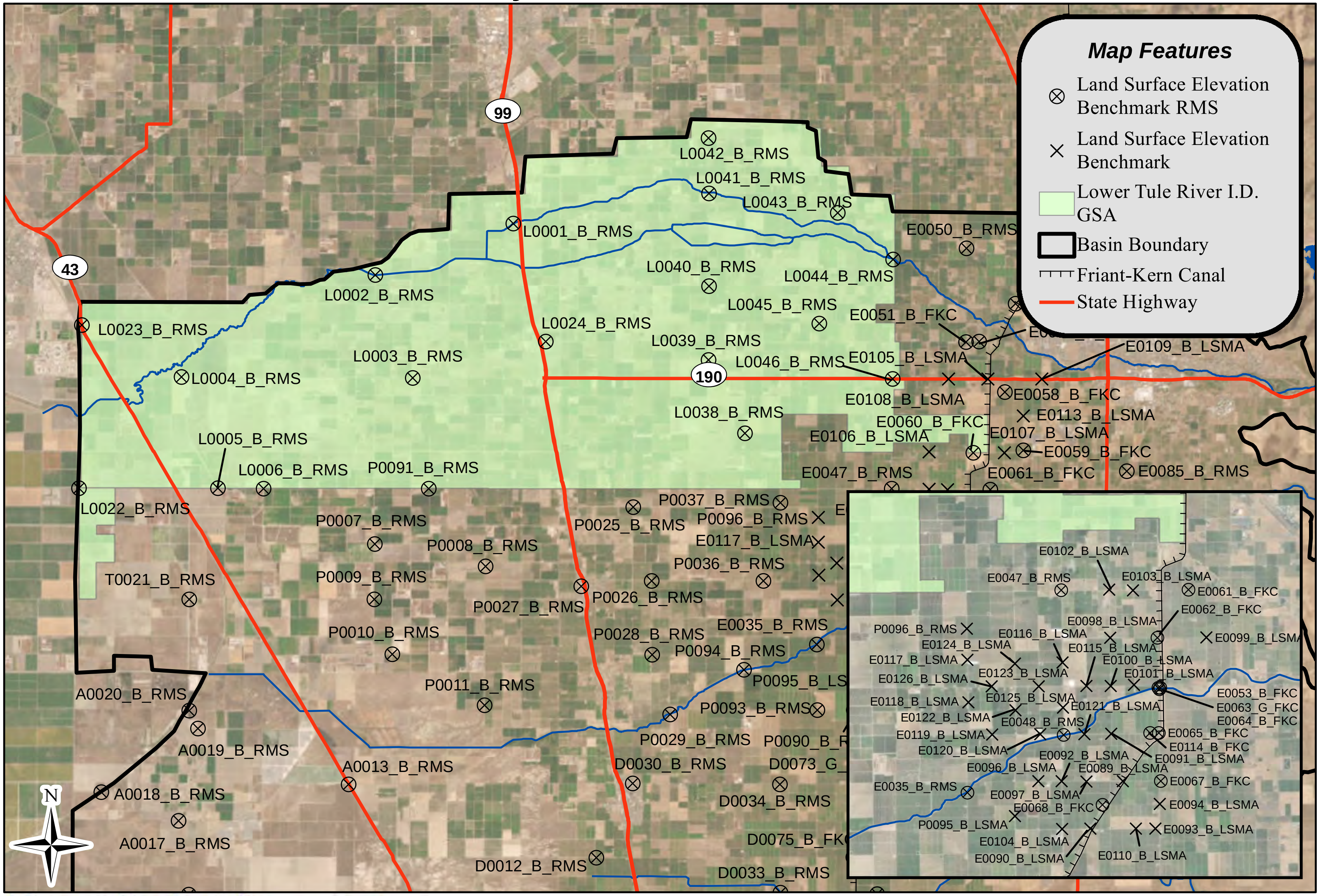
Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Lower Tule River Irrigation District GSA
RMS Groundwater Elevation Hydrographs



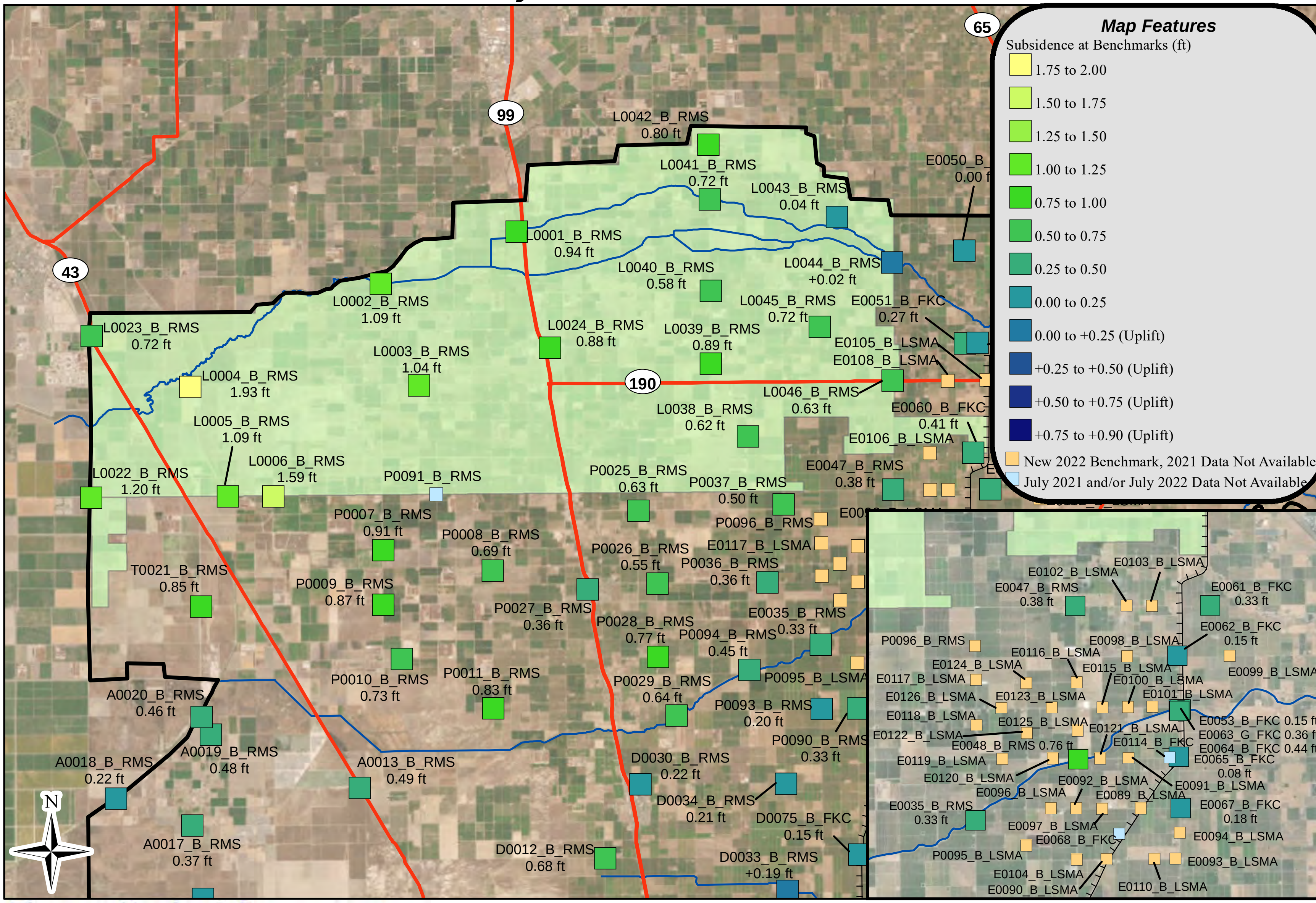


Thomas Harder & Co.
Groundwater Consulting

0 2 4 8
Miles
NAD 83 State Plane Zone 4

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

Appendix A
Figure 8



Thomas Harder & Co.
Groundwater Consulting

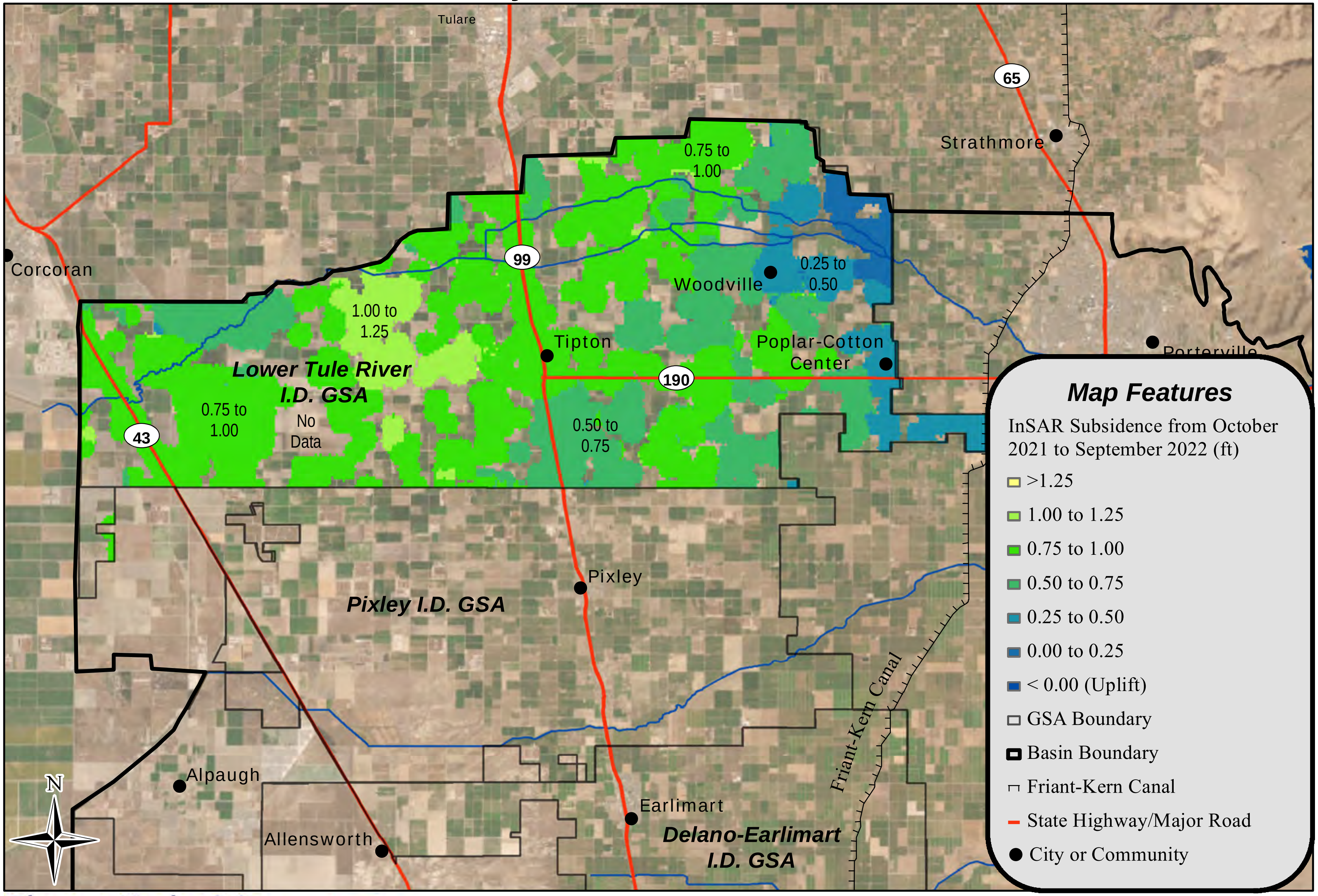
0 2 4 8 Miles
NAD 83 State Plane Zone 4

Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022 Lower Tule River I.D. GSA

Appendix A
Figure 9

Tule Subbasin Technical Advisory Committee

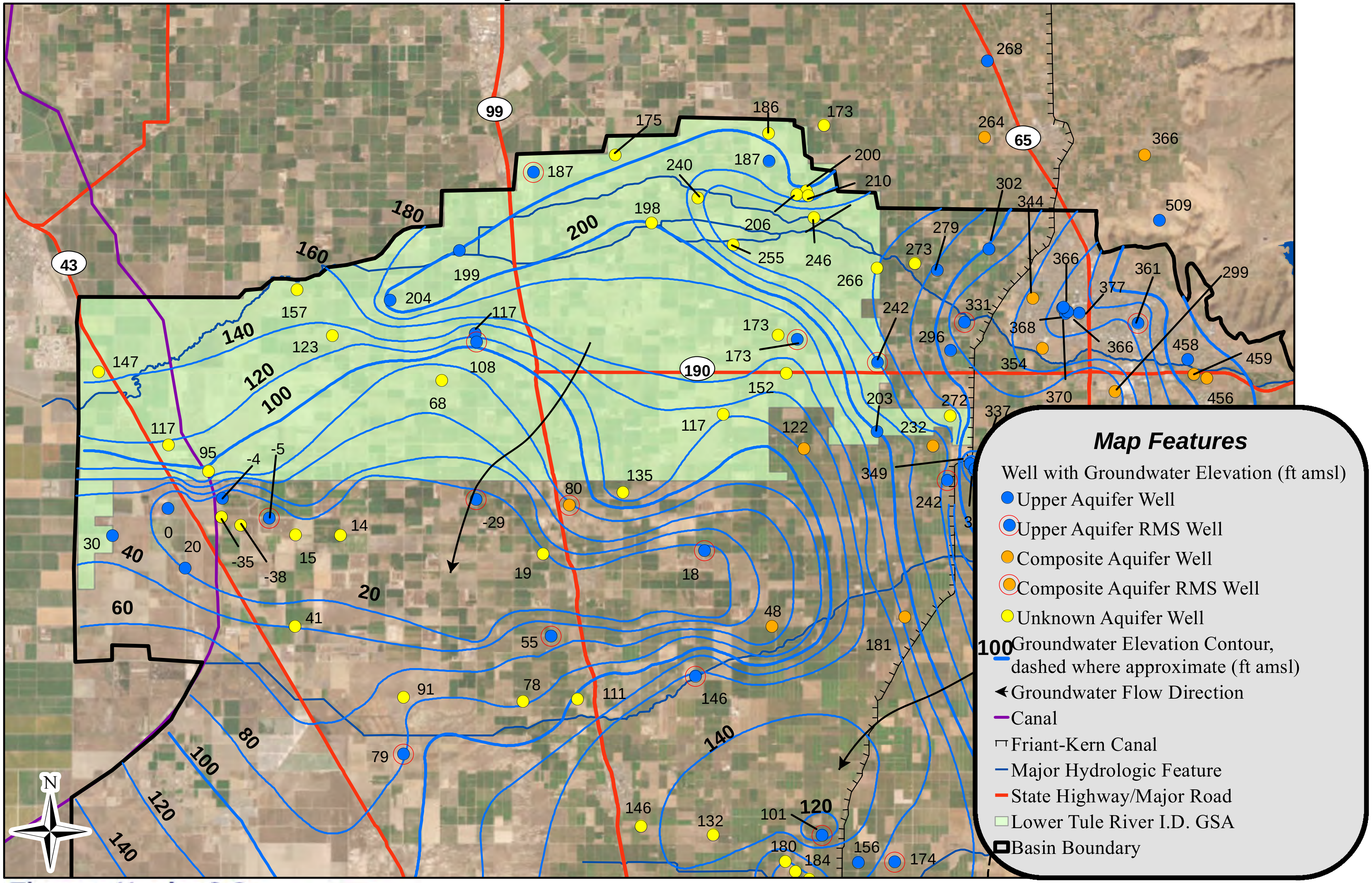


Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Land Subsidence - October 2021 - September 2022 Lower Tule River I.D. GSA

Appendix A
Figure 10



Thomas Harder & Co.
Groundwater Consulting

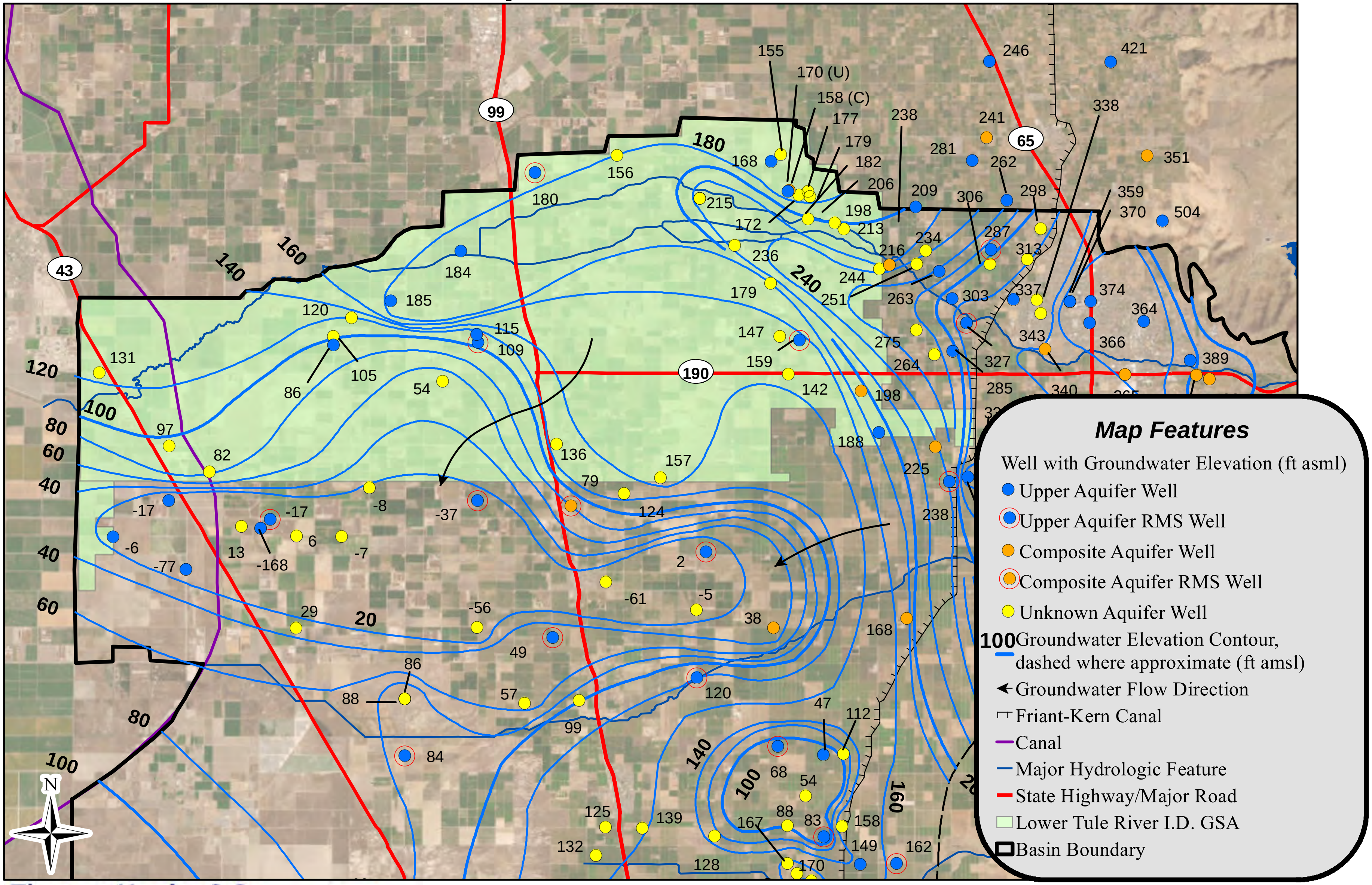
0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer Lower Tule River I.D. GSA

Appendix A
Figure 11

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

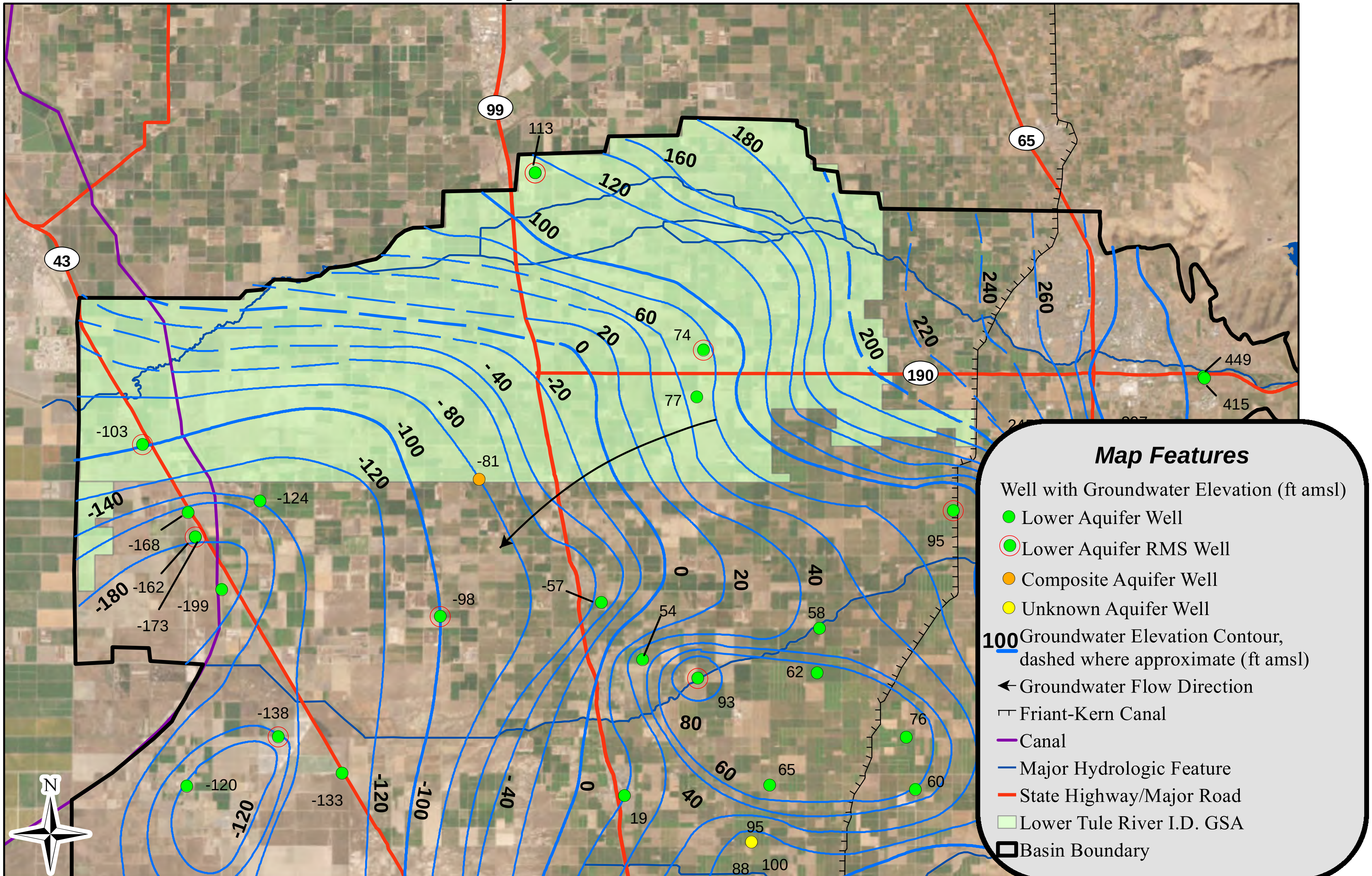
0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 12

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



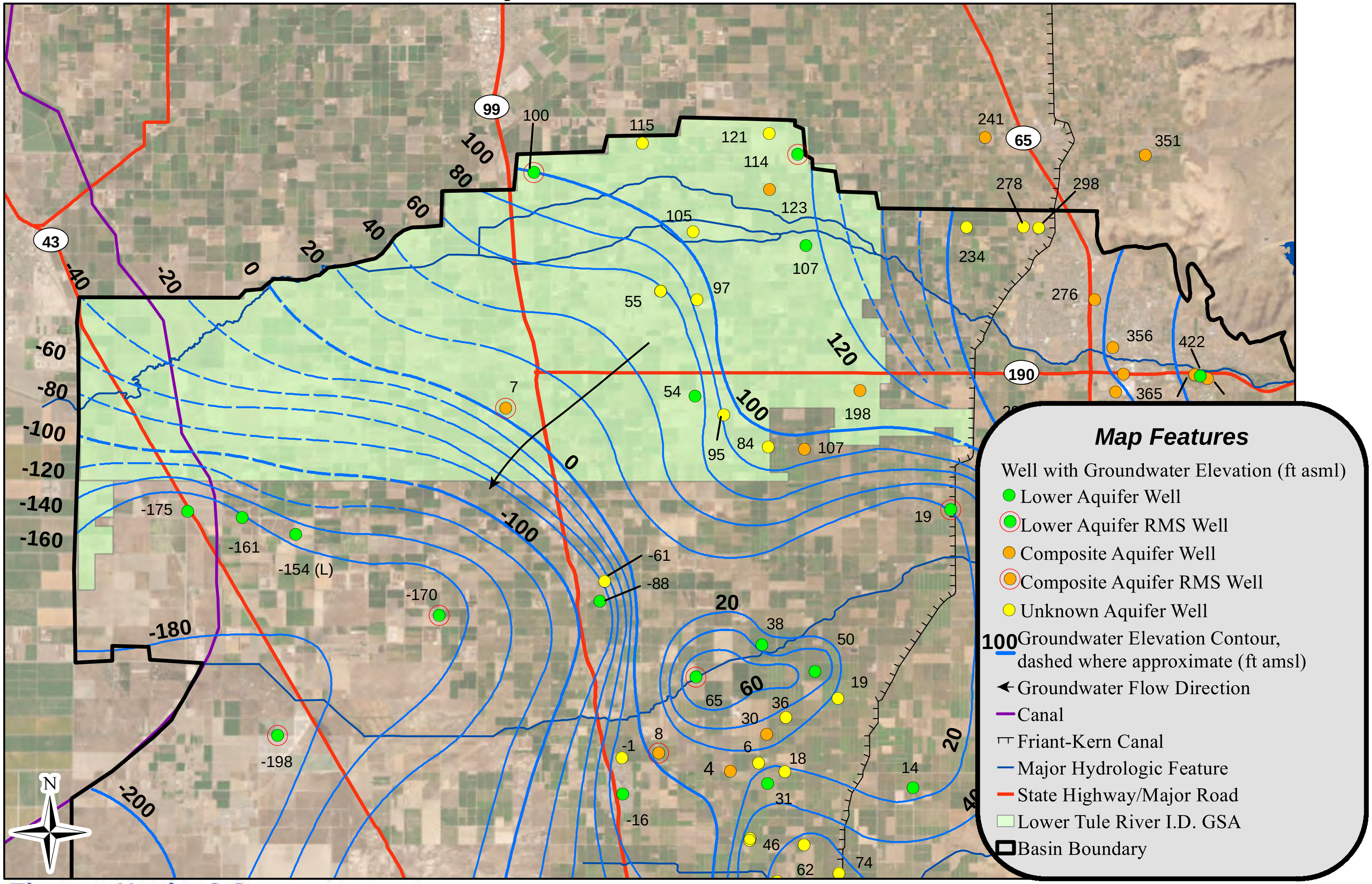
Thomas Harder & Co.
Groundwater Consulting

0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 13

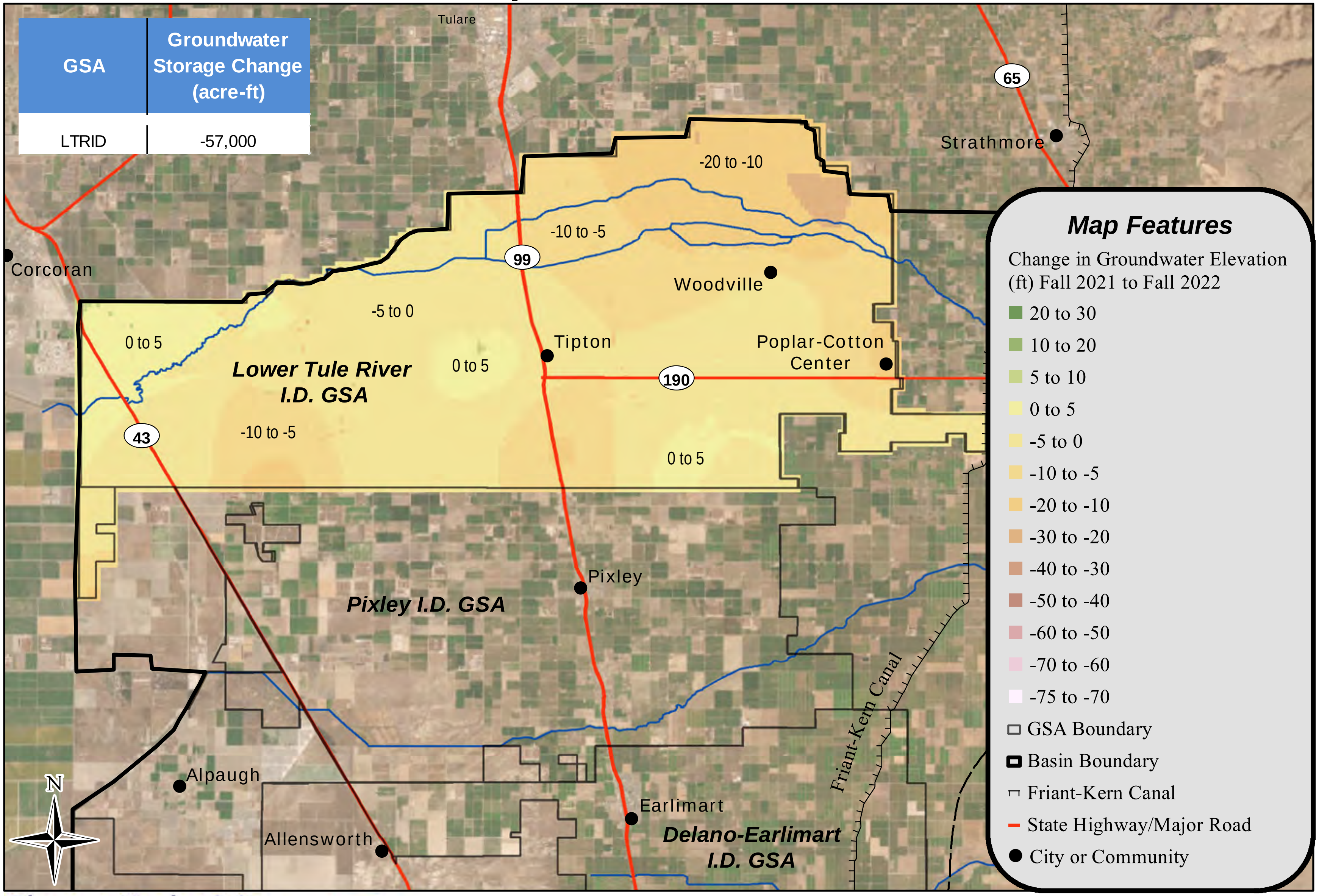
Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
Lower Tule River I.D. GSA
Appendix A
Figure 14



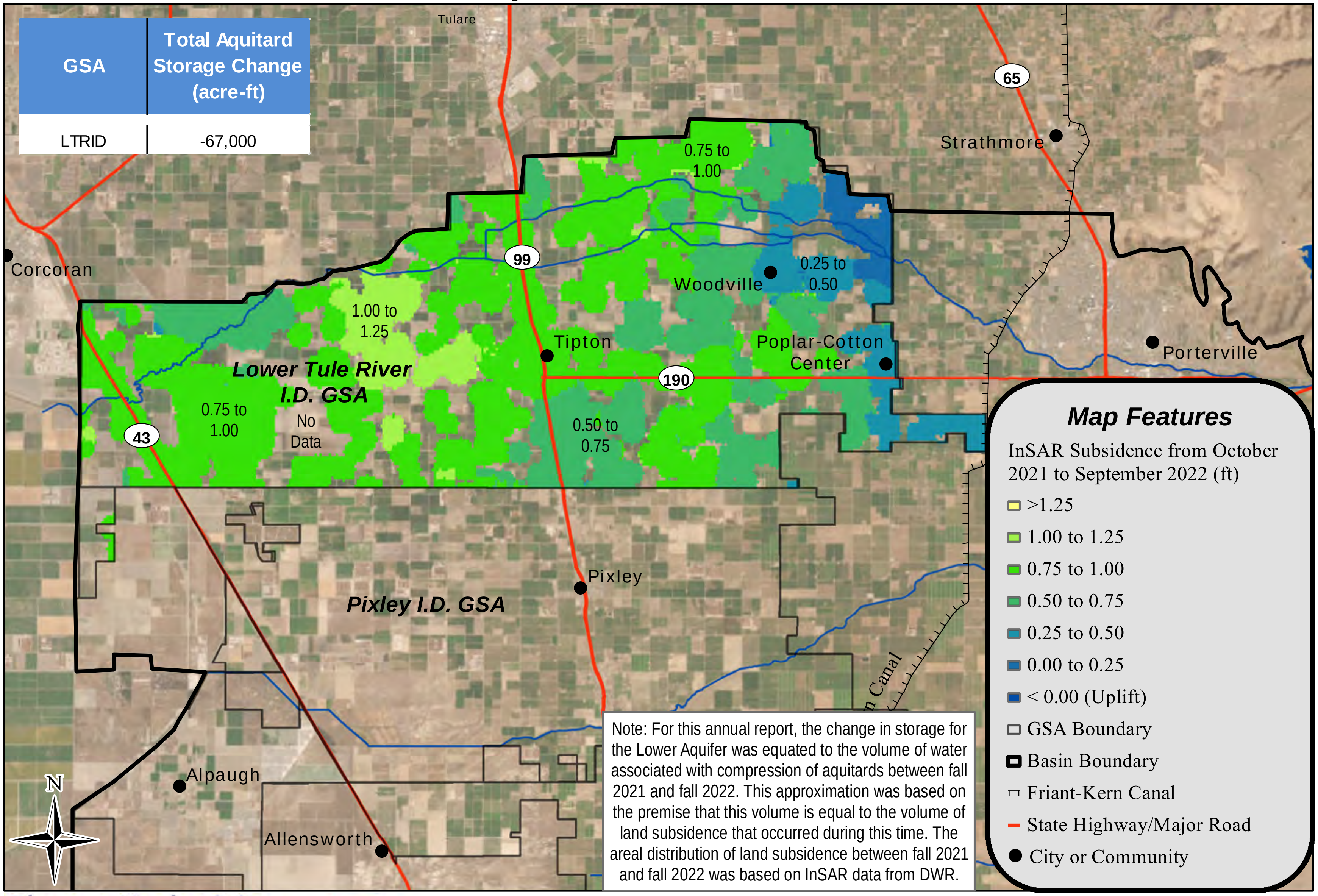
Thomas Harder & Co.
Groundwater Consulting

Change in Groundwater Elevation
Fall 2021 to Fall 2022 - Upper Aquifer
Lower Tule River I.D. GSA

Appendix A
Figure 15

Tule Subbasin Technical Advisory Committee

GSA	Total Aquitard Storage Change (acre-ft)
LTRID	-67,000



Note: For this annual report, the change in storage for the Lower Aquifer was equated to the volume of water associated with compression of aquitards between fall 2021 and fall 2022. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The areal distribution of land subsidence between fall 2021 and fall 2022 was based on InSAR data from DWR.

Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Change in Lower Aquifer Storage as Estimated from Land Subsidence - Fall 2021 to Fall 2022
Lower Tule River I.D. GSA

Appendix A
Figure 16

Appendix B

Eastern Tule GSA
2021/22 Annual Data

Eastern Tule GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
ETGSA	Greater Tule	125,000	0	0	125,000
	Porterville Community	0	10,670	0	10,670
	Ducor Community	0	200	0	200
	Terra Bella Community	0	0	0	0
	Kern-Tulare WD	7,000	0	0	7,000
	Total	***132,000***	***10,870***	***0***	***142,870***

Eastern Tule GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
ETGSA	Greater Tule	12,600	45,000	0	0	88,000	145,600
	Porterville Community	870	0	4,810	0	11,700	17,380
	Ducor Community	0	0	0	0	200	200
	Terra Bella Community	0	1,630	0	0	1,300	2,930
	Kern-Tulare WD	0	8,370	0	1,100	5,300	14,770
	Total	***13,470***	***55,000***	***4,810***	***1,100***	***106,500***	***180,880***

Eastern Tule GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
ETGSA	Greater Tule	125,000	145,600	270,600
	Porterville Community	10,670	17,380	28,050
	Ducor Community	200	200	400
	Terra Bella Community	0	2,930	2,930
	Kern-Tulare WD	7,000	14,770	21,770
	Total	***142,870***	***180,880***	***323,750***

Eastern Tule GSA
Land Surface Elevations at Representative Monitoring Sites

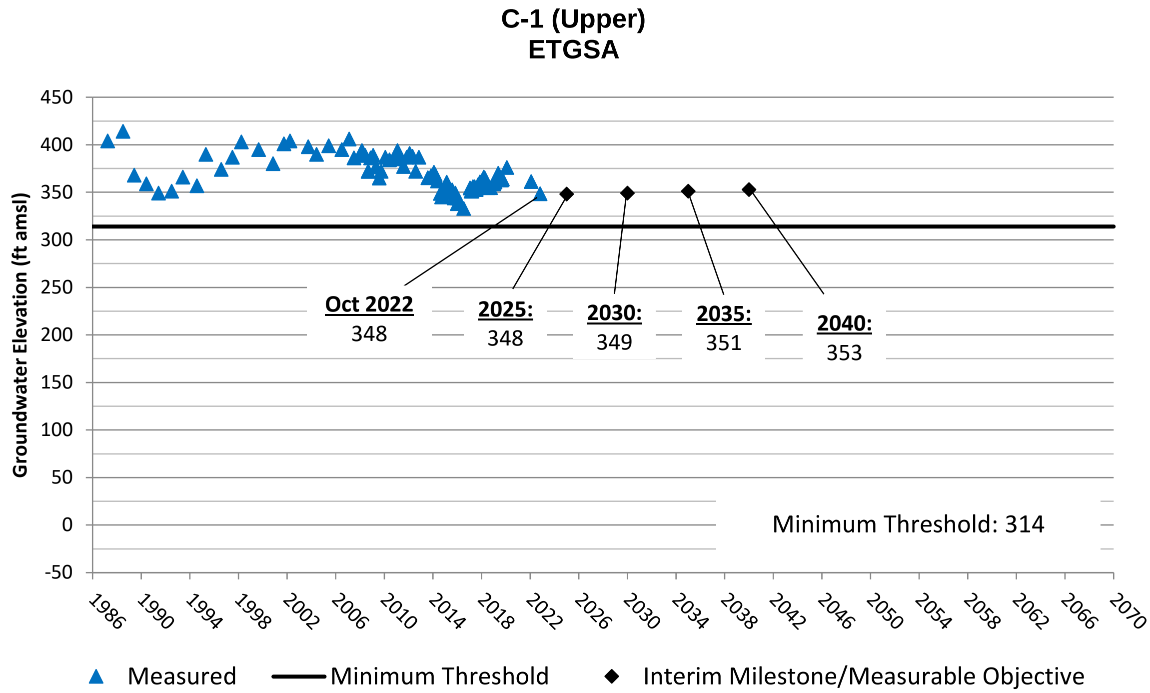
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
E0035_B_RMS	342.1	340.8	340.5	339.5
E0047_B_RMS	366.2	365.1	365.2	363.4
E0048_B_RMS	370.5	369.2	369.5	366.5
E0049_B_RMS	403.2	402.0	402.7	401.8
E0050_B_RMS	386.6	386.5	386.5	385.5
E0051_B_FKC	397.3	396.7	397.3	396.3
E0052_B_FKC	405.7	405.6	405.7	404.7
E0053_B_FKC	399.8	399.2	399.7	398.3
E0054_B_FKC	412.5	412.4	412.4	411.0
E0055_B_FKC	409.1	409.1	409.0	408.0
E0056_G_FKC	406.7	406.6	406.7	405.7
E0057_B_FKC	399.3	398.9	399.3	398.3
E0058_B_FKC	407.8	407.2	407.1	406.0
E0059_B_FKC	418.0	417.1	416.9	415.9
E0060_B_FKC	393.6	392.8	392.8	391.7
E0061_B_FKC	403.8	402.8	402.7	401.7
E0062_B_FKC	403.6	403.0	402.9	401.9
E0063_G_FKC	403.2	402.3	403.2	402.1
E0064_B_FKC	400.8	399.8	400.7	399.4
E0065_B_FKC	393.7	399.5	392.6	389.9
E0066_B_FKC	411.9	411.0	410.2	409.1
E0067_B_FKC	408.0	407.1	407.0	404.7
E0068_B_FKC	391.2	N/A	390.9	389.0
E0069_B_FKC	397.4	396.7	397.4	396.4
E0085_B_RMS	480.6	480.4	480.6	479.6
E0086_B_RMS	447.7	447.1	447.7	446.2
E0087_B_RMS	531.1	530.6	531.2	530.2
E0088_B_RMS	457.5	457.0	456.8	455.8
E0114_B_FKC	N/A	392.7	N/A	N/A

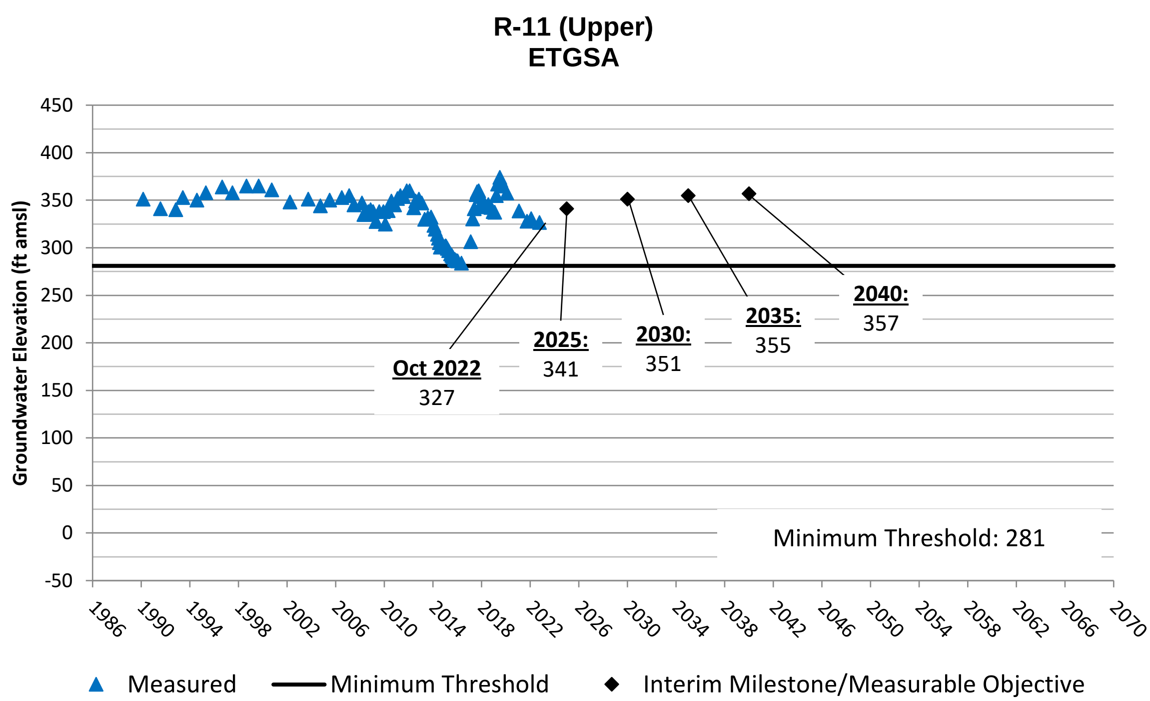
Notes:

N/A = Not available

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

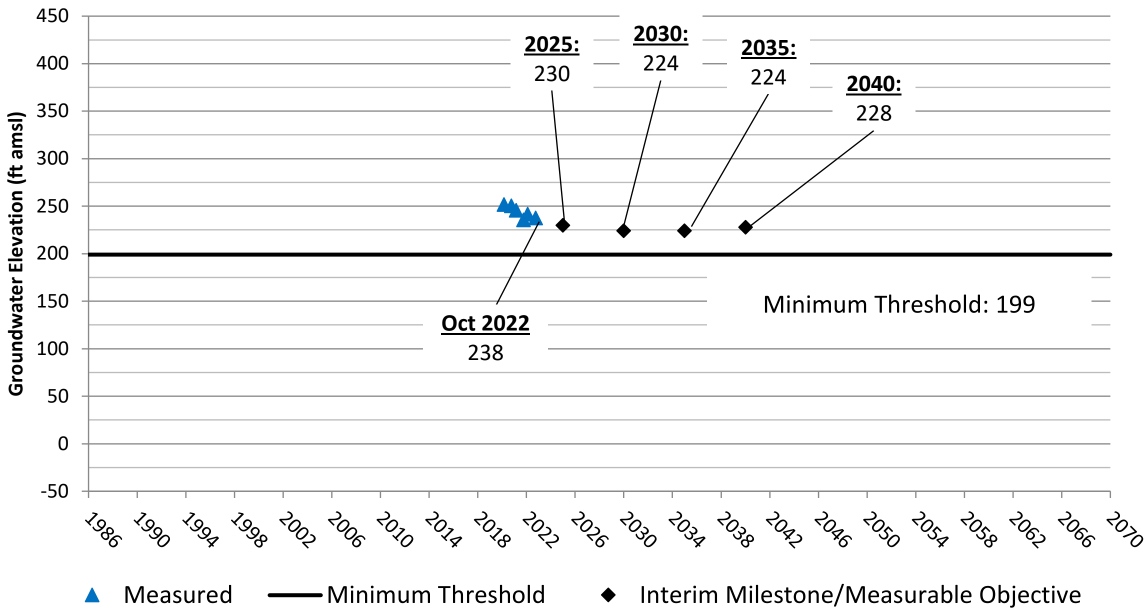
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



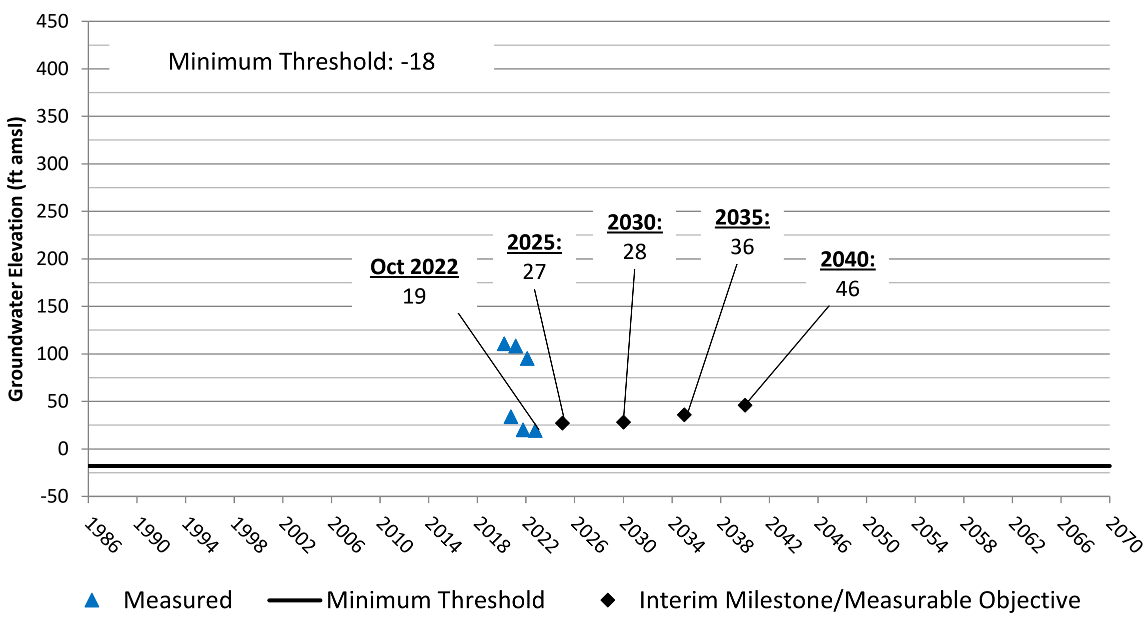


Eastern Tule GSA
RMS Groundwater Elevation Hydrographs

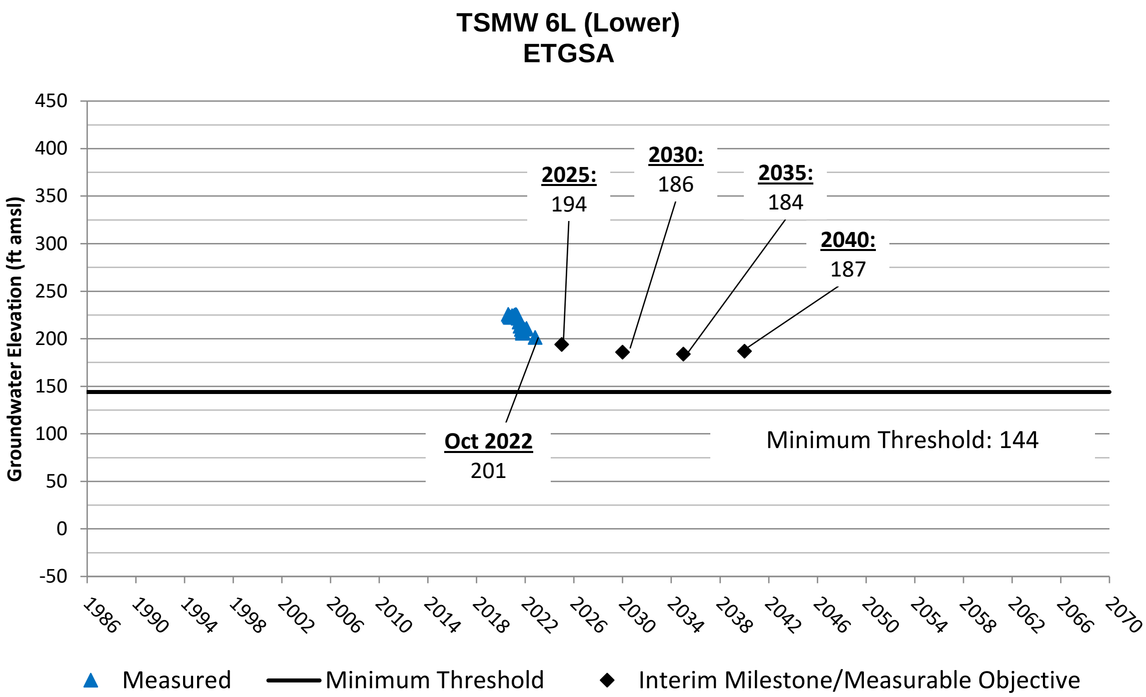
22S/26E-13R01 (Upper)
ETGSA

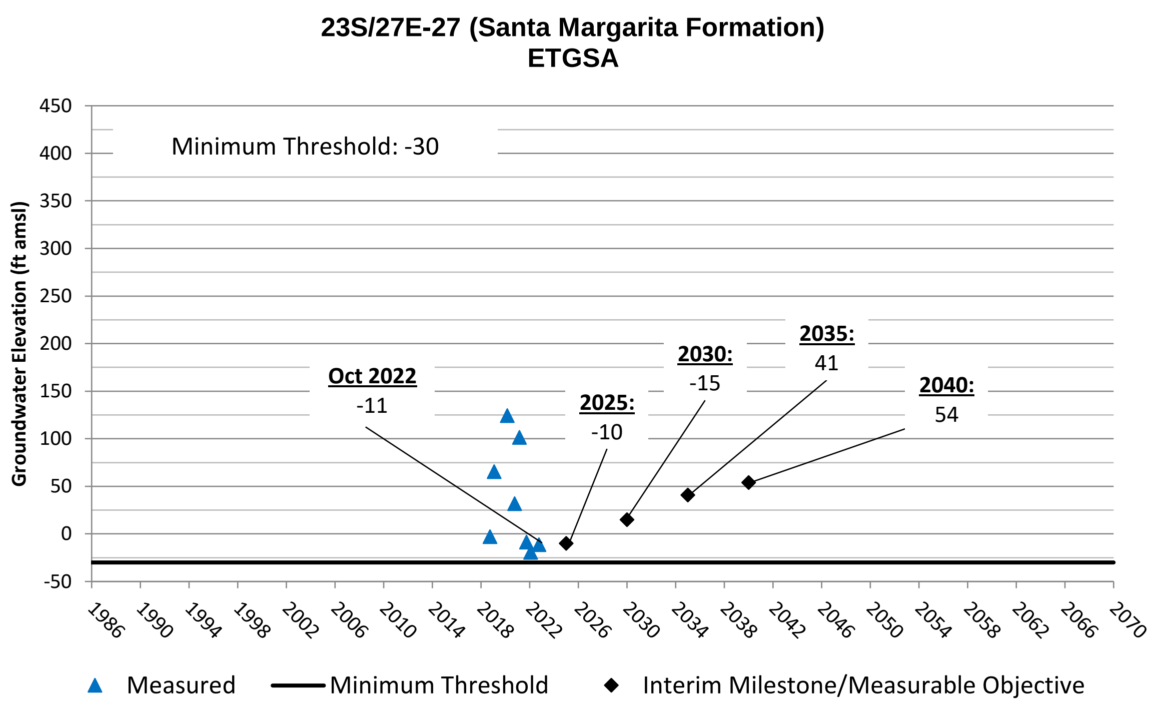


22S/26E-24 (Lower)
ETGSA



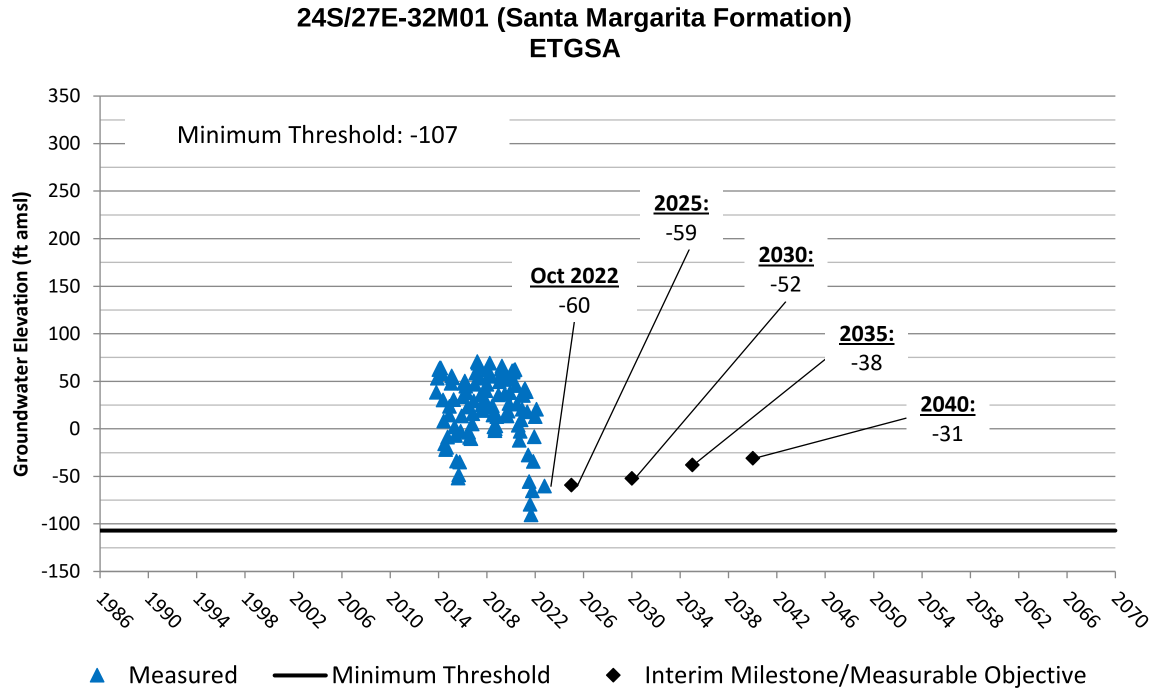
Eastern Tule GSA
RMS Groundwater Elevation Hydrographs

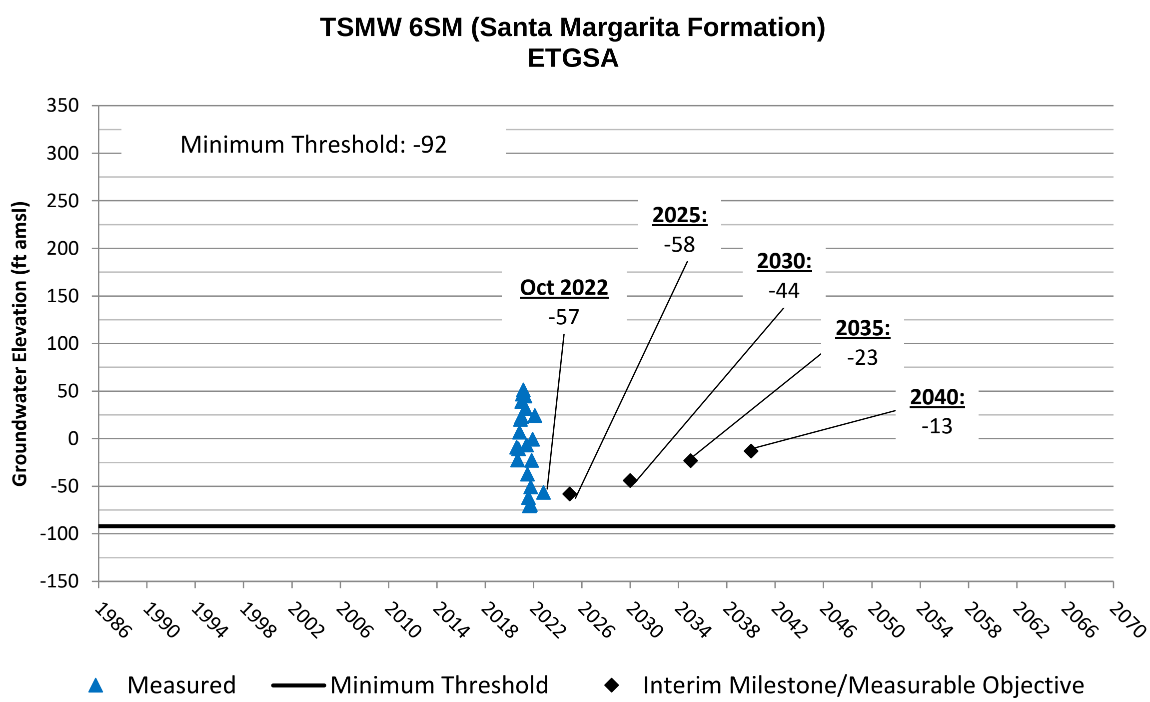




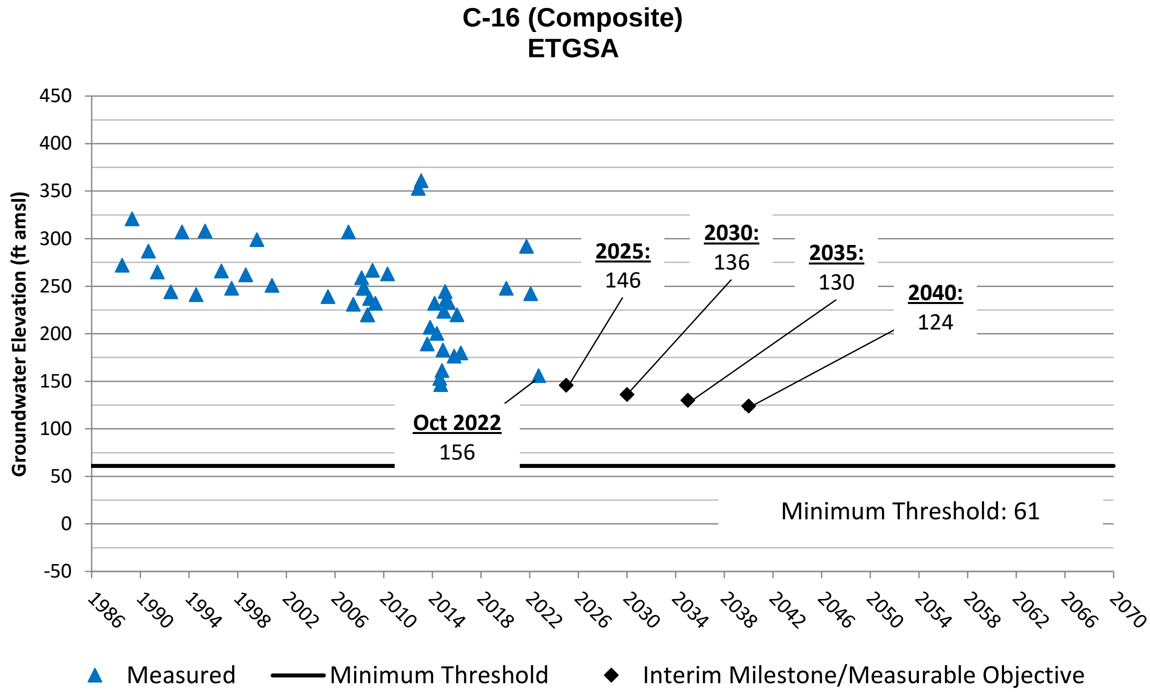
Thomas Harder & Co.
Groundwater Consulting

Eastern Tule GSA
RMS Groundwater Elevation Hydrographs

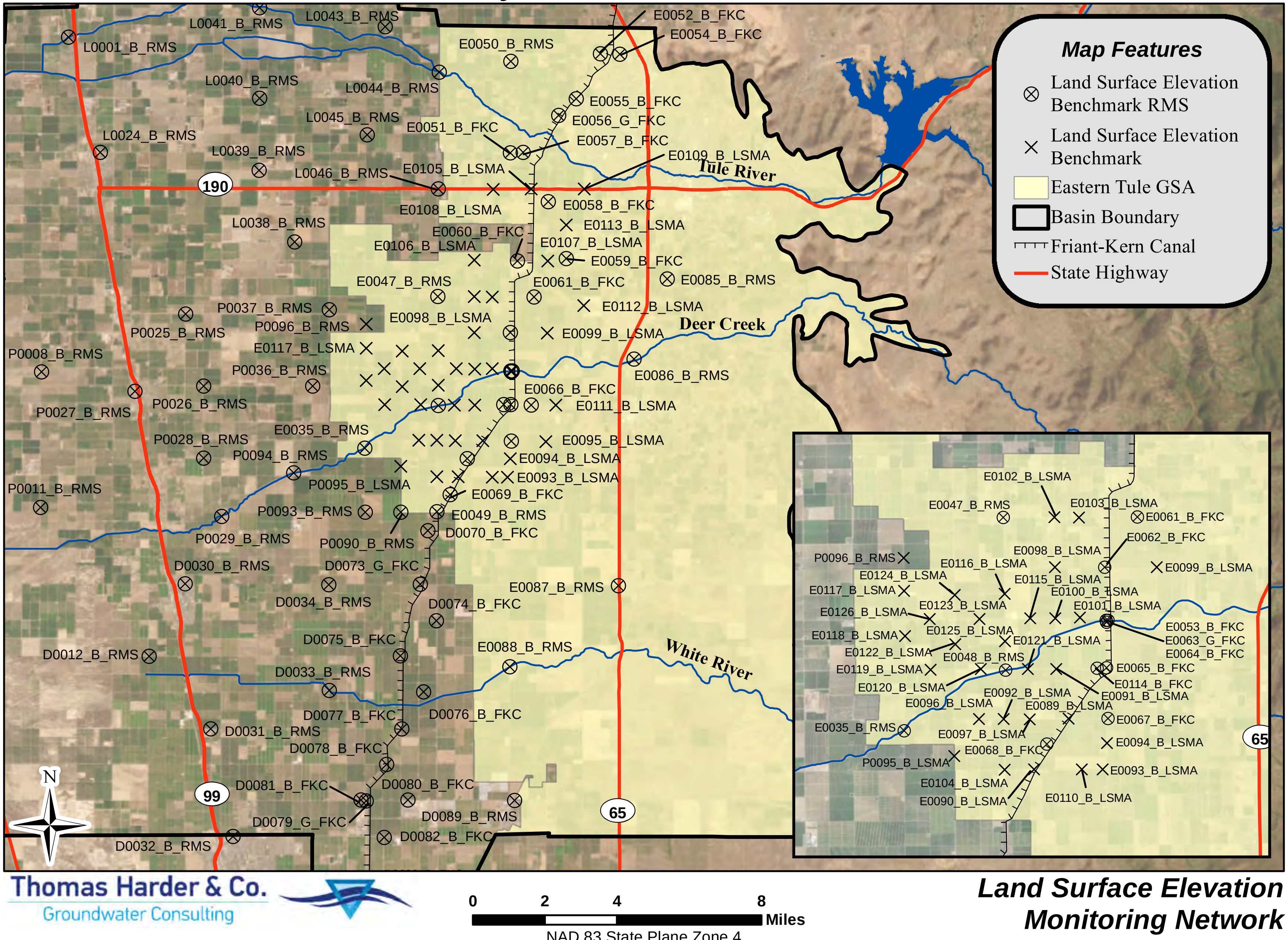




Eastern Tule GSA
RMS Groundwater Elevation Hydrographs



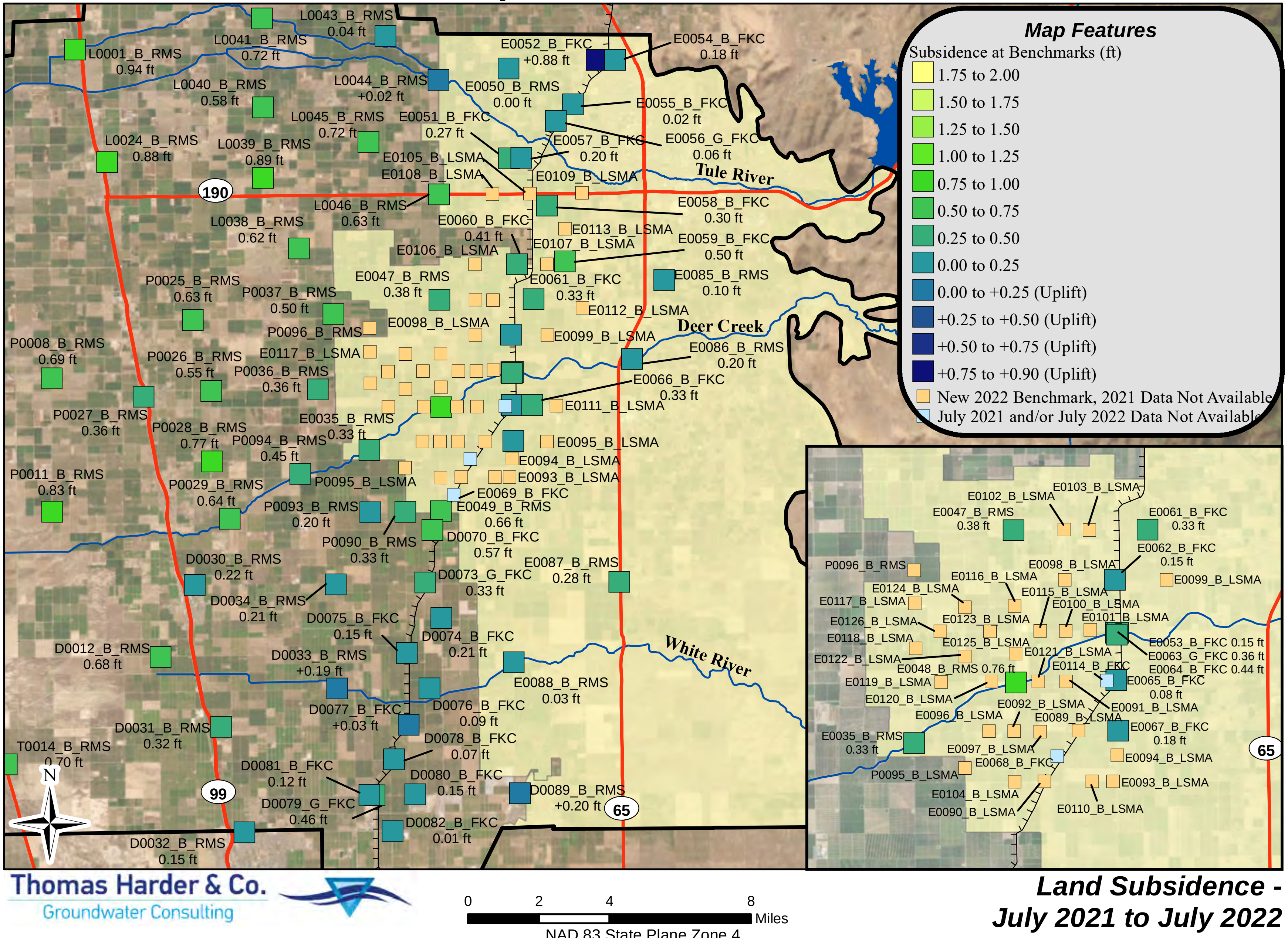
Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

Land Surface Elevation Monitoring Network Eastern Tule GSA

Appendix B
Figure 6

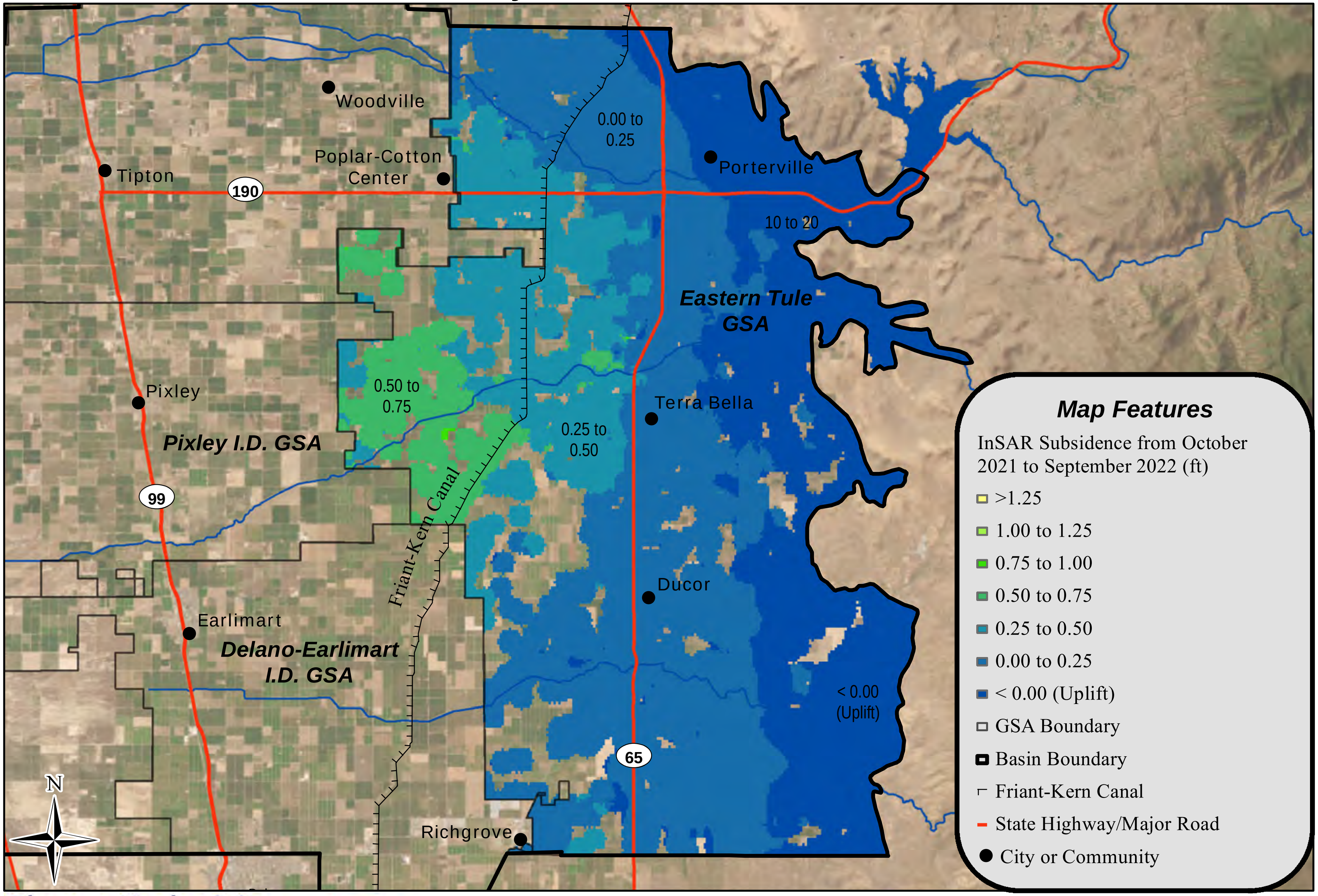


Thomas Harder & Co.
Groundwater Consulting

Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022 Eastern Tule GSA

Appendix B
Figure 7



Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

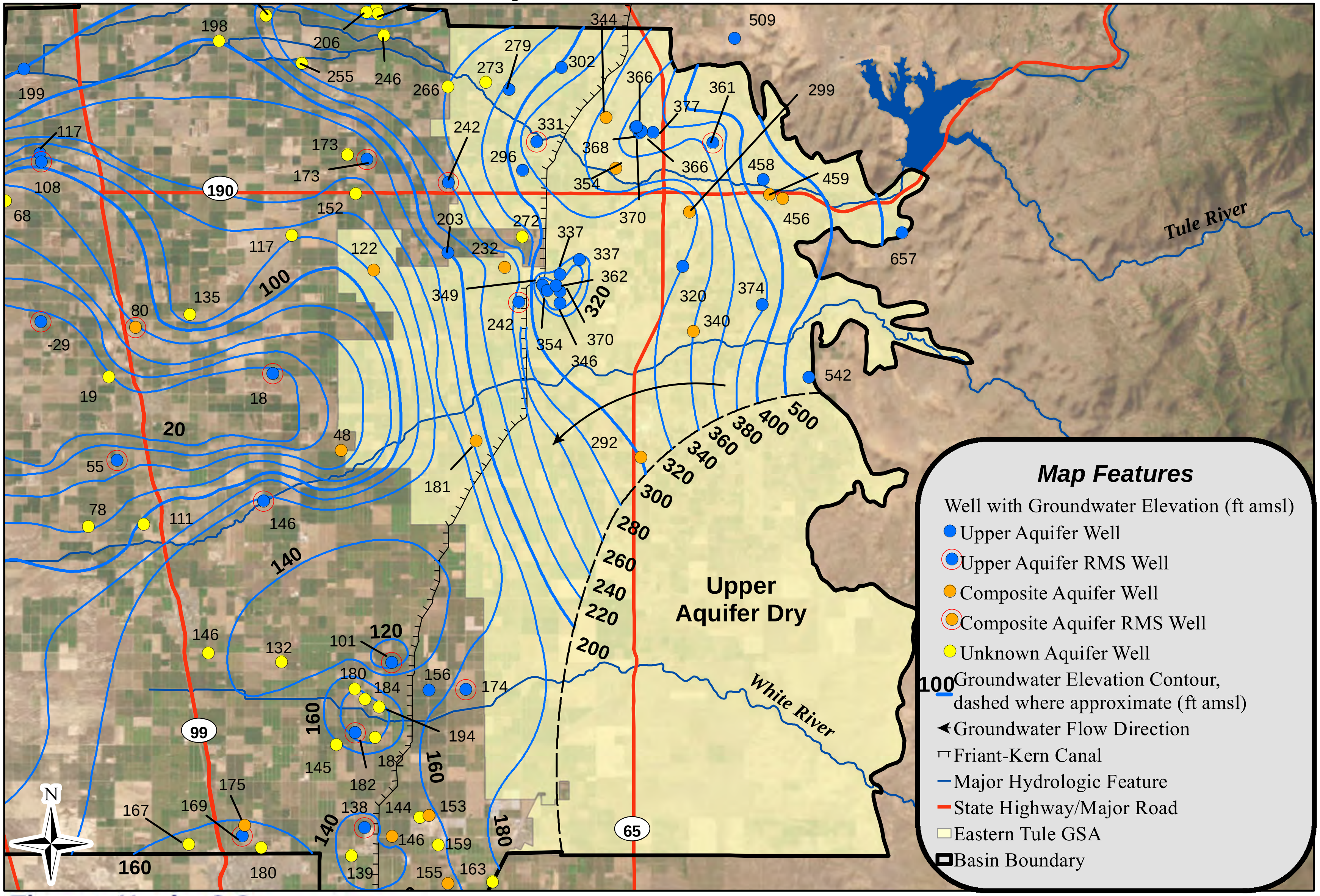
Land Subsidence - October 2021 - September 2022 Eastern Tule GSA

Appendix B
Figure 8

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report

March 2023



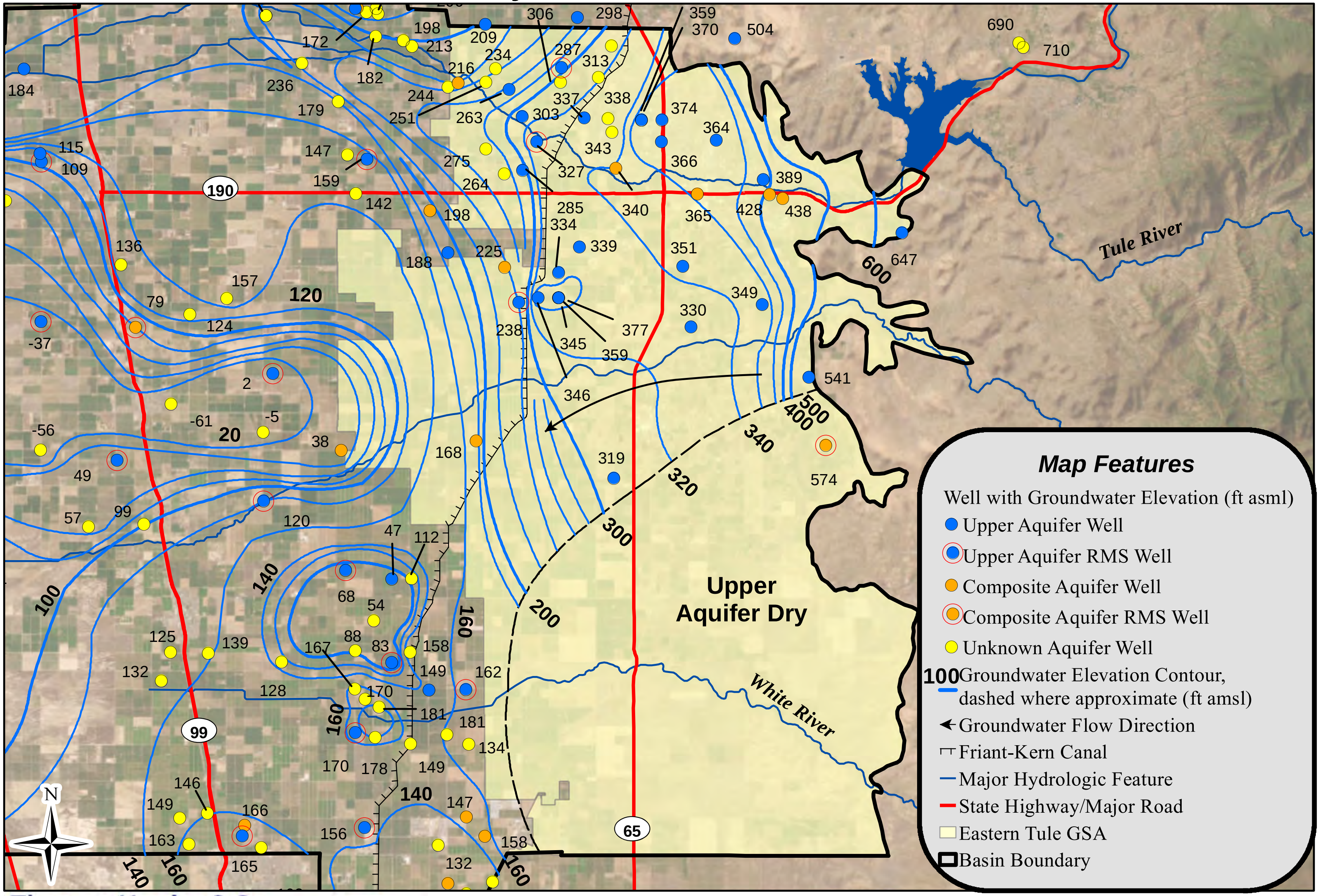
Thomas Harder & Co.
Groundwater Consulting

0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer
Eastern Tule GSA
Appendix
Figure 9

Tule Subbasin Technical Advisory Committee

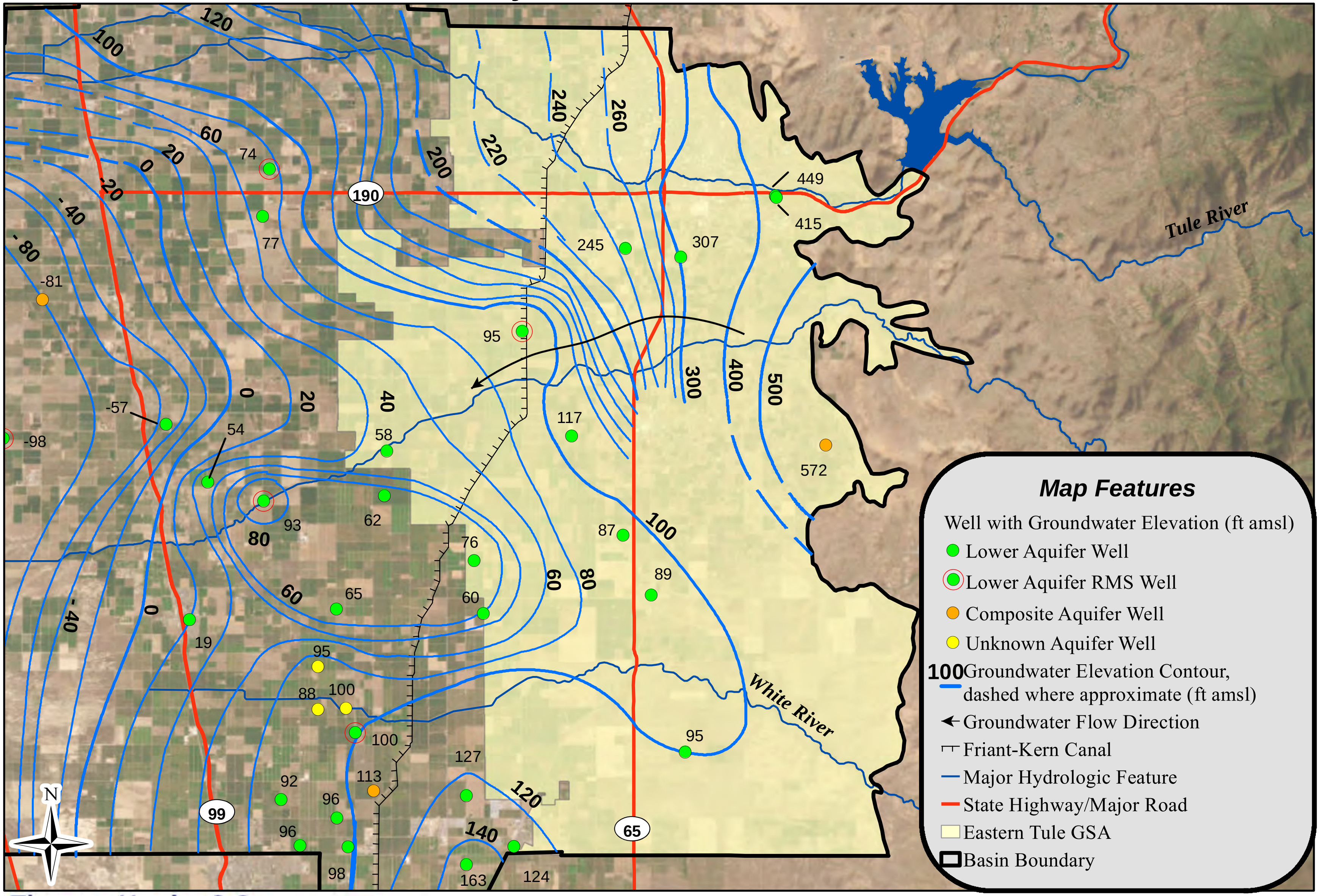


Thomas Harder & Co.
Groundwater Consulting

0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer
Eastern Tule GSA
Appendix B
Figure 10



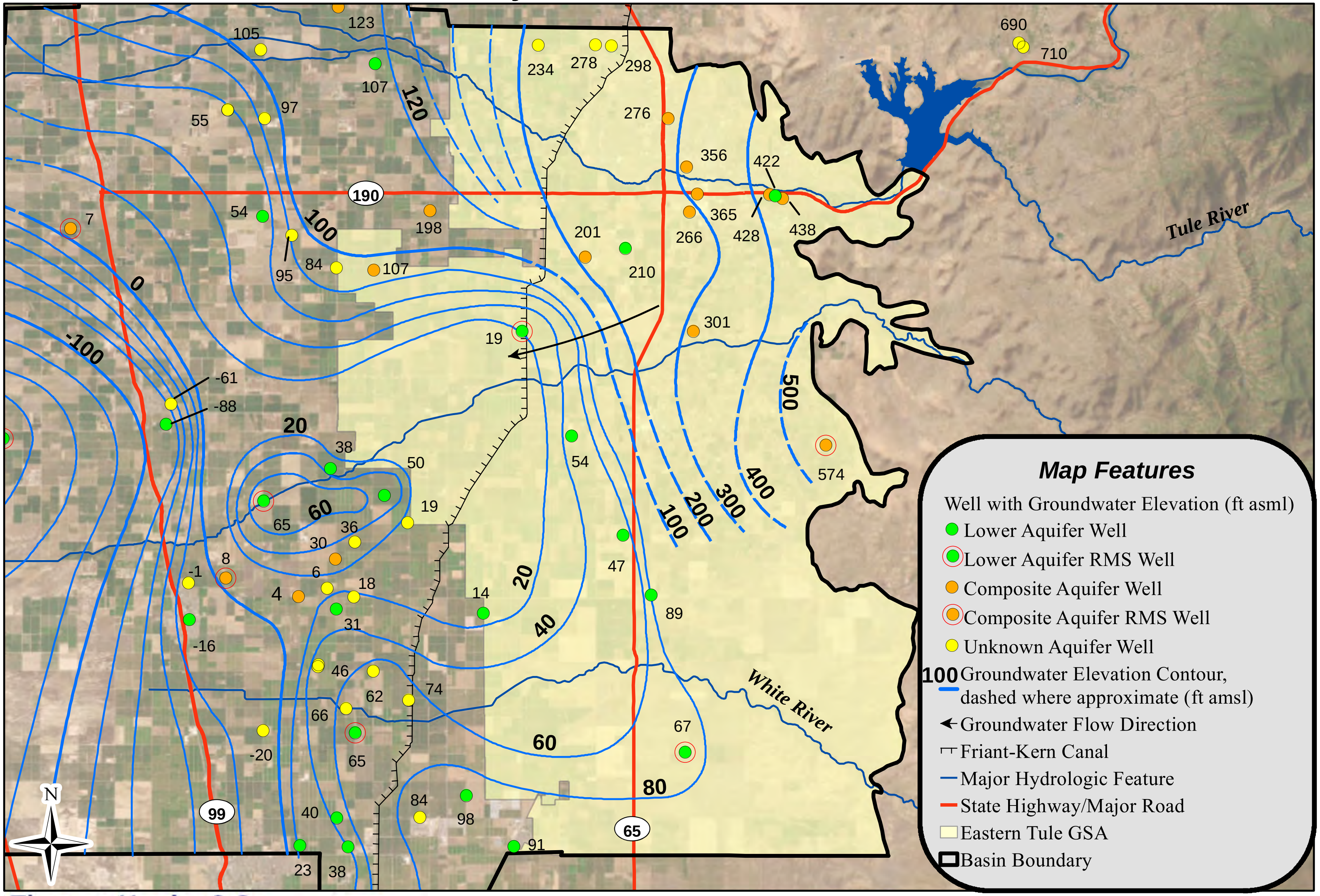
Thomas Harder & Co.
Groundwater Consulting

0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
Eastern Tule GSA
Appendix B
Figure 11

Tule Subbasin Technical Advisory Committee

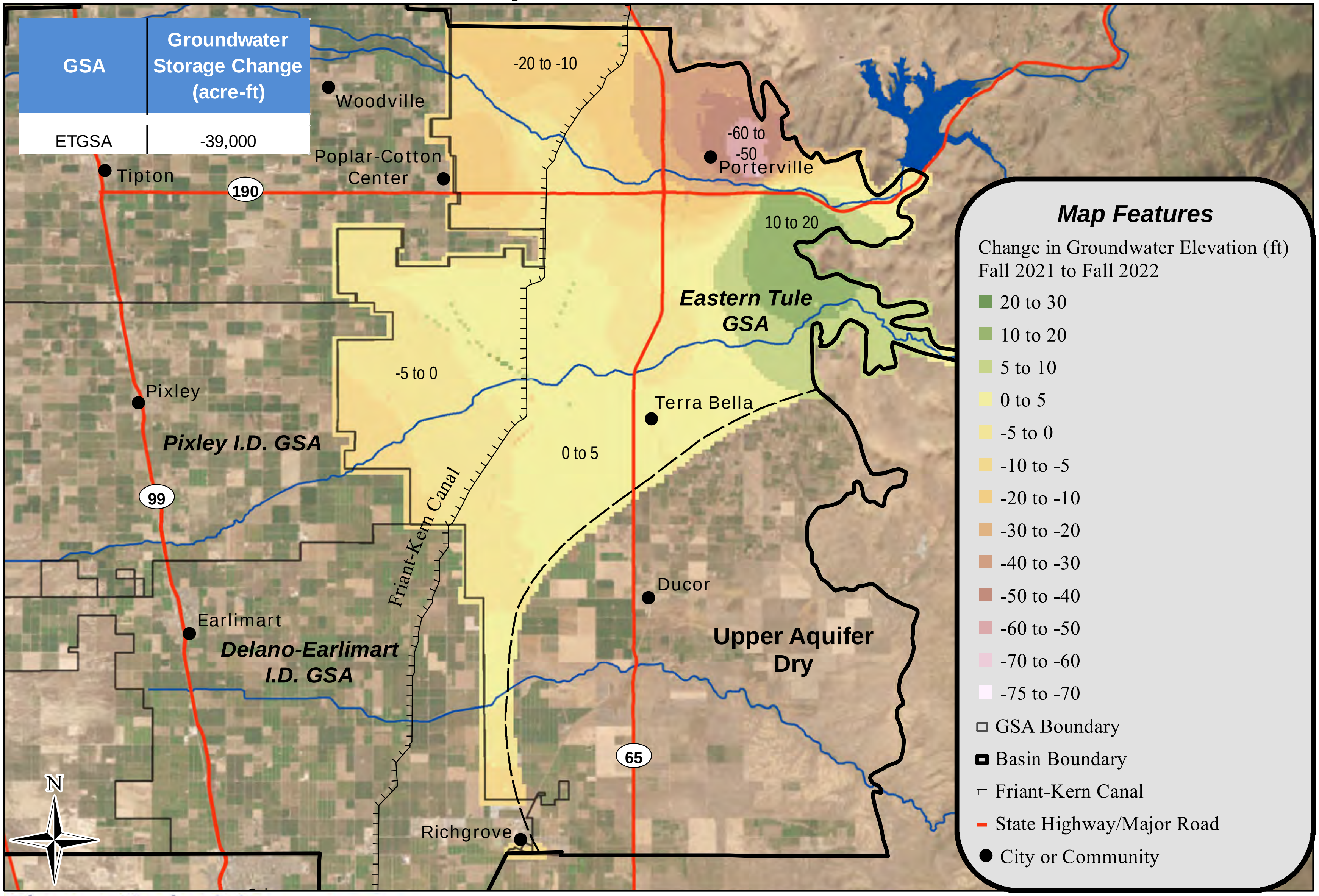


Thomas Harder & Co.
Groundwater Consulting

0 2 4 8 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
Eastern Tule GSA
Appendix B
Figure 12

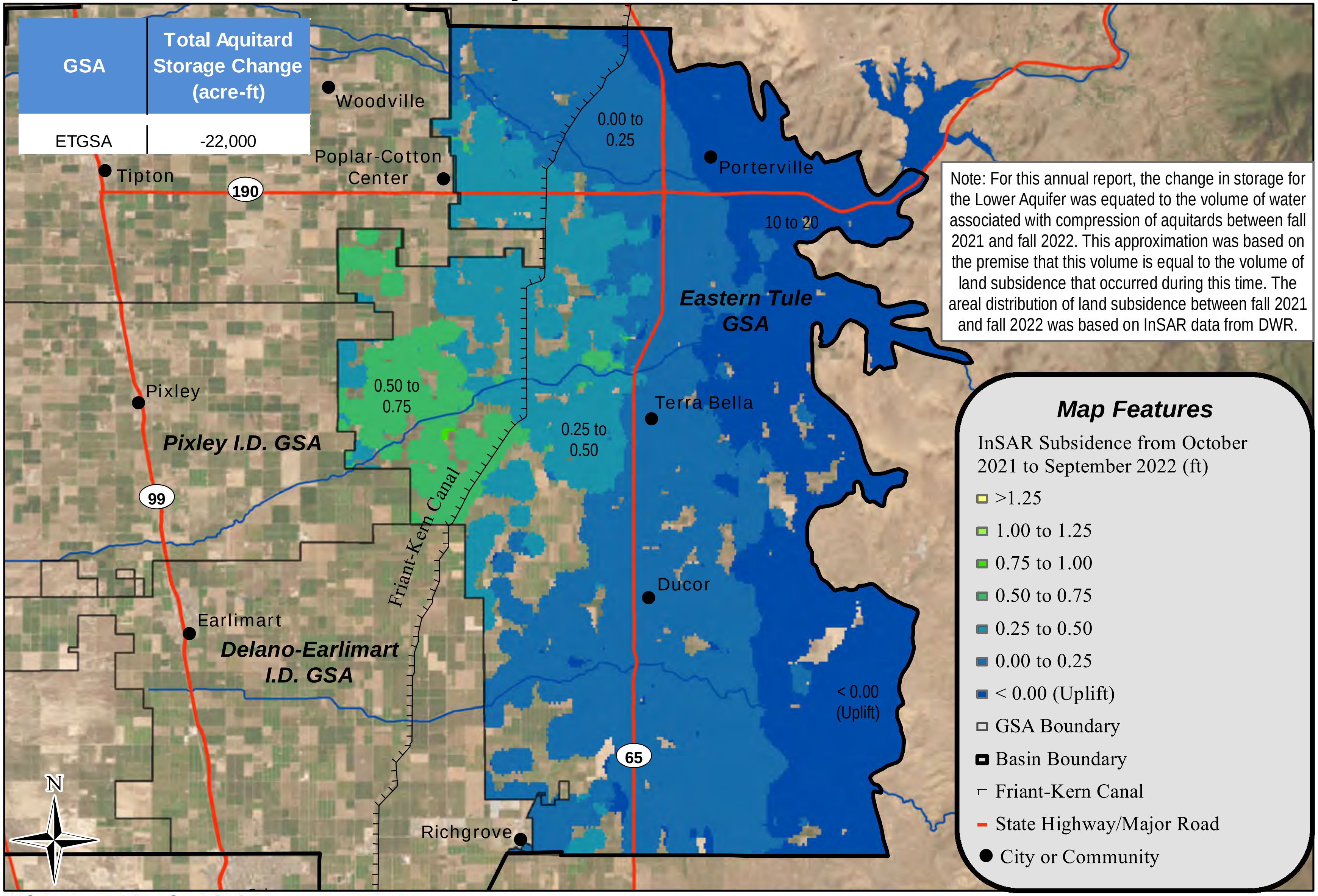


Thomas Harder & Co.
Groundwater Consulting

Change in Groundwater Elevation
Fall 2021 to Fall 2022 - Upper Aquifer
Eastern Tule GSA

Appendix B
Figure 13

GSA	Total Aquitard Storage Change (acre-ft)
ETGSA	-22,000



Note: For this annual report, the change in storage for the Lower Aquifer was equated to the volume of water associated with compression of aquitards between fall 2021 and fall 2022. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The areal distribution of land subsidence between fall 2021 and fall 2022 was based on InSAR data from DWR.

Thomas Harder & Co.
Groundwater Consulting

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

Change in Lower Aquifer Storage As Estimated from Land Subsidence - Fall 2021 to Fall 2022
Eastern Tule GSA

Appendix B
Figure 14

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Appendix C

Delano-Earlimart Irrigation District GSA 2021/22 Annual Data

Delano-Earlimart Irrigation District GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
DEID GSA	DEID	76,000	0	0	76,000
	Western	15,000	0	0	15,000
	Richgrove CSD	0	870	0	870
	Earlimart PUD	0	2,930	0	2,930
	Total	***91,000***	***3,800***	***0***	***94,800***

Delano-Earlimart Irrigation District GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
DEID GSA	DEID	0	73,000	0	0	30,100	103,100
	Western	0	0	0	0	3,400	3,400
	Richgrove CSD	0	0	0	0	200	200
	Earlimart PUD	0	0	0	0	500	500
	Total	***0***	***73,000***	***0***	***0***	***34,200***	***107,200***

Delano-Earlimart Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
DEID GSA	DEID	76,000	103,100	179,100
	Western	15,000	3,400	18,400
	Richgrove CSD	870	200	1,070
	Earlimart PUD	2,930	500	3,430
	Total	***94,800***	***107,200***	***202,000***

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

Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
D0012_B_RMS	267.1	266.1	263.3	262.1
D0030_B_RMS	272.8	272.1	270.3	269.2
D0031_B_RMS	296.7	295.9	294.9	293.9
D0032_B_RMS	316.7	316.4	316.7	315.7
D0033_B_RMS	366.1	365.7	365.1	364.0
D0034_B_RMS	340.8	339.8	338.8	337.8
D0070_B_FKC	389.4	388.4	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	405.6	405.0	404.0
D0074_B_FKC	415.5	415.1	413.8	412.8
D0075_B_FKC	403.2	402.7	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	405.5	405.6	404.6
D0079_G_FKC	407.1	406.9	406.9	405.9
D0080_B_FKC	433.1	432.8	432.5	431.5
D0081_B_FKC	399.5	399.2	399.3	398.3
D0082_B_FKC	423.4	423.4	423.1	422.1
D0083_B_FKC	419.5	419.6	418.8	417.8
D0084_B_FKC	407.3	406.8	405.9	404.9
D0089_B_RMS	498.2	498.3	497.3	496.3

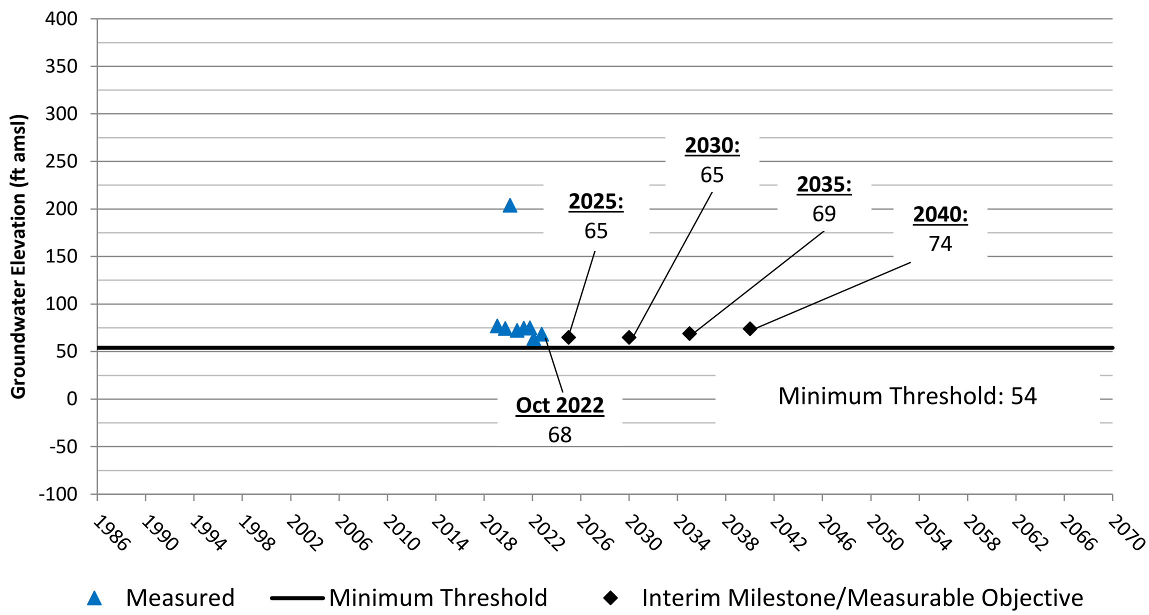
Notes:

N/A = Not available

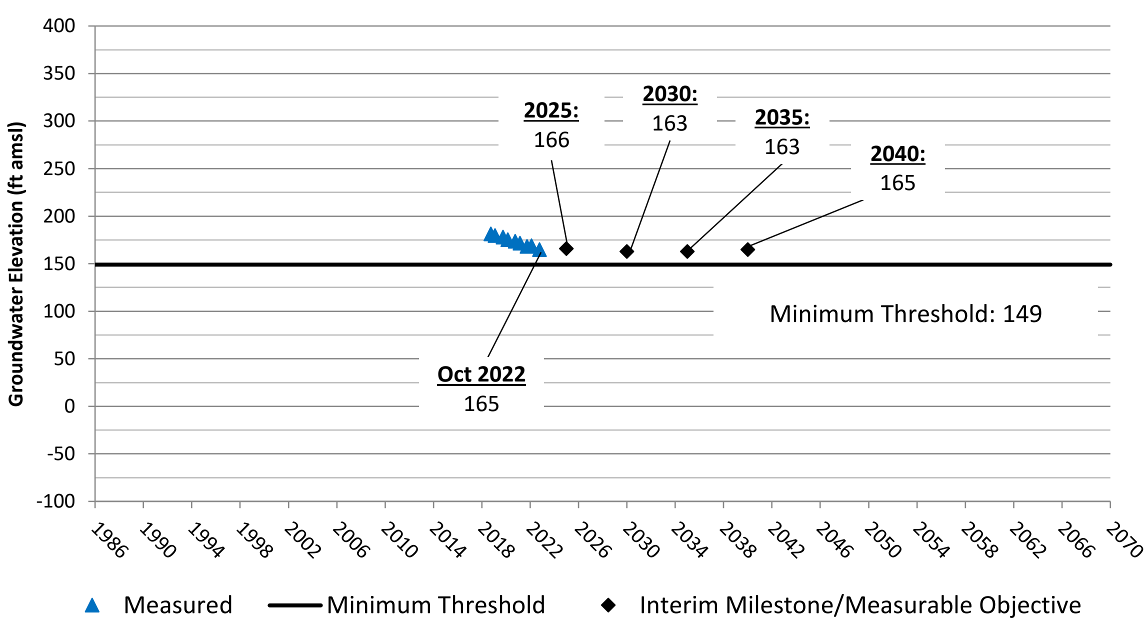
[1] Benchmarks surveyed in July and August of each year.

Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs

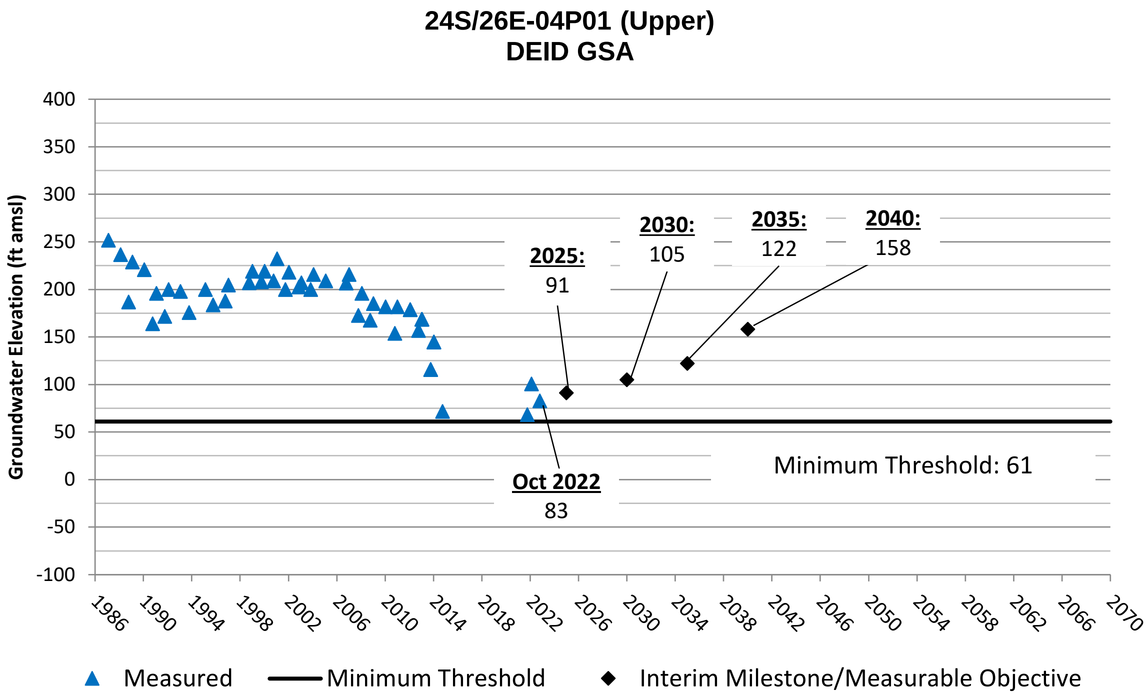
23S/26E-29D01 (Lower)
DEID GSA

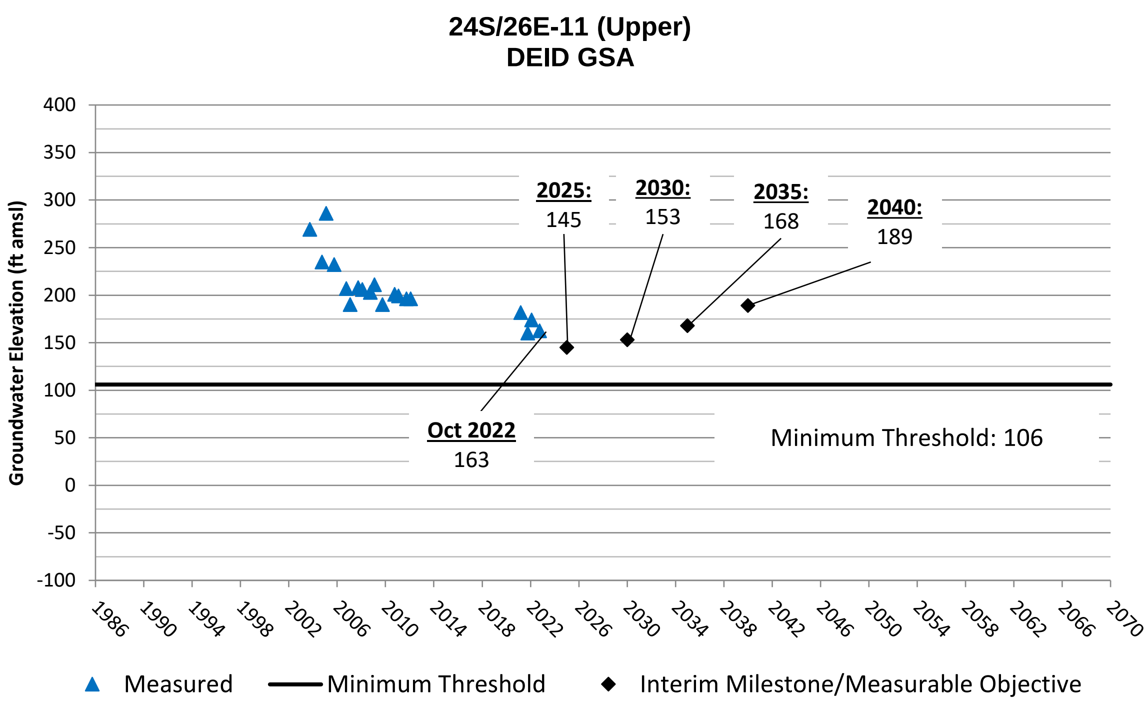


24S/25E-35H01 (Upper)
DEID GSA



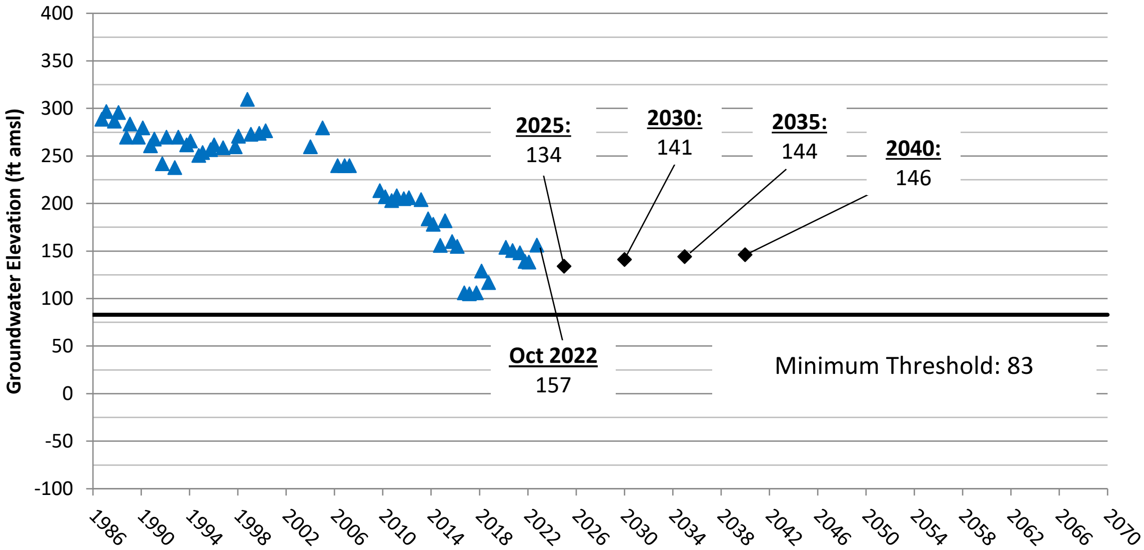
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



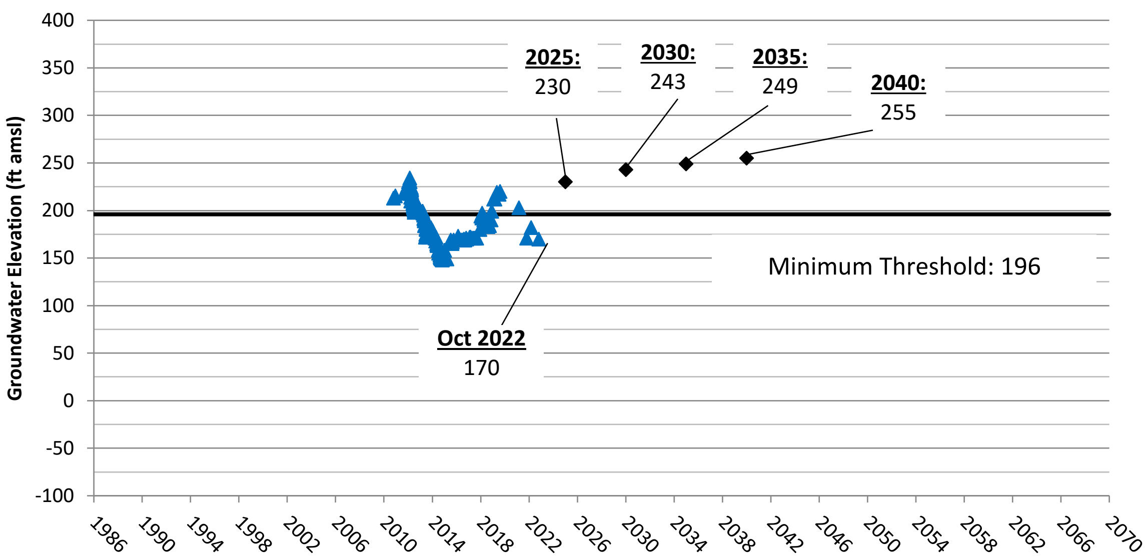


Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs

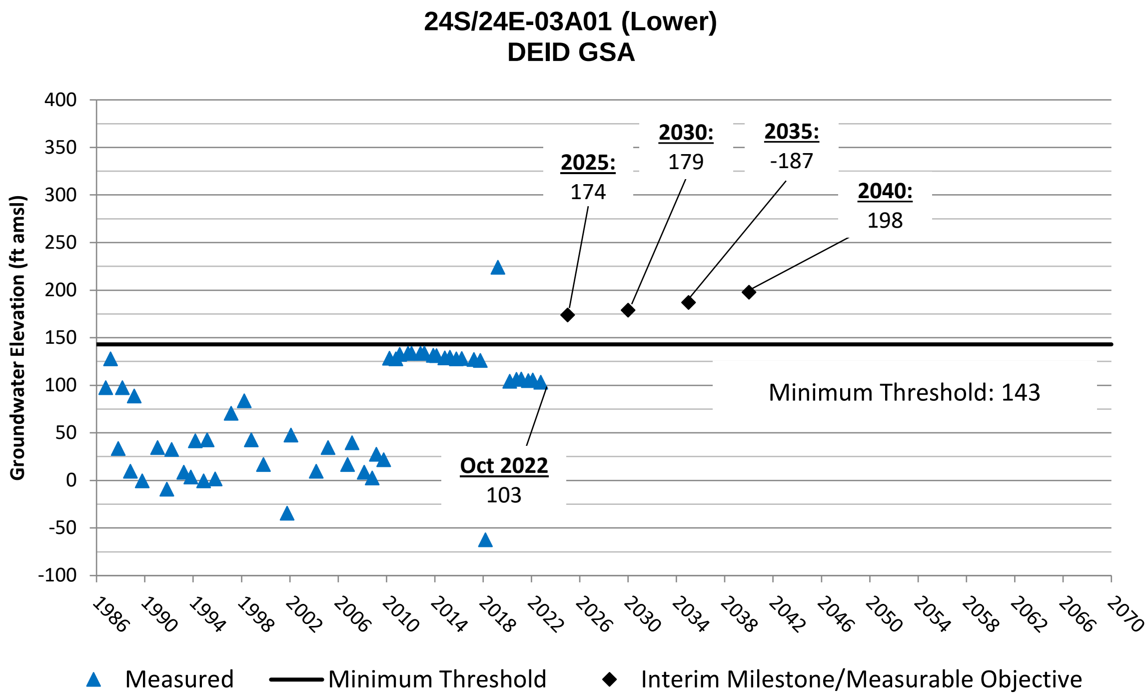
24S/26E-32G01 (Upper)
DEID GSA

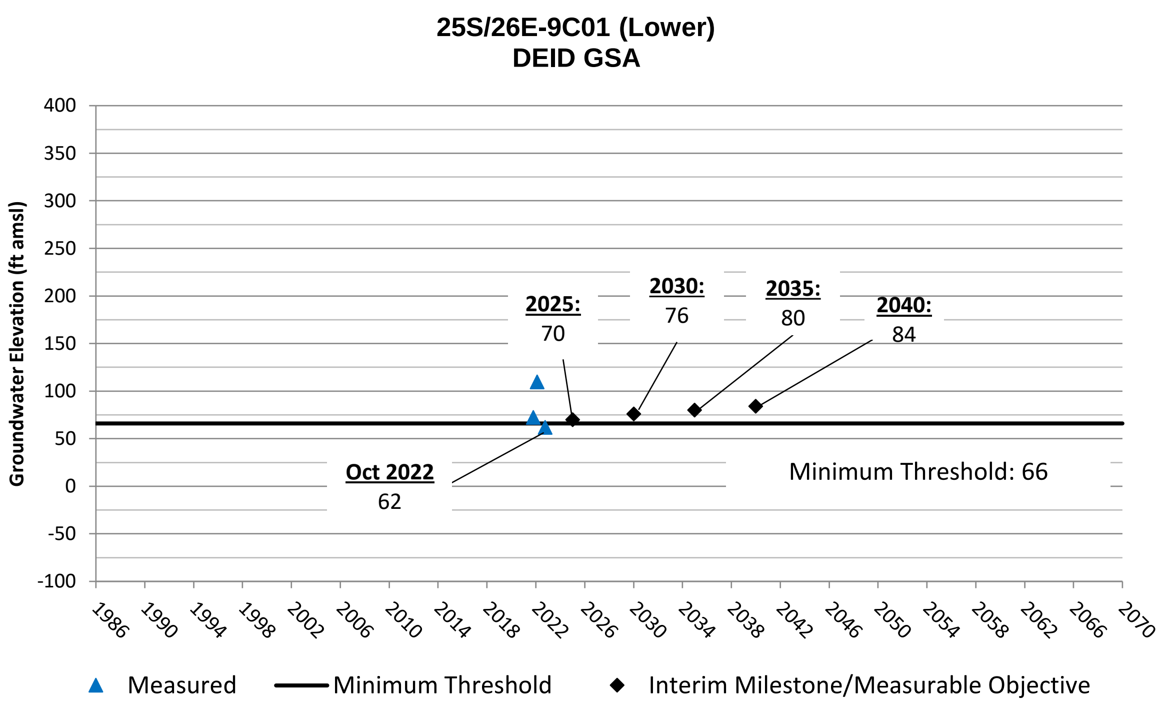


M19-U (Upper)
DEID GSA

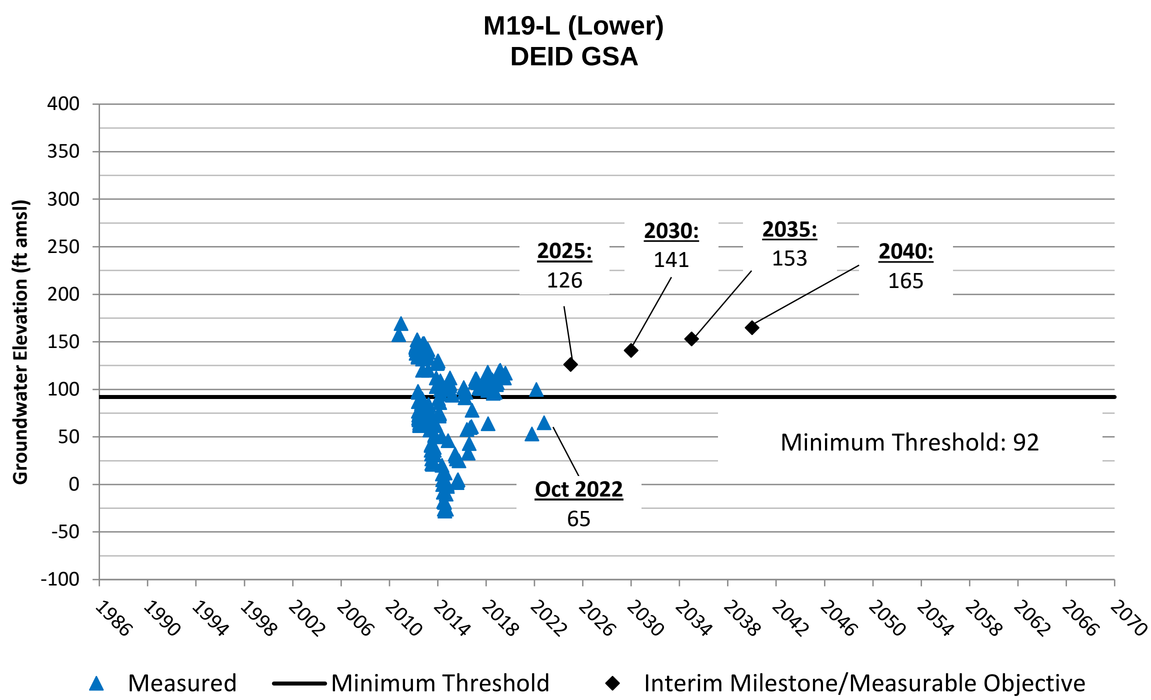


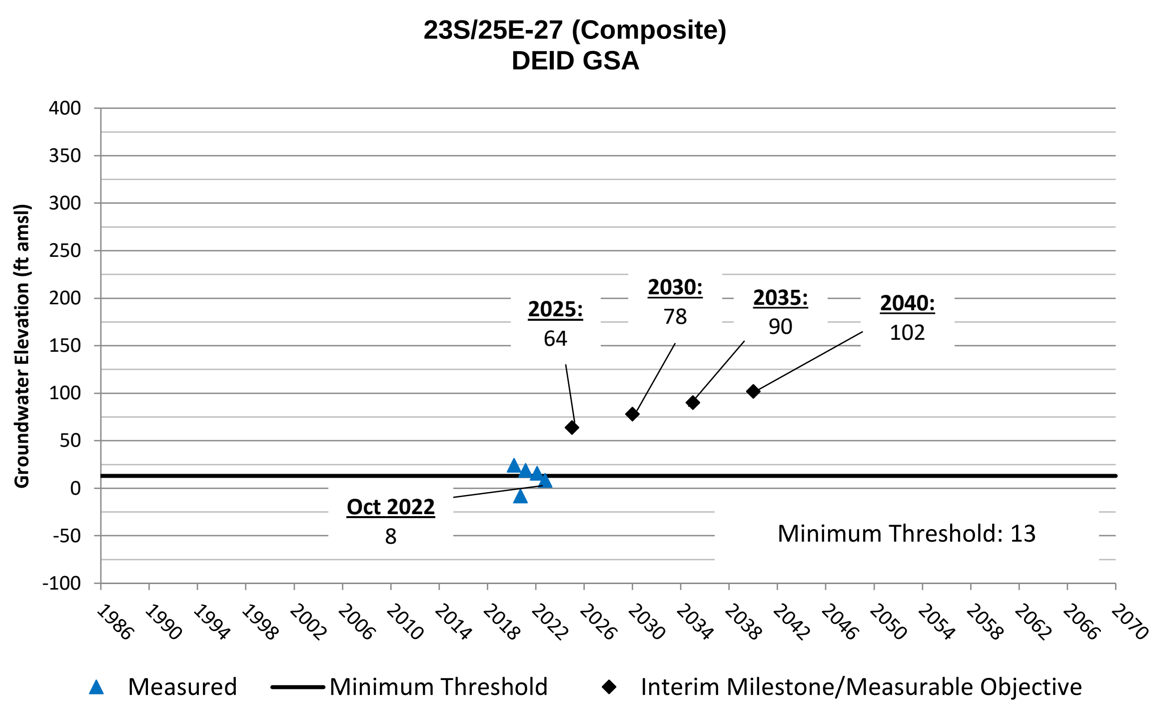
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs



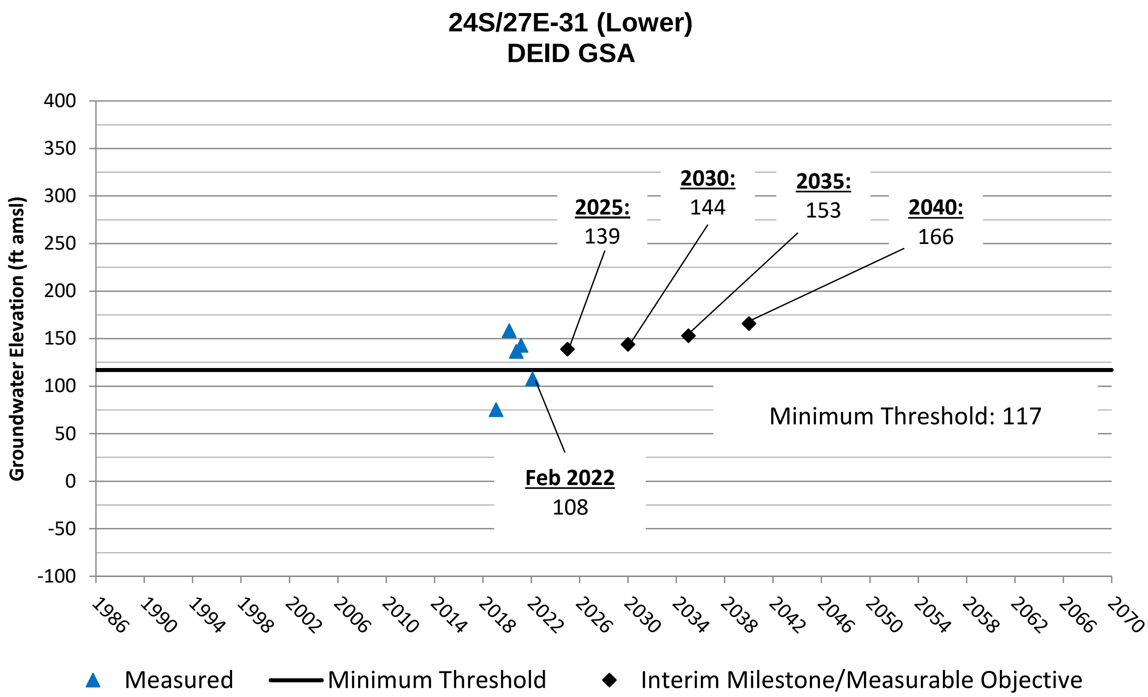


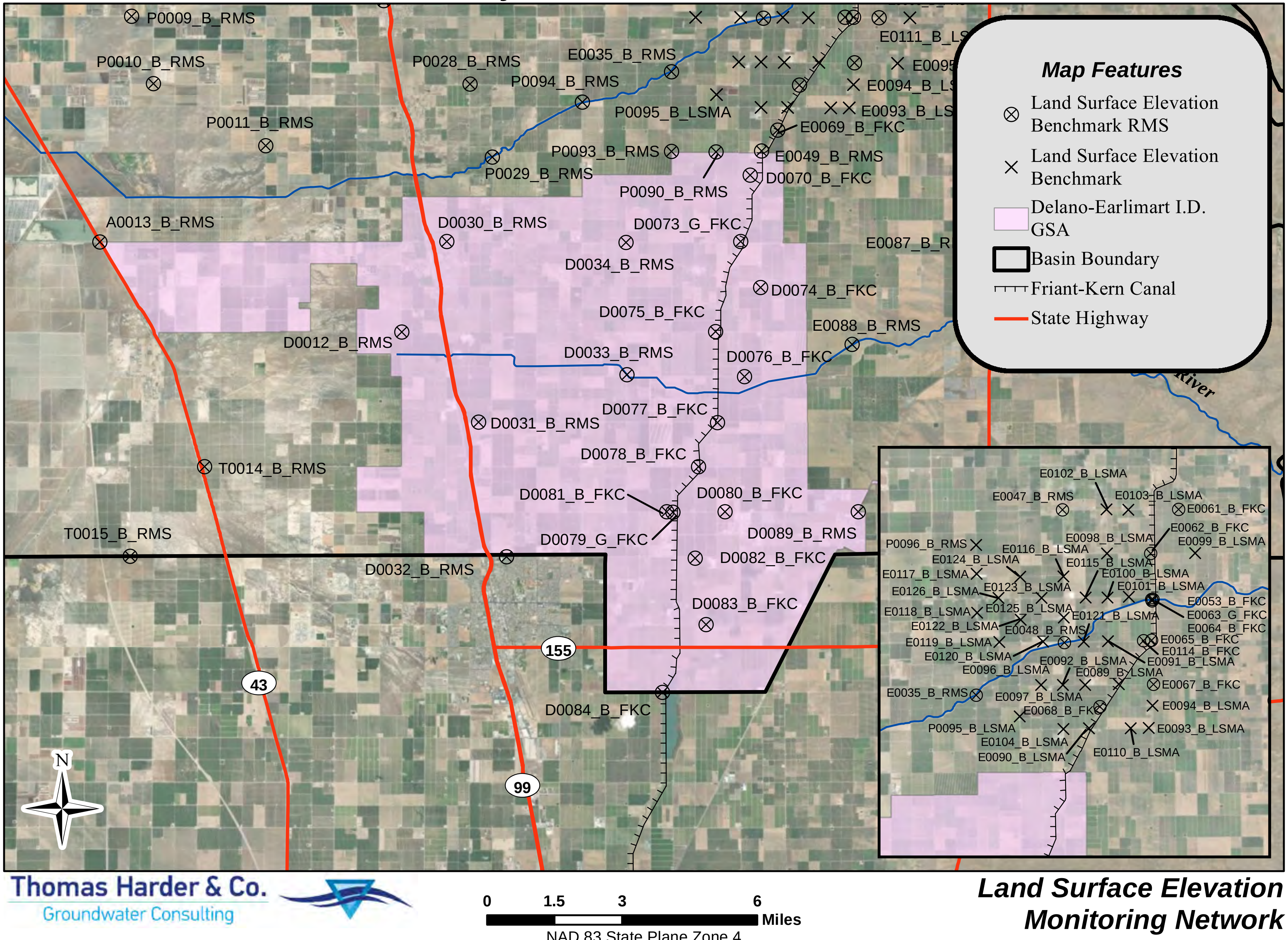
Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Delano-Earlimart Irrigation District GSA
RMS Groundwater Elevation Hydrographs





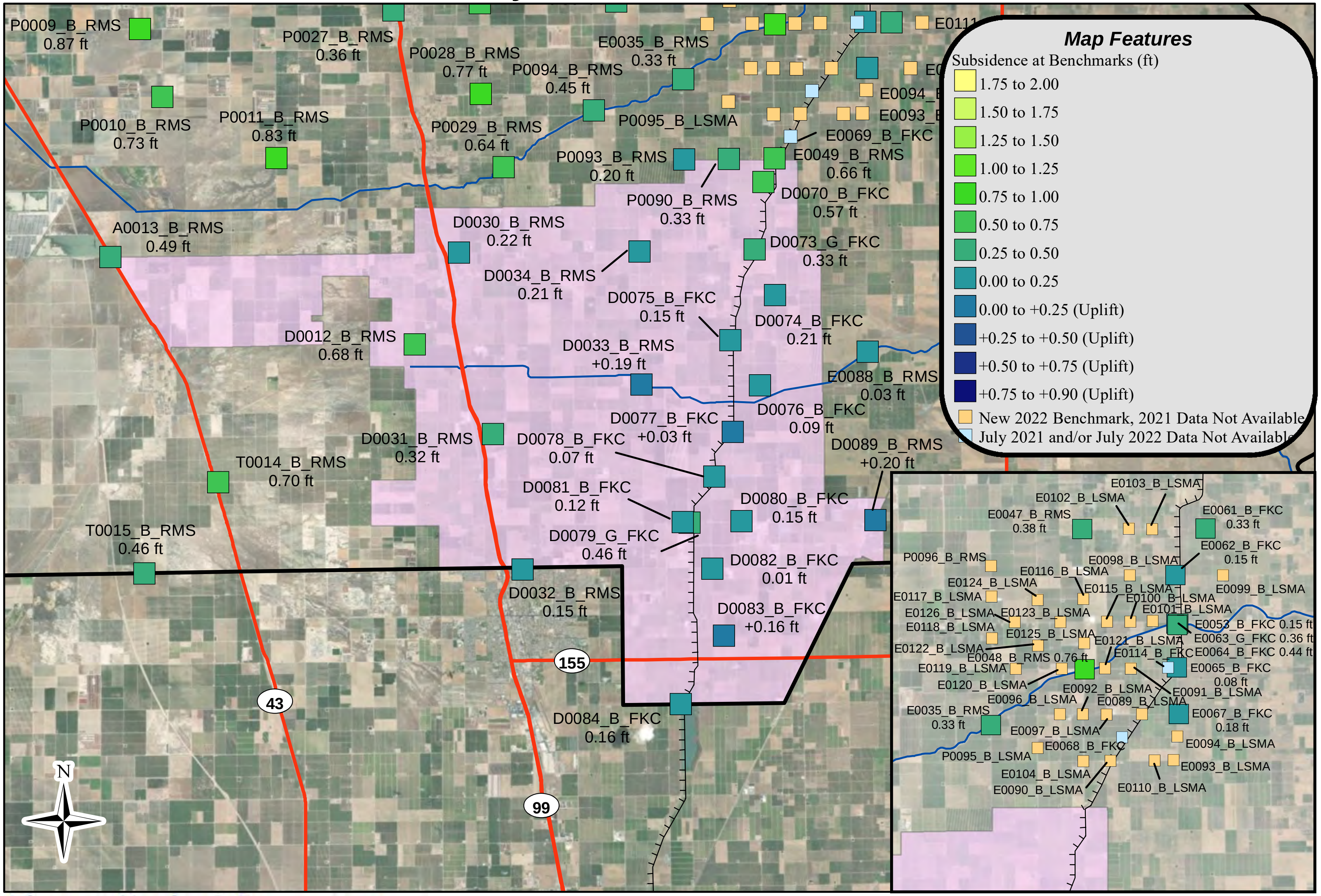
Thomas Harder & Co.
Groundwater Consulting

Land Surface Elevation Monitoring Network DEID GSA

Appendix C
Figure 7

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

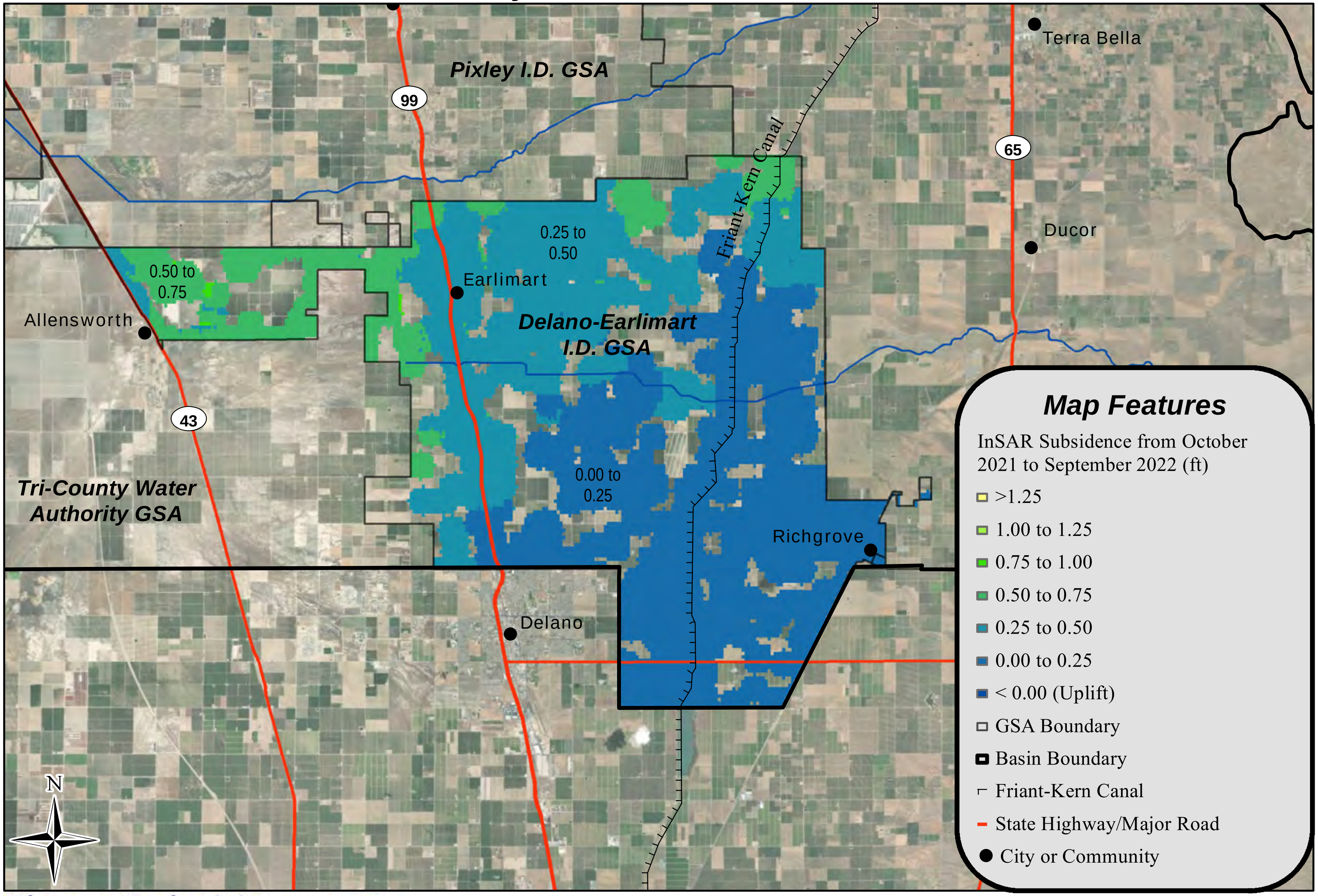
Data from Tule Subbasin Monitoring Network.
August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022 DEID GSA

Appendix C
Figure 8

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

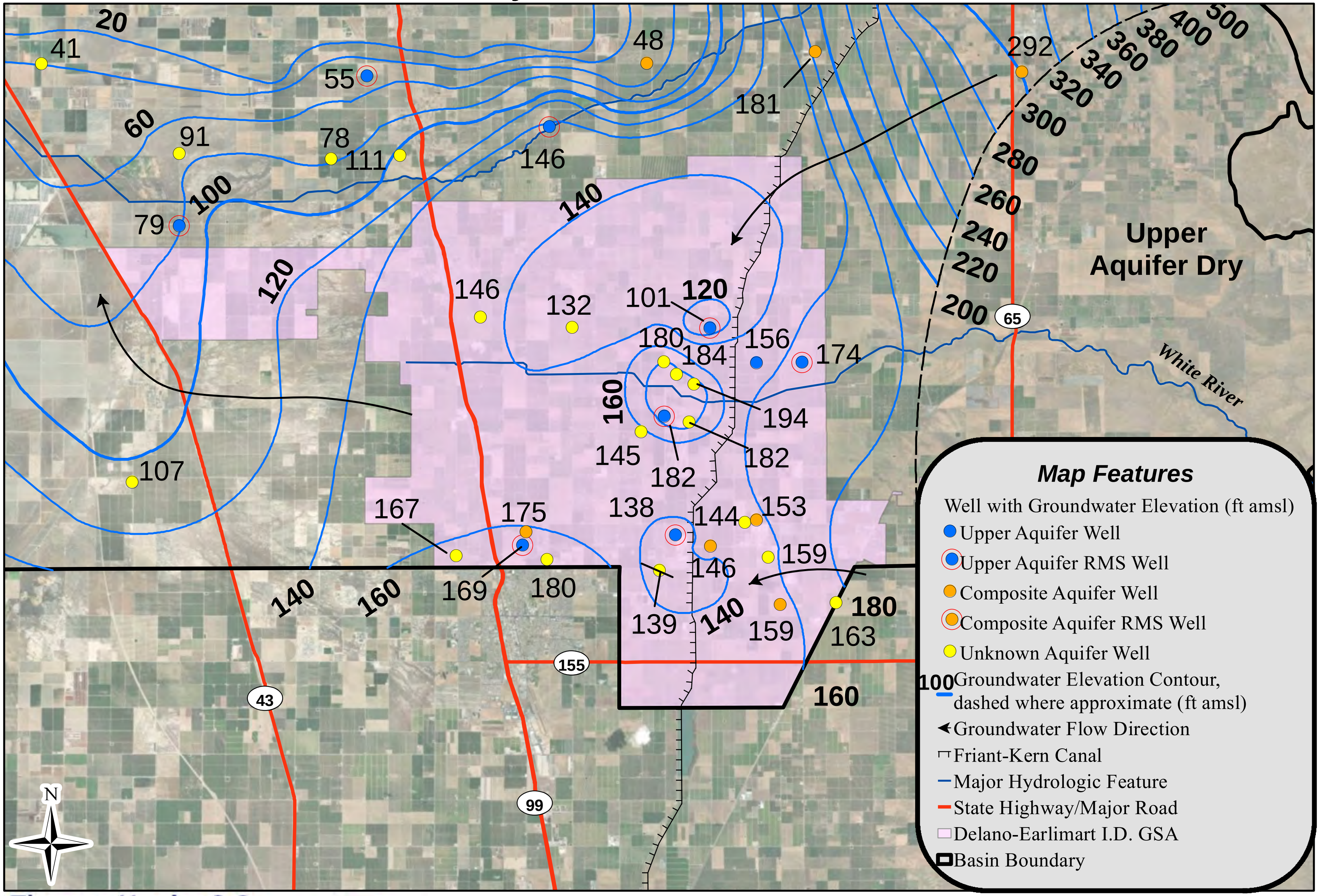
Land Subsidence - October 2021 - September 2022 DEID GSA

Appendix C
Figure 9

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

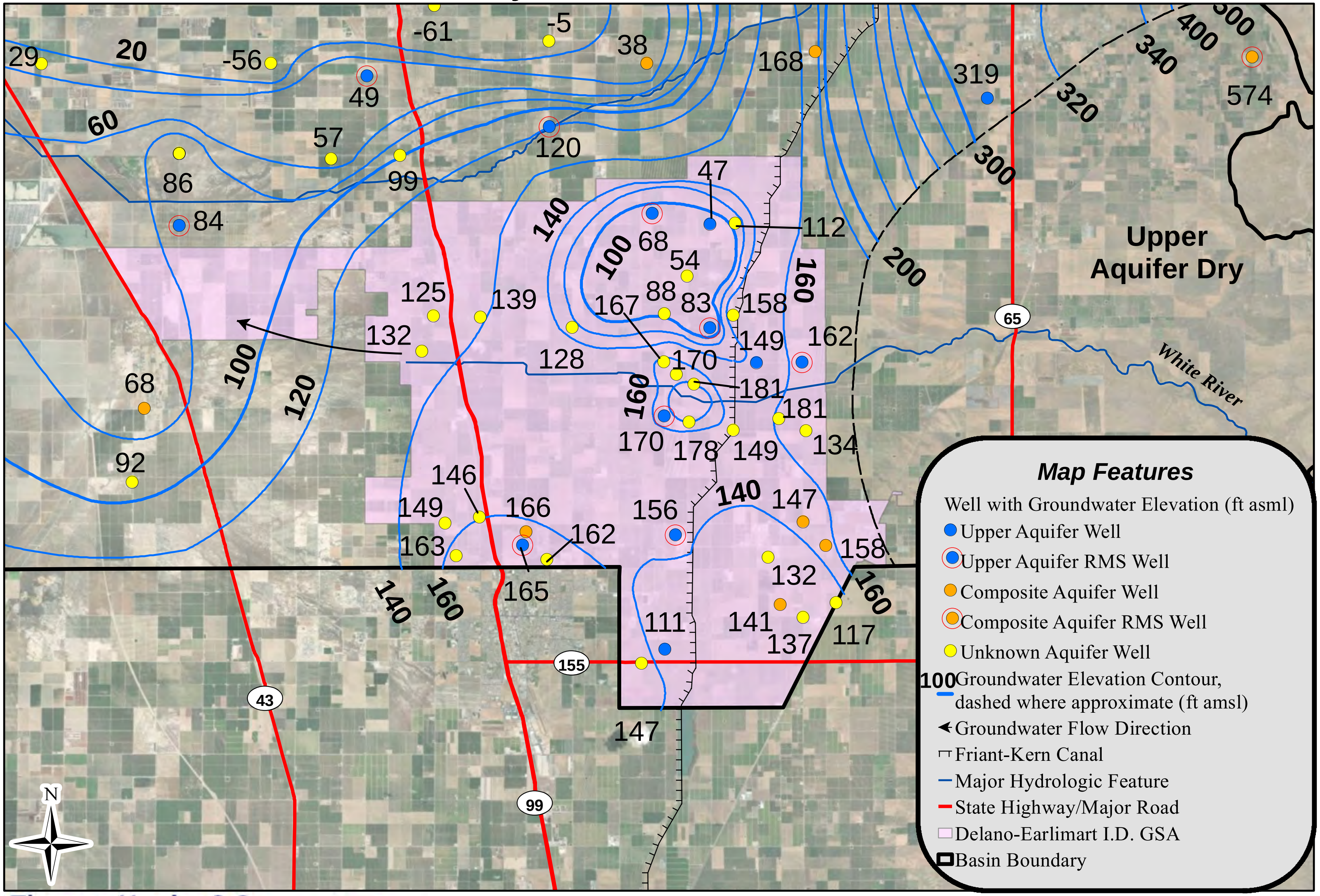
0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer
DEID GSA
Appendix C
Figure 10

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



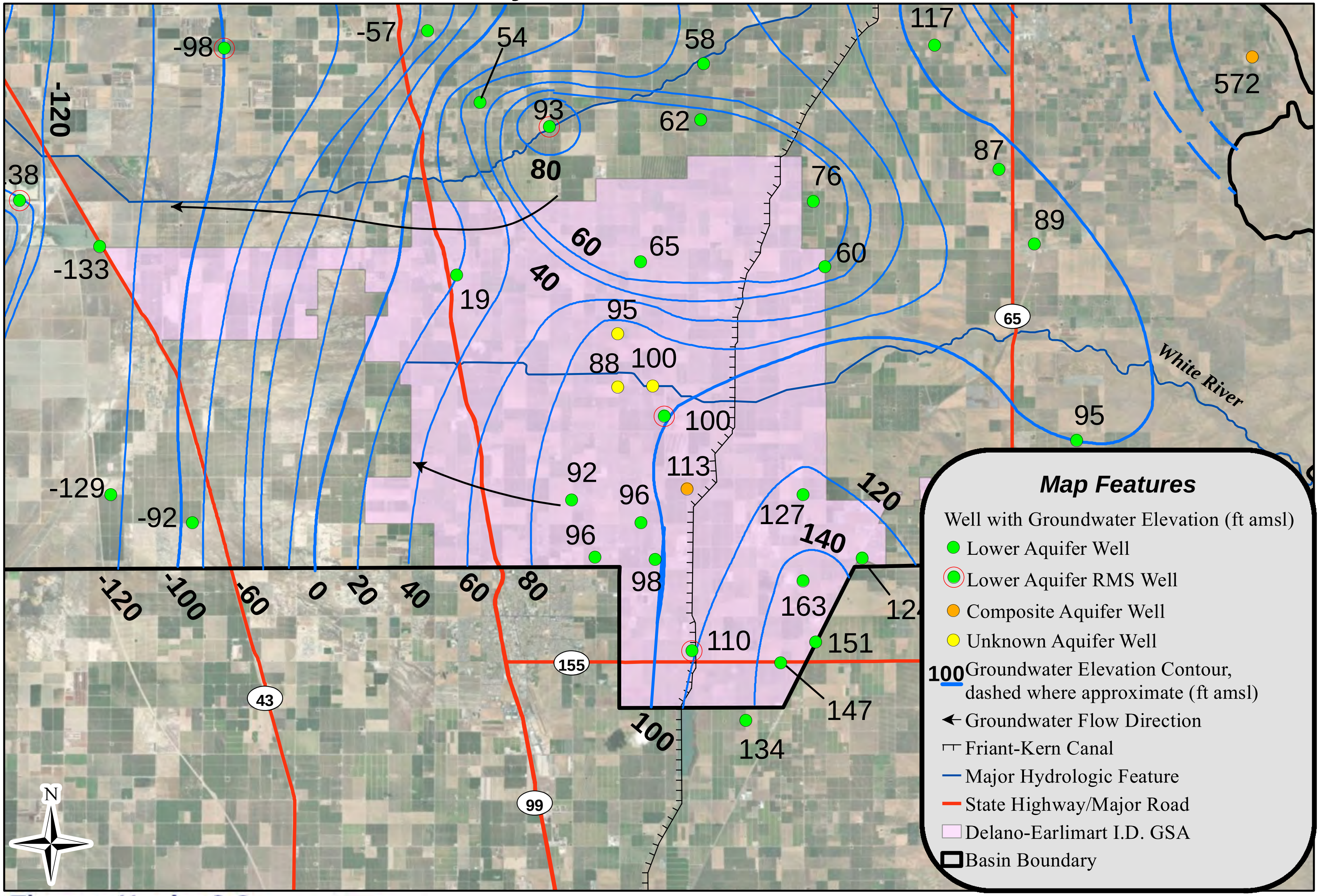
Thomas Harder & Co.
Groundwater Consulting

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer
DEID GSA
Appendix C
Figure 11

Tule Subbasin Technical Advisory Committee



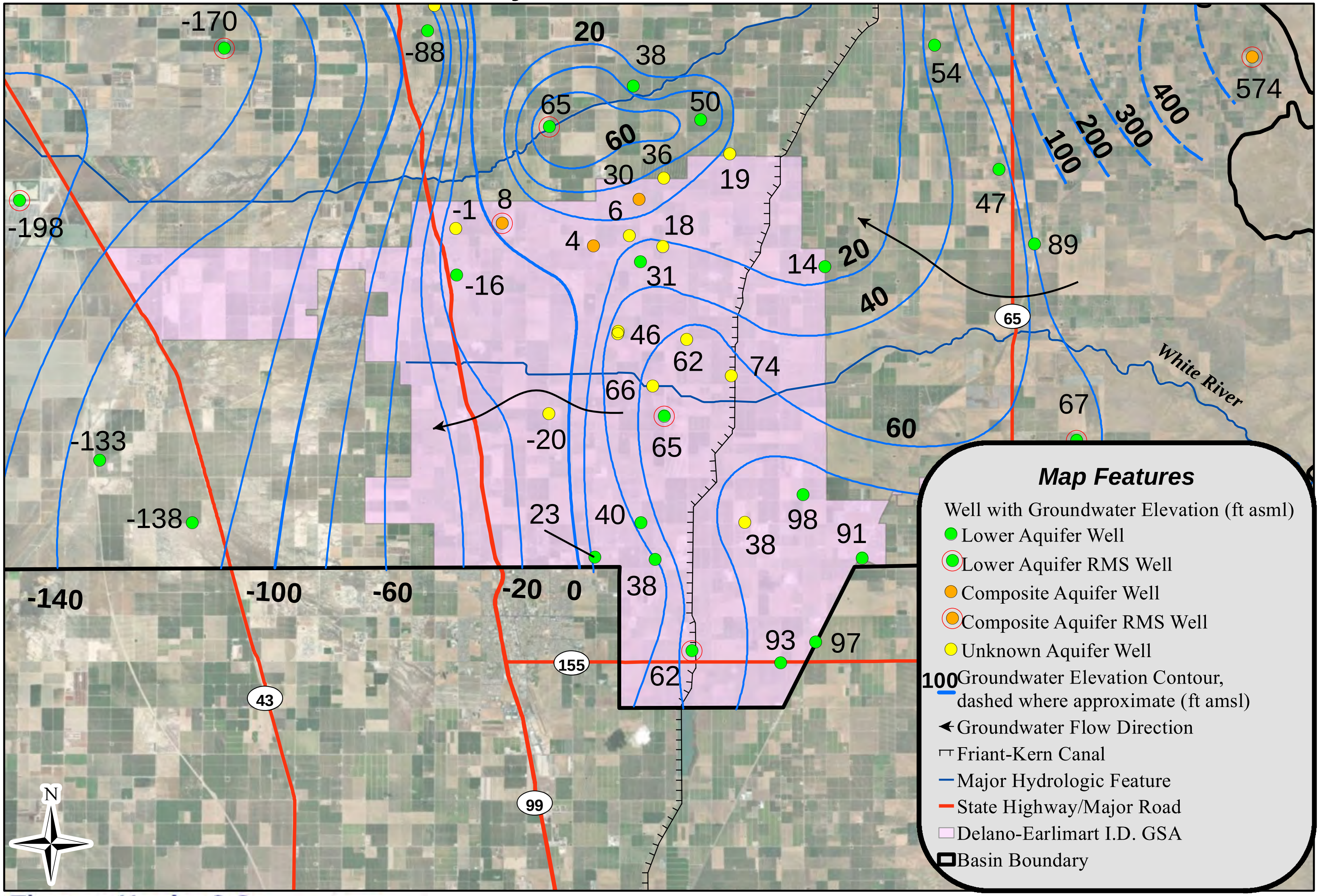
Thomas Harder & Co.
Groundwater Consulting

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
DEID GSA
Appendix C
Figure 12

Tule Subbasin Technical Advisory Committee

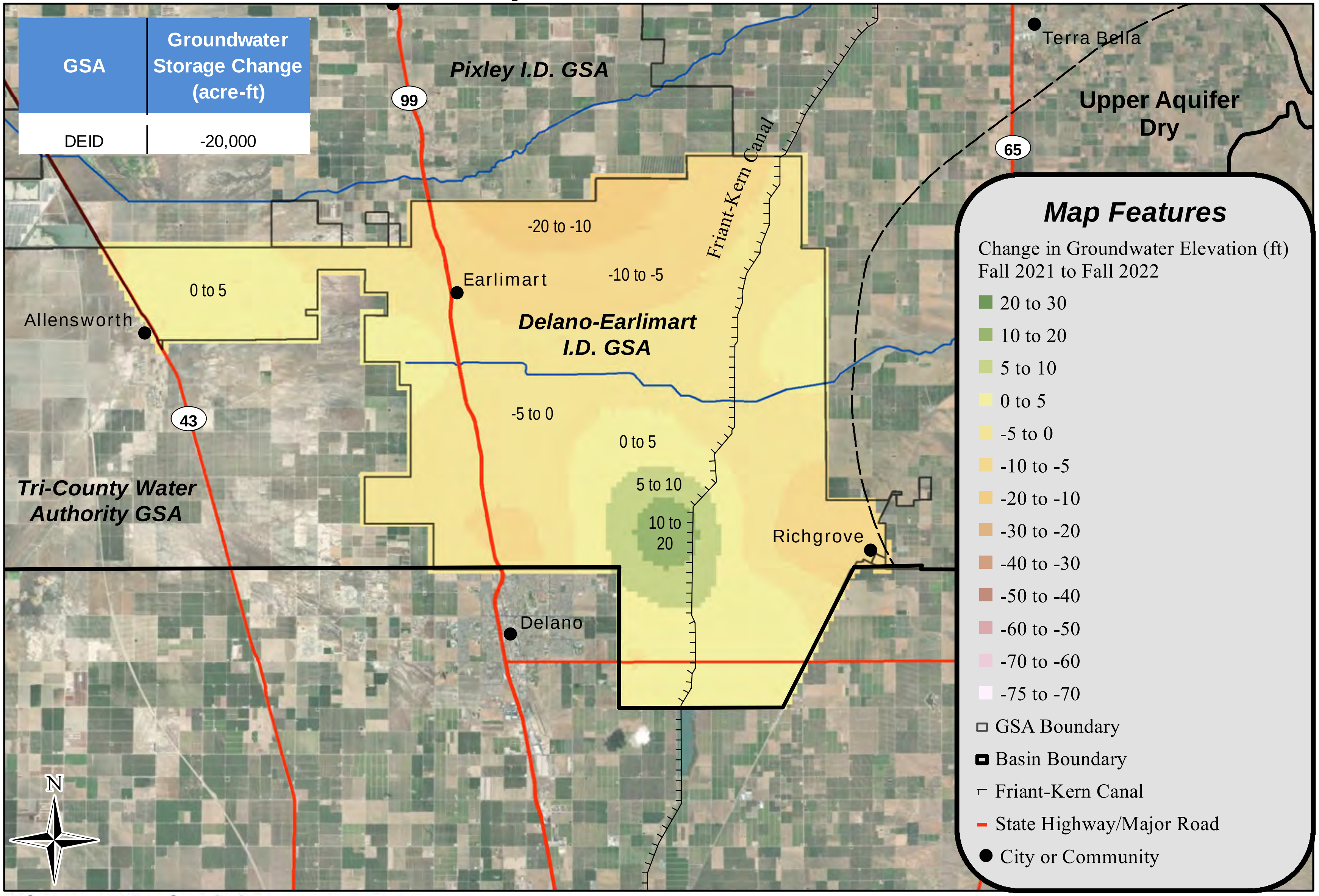


Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
DEID GSA
Appendix C
Figure 13

GSA	Groundwater Storage Change (acre-ft)
DEID	-20,000

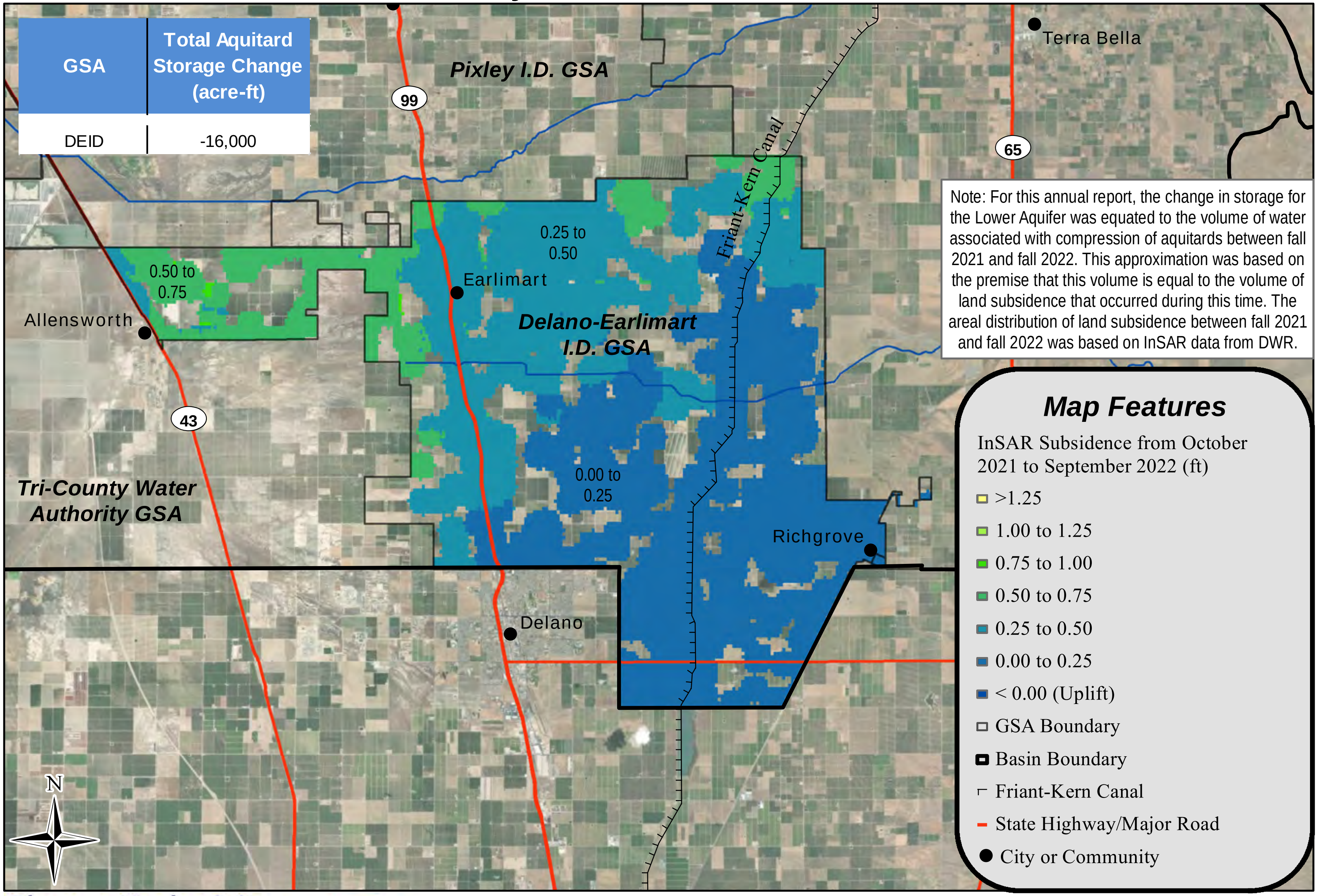


Thomas Harder & Co.
Groundwater Consulting

Change in Groundwater Elevation
Fall 2021 to Fall 2022 - Upper Aquifer
DEID GSA

Appendix C
Figure 14

GSA	Total Aquitard Storage Change (acre-ft)
DEID	-16,000



Note: For this annual report, the change in storage for the Lower Aquifer was equated to the volume of water associated with compression of aquitards between fall 2021 and fall 2022. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The areal distribution of land subsidence between fall 2021 and fall 2022 was based on InSAR data from DWR.

Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

Change in Lower Aquifer Storage as Estimated from Land Subsidence - Fall 2021 to Fall 2022
DEID GSA

Appendix C
Figure 15

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Appendix D

Pixley Irrigation District GSA 2021/22 Annual Data

Pixley Irrigation District GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Pixley ID GSA	Pixley ID	137,000	0	0	137,000
	Pixley PUD	0	560	0	560
	Teviston CSD	0	100	0	100
	Total	***137,000***	***660***	***0***	***137,660***

Pixley Irrigation District GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Pixley ID GSA	Pixley ID	0	8,000	0	0	33,600	41,600
	Pixley PUD	0	0	230	0	1,100	1,330
	Teviston CSD	0	0	0	0	700	700
	Total	***0***	***8,000***	***230***	***0***	***35,400***	***43,630***

Pixley Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
Pixley ID GSA	Pixley ID	137,000	41,600	178,600
	Pixley PUD	560	1,330	1,890
	Teviston CSD	100	700	800
	Total	***137,660***	***43,630***	***181,290***

Pixley Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

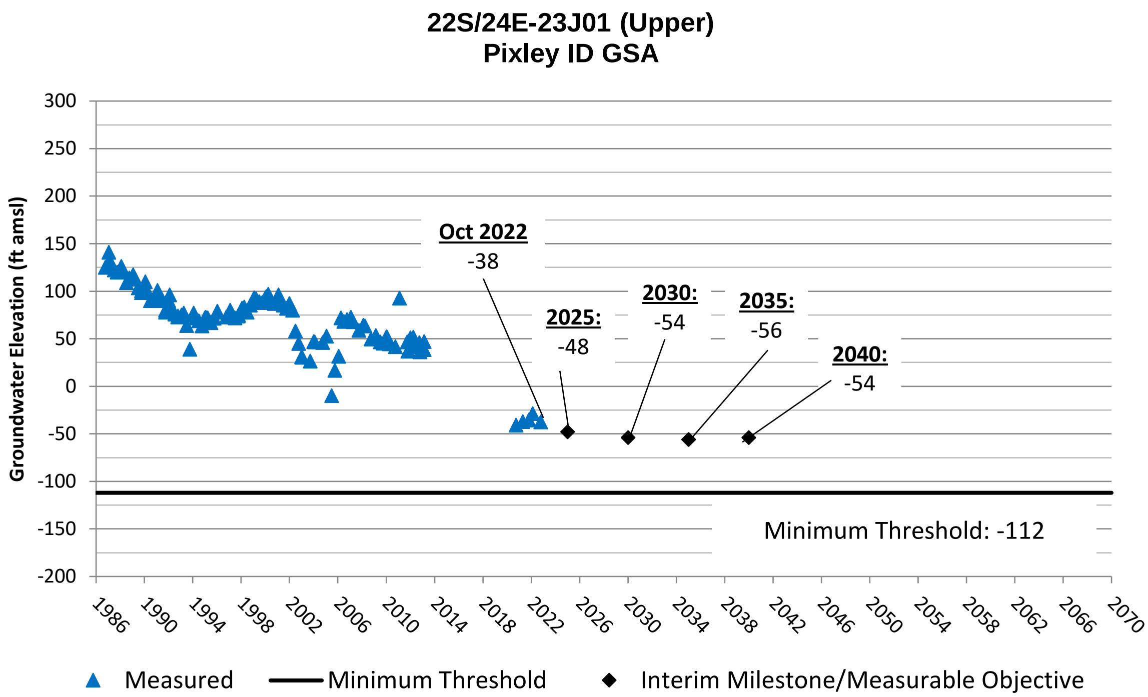
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
P0007_B_RMS	210.0	208.3	203.4	200.6
P0008_B_RMS	229.1	227.9	225.8	223.7
P0009_B_RMS	205.2	203.6	197.8	195.2
P0010_B_RMS	202.4	201.1	195.9	192.8
P0011_B_RMS	218.5	217.0	212.4	210.0
P0025_B_RMS	273.4	272.4	270.6	269.6
P0026_B_RMS	277.2	275.9	276.0	274.9
P0027_B_RMS	255.3	254.5	253.1	252.1
P0028_B_RMS	278.0	276.7	276.9	275.9
P0029_B_RMS	283.5	282.8	282.2	280.9
P0036_B_RMS	323.6	322.7	322.1	321.1
P0037_B_RMS	324.6	323.6	323.0	322.0
P0090_B_RMS	N/A	368.1	N/A	N/A
P0091_B_RMS	N/A	N/A	N/A	N/A
P0093_B_RMS	N/A	349.8	N/A	N/A
P0094_B_RMS	N/A	310.3	N/A	N/A

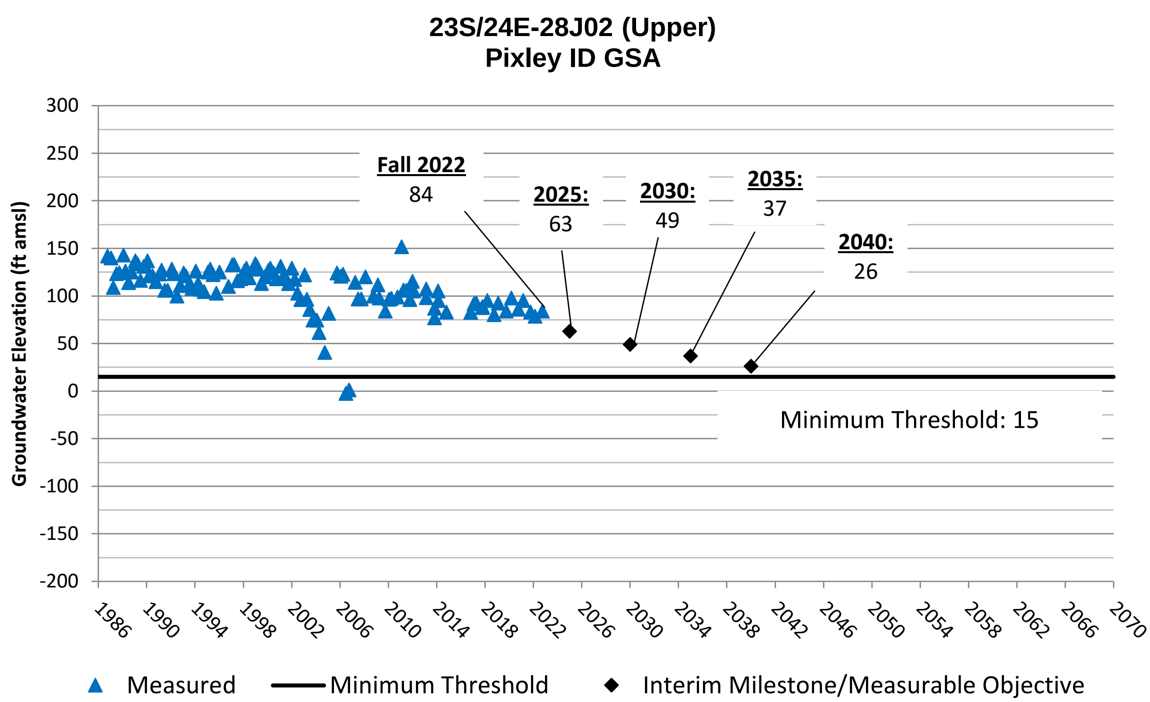
Note:

N/A = Not available

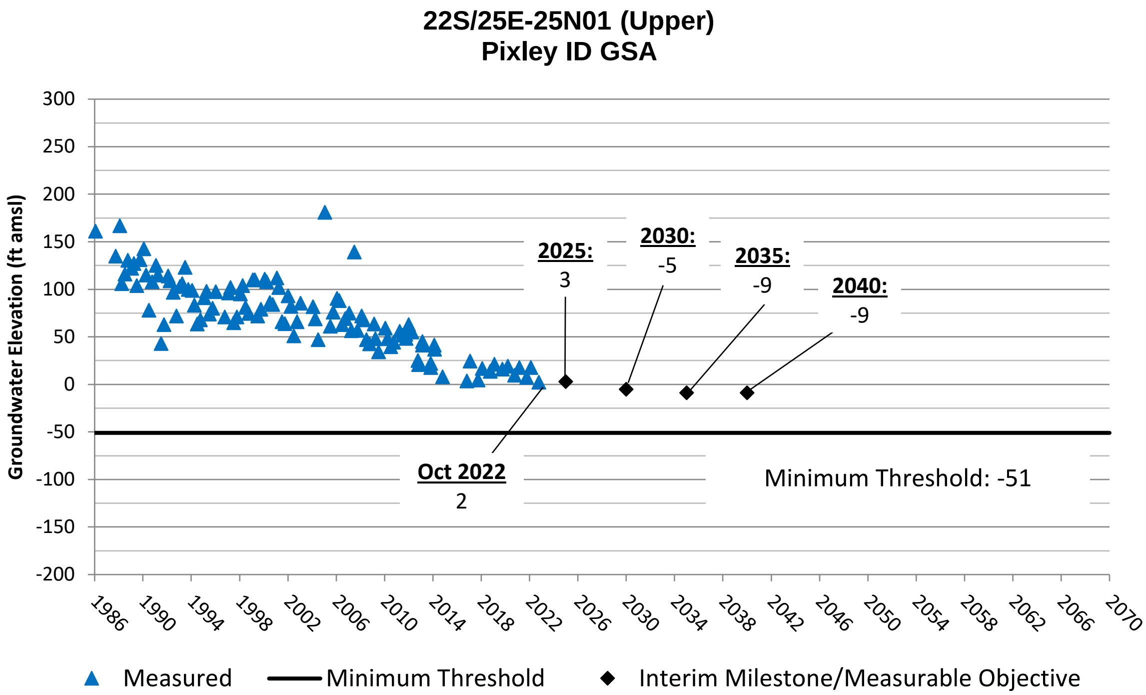
[1] Benchmarks surveyed in July and August of each year.

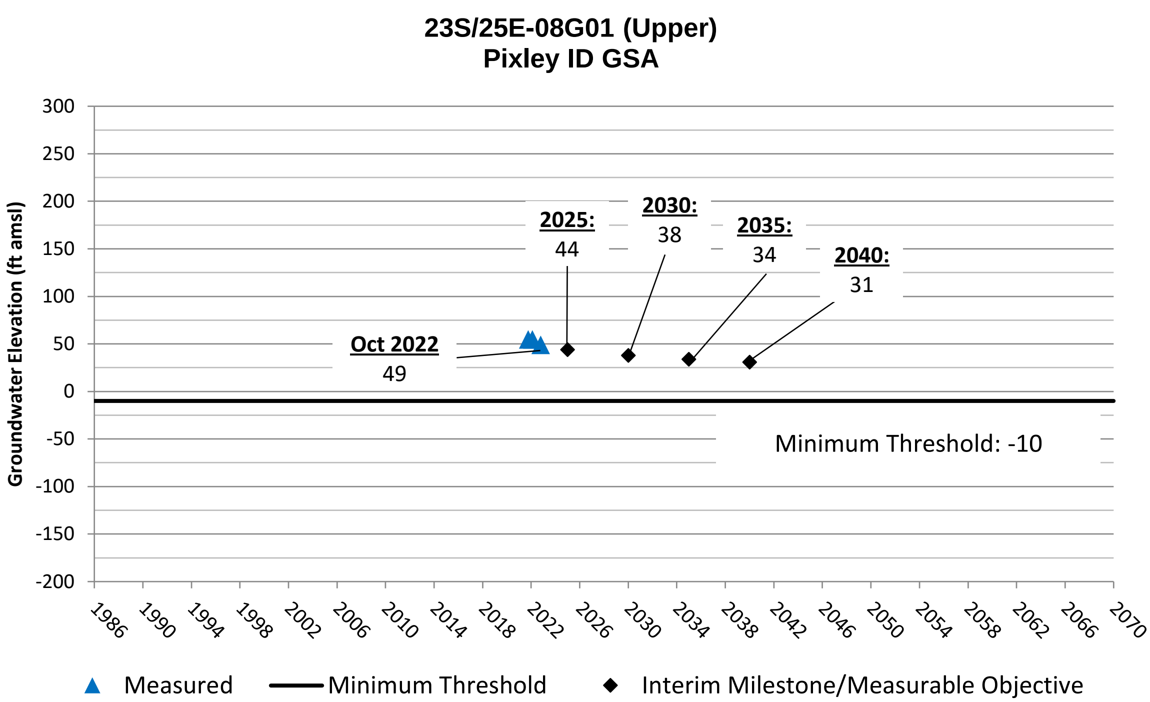
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



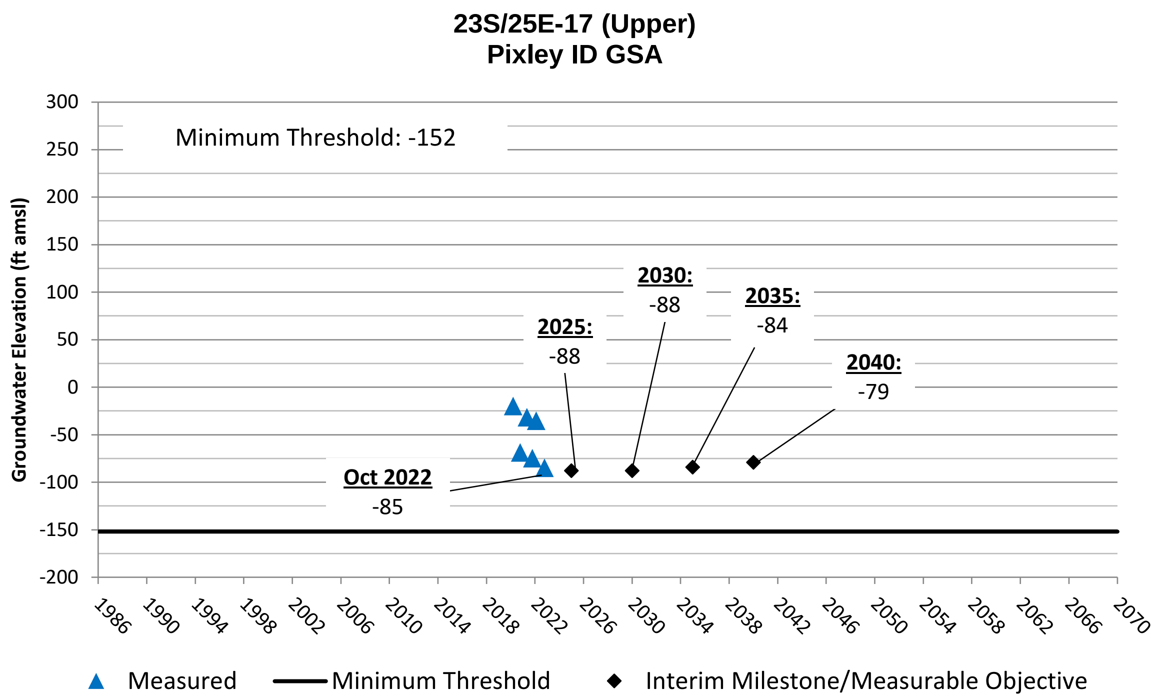


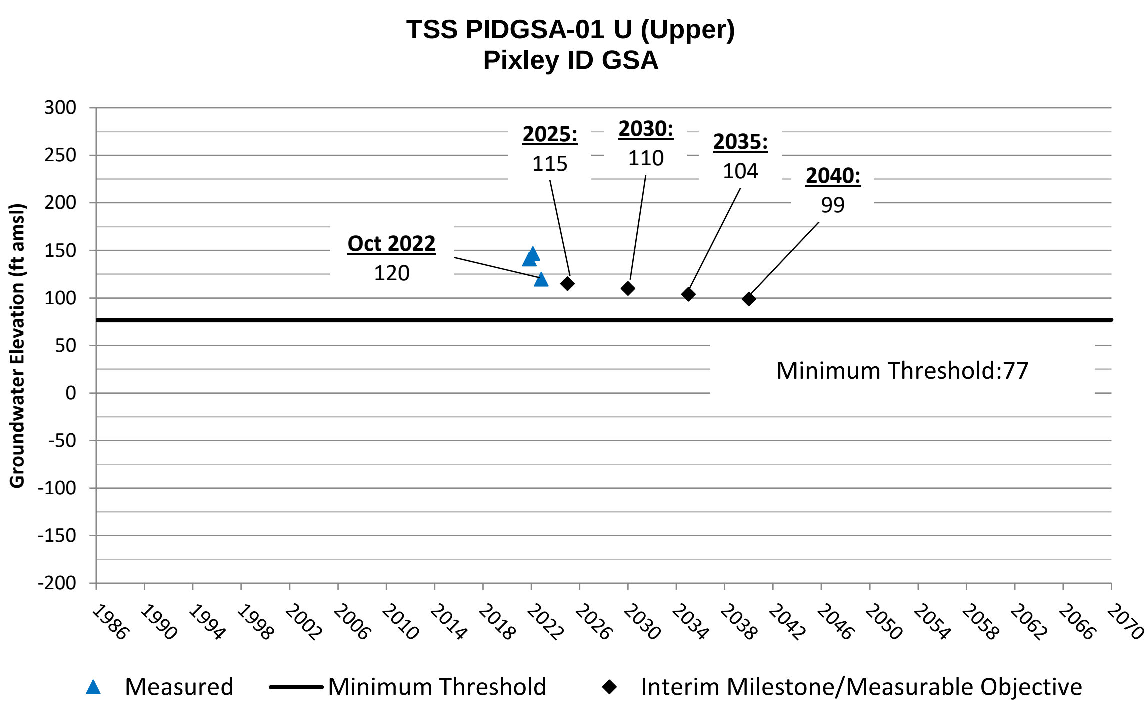
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs





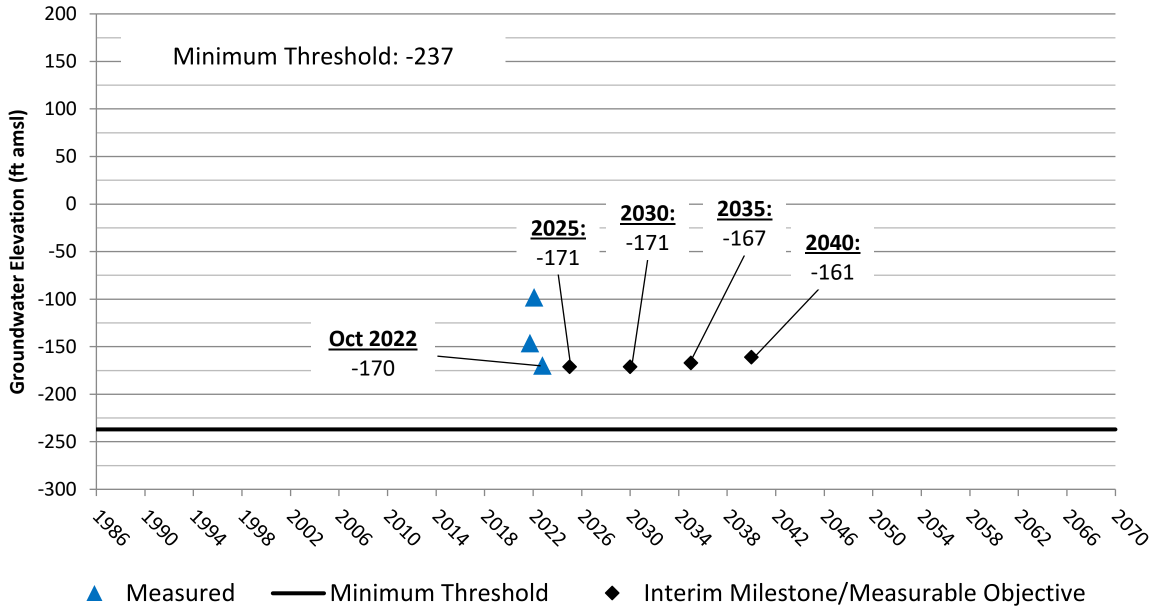
Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



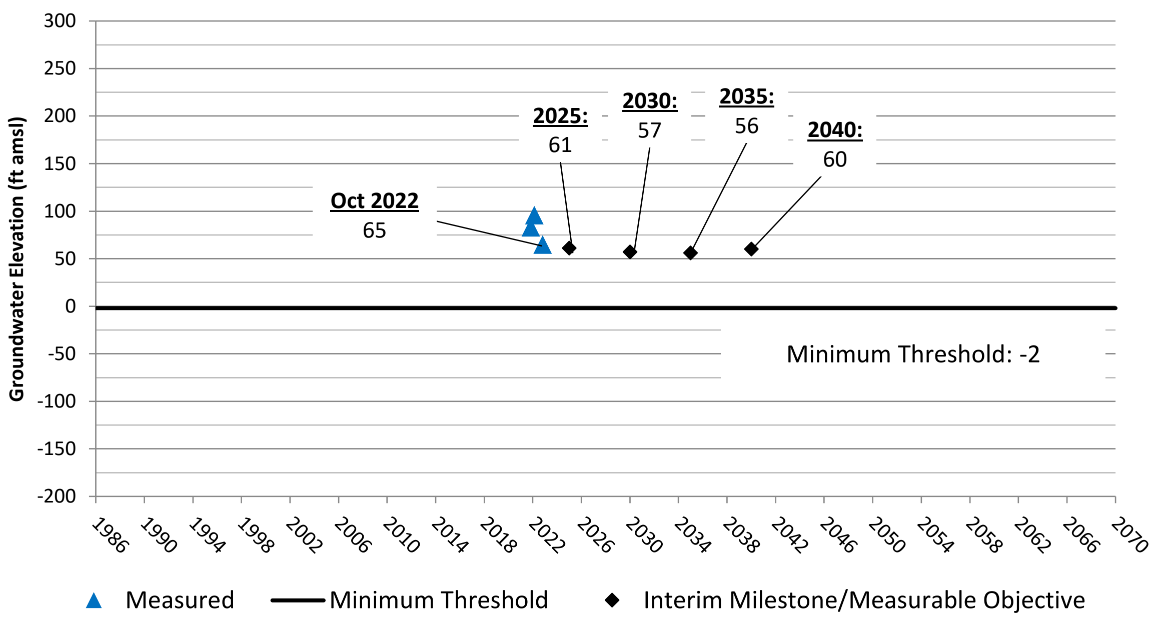


Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs

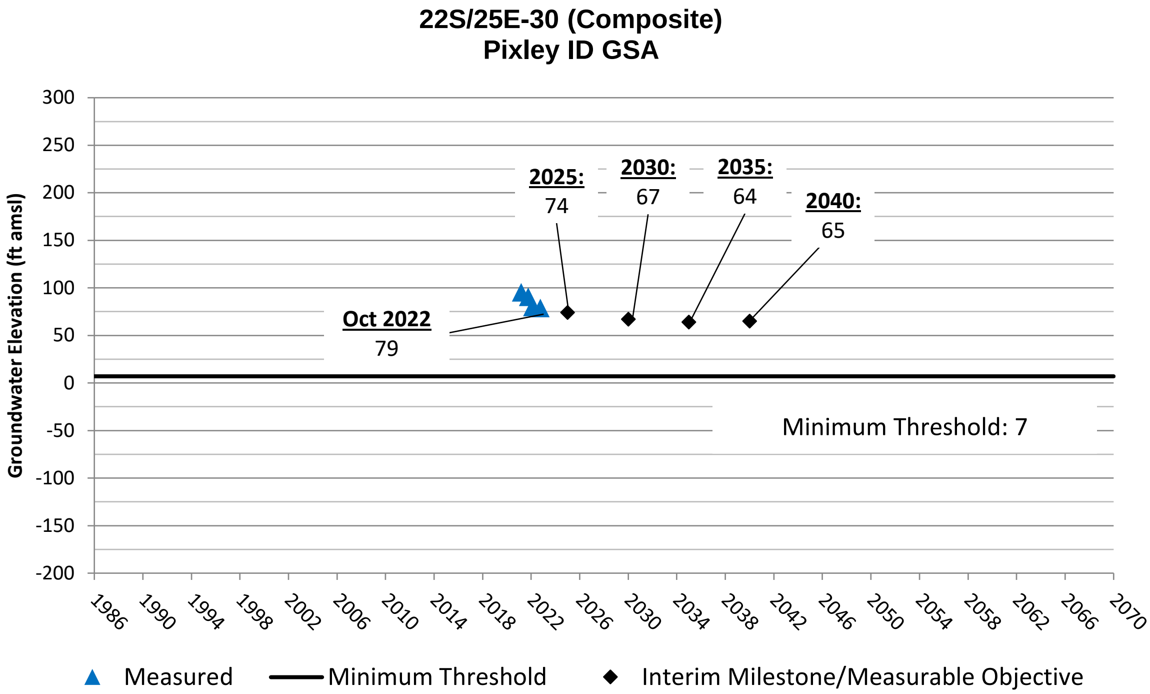
TSMW 1L (Lower)
Pixley ID GSA



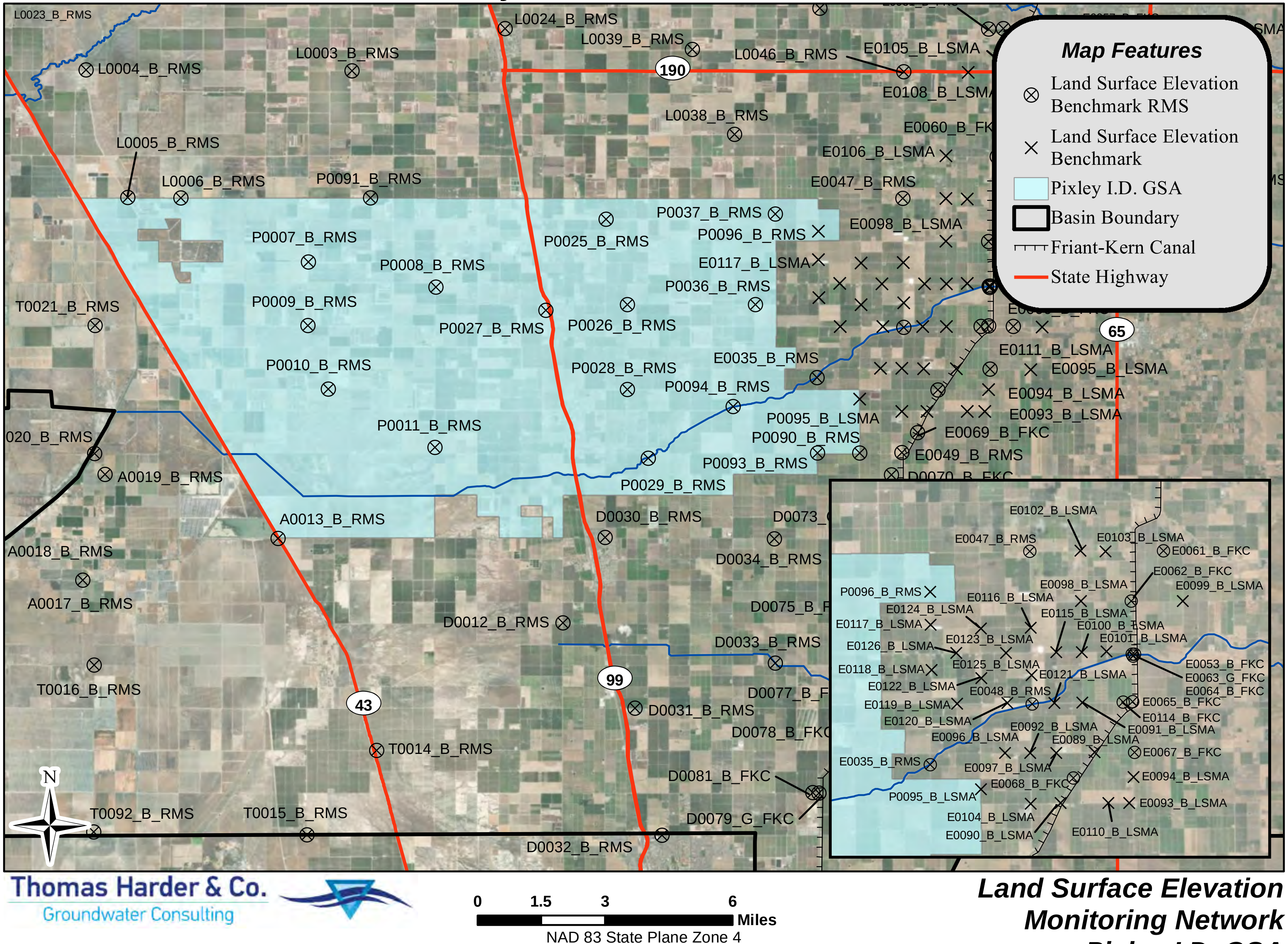
TSS PIDGSA-01 (Lower)
Pixley ID GSA



Pixley Irrigation District GSA
RMS Groundwater Elevation Hydrographs



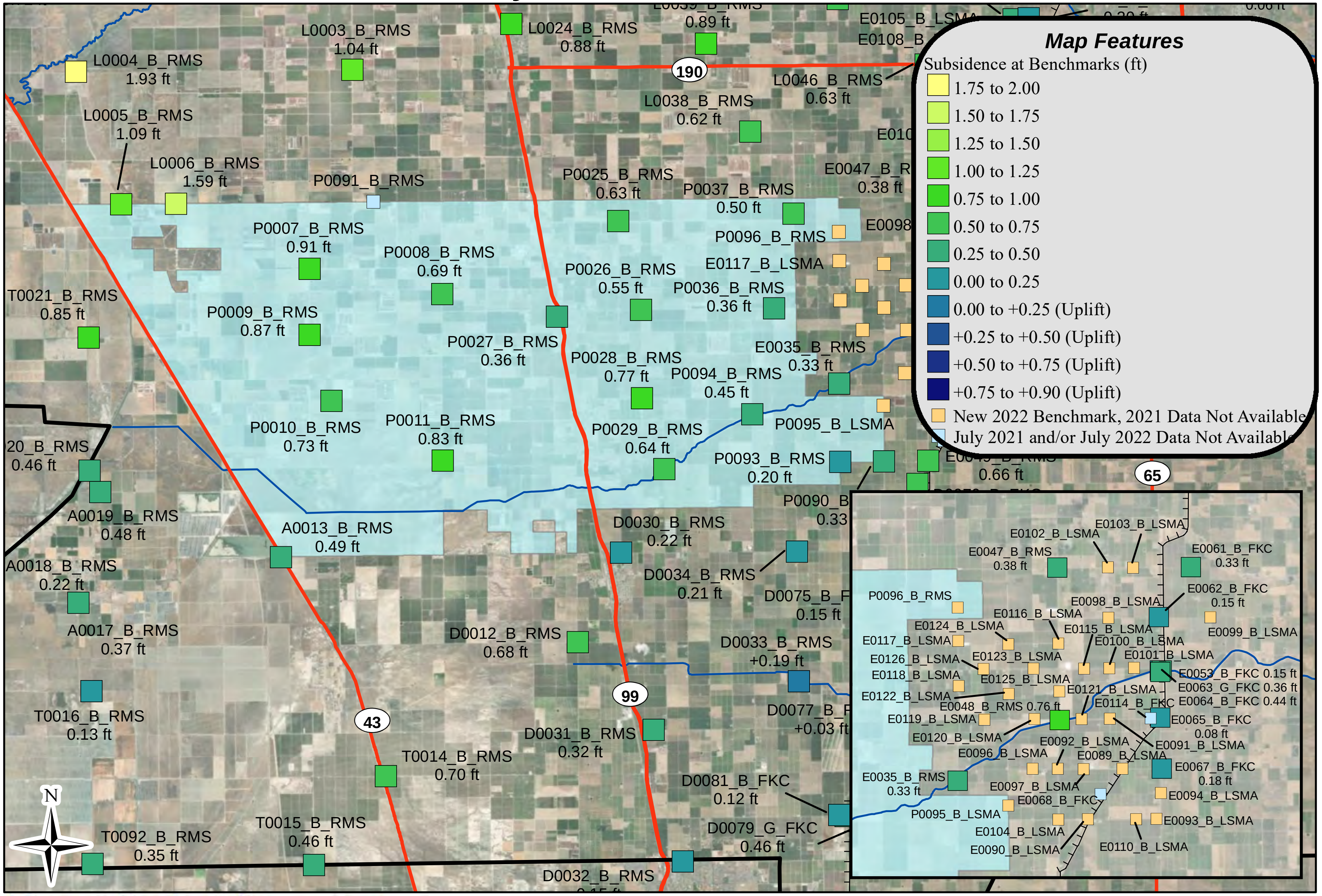
Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

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

Tule Subbasin Technical Advisory Committee

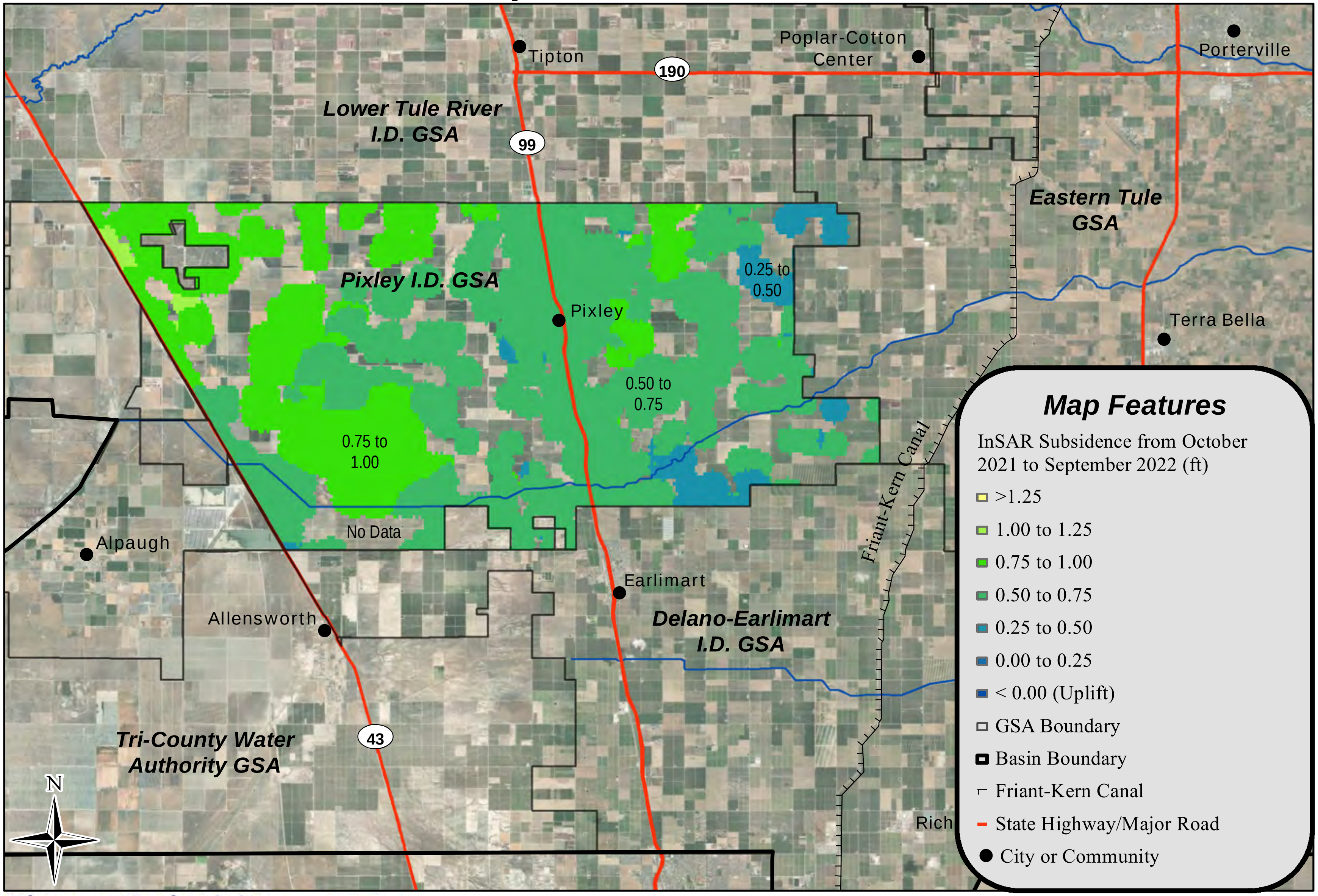


Thomas Harder & Co.
Groundwater Consulting

Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022
Pixley I.D. GSA

Appendix D
Figure 7



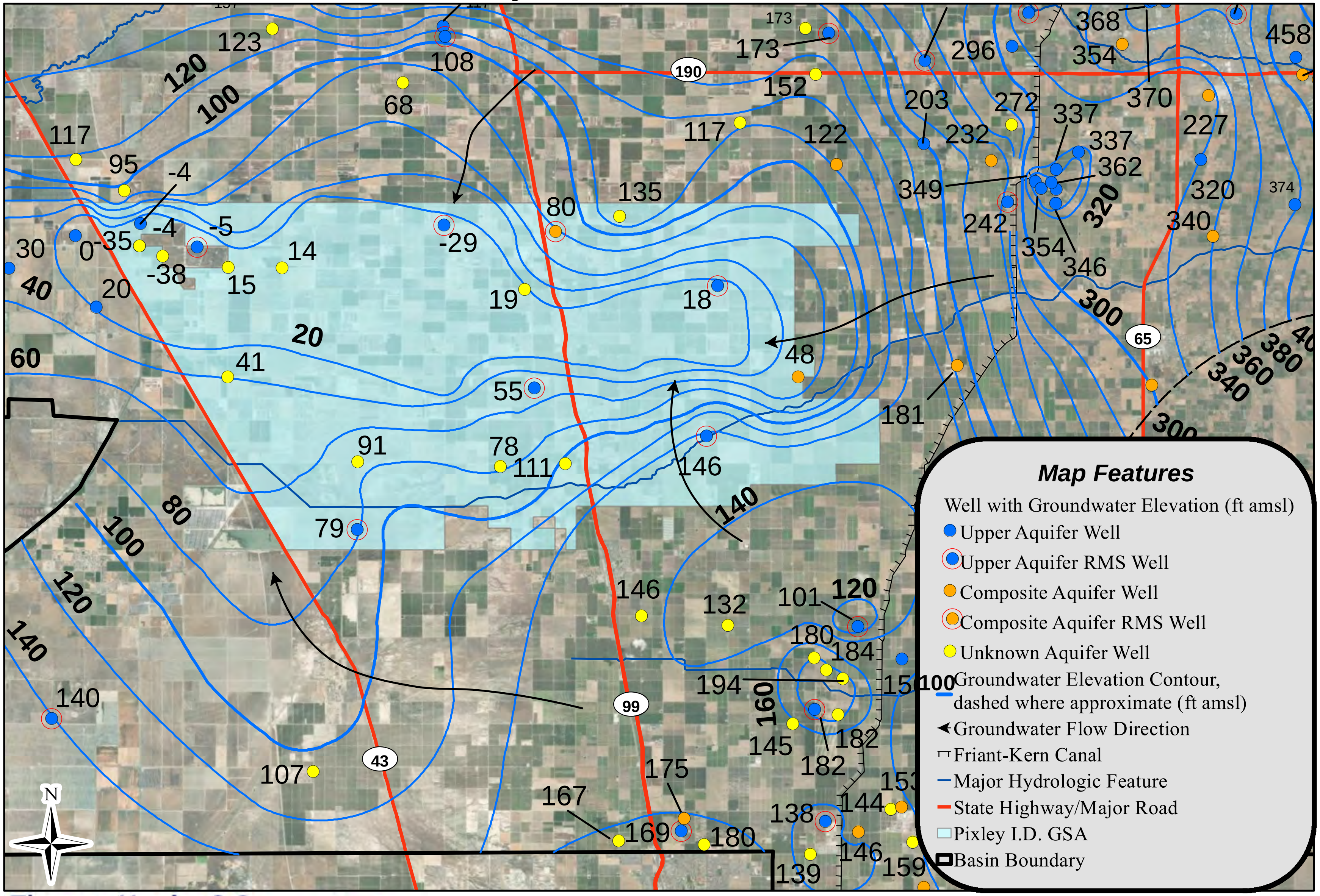
Thomas Harder & Co.
Groundwater Consulting

Land Subsidence -
October 2021 - September 2022
Pixley I.D. GSA

Appendix D
Figure 8

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Tule Subbasin Technical Advisory Committee

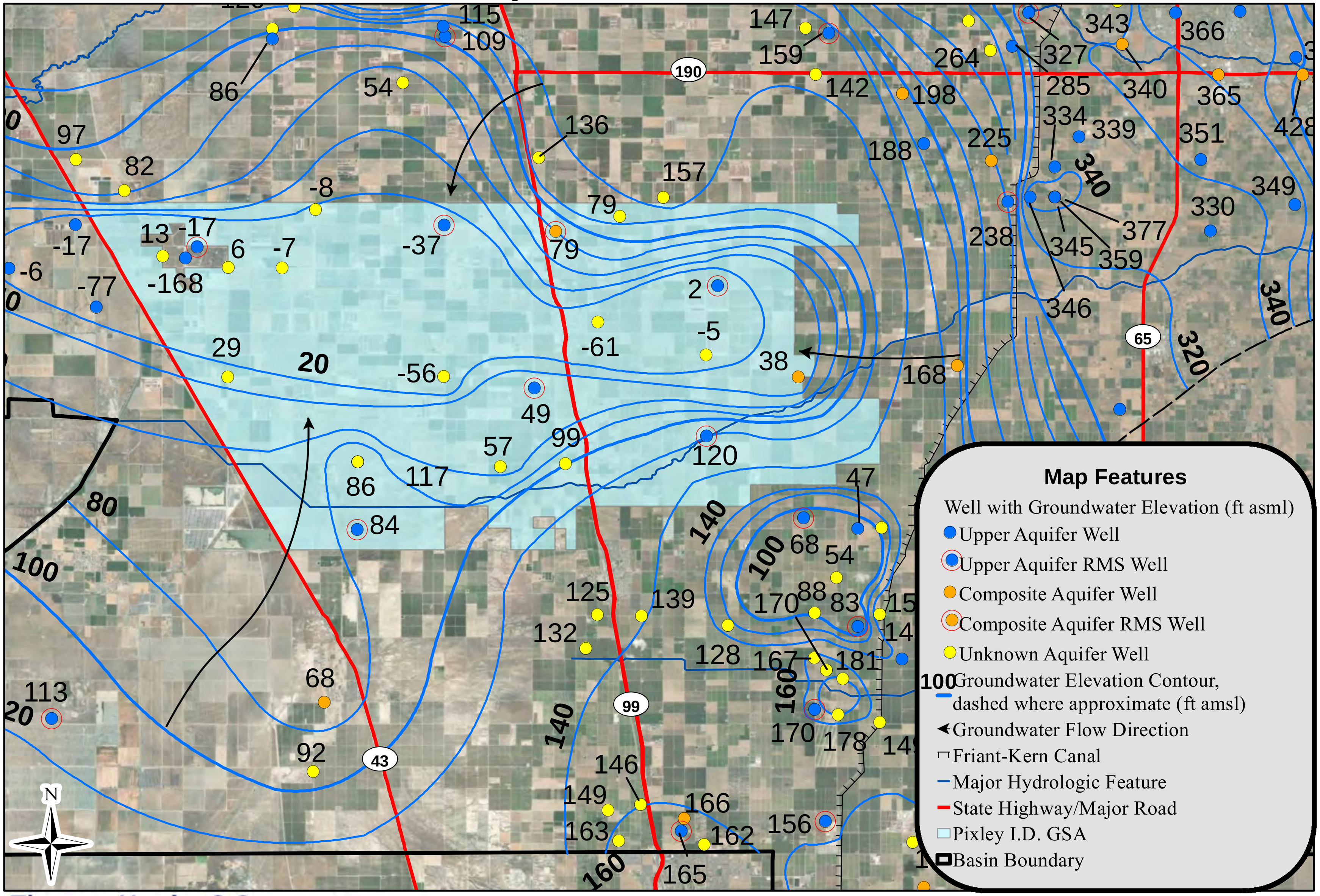


0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer
Pixley I.D. GSA
Appendix D
Figure 9

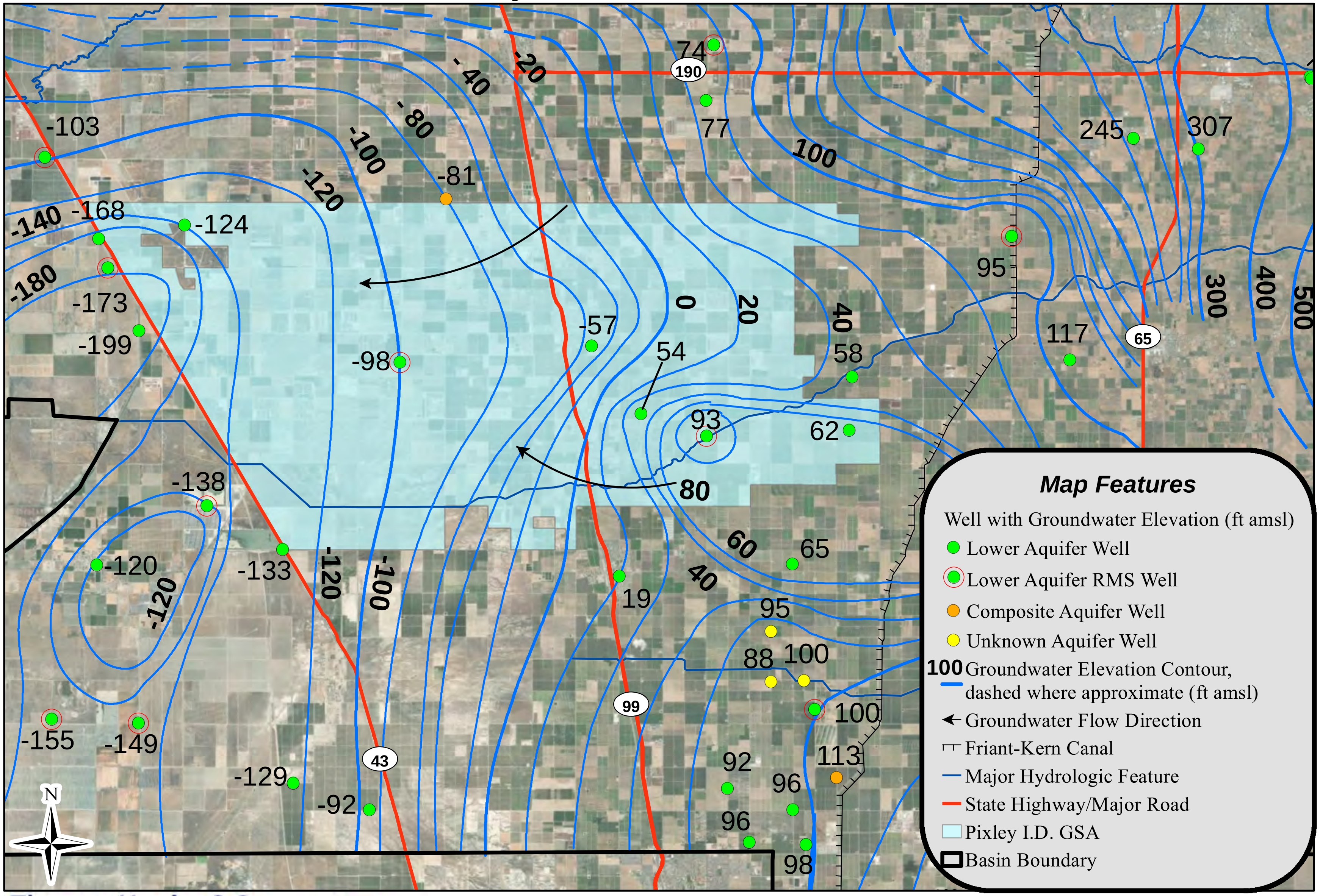


Thomas Harder & Co.
Groundwater Consulting

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

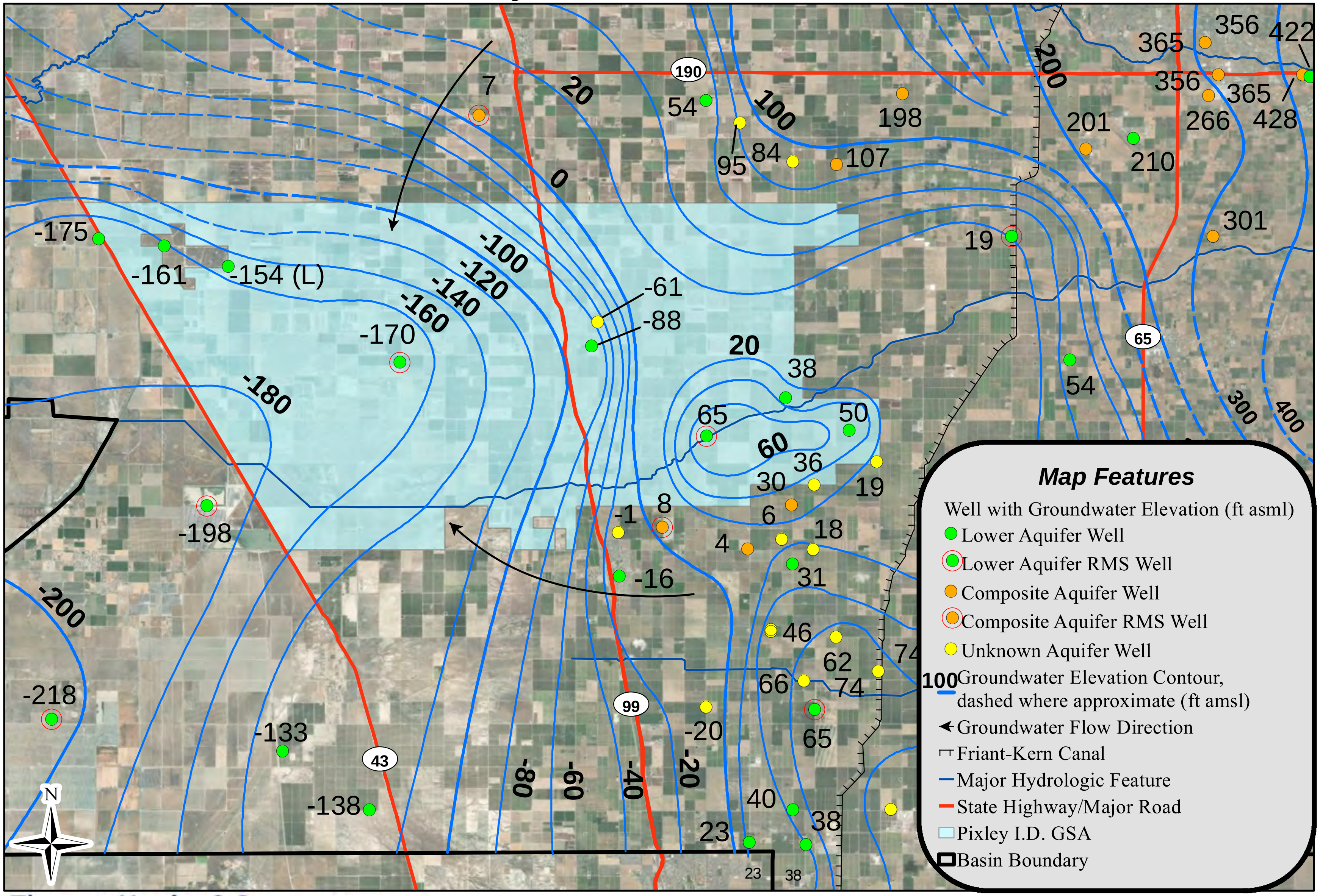
Fall 2022 Upper Aquifer
Pixley I.D. GSA
Appendix D
Figure 10



Thomas Harder & Co. Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
Pixley I.D. GSA
Appendix D
Figure 11

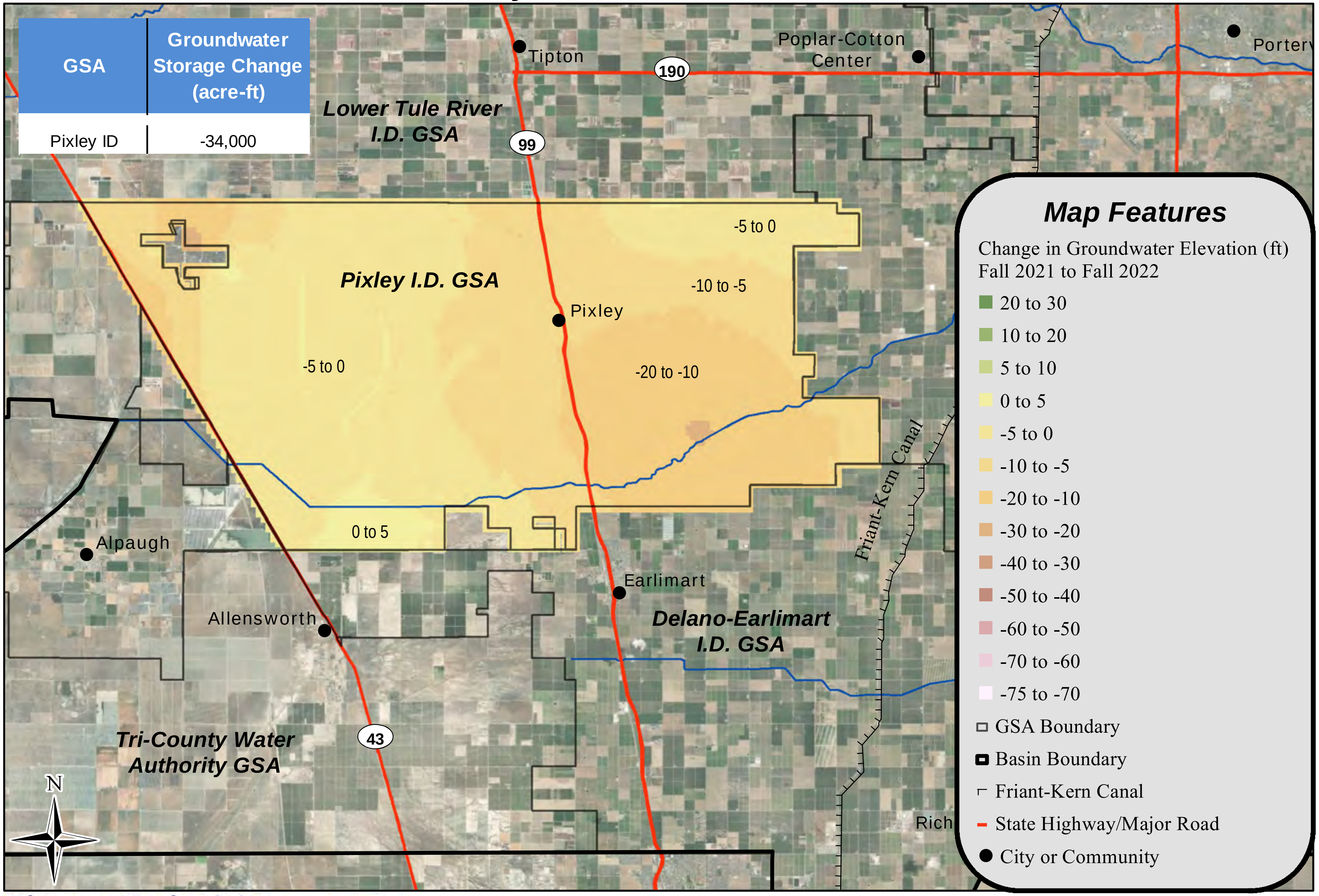


Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
Pixley I.D. GSA
Appendix D
Figure 12

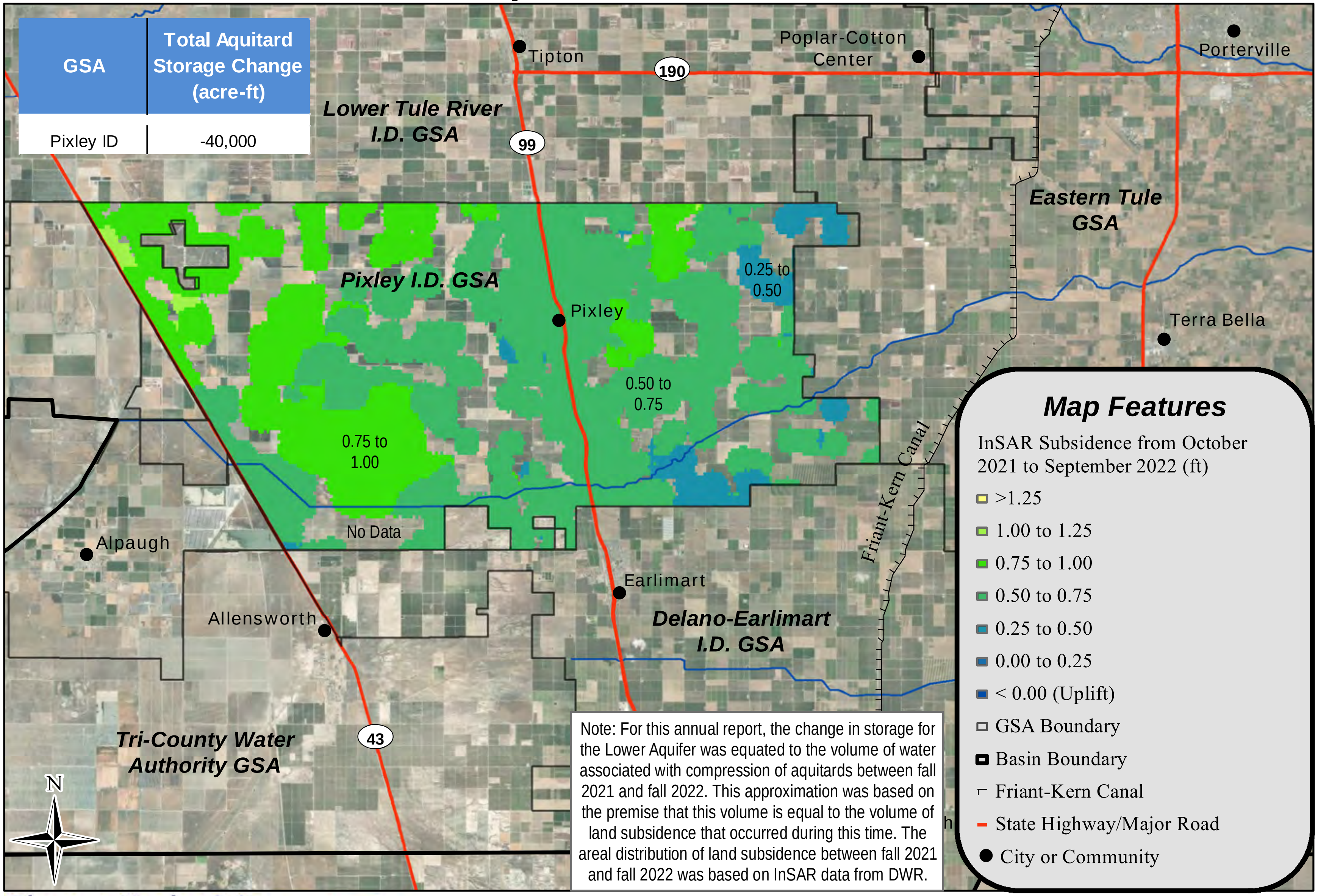
GSA	Groundwater Storage Change (acre-ft)
Pixley ID	-34,000



Thomas Harder & Co.
Groundwater Consulting

Change in Groundwater Elevation Fall 2021 to Fall 2022 - Upper Aquifer Pixley I.D. GSA

Appendix D
Figure 13



Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

Change in Lower Aquifer Storage as Estimated from Land Subsidence - Fall 2021 to Fall 2022
Pixley I.D. GSA

Appendix D
Figure 14

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Appendix E

Tri-County Groundwater Authority GSA 2021/22 Annual Data

Tri-County Water Authority GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
TCWA GSA	North	10,300	0	23,650	33,950
	Southeast	45,000	100	0	45,100
	Total	***55,300***	***100***	***23,650***	***79,050***

Tri-County Water Authority GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
TCWA GSA	North	0	0	0	0	5,000	5,000
	Southeast	0	0	0	0	21,400	21,400
	Total	***0***	***0***	***0***	***0***	***26,400***	***26,400***

Tri-County Water Authority GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
TCWA GSA	North	33,950	5,000	38,950
	Southeast	45,100	21,400	66,500
	Total	***79,050***	***26,400***	***105,450***

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

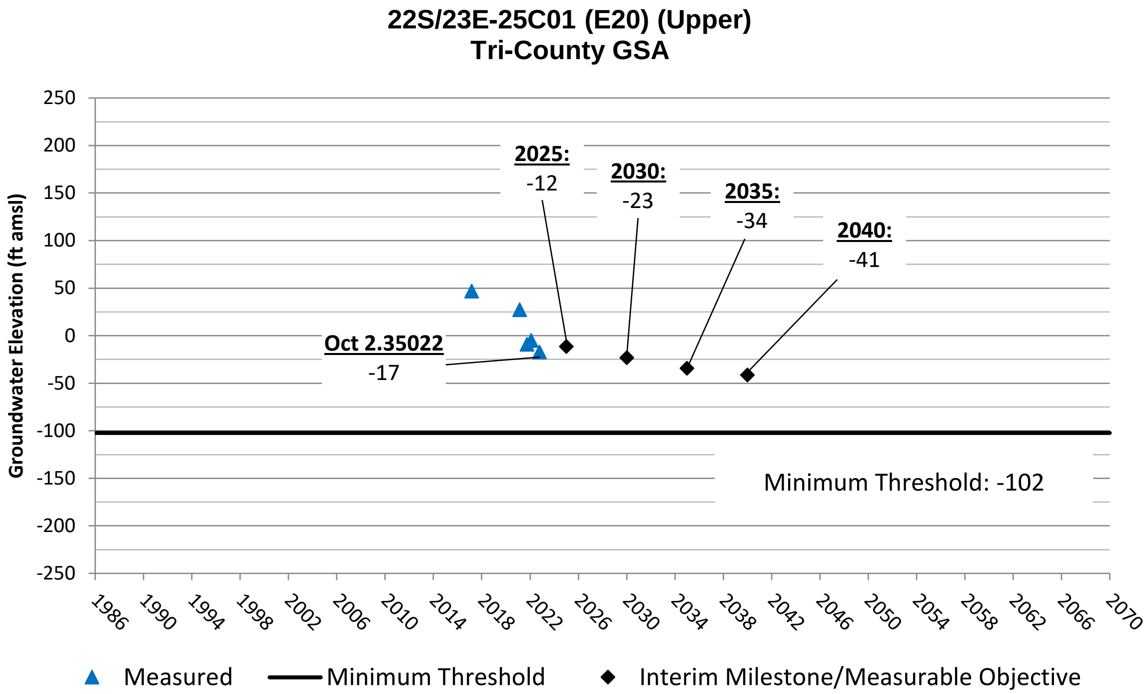
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
T0014_B_RMS	219.4	218.3	212.6	211.6
T0015_B_RMS	217.1	216.3	211.3	210.3
T0016_B_RMS	201.3	200.8	195.4	194.4
T0021_B_RMS	183.0	181.6	175.1	174.1
T0092_B_RMS	N/A	200.0	N/A	N/A

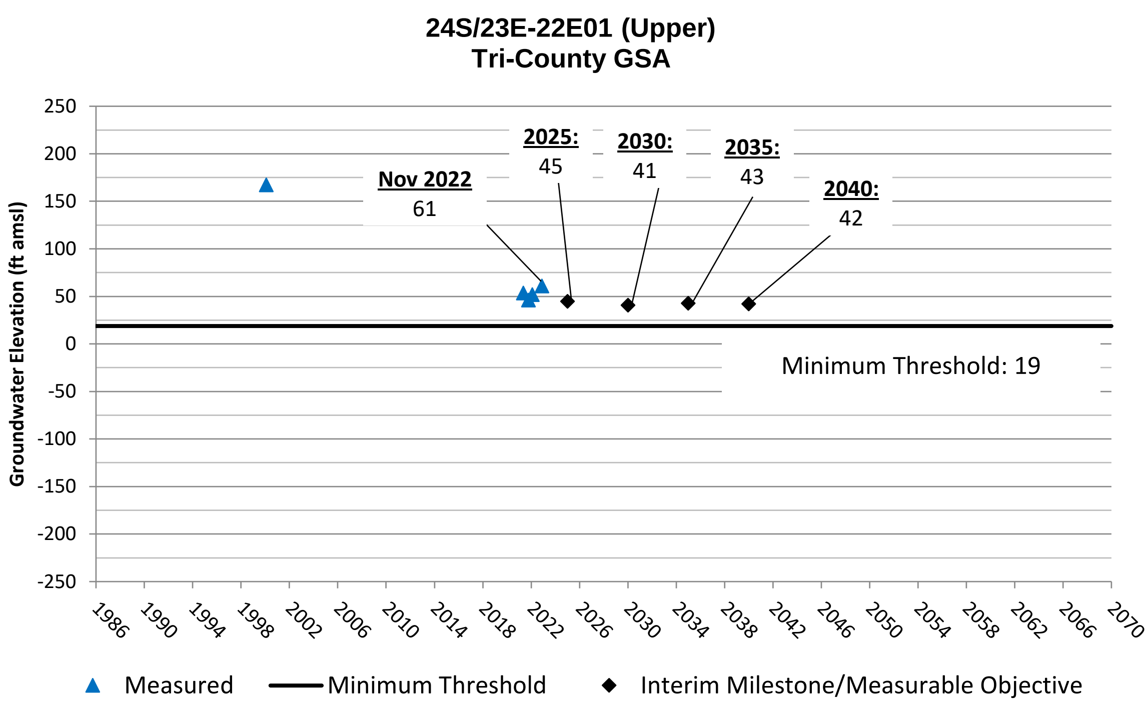
Note:

N/A = Not available

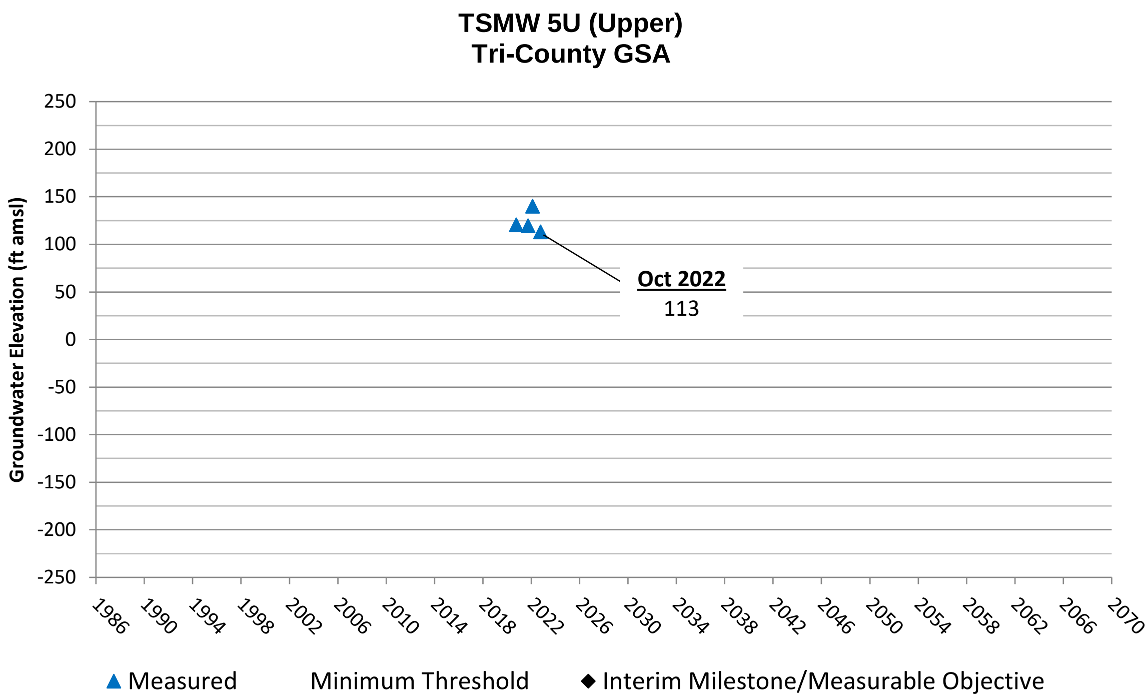
[1] Benchmarks surveyed in July and August of each year.

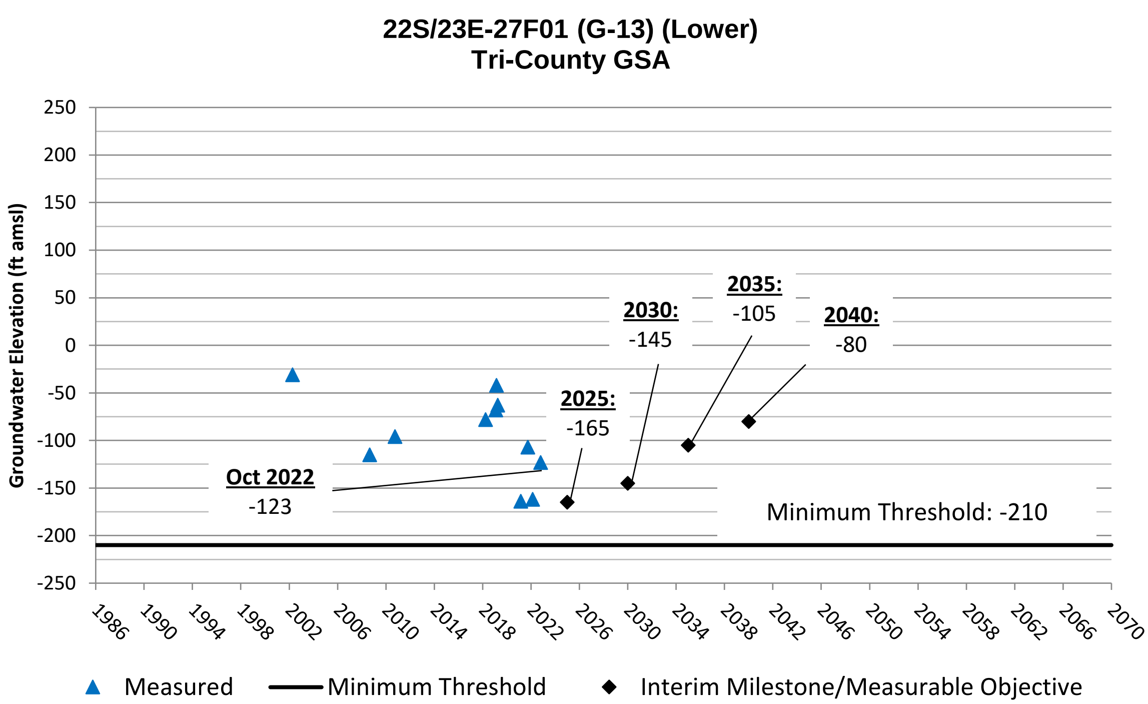
Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs



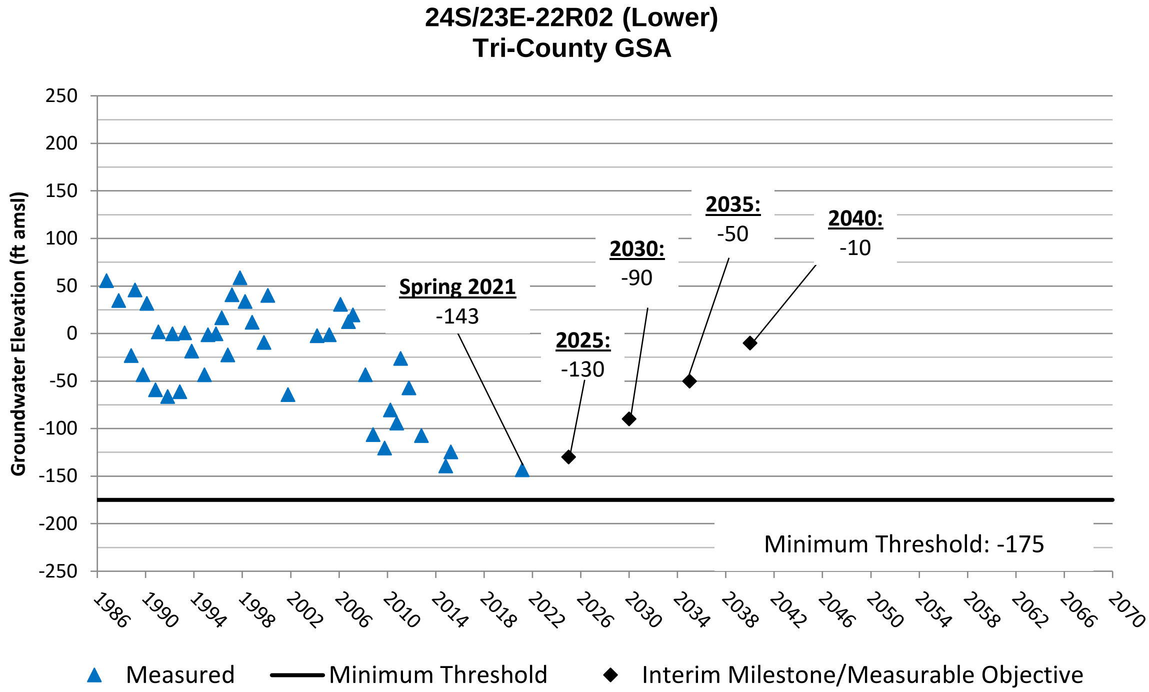


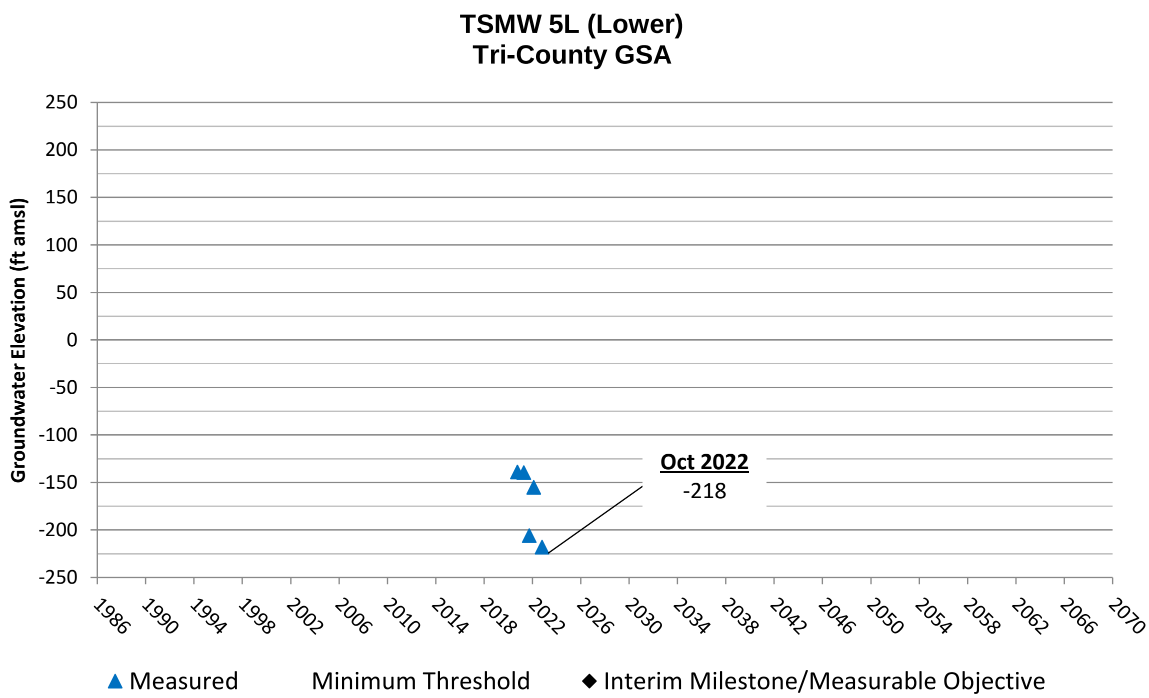
Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs



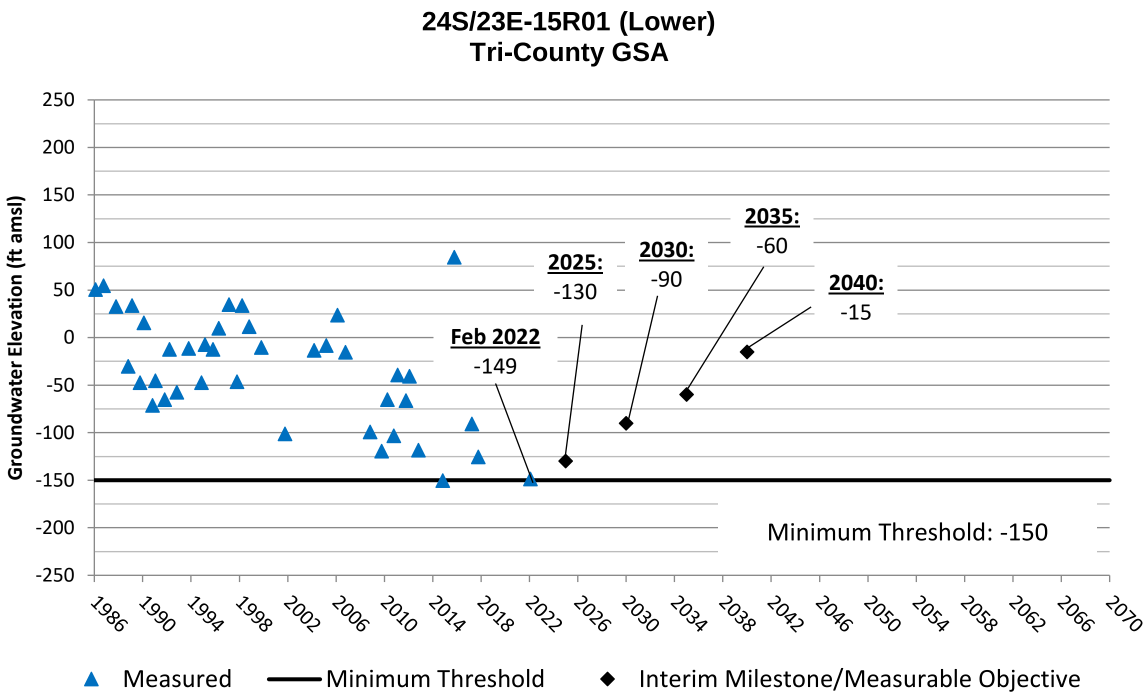


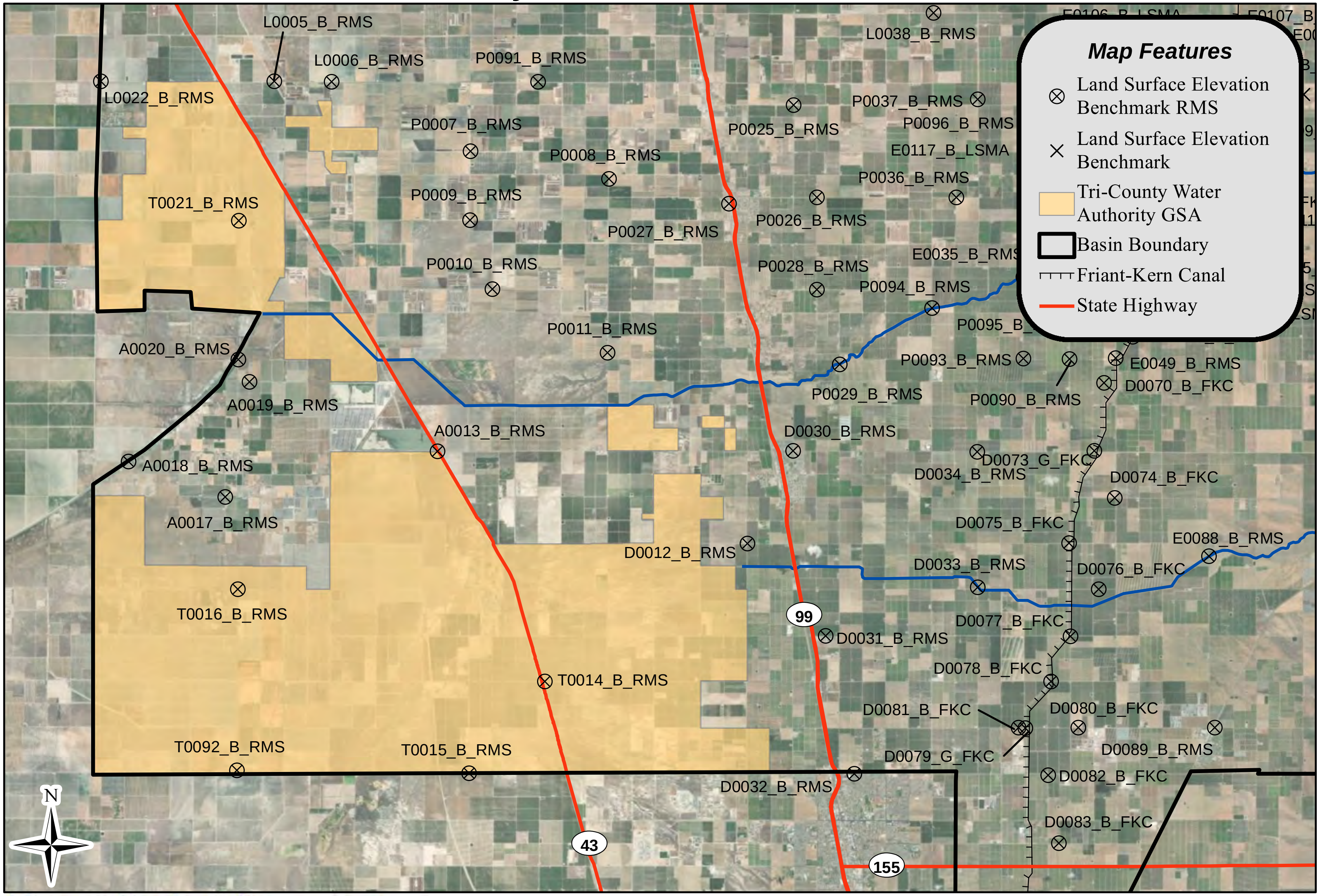
Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs





Tri-County Water Authority GSA
RMS Groundwater Elevation Hydrographs

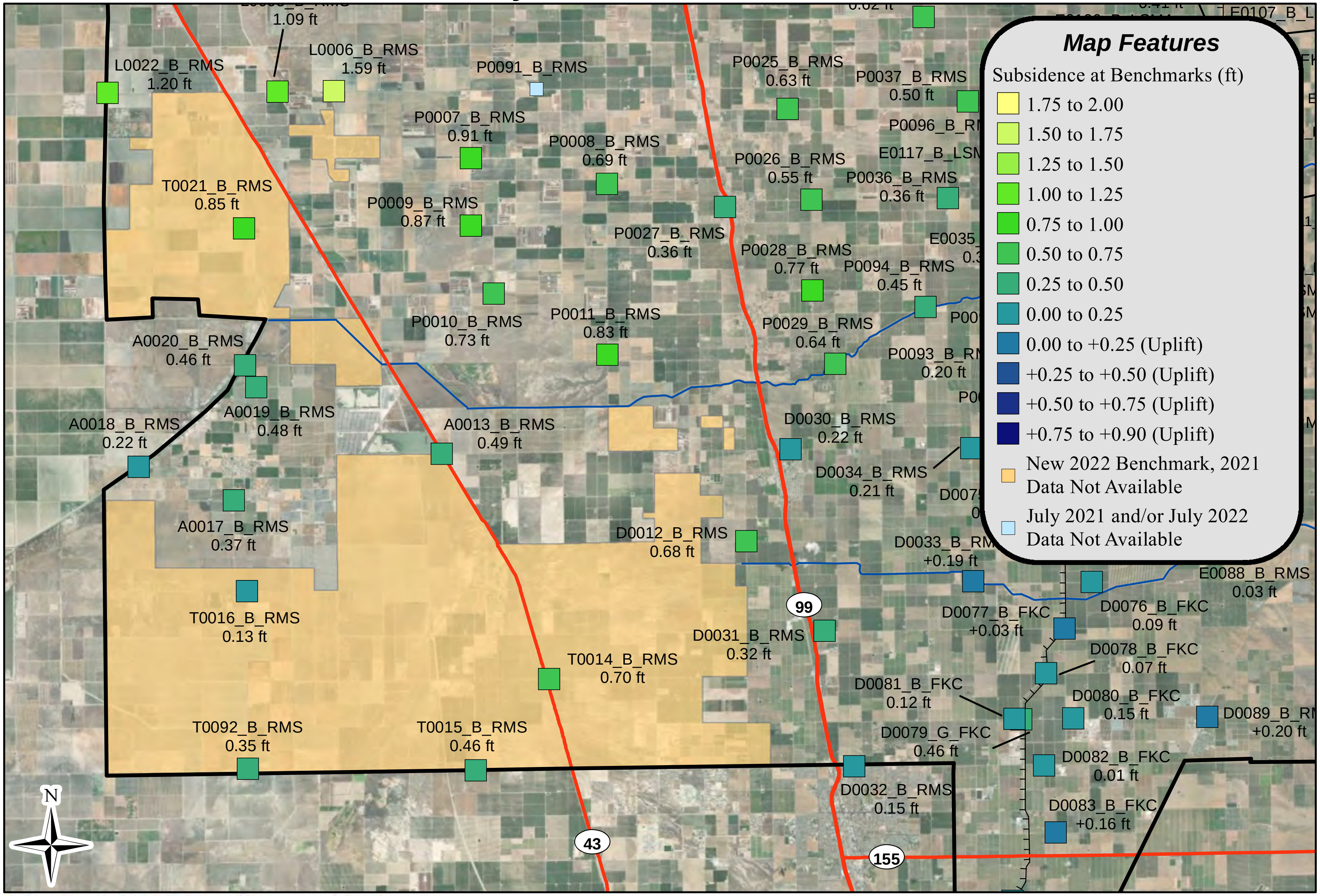




Thomas Harder & Co.
Groundwater Consulting

Land Surface Elevation Monitoring Network
Tri-County Water Authority GSA

Appendix E
Figure 5



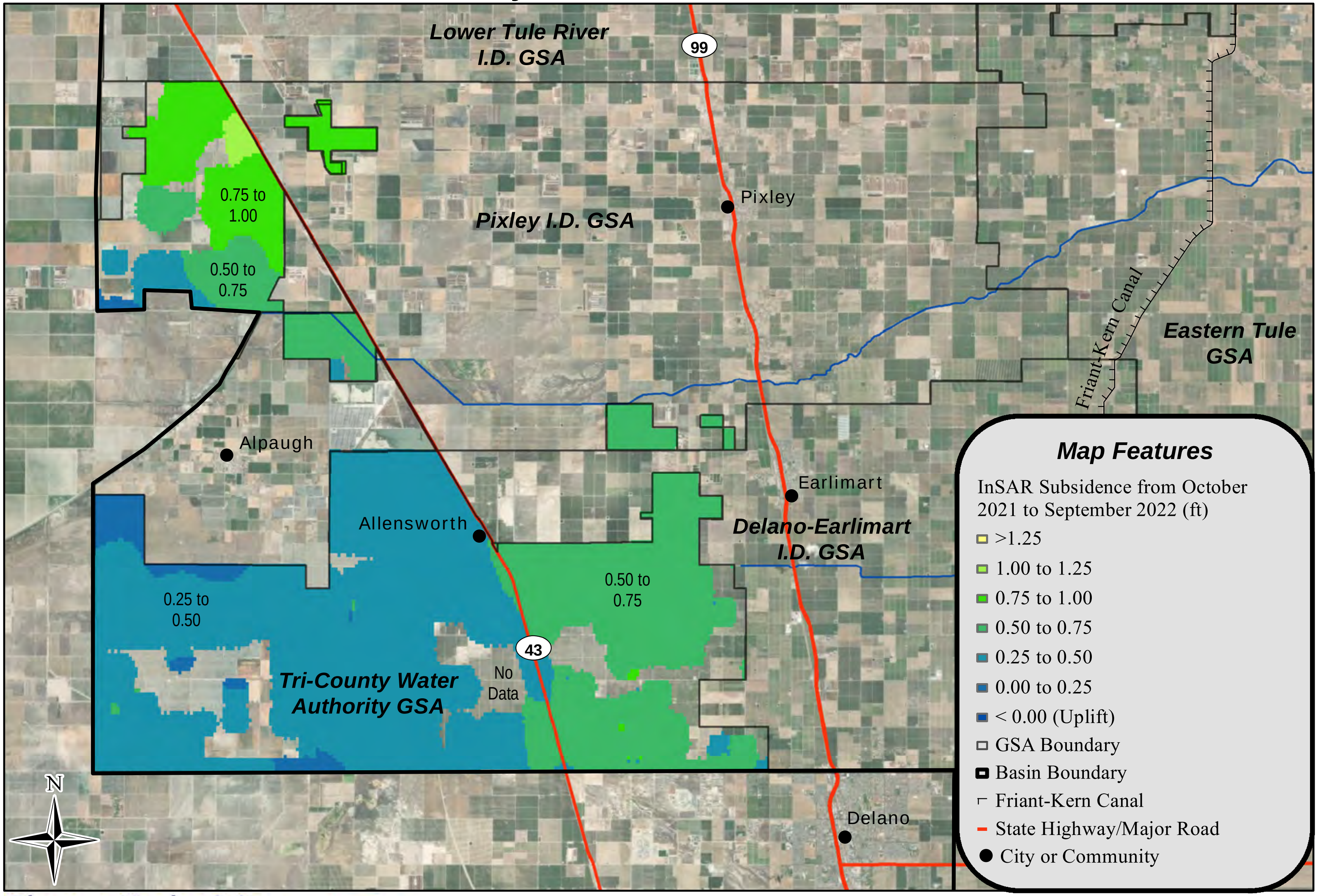
Thomas Harder & Co.
Groundwater Consulting

0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022
Tri-County Water Authority GSA

Appendix E
Figure 6

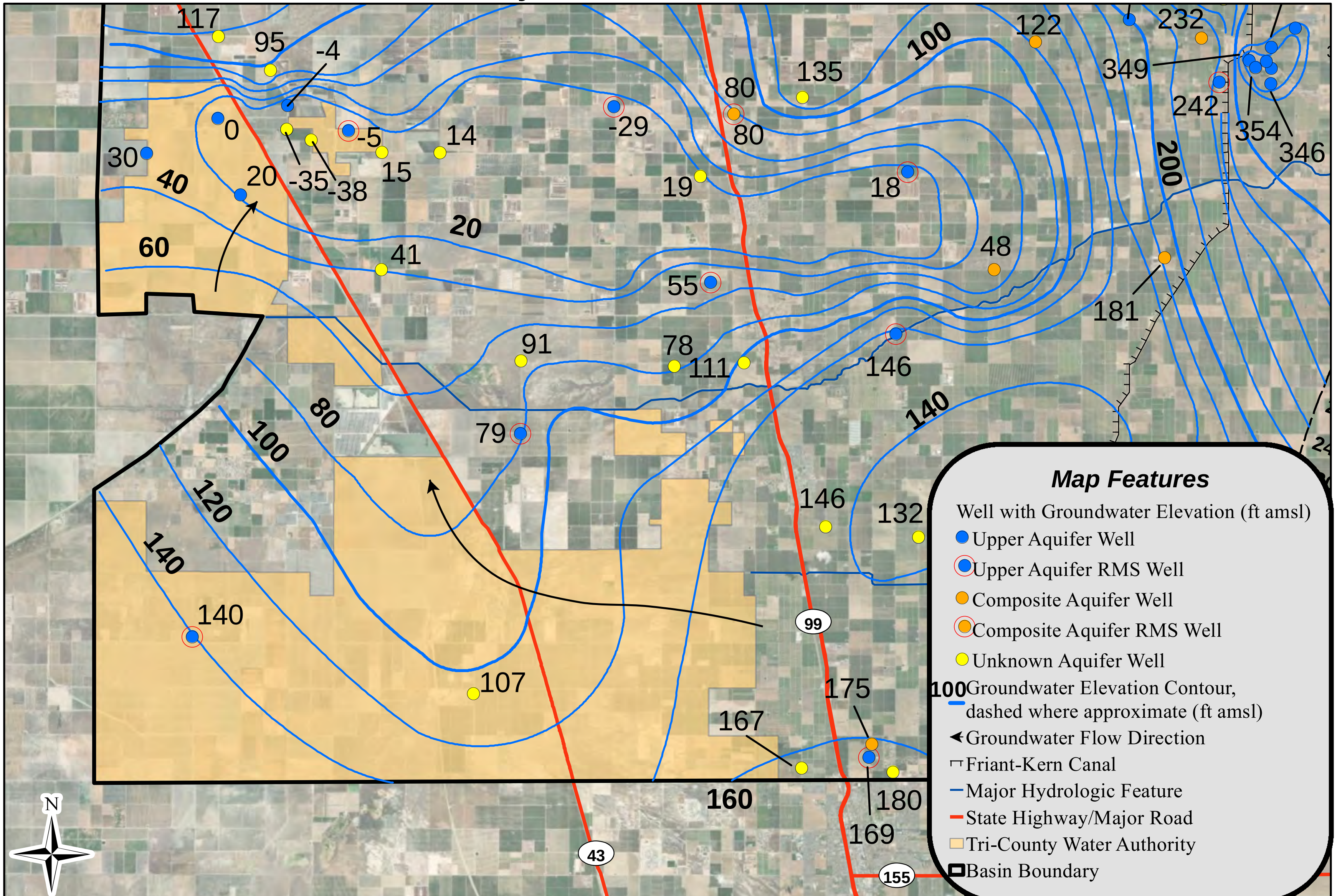


Thomas Harder & Co.
Groundwater Consulting

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Land Subsidence - October 2021 - September 2022 Tri-County Water Authority GSA

Appendix E
Figure 7

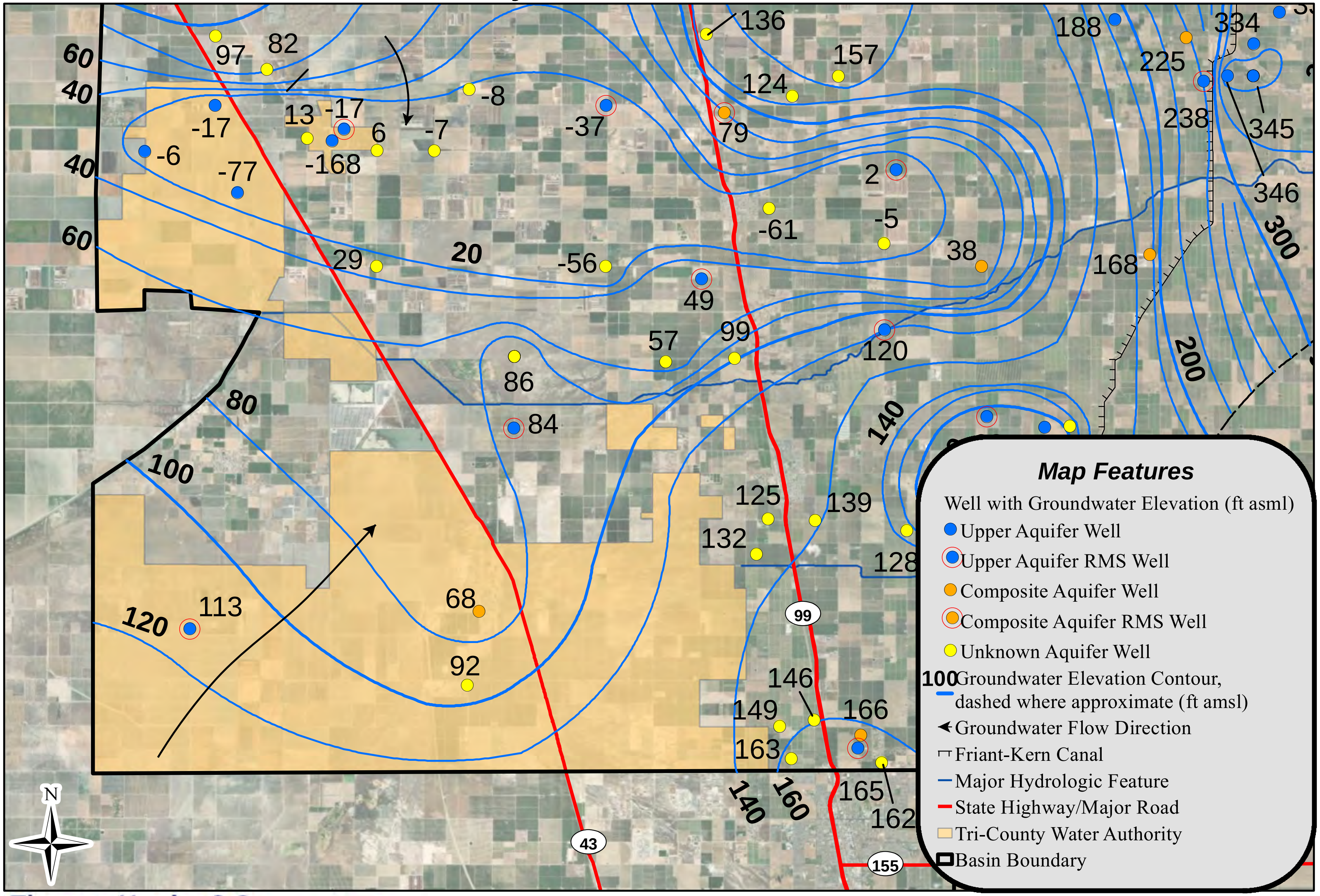


Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 8

Tule Subbasin Technical Advisory Committee



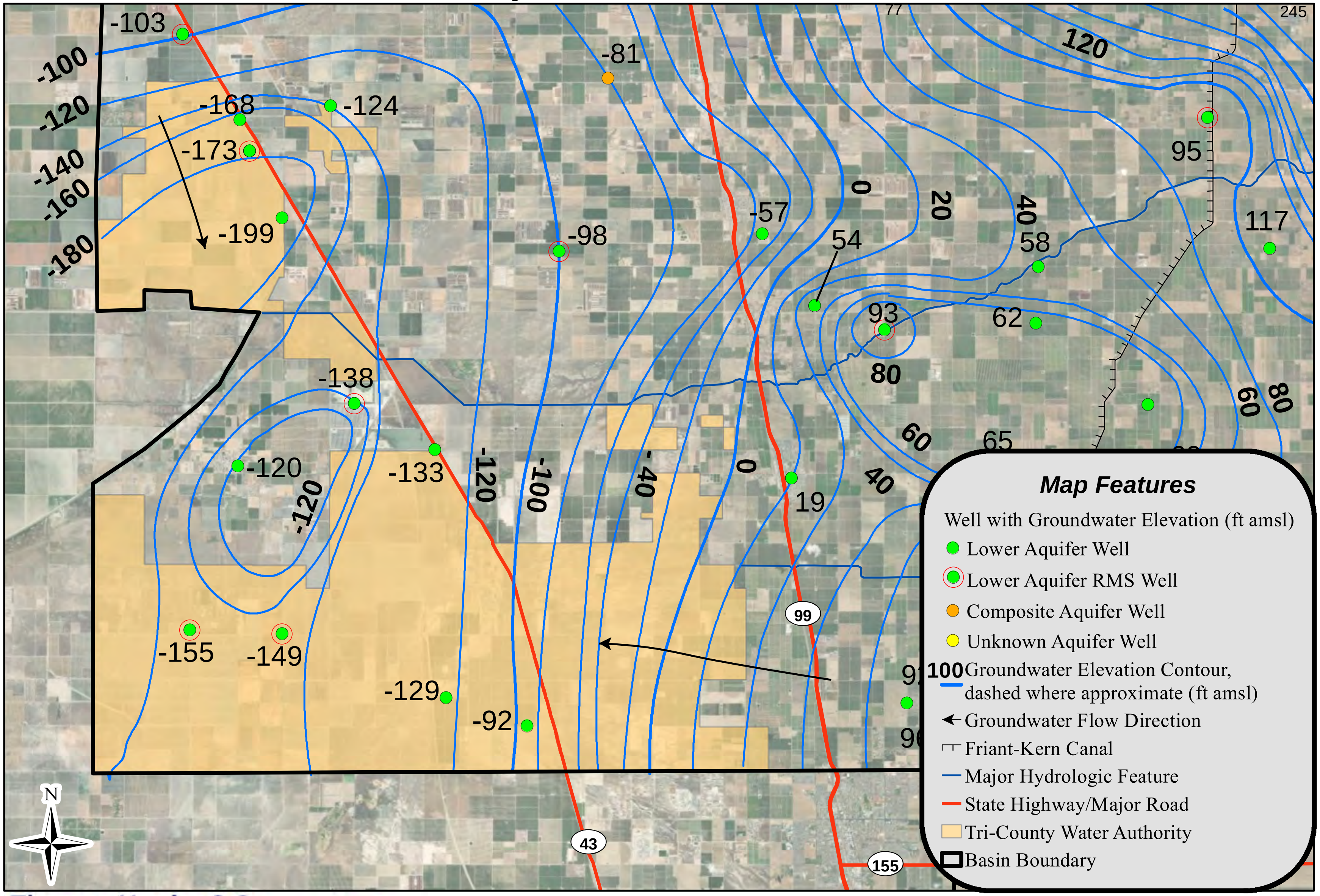
Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 9

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

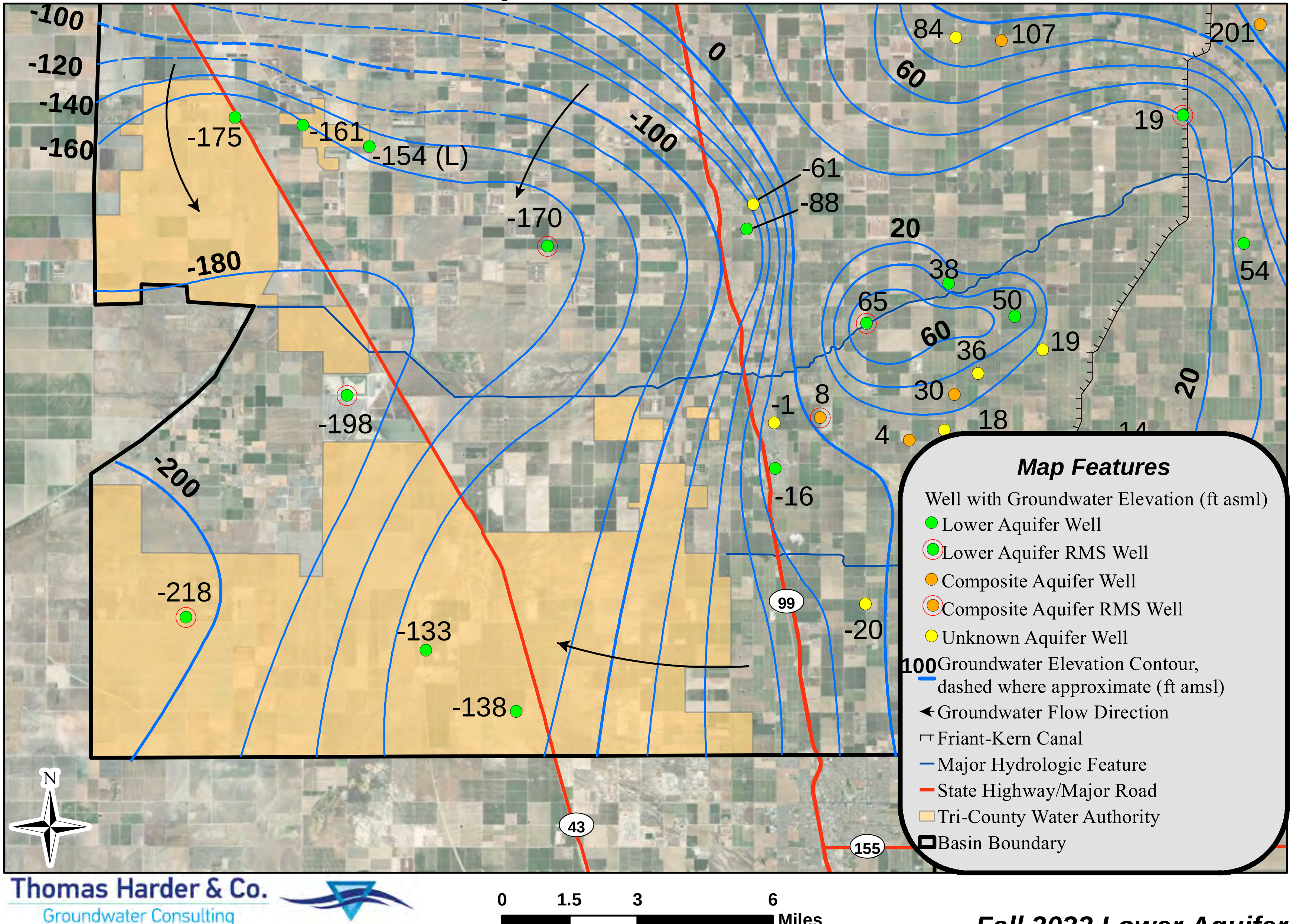
0 1.5 3 6 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 10

Tule Subbasin Technical Advisory Committee

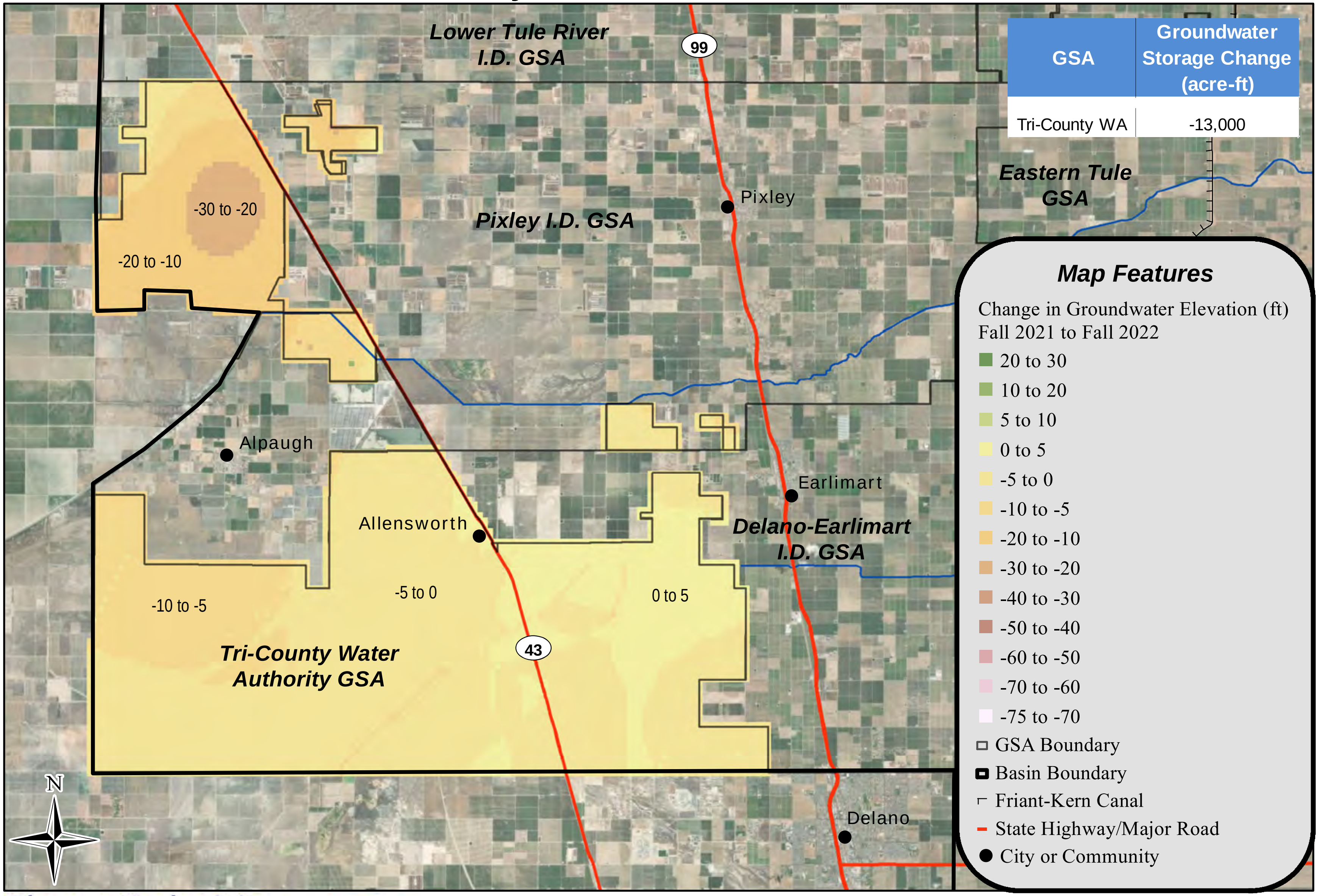
2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
Tri-County Water Authority GSA
Appendix E
Figure 11

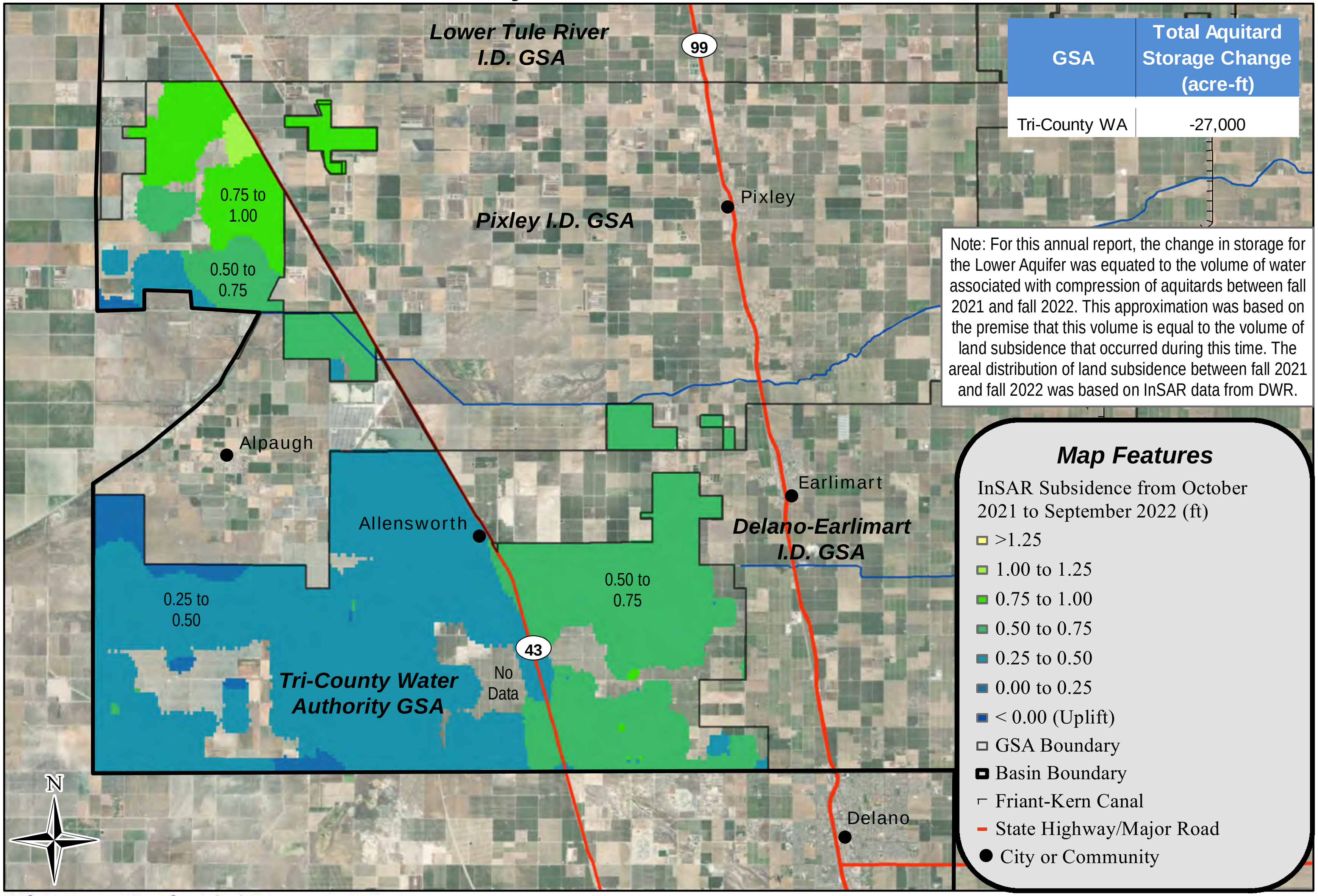


Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

Change in Groundwater Elevation
Fall 2021 to Fall 2022 - Upper Aquifer
Tri-County Water Authority GSA

Appendix E
Figure 12



GSA	Total Aquitard Storage Change (acre-ft)
Tri-County WA	-27,000

Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

Change in Lower Aquifer Storage as Estimated from Land Subsidence - Fall 2021 to Fall 2022
Tri-County Water Authority GSA

Appendix E
Figure 13

Appendix F

Alpaugh Irrigation District GSA
2021/22 Annual Data

Alpaugh Irrigation District GSA
Groundwater Extraction for Water Year 2021/22

GSA	Management Area	Agricultural Pumping	Municipal Pumping	Pumping for Export	Total
Alpaugh ID GSA	***Total***	***17,000***	***250***	***0***	***17,250***

Alpaugh Irrigation District GSA
Surface Water Supplies for Water Year 2021/22

GSA	Management Area	Stream Diversions	Imported Water	Recycled Water	Oilfield Produced Water	Precipitation	Total
Alpaugh ID GSA	***Total***	***0***	***0***	***0***	***0***	***5,900***	***5,900***

Alpaugh Irrigation District GSA
Tule Subbasin Total Water Use for Water Year 2021/22

GSA	Management Area	Groundwater Extraction	Surface Water Supplies	Total
Alpaugh ID GSA	***Total***	***17,250***	***5,900***	***23,150***

Alpaugh Irrigation District GSA
Land Surface Elevations at Representative Monitoring Sites

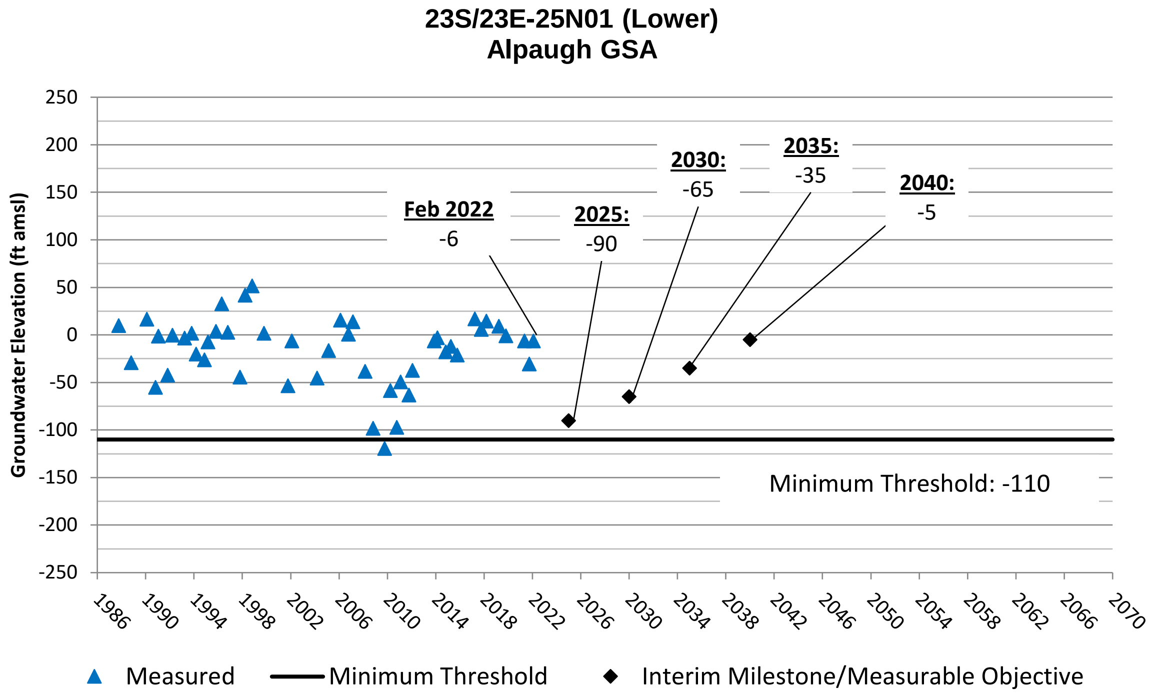
Site	Land Surface Elevation (ft amsl)[1]			
	2020 (Baseline)	2022	Measurable Objective	Minimum Threshold
A0013_B_RMS	196.8	195.8	189.6	187.9
A0017_B_RMS	204.4	203.8	199.1	198.0
A0018_B_RMS	196.1	195.8	192.2	191.2
A0019_B_RMS	192.3	191.4	186.9	185.9
A0020_B_RMS	195.1	190.6	189.5	188.5

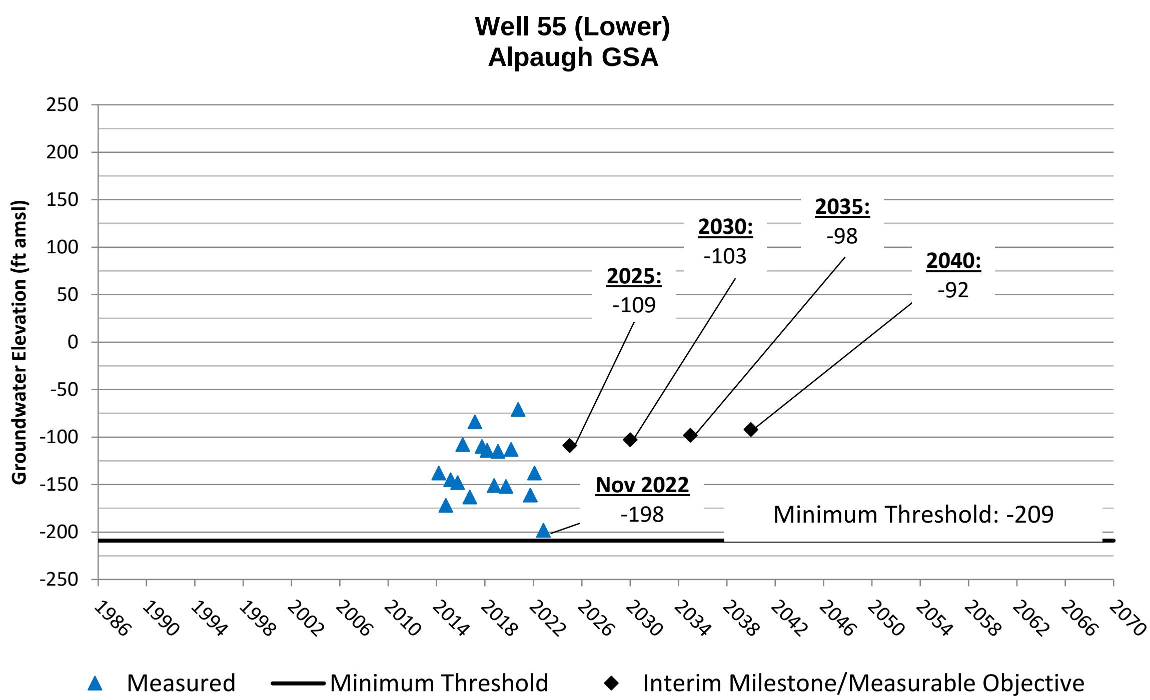
Notes:

N/A = Not available

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

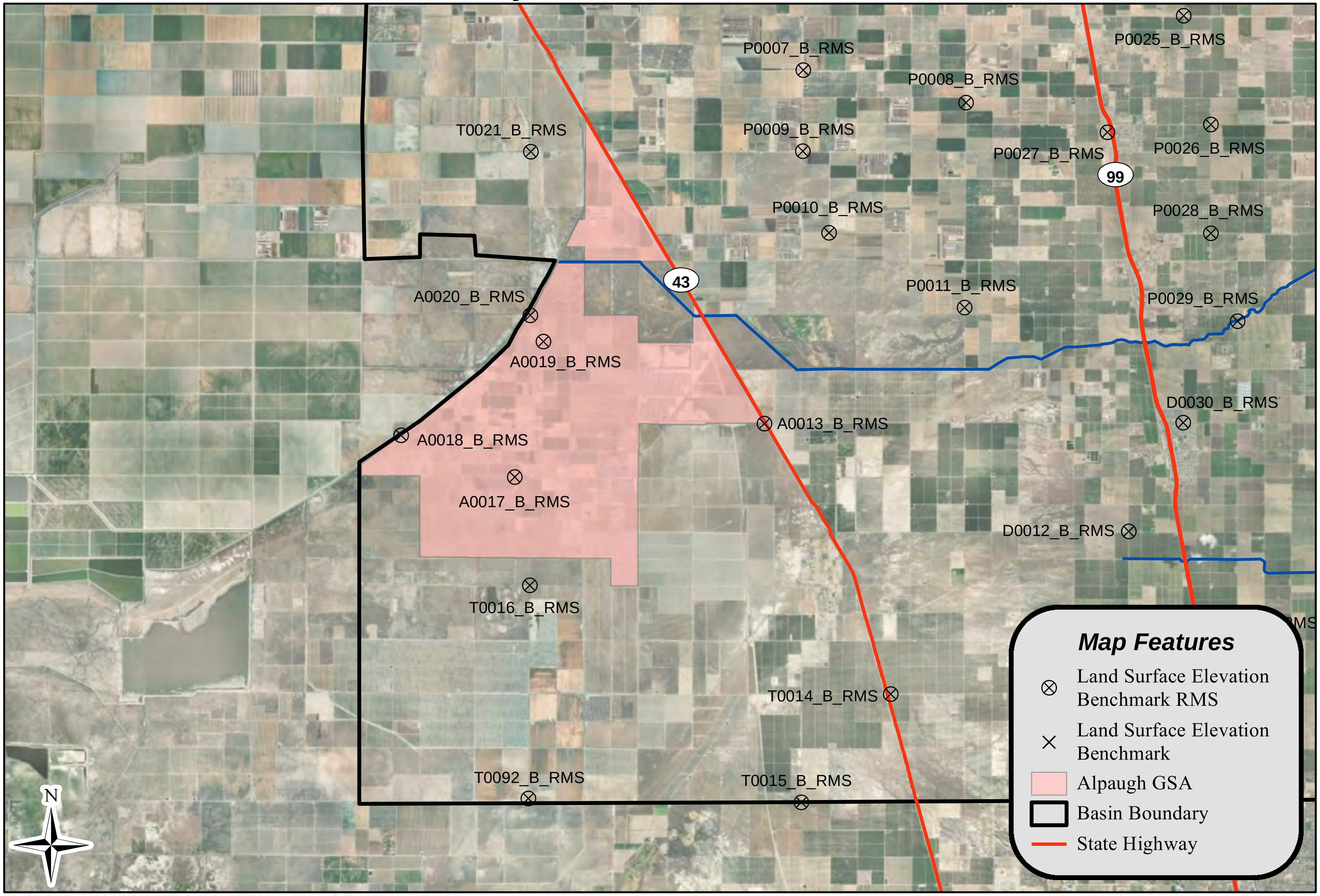
Alpaugh Irrigation District GSA
RMS Groundwater Elevation Hydrographs





Tule Subbasin Technical Advisory Committee

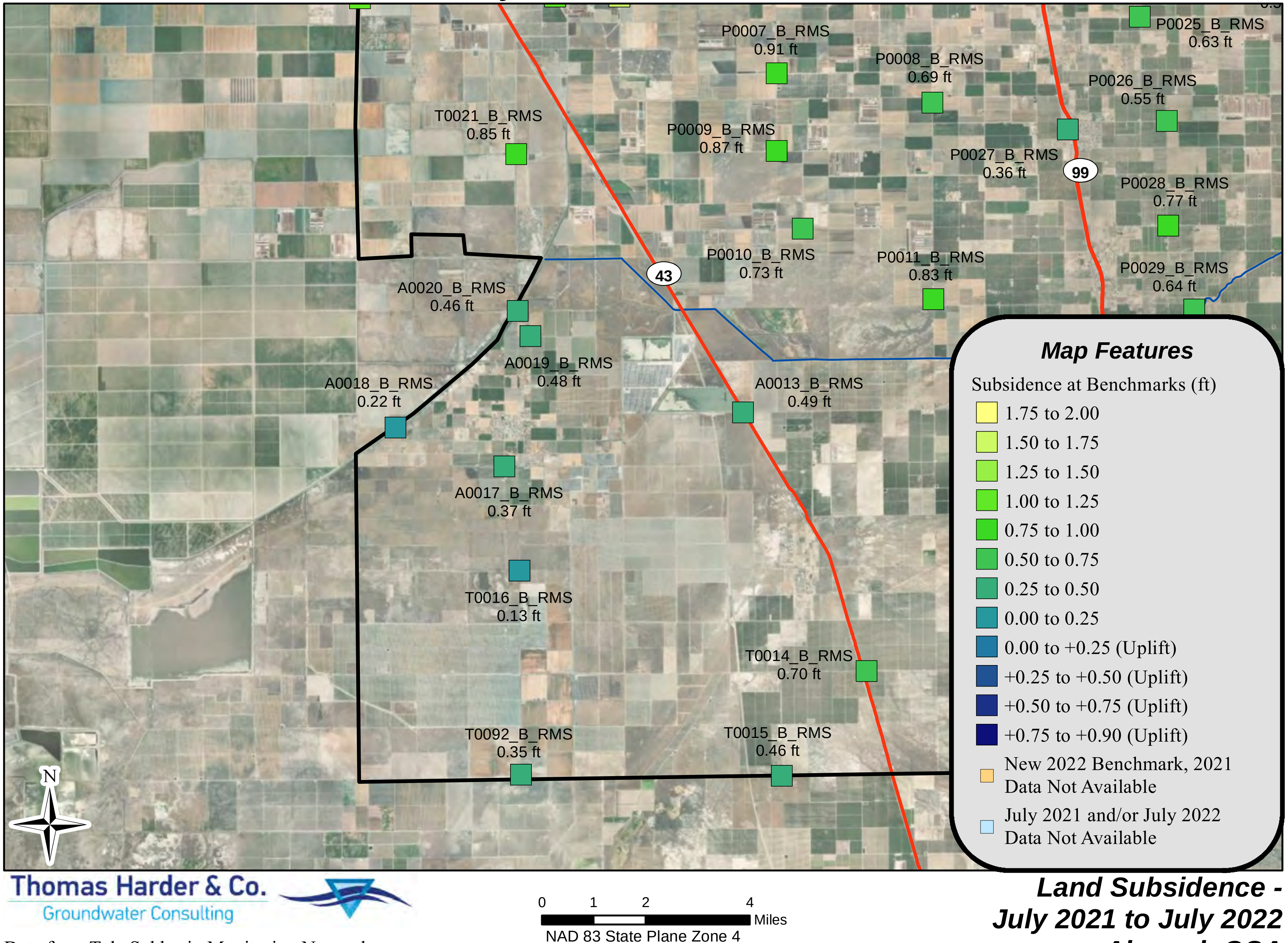
2021/2022 Annual Report
March 2023



Thomas Harder & Co.
Groundwater Consulting

Land Surface Elevation Monitoring Network
Alpaugh GSA

Appendix F
Figure 2



Thomas Harder & Co.
Groundwater Consulting

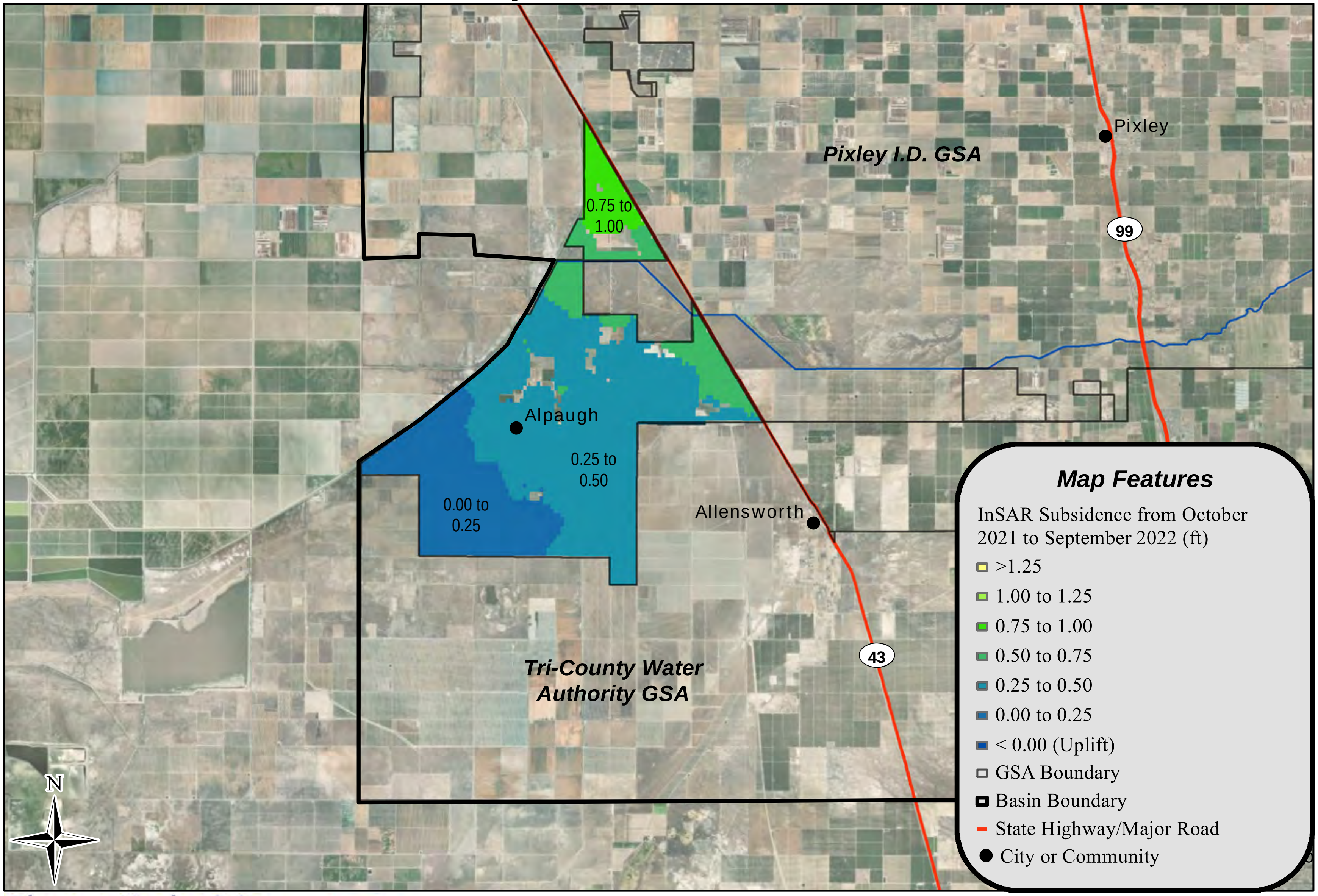
Data from Tule Subbasin Monitoring Network. August 2022 data was used if July 2022 data was not available.

Land Subsidence - July 2021 to July 2022 Alpaugh GSA

Appendix F
Figure 3

Tule Subbasin Technical Advisory Committee

2021/2022 Annual Report
March 2023



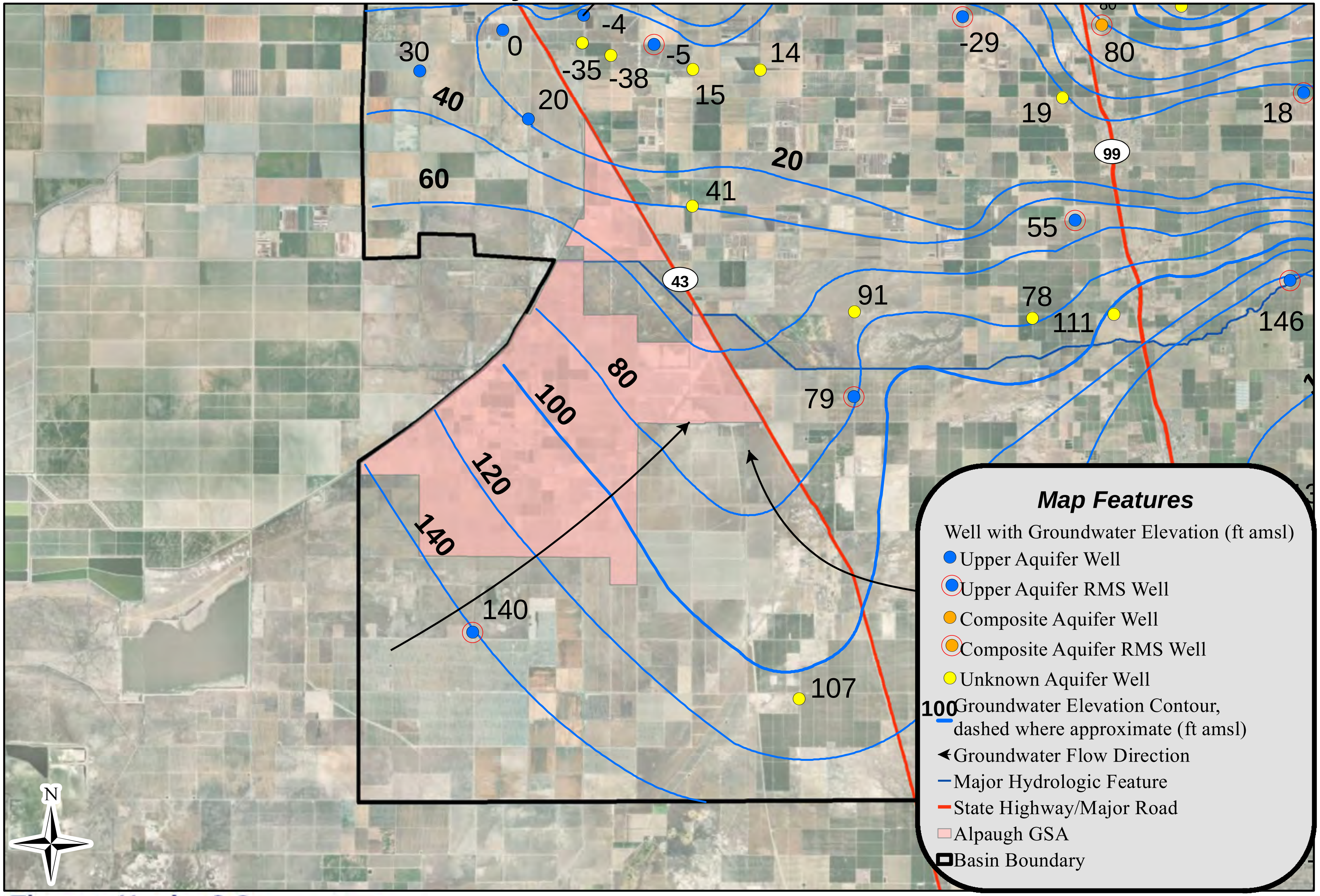
Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

Land Subsidence - October 2021 - September 2022 Alpaugh I.D. GSA
Appendix F
Figure 4

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

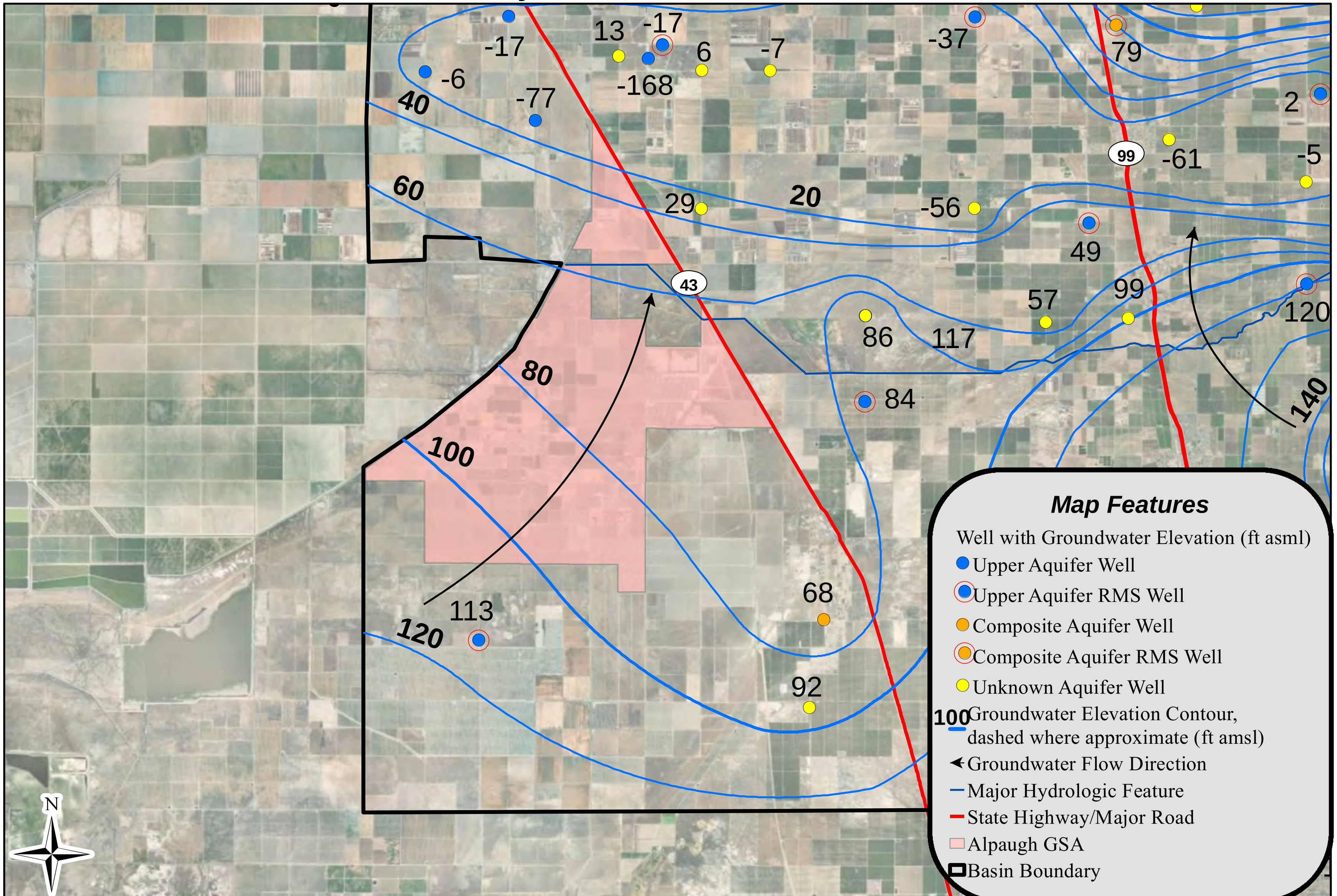
Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 5

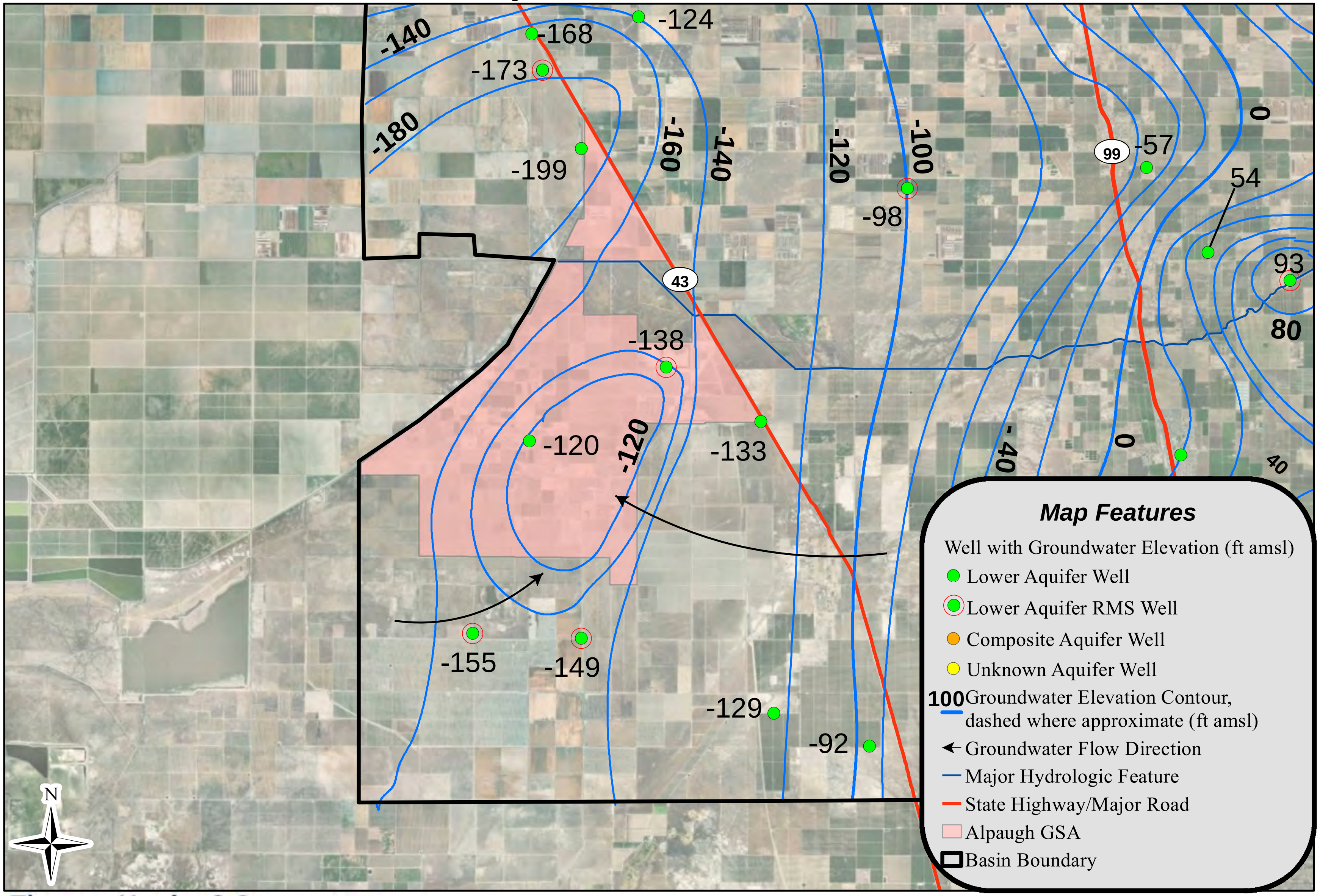


Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 6



Thomas Harder & Co.
Groundwater Consulting

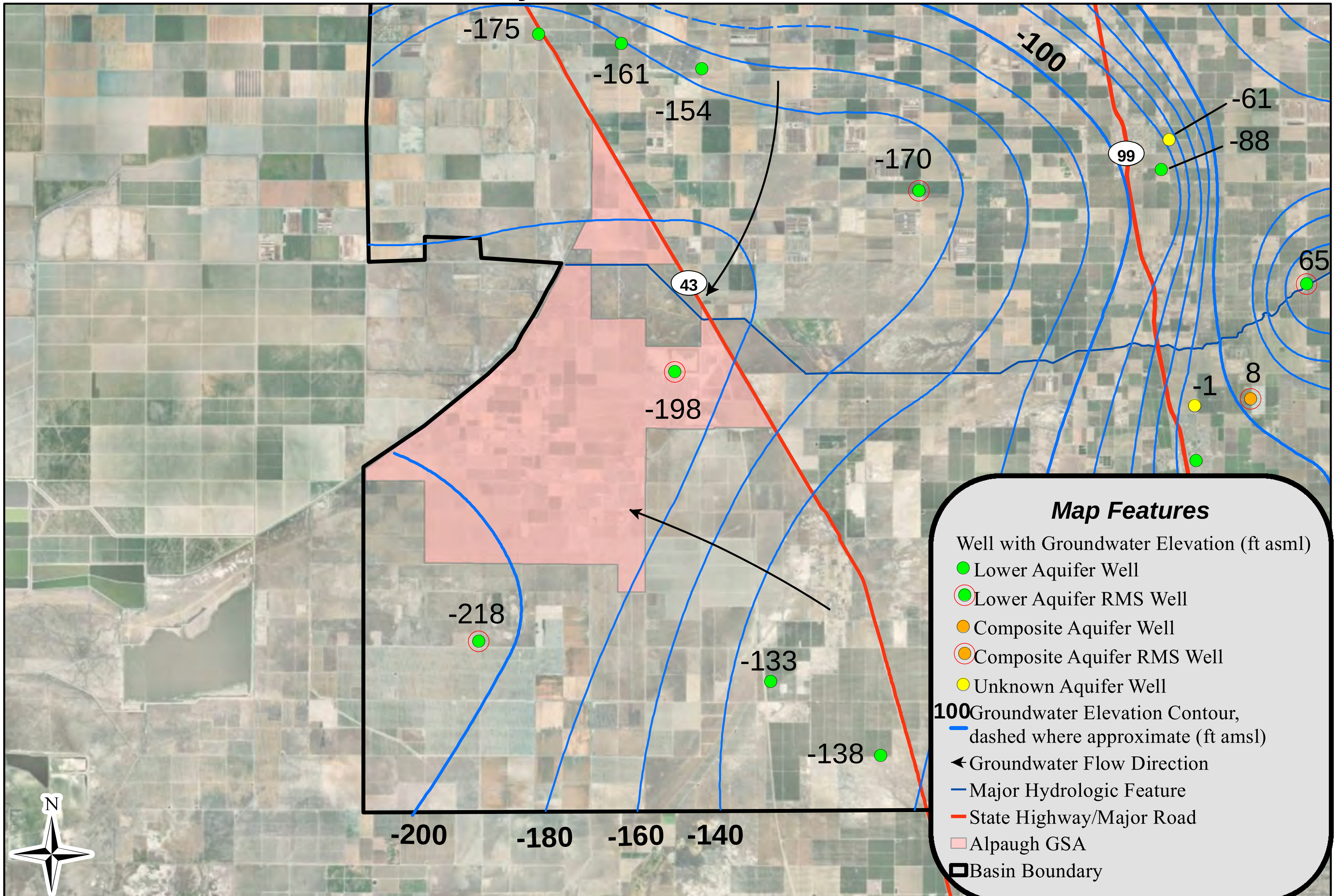
0 1 2 4 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 7

2021/2022 Annual Report
March 2023

Tule Subbasin Technical Advisory Committee



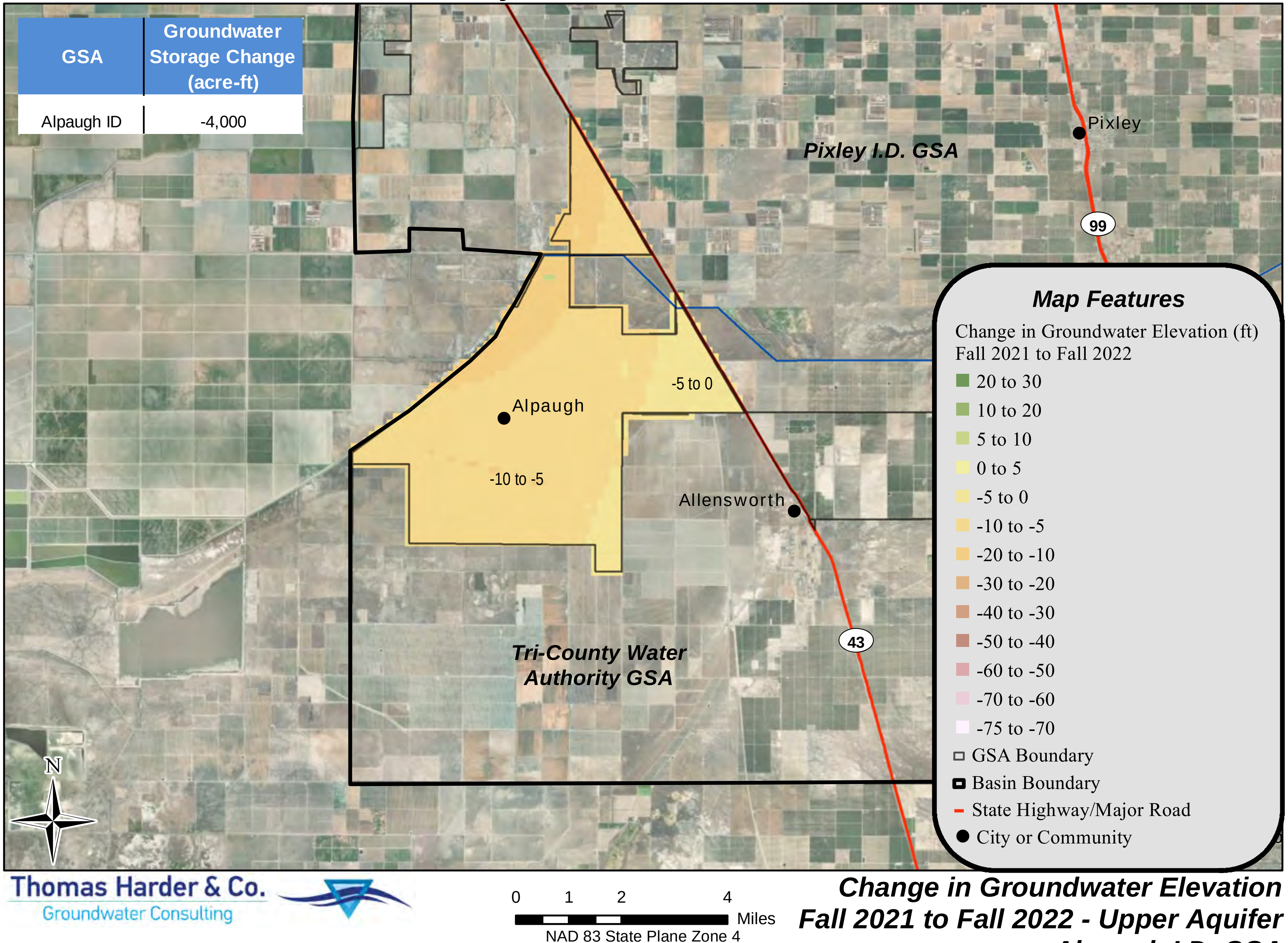
Thomas Harder & Co.
Groundwater Consulting

0 1 2 4 Miles
NAD 83 State Plane Zone 4

All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer
Alpaugh I.D. GSA
Appendix F
Figure 8

GSA	Groundwater Storage Change (acre-ft)
Alpaugh ID	-4,000

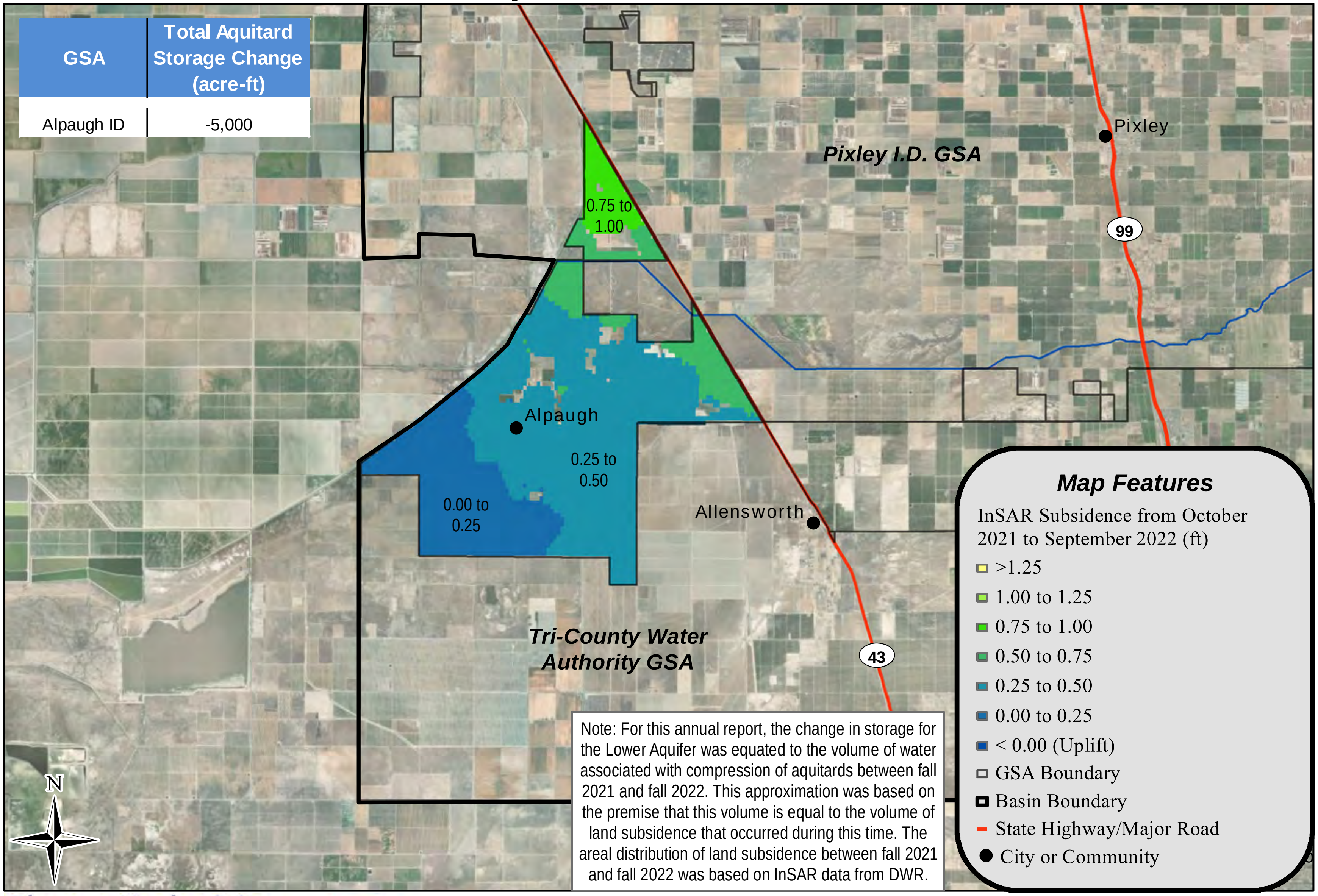


Thomas Harder & Co.
Groundwater Consulting

Change in Groundwater Elevation
Fall 2021 to Fall 2022 - Upper Aquifer
Alpaugh I.D. GSA

Appendix F
Figure 9

GSA	Total Aquitard Storage Change (acre-ft)
Alpaugh ID	-5,000



Note: For this annual report, the change in storage for the Lower Aquifer was equated to the volume of water associated with compression of aquitards between fall 2021 and fall 2022. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The areal distribution of land subsidence between fall 2021 and fall 2022 was based on InSAR data from DWR.

Thomas Harder & Co.
Groundwater Consulting

Change in Lower Aquifer Storage as Estimated from Land Subsidence - Fall 2021 to Fall 2022
Alpaugh I.D. GSA

Appendix F
Figure 10

InSAR data from:
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20211001/ImageServer
and
https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_Total_Since_20150613_20221001/ImageServer

ATTACHMENT 2 - LTRID GSA RULES AND OPERATING POLICIES

Lower Tule River 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 as described in more detail below:

Calculate Groundwater Consumed using Evapotranspiration

To calculate the amount of groundwater consumed by the crop, the following equation is applied:

1. Total Applied Surface Water is supplied and metered by the Irrigation District.
2. Total Crop Demand (Evapotranspiration or ET) is calculated by a third party, using NASA LandSat satellite imagery.
    a. Consumption, based on the ET calculations will first be reduced by surface water deliveries, then accounted for in the following sequencing:
        i. Precipitation Yield
        ii. Sustainable Yield credits
        iii. District allocated groundwater credits
        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.

    b. If surface water applied is more than ET, the landowner will receive a credit for over application of surface water according to the following schedule:

    Over Application of Surface Water for Irrigation Purposes

i. The credit calculated using this equation will be tracked and will increase the landowner groundwater account managed by the GSA. For every acre-foot of over applied surface water,

   90% credit goes to the landowner account, 10% to the GSA.

ii. For all groundwater credits issued to the landowners from over application of irrigation water, the credits 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 policy.

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.

Lower Tule River 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 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 districts 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 periods where surplus surface waters are available, landowners within the GSA can divert surface water into landowner owned designated recharge facilities for future groundwater credits. Surface water for banking can be:

1. Water the landowner purchases from the irrigation District through regular surface water purchase procedures.
2. Water rights water available to the landowner. E.g. Poplar Ditch share water
3. 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 this occurs, 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 also use District owned recharge facilities to generate groundwater credits subject to the following criteria:
    - The landowner provides water from available allocation, purchase or water rights
    - Use of the District recharge facility is subject to available capacity as determined by the District
    - Groundwater credits will be credited to the landowner account at 75% of the surface water diverted. The remaining 25% credit will remain with the GSA for the benefit of all the landowners.

Lower Tule River 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. Based on water diverted for recharge by the District, along with canal seepage losses in District canals. 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 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;
    1. 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.
    2. 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.
    3. 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.
    4. 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.
    5. 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.

- o The maximum amount of groundwater transfers accepted into the District per year will be limited to 10,000 AF.
- o The annual Deadline to submit transfer requests is May 1 of each year.
- o 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 into 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.

Lower Tule River 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. Surface water allocation
    ii. Precipitation yield credits
    iii. Sustainable yield groundwater credits
    iv. District allocated groundwater credits
    v. Transitional water credits**
    vi. 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.
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 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
    - Monitoring impacts and effects of groundwater pumping.
    - Other projects that may be identified by the GSA. (examples could include water conservation grants to GSA members, land conservation and set-aside programs, or any other projects the GSA deems appropriate to help meet the sustainability goal).

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.

Lower Tule River 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 ofDirectors.

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.

Lower Tule River Irrigation District Groundwater Sustainability Agency

DISTRICT ALLOCATED GROUNDWATER CREDITS

The Irrigation District (District) owns and operates existing recharge basins. These basins, along with the open channel canal distribution systems, provide for both direct and indirect groundwater recharge. During times when surface water supplies beyond the irrigation needs of the landowners are available, the District uses the basins to divert the surface water for groundwater recharge. This happens most often in wetter years and comes in the form of Class Two under the Friant Contracts and flood releases from Lake Success. Recharge through channel loss in the distribution system occurs at all times when water is in the canals. These District owned facilities create additional opportunities for establishing groundwater credits beyond the Safe Yield of the Tule Subbasin.

Any groundwater credits developed through recharge basins and through loss in the distribution system remains with the District and 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.

District Owned Land Based Groundwater Recharge Credits:

The lands owned through fee title by the irrigation district are allocated a sub basin wide Sustainable Yield. The Sustainable Yield allocated to District owned lands by virtue of being in the Tule Subbasin, may be re-allocated back to the District Landowners proportionate to the landowner's assessed acreage in the GSA.

Surface Water Recharge Groundwater Credits:

The imported surface water that is diverted for recharge by the District into District owned facilities (both recharge basins and canals) will be tracked and accounted as groundwater credits belonging to the District. The District will allocate these credits to lands within the GSA in the following manner:

- Up to 90% of the water diverted into the District groundwater recharge basins, and water accounted for as channel loss in the canals, will be available for allocation. The remaining 10% of the recharge water will not be allocated to landowners in the District as it is used to account for evaporation and other losses. Adjustments to the percent of recharge water allocated as groundwater credits may occur based on groundwater monitoring, avoiding undesirable results, and to help avoid minimum thresholds.
- The District will allocate the groundwater recharge credits proportionally to all landowners within the District by assessed acres. All District landowners pay an equal land based assessment and each landowner will be provided an equal groundwater credit based upon gross acreage owned within the District and irrespective of any

access to surface water that landowners may have through water rights, riparian water or any other surface water.

- The transfer or sale of the District groundwater recharge credits within the GSA will be permitted in accordance with Policy 3.

Lower Tule River 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 LTRID GSA boundary are the following CSDs and PUDs ("Community):

- Tipton CSD
- Woodville PUD
- Poplar CSD

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

Consistent with Section 6 of the MOU,_LTRID will identify the Community as a separate management area. As its own management area, LTRID 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 LTRID 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 LTRID 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 LTRID GSA for calculation and use in total LTRID GSA water balance.

- If the Community is providing any treated discharge to adjacent lands, the Community shall provide a regular accounting to the LTRID 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.

Lower Tule River 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 implementation is 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.

ATTACHMENT 3 – UPDATED SUSTAINABLE MANAGEMENT CRITERIA

TECHNICAL MEMORANDUM

To: LTRID GSA

From: Don Tucker – 4Creeks, Inc.

Date: March 29, 2023

Re: Updated Sustainable Management Criteria – Calculation and Methodology

Due to the nature of the well monitoring network and the variables involved, the Tule Subbasin Groundwater Sustainability Agencies (GSAs) recognize the importance of refining data analyses and the systems used to evaluate current conditions. Through the implementation of the Groundwater Sustainability Plans (GSPs) there have been several instances that require either the first-time establishment of sustainable management criteria (SMC) or the re-establishment of SMCs at Representative Monitoring Sites (RMS). This memo describes the types of scenarios that have been experienced in the three first years of GSP implementation that have required additional evaluations of the groundwater level SMCs and the process used to update them.

Generally, the following two circumstances have resulted in re-evaluation of groundwater level SMCs:

1. **New RMS**: Establishing SMC is one of the necessary components of adding new RMS to the groundwater monitoring network. Adding wells to the network is consistent with Section 4.1 of the Tule Subbasin 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."*
2. **RMS Re-evaluation:** - Re-evaluation of existing RMS SMCs occurs when the well was part of the initial monitoring network, but the SMCs established were influenced by erroneous data, an incorrect well was measured, construction information about the well was not known, or an unstable measurement was recorded when using an acoustic sounder. For these reasons, SMCs were re-calculated after analyzing the consistency of historical data.

Model outputs were generated by Thomas Harder & Co. in February 2023 using the 2020 Groundwater Flow Model and additional data from three years of monitoring activities (see TH&Co's Groundwater Flow Model Update for background regarding the process used to generate models at each of the wells in the network).

The following outlines the steps taken to update interim milestones, measurable objectives, and minimum thresholds at each of the representative monitoring site (RMS) wells:

Initial Set-Up

Step 1: Identify RMS Well and graph historical data (if available)

Set Interim Milestones/Measurable Objectives

Step 1: Add Updated Projected elevation to Groundwater from Groundwater Flow Model. Adjust starting point of the Flow Model Projections the **most recent or 2020** groundwater elevation measurement.

- For new RMS wells, the most recent groundwater elevation measurement was used as the starting point for adjusting the model projections and establishing SMCs.

For re-evaluated wells, the 2020 groundwater elevation measurement was used as the starting point for adjusting the model projections and establishing SMCs.

Step 2: Identify numerical elevation of groundwater every 5 years (interim milestones) and in 2040 (measurable objective) based on the adjusted Groundwater Flow Model projected elevations at this location. All numerical elevations will be based on spring (February – March) measurement readings.

Set Minimum Threshold

Several methods were used to establish minimum thresholds. The method that was used has been identified at each RMS:

- Historical Drought Slope - in scenarios where historical data was available, data points from January 2007 to December 2016 were plotted and linearly trended using Microsoft Excel. The slope value was then multiplied by 120 (number of months in period of interest). The calculated value was added to the 2030 Interim Milestone to set the minimum threshold. This provides operational flexibility if a 10-year drought period begins in 2030, during plan implementation.
- Modeled Drought Slope – in scenarios where historical data was not available, data points from the model from January 2007 to December 2016 were plotted and linearly trended using Microsoft Excel. The slope value was then multiplied by 120 (number of months in period of interest). The calculated value was added to the 2030 Interim Milestone to set the minimum threshold. This provides operational flexibility if a 10-year drought period begins in 2030, during plan implementation.
- Historical/Adjusted Model Drought Slope - in scenarios where historical data was partially available during the drought period, a combination of historical data and an adjusted model was used to calculate the minimum threshold in the same manner as outlined in the two previous scenarios.
- Modeled Groundwater Elevation – if historical data was not available and the modeled drought slope was negligent, the drop in groundwater elevation during the modeled drought period was used. This drop was then applied to the 2030 Interim Milestone to set the Minimum Threshold. This provides operational flexibility if a 10-year drought period begins in 2030, during plan implementation.

The table below lists the wells that have updated Sustainable Management Criteria and the reason(s) for the update.

RMS Well ID	Type of Change (New/Revised)	Description of reasoning
LTRID TSS L	New	New RMS
LTRID TSS M	New	New RMS
LTRID TSS U	New	New RMS
20S26E32	Revised	Revised to use adjusted model
21S26E34	Revised	Revised to use groundwater elevation to generate SMC
21S23E32K001M	Revised	Used updated model output
22S24E01Q001M	Revised	Revised to correct adjusted model
21S25E36	Revised	Revised to use adjusted model
22S223E08	Revised	Used updated model output
21S24E35A001M	Revised	Used updated model output
21S26E32B002M	Revised	Used updated model output
21S23E30J001M	Revised	Abandoned well; inconsistent measurements

Sincerely,

Don Tucker, 4Creeks

ATTACHMENT 4 – LTRID GSA DOMESTIC WELL PROTECTION PROJECTS AND MANAGEMENT ACTIONS

Lower Tule River Irrigation District Groundwater Sustainability Agency
Pixley Irrigation District Groundwater Sustainability Agency
Groundwater Sustainability Plan Impact Mitigation Plan

1.0 INTRODUCTION – Establishment of Groundwater Well Mitigation Program.

Sustainable management criteria identified in each of the Tule Subbasin Groundwater Sustainability Agencies' (GSAs) Groundwater Sustainability Plans (GSPs) have been developed to address significant and unreasonable impacts to agricultural, municipal, and industrial beneficial uses of groundwater. However, analysis based on available data suggest that numerous shallow domestic wells and potentially other wells may be impacted during the Sustainable Groundwater Management Act (SGMA) GSP implementation period between 2020 and 2040 as a result of continued lowering of groundwater levels during this period. Wells, land use, property, and infrastructure may also be impacted from land subsidence and changes in groundwater quality during this period.

The Subbasin has been in overdraft for many years resulting in a significant lowering of regional and local groundwater levels. The GSPs are designed for the Subbasin to reach sustainability by 2040 and beyond. However, until sustainability is reached, some level of continued groundwater level decline and land subsidence is expected in areas of the Subbasin while the GSAs are in the process of implementing projects and management actions to achieve sustainability by 2040. The purpose of the GSAs' Mitigation Programs is to mitigate those wells, critical infrastructure, and land uses that are adversely affected by declining groundwater levels, land subsidence, and changes to groundwater quality while the GSAs reach sustainability.

As part of revisions to the Tule Subbasin Groundwater Sustainability Plans (GSPs) and Coordination Agreement approved by the Groundwater Sustainability Agencies (GSAs) within the Tule Subbasin, the GSAs each agreed to develop mitigation plans to address significant and unreasonable impacts to beneficial uses of groundwater during the sustainability transition period between 2020 and 2040. The revised Tule Subbasin Coordination Agreement submitted in July 2022 included a Mitigation Program Framework as Attachment 7, which outlined the general standards that each GSA would commit to in developing their respective Mitigation Programs. The GSAs further committed to completing the mitigation claims process for domestic and municipal wells by December 31, 2022 and all other aspects of the Mitigation Programs by June 30, 2023. The Mitigation Framework is attached to this policy as Attachment 1.

1.1 Purpose and Scope

Thomas Harder and Company prepared a Technical Memorandum, attached as Attachment 2, to provide the minimum technical requirements for use by each Tule Subbasin GSA to address claims of impact from lowered groundwater levels associated with GSP-/GSA-approved or authorized activities. In consideration of the technical information provided therein, and in accordance with the Mitigation Framework in the Coordination Agreement, each GSA Mitigation Program will identify the specific criteria and processes for mitigating claims of impact caused by pumping within their respective GSA boundaries. The purpose of this policy is to establish a Mitigation Program for the Lower Tule River Irrigation District GSA and Pixley Irrigation District GSA consistent with the Mitigation Framework (Attachment 1) and the Harder Technical Memorandum (Attachment 2).

2.0 GROUNDWATER WELL LEVEL IMPACT – MITIGATION CLAIM PROCESS

The Mitigation Program allows for domestic, industrial, municipal, and certain agricultural well owners adversely affected by groundwater level impacts to file a claim with the GSA in which the well is located. The process for receiving and investigating claims of groundwater level impact is set forth in sections 2.1 through 2. Is shown in Attachment 3, Groundwater Level Impact Claim Process – Investigation Phase. For groundwater levels, an "impact" is defined as the inability of a well owner to pump groundwater of sufficient quantity to meet their water supply needs due to lowered groundwater levels resulting from Tule Subbasin GSP-/GSA-approved or authorized activities. The impact must be realized after January 2015. Responsibilities of the claimant are shown in green, and responsibilities of the GSA are shown in blue in Attachment 3. Decision points are shown in orange.

All claims will be investigated and evaluated within 45 days of receipt of the claim.

2.1 Filing a Claim

The claim process starts with the affected party ("Claimant") filing a claim with the GSA in which the party's well is located, or in which the Claimant asserts the activity was the cause of the Claimant's impacts. The claim will be filed using a form like that provided in Attachment 5 -Impact Claim Form.

- Claim forms will only be accepted for claim impacts occurring after January 1, 2023
- Claims can only be filed by the owner of the well
- Claim forms will only be accepted on wells that were in existence and actively in service as of December 31, 2022.
- Wells older than 25 years (per IRS depreciation schedules) will not be eligible for mitigation

To process a claim, the Claimant must provide some basic information on the Impact Claim Form to enable further investigation of the claim, including:

a) The Claimant's name and contact information,
b) The type and location of the well,
c) Request for interim water supply,
d) Well construction information
e) Pump information
f) description of the issue with the well, and
g) The applicant's signature.

The filing of a claim will require that the Claimant provide access to the well to verify the claim. In signing the impact claim form, the Claimant agrees to release all data associated with the well and provide access to the well for inspection by a GSA technical representative. Denial of access to the well for inspection by the GSA will result in denial of the claim.

2.2 Impact Assessment

2.2.1. Technical Review and Verification of Claimant-Provided Data

A GSA technical representative will review all available information provided by the Claimant for the affected well prior to inspection in the field. Data to be reviewed will include, but not limited to:

a) The CDWR driller's log,
b) Information on date the well was constructed,
c) Well construction information (casing diameter, casing depth, perforation interval), Available downhole video surveys,
d) Historical groundwater levels,
e) Pump type and intake depth,
f) Motor size,
g) Pump age,
h) Typical discharge rate,
i) Last pump test date,
j) Last service date,
k) Last static and pumping groundwater levels, and
l) Information on the nature of the problem.

Based on a review of the available data provided by the Claimant, the GSA will determine whether the claim can be verified based on the data.

Completeness of the dataset relative to the requested information will be reviewed for the following criteria, reliability of the data provided, the nature and status of the issue, and evidence of well impact due to GSP-/GSA-approved or authorized activities, as opposed to impact from other sources.

If the completeness of the data supporting the claim can be verified based on available information, then the GSA technical representative will assess the claim pursuant to section 2.3.1, 2.3.2, or 2.3.3. If not, a GSA technical representative will need to inspect the well and collect supplemental information. The types of information to be collected will depend on the data available from the Claimant. Determination of the extent of additional data collection necessary to verify the claim will be at the sole discretion of the GSA.
In general, the minimum data to be collected in the field will include:

- Well name
- Pump size (horsepower)
- Casing type and diameter
- Static groundwater level
- Discharge rate
- Pumping groundwater level

The owner or owner's representative authorized to operate the pump will be asked to be onsite at the time of inspection to operate the pump. The GSA technical representative will record observations from the inspection. If a driller's log or other information is not available to confirm the total depth and condition of the well and if the pump intake depth cannot be confirmed from available information, it may be necessary to have the pump removed from the well and conduct a downhole video survey. Removing the pump will enable the GSA technical representative to measure the column pipe and thus confirm the pump intake depth and inspect the condition of the pump. The video log will enable inspection of the condition of the casing and perforations and confirm the perforation interval, total depth, and static groundwater level of the well. Upon completion of the investigation, the contractor will be required to reinstall the pump and reestablish all connections. If the pump was operating prior to removal, the contractor will be required to demonstrate that the pump is functioning properly after reinstallation. A sounding port or flow meter may also be installed to collect pumping water level data or discharge rate data, respectively. The GSA will fund the contractor to remove the pump and conduct the video survey. If the claim is ultimately denied, the claimant will reimburse the GSA. The GSA require the well owner to sign a release of liability for any damage to the pump, pump column, or well resulting from removal of the pump and conducting the video log.

2.2.2 Evaluations of Claims of Groundwater Level Impacts

Based on the analysis of data for the impacted well, the GSA technical representative will provide a recommendation to the Groundwater Planning Commision whether the well qualifies for mitigation. In making the recommendation, the GSA technical representative will consider primarily that the foundational premise of the Mitigation Program, as it relates to groundwater levels, is to address impacts to domestic, municipal, industrial, and agricultural wells from GSP-/GSA-approved or authorized activities. As SGMA does not require the GSAs to address impacts prior to January 2015, only impacts associated with groundwater level declines after this time will be considered.

The graphic in Attachment 4 provides a basis for evaluating claims based on the data provided by the Claimant or collected by the GSA. As shown, Examples 1 and 2 illustrate groundwater level impacts that would qualify for mitigation. Example 1 is a case where the static groundwater level is below the 2015 groundwater level and the pumping groundwater level, at the historical discharge rate, is within 10 feet of the bottom of the well. In Example 2, the static groundwater level is measured below the 2015 groundwater level and the pumping groundwater level, at the historical discharge rate, has dropped to within 20 feet of the pump intake. In both cases, the lowered groundwater levels can be attributed to transitional pumping overdraft and there is no option to restore the water supply without mitigation. The evaluation should consider whether there is adequate separation between the pump intake and the bottom of the well (e.g., 10 feet) and whether there is adequate pump submergence (e.g., 20 feet).

Examples 3 through 6 on Figure 2 illustrate cases where the well impact is not associated with lowered groundwater levels from GSP-/GSA-approved or authorized activities. In these cases:

- The pumping groundwater level would have already been below the bottom of the well before January 2015 (Example 3),
- The pumping groundwater level would have already been below the bottom of the pump intake before January 2015 (Example 4),
- The static groundwater level would have been below the pump intake prior to January 2015 (Example 5),
- The pump is not functioning for reasons other than groundwater level decline (e.g. mechanical failure) (Example 6).

In many cases, it is anticipated that a static groundwater level measured in the impacted well from January 2015 will not be available. For those cases, the reference January 2015 static groundwater level will be inferred from a groundwater level contour map generated based on available data from other wells measured at that time. Separate groundwater contour maps will be generated for the Upper and Lower Aquifers. The reference static groundwater level will be assigned from the contour map of the aquifer in which the well is predominantly perforated.

There are other factors, independent of lowered groundwater levels, that can cause a well to stop functioning, such as pump mechanical failure due to age or malfunction, holes in the well casing allowing sand into the pump intake, holes in the pump column associated with corrosion and wear, excessive plugging of screens due to lack of maintenance (e.g. well rehabilitation), and others. All these factors will need to be taken into consideration when assessing the need for mitigation.

Other factors to be considered when evaluating a claim will include, but are not limited to:

- If the Claimant is asserting an impact to an agricultural well, and the Claimant has been utilizing groundwater under a transitional pumping allocation, or otherwise contributing to transitional overdraft, the GSA will reject the claim. This includes claims where a well is being used for both domestic use and irrigation.

If the relative contribution to the problem by the claimant, or by neighboring property owner actions or other overdraft results are not attributable to the GSP, the claim is not eligible for mitigation. If the problem is being caused by specific neighboring well issues, a claimant may be able to pursue corrections through the civil court process and will be so advised.

If the GSA Technical Representative recommends that the impact is eligible for mitigation, a specific mitigation measure as described in Section 3 will be considered for recommendation.

2.23 GSA Consideration of Technical Representative Recommendation

The Technical Representative Recommendation will be submitted to Groundwater Planning Commission (GPC). The GPC is delegated authority by the GSA Governing Body to determine whether to accept claims, and to determine mitigation measures. Claimant has right to appeal GPC decisions to the GSA Governing Body.

Decisions by the GPC or the GSA governing body to accept a mitigation claim is not an acceptance of liability and shall not be a legal determination of any parties' rights. The Mitigation Program is provided as an administrative action to further the goals and objectives of the GSP and SGMA in general.

2.3 IDENTIFICATION OF MITIGATION MEASURES FOR ACCEPTED CLAIMS

In the event that, under the Impact Assessment process, the GSA determines that GSA or GSA-allowed activities have had an impact on an existing well (i.e., impacts related to post-2015 overdraft), the GSA will implement a mitigation measure(s) for the existing well. Mitigation measures that could be adopted to address impacts attributed to the GSA allowed activities could include the following:

- Providing a short-term emergency interim water supply to domestic well owners. Short-term emergency supplies shall be provided as soon as reasonably possible, but in all cases

within 14 days of notification to the GSA of such needs.
- Providing funds to lower a well pump.
- Providing funds to complete a connection to an M&I water provider.
- Supplying an equivalent water supply from an alternate source.
- Providing funds to replace the affected well with a deeper well that meets state and local requirements; or with the consent of the affected landowner, providing other acceptable mitigation.
- The GSA require the well owner to sign a release of liability for any claims following mitigation implementation

Factors to be considered when determining the level of mitigation include, but are not limited to, the following:
- Well age – mitigation measures may be prorated based on well age, per manufacturer well life specifications
- Well depth – mitigation measures may be prorated, per linear foot, based on the depth the current well is drilled to vs. the depth a new well needs to be drilled to.

Mitigation measures will be determined by the GPC, on recommendation of the technical representative, . Once a longterm solution is identified and offered by the GSA, if it is not accepted by the claimant within 30 days, the claim will be denied and not eligible for a future claim to be filed.

2.3.1 Provision for Interim Water Supply

The claim process allows for the provision of an interim water supply should the Claimant request it. The interim water supply is meant to provide water to the applicant while the claim is investigated and prior to arranging a more permanent mitigation. If a claim is denied, it no longer qualifies for the provision of an interim water supply. Potential sources of interim water supply include (but are not limited to):

- Trucking water
- Connecting to the water supply of a neighboring landowner
- Obtaining a temporary/permanent connection to the municipal water supply system

- The GSA will fund the interim water supply or refer the claimant to existing programs that provide short term water supplies. If the claim is denied by the GSA, the cost is subject to reimbursement by the Claimant.

2.3.2 Evaluation of Potential for Municipal Water Supply Connection

In some urban areas of the Tule Subbasin, impacted domestic or industrial wells may be in close proximity to existing municipal water supply infrastructure. If so, the GSA will contact the local municipality, on behalf of the Claimant, to determine the feasibility of connecting the Claimant to the existing municipal water supply system. If a connection is feasible, the Claimant will be provided with a contact person at the municipality to arrange the connection to the municipal system. For those claims that can be satisfied through a municipal water supply connection, the GSA will waive all well inspection requirements. However, the Claimant must agree to allow the GSA to destroy or properly abandon the impacted well, in accordance with California Department of Water Resources requirements and County of Tulare regulations.

- The GSA, or other existing program that provides short term water supplies, will continue to fund the interim water supply to the Claimant, until the connection to the municipal system is complete
- GSA, municipality, and Claimant will work together to determine cost share funding to connect the Claimant to the municipal water system and the cost to destroy the impacted well

If the Claimant refuses to connect to the municipal water system, the Claimant will be required to allow the GSA to inspect the well in accordance with Section 2 herein.

2.3.3 Assistance for Claimants Whose Claims have been denied

For claimants who have denied claims, the GSA will provide references to other local, county and state programs that provide solutions.

3. Subsidence Mitigation

Section to be developed by June 30, 2023

4. Water Quality Mitigation

Section to be developed by June 30, 2023

5.0 Funding Plan

The GSA will develop a budget and reserve account for in order to implement this plan. It is anticipated that the funding for the budget and reserve account will come from Transitional Fees collected by the GSA.

6.0 Reporting and Monitoring of Plan Implementation

The GSA will monitor mitigation implementation activities on an ongoing basis. Mitigation Plan implementation and actions will be included in the GSA's annual GSP update to the Department of Water Resources.

ATTACHMENTS
Attachment 1 – Mitigation Program Framework, Coordination Agreement Attachment 7
Attachment 2 – Thomas Harder and Company Technical Memorandum – Technical Requirements for Addressing Impact Claims from Groundwater Levels for Tule Subbasin Groundwater Sustainability Agencies
Attachment 3 – Groundwater Level Impact Claim Process – Investigation Phase Flow Chart
Attachment 4 – Groundwater Level Impact Claim Process – Evaluation Examples
Attachment 5 – Claim Form
Attachment 6 - Well Inspection Form
Attachment 7 - Release of liability forms

MITIGATION PROGRAM FRAMEWORK
COORDINATION AGREEMENT ATTACHMENT 7
Framework for GSA Mitigation Programs to Address Groundwater Levels, Land Subsidence and Groundwater Quality Impacts

Introduction

Sustainable management criteria identified in each of the Tule Subbasin Groundwater Sustainability Agencies' (GSAs) Groundwater Sustainability Plans (GSPs) have been developed to address significant and unreasonable impacts to agricultural, municipal, and industrial beneficial uses of groundwater. However, analysis based on available data suggests that numerous shallow domestic wells and potentially other wells may be impacted during the Sustainable Groundwater Management Act (SGMA) GSP implementation period between 2020 and 2040 as a result of continued lowering of groundwater levels during this period. Wells, land use, property, and infrastructure may also be impacted from land subsidence and changes in groundwater quality during this period.

The Tule Subbasin GSAs agree to each individually implement a Mitigation Program (Program) as needed to offset impacts associated with GSP-allowed activities, subject to the following framework and subject to the schedule provided herein. The goal of this framework is to establish a standard for mitigation programs to be implemented by each GSA for the purpose of mitigating anticipated impacts to beneficial uses to a level that avoids the occurrence of an Undesirable Result.

Each Mitigation Program may be extended or revised based on groundwater conditions in the future.

Mitigation Program Framework

The Subbasin has been in overdraft for many years, resulting in a significant lowering of regional and local groundwater levels. The GSPs are designed for the Subbasin to reach sustainability by 2040 and beyond. However, until sustainability is reached, some level of continued groundwater level decline and land subsidence is expected in areas of the Subbasin while the GSAs are in the process of implementing projects and management actions to achieve sustainability by 2040. The purpose of the GSAs' Mitigation Programs is to mitigate those wells, critical infrastructure, and land uses that are adversely affected by declining groundwater levels, land subsidence, and changes to groundwater quality while the GSAs reach sustainability.

Each GSA shall include a Program as a project or management action identified in that GSA's GSP, describing the following elements:

a) Identification of Impacts to be Addressed by Mitigation Program

Each Tule Subbasin GSA will adopt and implement a Mitigation Program to identify the specific needs for mitigation caused by pumping within the GSA's boundaries. Each GSA Mitigation

Program will separately identify the impacts to beneficial uses that the Program is intended to address. Each GSA Mitigation Program must provide a claim process to address impacts to (i) domestic and municipal wells, (ii) agricultural wells, and (iii) critical infrastructure. Decisions to include or exclude impacted users from participation in a GSA's Mitigation Program shall be supported by appropriate written technical data and analysis.

b) Process

For claims of impact to wells related to groundwater level declines, the process to be adopted by each GSA's Mitigation Program may include:

1) an application process by the well owner;
2) data collection by the GSA to verify the claim;
3) identification of suitable mitigation; and/or
4) response to said affected user.

For claims of impact to land uses from land subsidence, the process may include:

1) an application process by the affected party;
2) data collection by the GSA to verify the claim;
3) identification of suitable mitigation; and/or
4) coordination, as necessary, with said affected parties to implement the mitigation.

For claims of impact to groundwater quality that is attributable to pumping allowed by a GSA/GSP, the process may include:

1) an application process by the affected party;
2) data collection by the GSA to verify the claim;
3) identification of suitable mitigation; and/or
4) coordination, as necessary, with said affected parties to implement the mitigation.

SGMA requires GSAs and GSPs to measure sustainability from 2015 forward. As a result, GSAs do not necessarily need to provide mitigation for impacts that occurred prior to January 1, 2015.

For those claims that are shown not to be related to GSP-/GSA-approved or authorized activities, the GSA will, to the extent possible, provide assistance to the affected party to identify programs for addressing their issue.

c) *Investigation*

Once a claim of adverse impact has been made to a GSA, whether it be for well, specific land use, critical infrastructure or groundwater quality issue(s), the GSA will investigate the claim.

d) *Qualifications for Mitigation*

GSAs may determine whether to provide full or partial mitigation based on a user's compliance with the GSA's GSP, Rules & Regulations, and other laws or regulations. For example, a user whose own pumping has caused or contributed to overdraft or damage to their own well may not qualify for mitigation under the Program. Further, mitigation will be applied only to those claims that are shown to be attributable to GSP-/GSA-approved or authorized activities. Each GSA's Program will also address how claims that a GSA determines are caused by pumping outside the GSA's boundaries will be addressed.

e) *Mitigation*

Once a claim of impact has been confirmed to be due to GSP-/GSA-approved or authorized activities, the GSA will identify suitable mitigation to alleviate the impact.

For groundwater level impacts, this could be any of the following:

1) Deepening the well;
2) Constructing a new well;
3) Modifying pump equipment;
4) Providing temporary or permanent replacement water;
5) Coordinating consolidation of the domestic well owner with existing water systems; or
6) With the consent of the affected user, providing other acceptable means of mitigation.

For land use impacts, this could be any of the following:

1) Repair to canals, turnouts, stream channels, water delivery pipelines, and basins;
2) Repair to damaged wells;
3) Addressing flood control;
4) Addressing other damaged infrastructure; or
5) With the consent of the affected user, providing other acceptable means of mitigation.

For groundwater quality impacts (due to groundwater management/actions), this could be any of the following:

1) Adjusting groundwater pumping locations, rates, or schedules;
2) Modifying project operations;
3) Providing temporary or permanent replacement water;
4) Coordinating consolidation with existing water systems; or
5) With the consent of the affected user, providing other acceptable means of mitigation.

Various factors may reflect the proper mitigation methods for the specific issue. For example, age, location, financial impact to the beneficial user as a result of mitigation, and the beneficial user may reflect which mitigation measures are chosen by a particular GSA.

f) *Outreach*

Public outreach and education will be separately performed during development of the Mitigation Program and prior to implementation by each GSA.

Prior to implementation, extensive outreach will be needed to notify landowners of each GSA's Program requirements and how they can apply for assistance. Outreach may need to be performed in multiple languages as appropriate for each particular GSA. Outreach methods could include workshops, mailings, flyers, website postings, Board meeting announcements, etc.

g) Program Adoption Schedule

Each GSA will formulate and implement a mitigation claims process for domestic and municipal use impacts by December 31, 2022 and complete all other aspects of the Mitigation Program by June 30, 2023. During Program development, the GSAs will conduct community outreach and refer landowners and others to available local programs as well as other resources and funding programs from the County, State, or non-profit organizations, including the Tule Basin Water Foundation.

h) Mitigation Program Funding Source

Each GSA will develop a funding mechanism for the Program, which is dependent on the specific GSA needs for specific expected impacted wells, critical infrastructure, and land uses within each GSA. Funding is anticipated to be available for each GSA's Mitigation Program through implementation of assessments, fees, charges, and penalties. In addition, the GSAs will explore grant funding. The State has many existing grant programs for community water systems and well construction funding. County, state, and federal assistance will be needed to successfully implement the respective Mitigation Programs. Each GSA may, separately or in coordination with other GSAs, also work with local NGOs that may be able to provide assistance or seek grant monies to help fund the Program. GSAs may act individually or collectively to address and fund mitigation measures.

Technical Memorandum

To: Tule Subbasin Technical Advisory Committee

From: Thomas Harder, P.G., C.HG.
Thomas Harder & Co.

Date: 13-Dec-22

Re: Technical Requirements for Addressing Impact Claims from Groundwater Levels for Tule Subbasin Groundwater Sustainability Agencies

1 Background and Purpose

In response to California Department of Water Resources (CDWR) comments to the Tule Subbasin draft Groundwater Sustainability Plans (GSPs) and Coordination Agreement, the Groundwater Sustainability Agencies (GSAs) each agreed to develop mitigation plans to address significant and unreasonable impacts to beneficial uses of groundwater during the sustainability transition period between 2020 and 2040. The revised Tule Subbasin Coordination Agreement submitted in July 2022 included a Mitigation Program Framework as Attachment 7, which outlined the general standards that each GSA would commit to in developing their respective Mitigation Programs. The GSAs further committed to completing the mitigation claims process for domestic and municipal wells by December 31, 2022 and all other aspects of the Mitigation Programs by June 30, 2023.

The purpose of this document is to provide the minimum technical requirements for use by each Tule Subbasin GSA to address claims of impact from lowered groundwater levels associated with GSP-/GSA-approved or authorized activities or unmanaged pumping. In consideration of the technical information provided herein, and in accordance with the Mitigation Framework in Attachment 7 of the Coordination Agreement, each GSA Mitigation Program will identify the specific criteria and processes for mitigating claims of impact caused by pumping within their respective GSA boundaries. Each Mitigation Program must provide a claim process to address impacts to:

(i) domestic and municipal wells,
(ii) agricultural wells, and
(iii) critical infrastructure.

Impacts may be related to one or more of the three sustainability indicators related to GSP-/GSA-approved or authorized activities:

1. Groundwater level declines
2. Land subsidence, and
3. Groundwater quality.

This TM addresses impacts related to groundwater levels.[1] Decisions to include or exclude impacted users from participation in a GSA's Mitigation Program shall be supported by appropriate written technical data and analysis, as described herein. In addition, this TM includes additional considerations, outside the technical requirements, for developing Mitigation Programs.

Each Mitigation Program will document:

1. Types of Impacts to be Addressed by the Mitigation Program
2. A Process for Responding to Claims of Impact
3. A Process for Investigating Claims
4. Qualifications for Mitigation
5. Types of Mitigation to Address Claims
6. An Outreach Program Prior To and During Mitigation Program Development
7. The Program Adoption Schedule
8. Mitigation Program Funding Source(s)

Mitigation will be applied only to those claims that are shown to be attributable to GSP-/GSA-approved or authorized activities.

2 Process Overview for Claims of Groundwater Level Impacts

The Mitigation Program framework outlined in the Tule Subbasin Coordination Agreement allows for domestic, industrial, municipal, and certain agricultural beneficial users of groundwater suffering from significant and unreasonable impacts (as defined in the Tule Subbasin Coordination Agreement and Mitigation Program Framework) to file a claim with the GSA in which the well is located. The overall process for receiving and investigating claims of groundwater level impact is shown on Figure 1. For groundwater levels, a significant and unreasonable "impact" is defined as the inability of a beneficial user to pump groundwater of sufficient quantity to meet their water supply needs due to lowered groundwater levels resulting from Tule Subbasin GSP-/GSA-approved or authorized activities. The GSAs are not required to address impacts that occurred prior to January 2015. Responsibilities of the claimant are shown in green and responsibilities of the GSA are shown in blue on Figure 1. Decision points are shown in orange. All claims will be investigated and evaluated within 45 days of receipt of the claim.

[1] Technical requirements for mitigation of impacts associated with land subsidence and groundwater quality will be addressed in separate Technical Memoranda.

2.1 Filing a Claim

The claim process starts with the affected party ("Claimant") filing a claim with the GSA in which the party's well is located. The claim will be filed using a form like that provided in Attachment 1. To process a claim, the Claimant must provide some basic information to enable further investigation of the claim, including (but not limited to):

- The Claimant's name and contact information,
- The type and location of the well,
- Request for interim water supply,
- Well construction information,
- Pump information,
- Historical operating and groundwater conditions for the well,
- A description of the issue with the well, and
- The applicant's signature.

GSAs may determine whether to provide full or partial mitigation based on a user's compliance with the GSA's GSP, Rules & Regulations, and other laws or regulations. Further, mitigation will be applied only to those claims that are shown to be attributable to GSP-/GSA-approved or authorized activities. If the Claimant is pumping groundwater under a transitional pumping allocation, or otherwise contributing to transitional overdraft, a GSA may consider this fact in determining whether to accept or reject the claim.

2.2 Provision for Interim Water Supply

For claims not denied in Section 2.1, the claim process allows for the provision of an interim water supply should the Claimant request it. The interim water supply is meant to provide water to the applicant while the claim is investigated and prior to arranging a more permanent mitigation. Potential sources of interim water supply include (but are not limited to):

- Trucking water
- Utilizing filling stations
- Connecting to the water supply of a neighboring landowner
- Obtaining a temporary/permanent connection to the municipal water supply system

Considerations for each GSA Mitigation Program include:

- Funding
- If the GSA funds it, is the cost subject to reimbursement by the Claimant if the investigation finds that the issue is not associated with GSA activities or post-2015 overdraft?

2.3 Evaluation of Potential for Municipal Water Supply Connection

In some urban areas of the Tule Subbasin (e.g. Porterville), impacted domestic or industrial wells may be in close proximity to existing municipal water supply infrastructure. If so, the GSA will contact the local municipality, on behalf of the Claimant, to determine the feasibility of connecting the Claimant to the existing municipal water supply system. If a connection is feasible, the Claimant will be provided a contact person at the municipality to arrange the connection to the municipal system. For those claims that can be satisfied through a municipal water supply connection, the GSA may waive well inspection requirements. However, the Claimant must agree to allow the GSA to destroy or properly abandon the impacted well, in accordance with California Department of Water Resources requirements and County of Tulare regulations, if it is in the GSA's interest to do so.

Considerations for each GSA Mitigation Program include:

- Will the GSA continue the interim water supply to the Claimant, free of cost, until the connection to the municipal system is complete?
- Who will fund the cost to connect the Claimant to the municipal water system (GSA, municipality, Claimant)?
- Who will fund the cost to destroy the impacted well?

If the Claimant refuses to connect to the municipal water system, the Claimant will be required to allow the GSA to inspect the well in accordance with Sections 2.4, 2.5, and 2.6, herein.

2.4 Provision of Access to the Well for Inspection by the GSA

Mitigation of any claim of impact not rejected in Section 2.1 and not mitigated in Section 2.3 herein, will require that the Claimant provide access to the well to verify the claim. In signing the impact claim form (Attachment 1), the Claimant agrees to release all data associated with the well and provide access to the well for inspection by a GSA technical representative. Denial of access to the well for inspection by the GSA will result in denial of mitigation.

2.5 Preliminary Well Assessment Based on Existing Data

A GSA technical representative will review all available information provided by the Claimant for the affected well prior to inspection in the field. Data to be reviewed will include (but not necessarily be limited to):

- The CDWR driller's log,
- Information on date the well was constructed,
- Well construction information (casing diameter, casing depth, perforation interval),
- Available downhole video surveys,

- Historical groundwater levels,
- Pump type and intake depth,
- Motor size,
- Pump age,
- Typical discharge rate,
- Historical electrical use,
- Historical production,
- End use of the water (e.g. agricultural irrigation, domestic supply, etc.),
- Land IQ satellite consumptive use data (if agricultural),
- Last pump test date,
- Last service date,
- Last static and pumping groundwater levels, and
- Information on the nature of the problem.

Based on a review of the available data provided by the Claimant, the GSA will determine whether the claim can be verified based on the data. Criteria for the determination will include:

- Completeness of the dataset relative to the requested information,
- Reliability of the data provided,
- Nature and status of the issue,
- Evidence of well impact due to GSP-/GSA-approved or authorized activities.

If the claim can be verified based on available information from the Claimant or the Tule Subbasin Data Management System, then the GSA technical representative will issue a recommendation for appropriate mitigation. If not, the GSA will conduct additional investigation to verify the claim as described in Section 2.6.

2.6 As-Needed Supplemental Well Inspection and Data Collection

To verify a claim that cannot be confirmed from existing information provided by the Claimant, a GSA technical representative will need to inspect the well and collect supplemental information. The types of information to be collected will depend on the data available from the Claimant. Determination of the extent of additional data collection necessary to verify the claim will be at the sole discretion of the GSA.

In general, the minimum data to be collected in the field will include:

- Well name
- Pump size (horsepower)
- Casing type and diameter
- Static groundwater level

- Discharge rate
- Pumping groundwater level

The owner or owner's representative authorized to operate the pump will be asked to be onsite at the time of inspection to operate the pump. The GSA technical representative will record observations from the inspection on a form like that provided in Attachment 2.

If a CDWR driller's log or other information is not available to confirm the total depth and condition of the well and if the pump intake depth cannot be confirmed from available information, it may be necessary to have the pump removed from the well and conduct a downhole video survey. Removing the pump will enable the GSA technical representative to measure the column pipe and thus confirm the pump intake depth and inspect the condition of the pump. The video log will enable inspection of the condition of the casing and perforations and confirm the perforation interval, total depth, and static groundwater level of the well. Upon completion of the investigation, the contractor will be required to reinstall the pump and reestablish all connections. If the pump was operating prior to removal, the contractor will be required to demonstrate that the pump is functioning properly after reinstallation. A sounding port or flow meter may also be installed to collect pumping water level data or discharge rate data, respectively.

Considerations for each GSA Mitigation Program include:

- Who will fund the contractor to remove the pump and conduct the video survey?
- If the GSA funds it, is the cost subject to reimbursement by the Claimant if the investigation finds that the issue is not associated with transitional overdraft pumping.
- Will the GSA require the well owner to sign a release of liability for any damage to the pump, pump column, or well resulting from removal of the pump and conducting the video log?

3 Evaluation of Claims of Groundwater Level Impacts

The foundational premise of the Mitigation Program, as it relates to groundwater levels, is to address significant and unreasonable impacts to domestic, municipal, industrial and agricultural wells from GSP-/GSA-approved or authorized activities.

The graphic on Figure 2 provides illustrated examples of groundwater level conditions that could be cause to approve or deny claims based on the data provided by the Claimant or collected by the GSA. It is noted that the examples shown on Figure 2 are not exhaustive and are provided for guidance only. Further, as SGMA does not require the GSAs to address impacts prior to January 2015, the examples assume that impacts prior to this time will not be considered for mitigation. In practice, it will be up to each GSA to determine if impacts that occurred prior to January 2015 will be evaluated and factored into considerations of mitigation. As shown, Examples 1 and 2 illustrate groundwater level impacts that would qualify for mitigation. Example 1 is a case where the static groundwater level is below the 2015 groundwater level and the pumping groundwater level, at the historical discharge rate, is within 10 feet of the bottom of the well. In Example 2, the static groundwater level is measured below the 2015 groundwater level and the pumping groundwater level, at the historical discharge rate, has dropped to within 20 feet of the pump intake. In both cases, the lowered groundwater levels can be attributed to overdraft and there is no option to restore the water supply without mitigation. The evaluation should consider whether there is adequate separation between the pump intake and the bottom of the well (e.g., 10 feet) and whether there is adequate pump submergence (e.g., 20 feet).

Examples 3 through 6 on Figure 2 illustrate cases where the well impact is not associated with lowered groundwater levels from GSP-/GSA-approved or authorized activities. In these cases:

- The pumping groundwater level would have already been below the bottom of the well before January 2015 (Example 3),
- The pumping groundwater level would have already been below the bottom of the pump intake before January 2015 (Example 4),
- The static groundwater level would have been below the pump intake prior to January 2015 (Example 5),
- The pump is not functioning for reasons other than groundwater level decline (e.g. mechanical failure)(Example 6).

In many cases, it is anticipated that a static groundwater level measured in the impacted well from January 2015 will not be available. For those cases, the reference January 2015 static groundwater level will be inferred from a groundwater level contour map generated based on available data from other wells measured at that time. Separate groundwater contour maps will be generated for the Upper and Lower Aquifers. The reference static groundwater level will be assigned from the contour map of the aquifer in which the well is predominantly perforated.

There are other factors, independent of lowered groundwater levels, that can cause a well to stop functioning, such as pump mechanical failure due to age or malfunction, holes in the well casing allowing sand into the pump intake, holes in the pump column associated with corrosion and wear, excessive plugging of screens due to lack of maintenance (e.g. well rehabilitation), and others. All these factors will need to be taken into consideration when assessing the need for mitigation.

Based on the analysis of data for the impacted well, the GSA technical representative will provide a recommendation to the GSA Board of Directors whether the well qualifies for mitigation.

A consideration for each GSA Mitigation Program includes:

- Will there be an appeal process available to the Claimant and, if so, what will that process consist of?

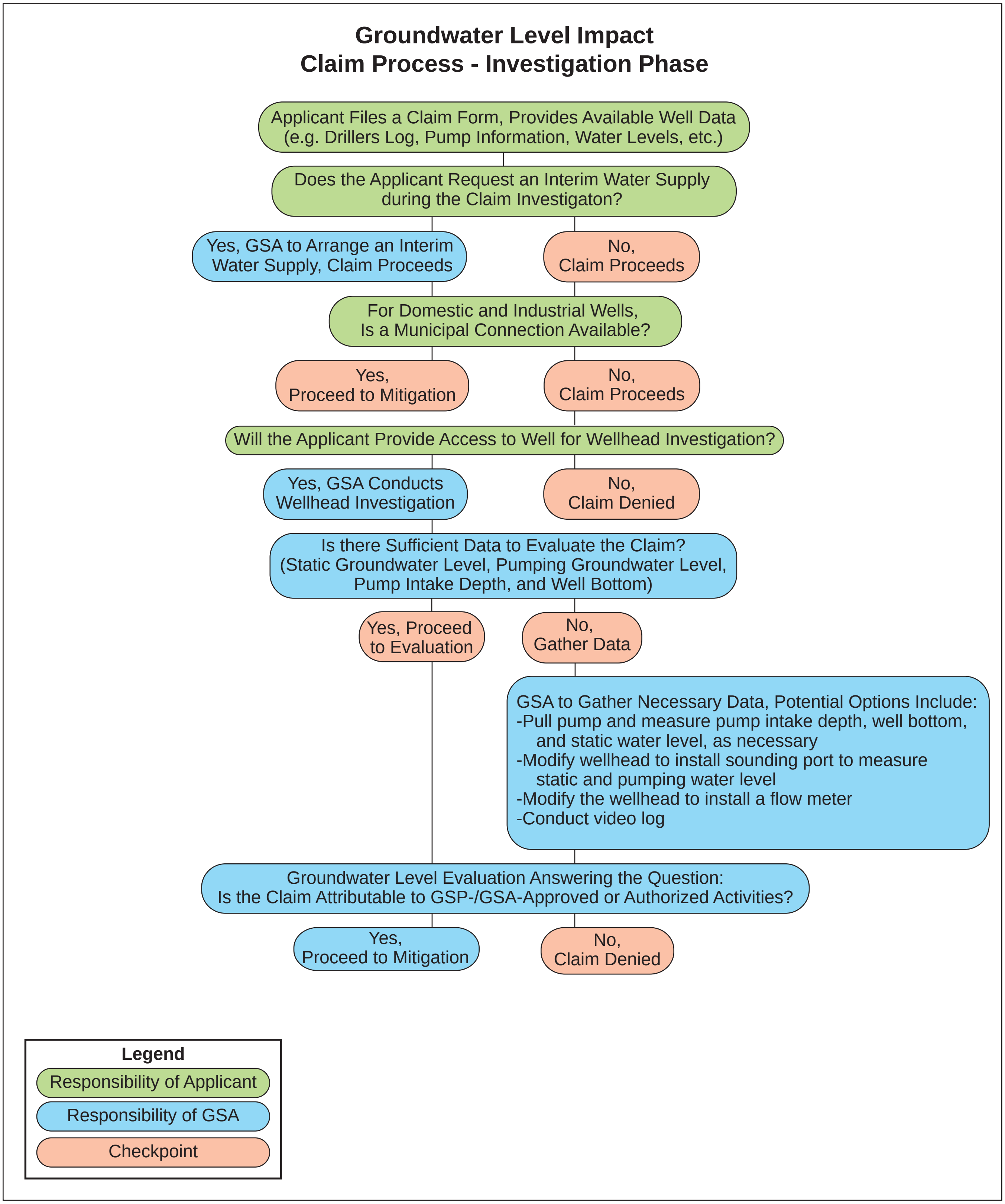
4 Potential Options for Mitigation

Mitigation measures, if approved, could include (but are not necessarily limited to) one or more of the following:

- Providing a short-term emergency water supply to domestic and municipal well owners. Short-term emergency supplies shall be provided as soon as reasonably possible, but in all cases within 14 days of notification to the GSA of such needs;
- Providing funds to lower a well pump;
- Providing funds to complete a connection to an M&I water provider;
- Supplying an equivalent water supply from an alternate source;
- Providing funds to replace the affected well with a deeper well that meets state and local requirements; or
- With the consent of the affected landowner, providing other acceptable mitigation.

Tule Subbasin Technical Advisory Committee
Mitigation Program - Technical Framework

Figure 1

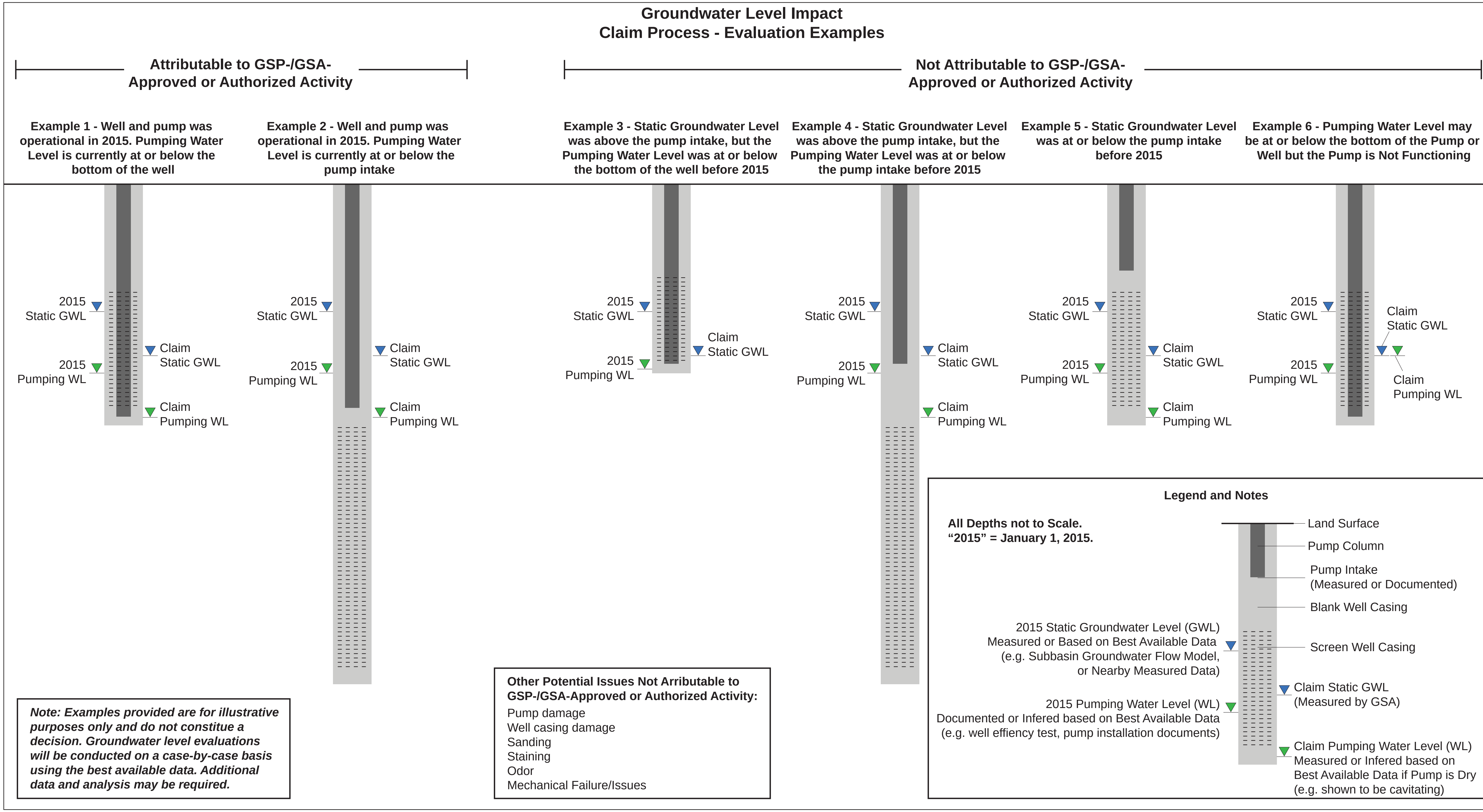


Thomas Harder & Co.
Groundwater Consulting

December 2022

Tule Subbasin Technical Advisory Committee
Mitigation Program - Technical Framework

Figure 2



Thomas Harder & Co.
Groundwater Consulting

December 2022

Tule Subbasin Technical Advisory Committee
Example Groundwater Sustainability Agency
Groundwater Level Impact Claim Form

Claimant Information	
Contact Name:	**Well Location Sketch:**
Phone Number:	
Mailing Address:	
Well Name:	
Well Location (Address/Description):	
Well Type: ☐ **Domestic** ☐ **Industrial** ☐ **Agricultural** ☐ **Other (Specify):**	

Interim Water Supply	
Does the Claimant Request an Interim Water Supply?	☐ **Yes** ☐ **No**
Number of Residences/Business Served (If Applicable):	
Number of Cropped Acres and Crop Type (If Applicable):	
Estimated Daily Water Use (Gallons, Cubic Feet, or Acre-Ft):	

Well Construction Information	
Is a Department of Water Resources Well Completion Report (i.e. Driller's Log) Available?	☐ **Yes (Attach if Available)** ☐ **No**
Casing/Well Depth (ft):	
Perforation Interval(s) (ft):	
Casing Material:	**Casing Diameter (inches):**
Date Constructed (If Known) and/or Well Age (Estimated):	
Date of Last Video Survey (If Available):	
Well Photos Attached: ☐ **Yes** ☐ **No**	

Tule Subbasin Technical Advisory Committee
Example Groundwater Sustainability Agency
Groundwater Level Impact Claim Form

Pump Information	
Type: ☐ **Submersible**	☐ **Vertical Turbine**
Intake Depth (ft):	**Motor Size (horsepower):**
Age (Known or Estimated):	**Typical Discharge Rate (gpm):**
Last Pump Test Date (Attach Record if Available):	
Last Service Date (Attach Record if Available):	

Issue Status	
Date Issue Arose:	
Issue: ☐ **No flow** ☐ **Reduced Flow** ☐ **Breaking Suction** ☐ **Future Concern**	
Comments/Description:	
Static Water Level (ft):	**Pumping Water Level (ft):**
Status: ☐ **Not Resolved, Contractor not Contacted (Note: Contacting a Contractor Not Required)** ☐ **Not Resolved, Contractor Provided Estimate (attach estimate if applicable)** ☐ **Resolved (attached records if applicable)**	
Contractor Company Name:	
Contractor Contact Name:	**Contact Phone Number:**
Contractor Address:	

Applicant	
By signing this Groundwater Level Impact Claim Form, the applicant agrees to provide the GSA with access to the well for the Wellhead Investigation.	
Print Name:	**Date:**
Signature:	

GSA Use Only	
Received By:	**Date:**

Tule Subbasin Technical Advisory Committee
Example Groundwater Sustainability Agency
Groundwater Level Impact Well Inspection Form

Inspector	
Inspector Name:	**Date:**
Representing (e.g. Irrigation District, Consultant, etc.):	

Owner Information
Owner's Name:
Field Contact Name (If Different):
Address:
Phone Number:

Well Information
Well Name:
Date Constructed:
Casing/Well Depth:
Casing Material:
Casing Diameter (inches):
Perforation Interval(s):

Pump Information:	
Type: ☐ **Submersible** ☐ **Vertical Turbine**	
Electrical Power (kW):	**Motor Size (horsepower):**
Intake Depth (ft):	
Equipped with Flow Meter: ☐ **Yes** ☐ **No**	
Flow Meter Description (Attach Photo):	
Discharge Rate (gpm) and Source:	
Discharge Line Diameter (Inches):	

Tule Subbasin Technical Advisory Committee
Example Groundwater Sustainability Agency
Groundwater Level Impact Well Inspection Form

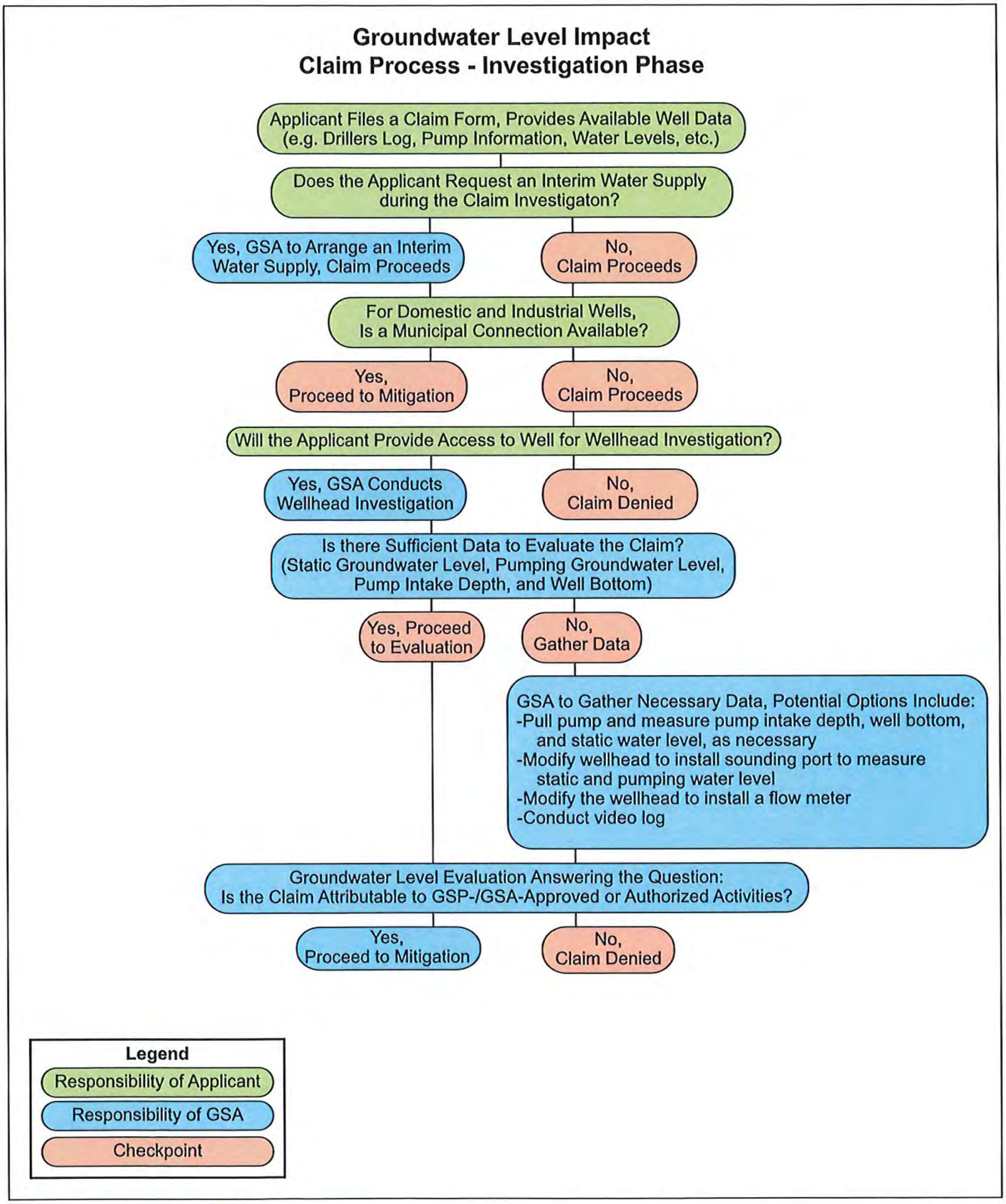
Site Inspection	
Sounder Access Port Description and Opening Diameter (in):	
Reference Point Description and Stick Up (ft):	
Time Since Last Pumped:	**Time Since Pumping Started:**
Measured Static Water Level (ft):	**Measured Pumping Water Level (ft):**
Observed Pumping Description (e.g., working, won't turn on, dry after 5 minutes, pumping air, cavitating, etc.):	
Observed Pumping Rate (gpm) and Description (e.g., flow meter, bucket test, etc.):	
Distribution System Description (e.g., pressure tank, storage tank, residence, etc.)	

Location Sketch		
Well Coordinates:		
Survey Method:	**Latitude:**	**Longitude:**

Attachment 3 – Groundwater Level Impact Claim Process – Investigation Phase Flow

Tule Subbasin Technical Advisory Committee
Mitigation Program - Technical Framework

Figure 1



Thomas Harder & Co.
Groundwater Consulting

December 2022

Tule Subbasin Technical Advisory Committee
Mitigation Program - Technical Framework

Figure 2

Groundwater Level Impact Claim Process - Evaluation Examples

Attributable to GSP-/GSA-Approved or Authorized Activity

Example 1 - Well and pump was operational in 2015. Pumping Water Level is currently at or below the bottom of the well

Example 2 - Well and pump was operational in 2015. Pumping Water Level is currently at or below the pump intake

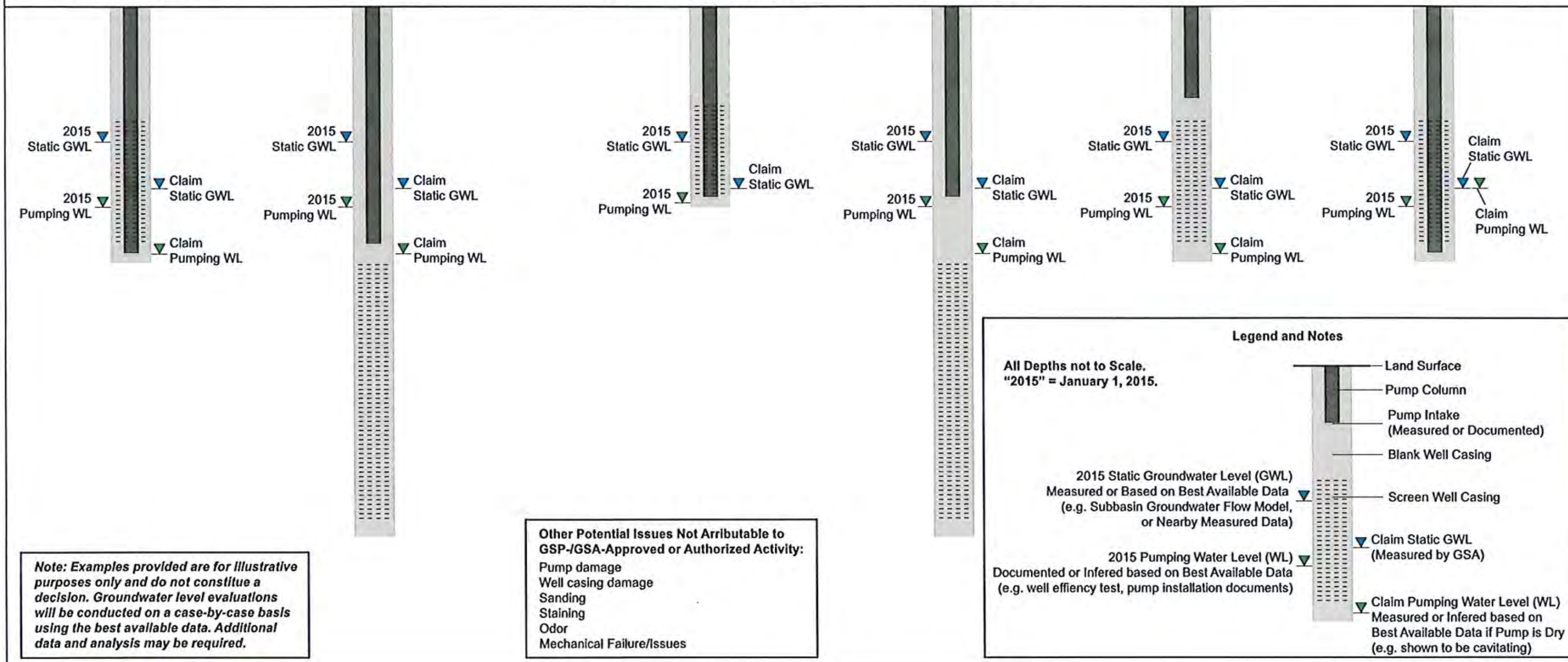
Not Attributable to GSP-/GSA-Approved or Authorized Activity

Example 3 - Static Groundwater Level was above the pump intake, but the Pumping Water Level was at or below the bottom of the well before 2015

Example 4 - Static Groundwater Level was above the pump intake, but the Pumping Water Level was at or below the pump intake before 2015

Example 5 - Static Groundwater Level was at or below the pump intake before 2015

Example 6 - Pumping Water Level may be at or below the bottom of the Pump or Well but the Pump is Not Functioning



Note: Examples provided are for illustrative purposes only and do not constitue a decision. Groundwater level evaluations will be conducted on a case-by-case basis using the best available data. Additional data and analysis may be required.

Other Potential Issues Not Arributable to GSP-/GSA-Approved or Authorized Activity:
Pump damage
Well casing damage
Sanding
Staining
Odor
Mechanical Failure/Issues

Thomas Harder & Co.
Groundwater Consulting

December 2022

Attachment 5 – Claim

Lower Tule River and Pixley Irrigation Districts
Groundwater Sustainability Agency
Groundwater Level Impact Claim Form

Claimant Information	
Contact Name:	**Well Location Sketch:**
Phone Number:	
Mailing Address:	
Well Name:	
Well Location (Address/Description):	
Well Type:	
☐ **Domestic** ☐ **Industrial** ☐ **Agricultural** ☐ **Other (Specify):**	

Interim Water Supply	
Does the Claimant Request an Interim Water Supply?	☐ **Yes** ☐ **No**
Number of Residences/Business Served (If Applicable):	
Number of Cropped Acres and Crop Type (If Applicable):	
Estimated Daily Water Use (Gallons, Cubic Feet, or Acre-Ft):	

Well Construction Information		
Is a Department of Water Resources Well Completion Report (i.e. Driller's Log) Available?	☐ **Yes (Attach if Available)**	☐ **No**
Casing/Well Depth (ft):		
Perforation Interval(s) (ft):		
Casing Material:	**Casing Diameter (inches):**	
Date Constructed (If Known) and/or Well Age (Estimated):		
Date of Last Video Survey (If Available):		
Well Photos Attached:	☐ **Yes**	☐ **No**

Pump Information	
Type: ☐ **Submersible**	☐ **Vertical Turbine**
Intake Depth (ft):	**Motor Size (horsepower):**
Age (Known or Estimated):	**Typical Discharge Rate (gpm):**
Last Pump Test Date (Attach Record if Available):	
Last Service Date (Attach Record if Available):	

Issue Status	
Date Issue Arose:	
Issue: ☐ **No flow** ☐ **Reduced Flow** ☐ **Breaking Suction** ☐ **Future Concern**	
Comments/Description:	
Static Water Level (ft):	**Pumping Water Level (ft):**
Status: ☐ **Not Resolved, Contractor not Contacted (Note: Contacting a Contractor Not Required)** ☐ **Not Resolved, Contractor Provided Estimate (attach estimate if applicable)** ☐ **Resolved (attached records if applicable)**	
Contractor Company Name:	
Contractor Contact Name:	**Contact Phone Number:**
Contractor Address:	

Applicant	
By signing this Groundwater Level Impact Claim Form, the applicant agrees to provide the GSA with access to the well for the Wellhead Investigation.	
Print Name:	**Date:**
Signature:	

GSA Use Only	
Received By:	**Date:**

Lower Tule River and Pixley Irrigation Districts Groundwater Sustainability Agency Groundwater Level Impact Well Inspection Form

Inspector	
Inspector Name:	**Date:**
Representing (e.g. Irrigation District, Consultant, etc.):	

Owner Information
Owner's Name:
Field Contact Name (If Different):
Address:
Phone Number:

Well Information
Well Name:
Date Constructed:
Casing/Well Depth:
Casing Material:
Casing Diameter (inches):
Perforation Interval(s):

Pump Information:	
Type: ☐ **Submersible** ☐ **Vertical Turbine**	
Electrical Power (kW):	**Motor Size (horsepower):**
Intake Depth (ft):	
Equipped with Flow Meter: ☐ **Yes** ☐ **No**	
Flow Meter Description (Attach Photo):	
Discharge Rate (gpm) and Source:	
Discharge Line Diameter (Inches):	

Site Inspection	
Sounder Access Port Description and Opening Diameter (in):	
Reference Point Description and Stick Up (ft):	
Time Since Last Pumped:	**Time Since Pumping Started:**
Measured Static Water Level (ft):	**Measured Pumping Water Level (ft):**
Observed Pumping Description (e.g., working, won't turn on, dry after 5 minutes, pumping air, cavitating, etc.):	
Observed Pumping Rate (gpm) and Description (e.g., flow meter, bucket test, etc.):	
Distribution System Description (e.g., pressure tank, storage tank, residence, etc.)	

Location Sketch		
Well Coordinates:		
Survey Method:	**Latitude:**	**Longitude:**

Attachment 7 - Release of liability

LOWER TULE RIVER AND PIXLEY IRRIGATION DISTRICTS
GROUNDWATER SUSTAINIBILITY AGENCY

WAIVER AND RELEASE OF LIABILITY AND INDEMNITY AGREEMENT

Landowner Names and Addresses (Please Print):

_______________ _______________
_______________ _______________
_______________ _______________

I have submitted an impact claim form to the Groundwater Sustainability Agency ("GSA"). It is understood that I must give access to my well for inspection and that the GSA may provide a temporary alternative water supply.

It is acknowledged and agreed that any temporary water supply being provided is non-potable and is not for human consumption, and that the entities providing such water make no representation, warranty or guarantee as to the quality of the water provided or its suitability for any particular use. It is acknowledged and agreed that the temporary water supply provided shall be used for in-home emergency use only and shall not be used or applied outside of the home on, including but not limited to, hardscapes, landscapes, vegetation, plants, crops, etc. It is acknowledged and agreed that the provision of an interim water supply hereunder is temporary; neither this agreement nor the provision of water hereunder creates a water right, public utility service right or any right to continued or permanent water service; and the provision of this temporary water supply may be terminated in the sole discretion of the entities listed above.

In consideration for the provision of temporary water supplies to the Property, I, for myself and on behalf of any other person residing at or visiting the Property, if any (collectively "Water Users"), do hereby release, waive, discharge, and covenant not to sue the above named irrigation district serving as the GSA, and the district's respective project participants, including the directors, officers, owners, employees, independent contractors or agents of all of the same (collectively referred to herein as the "GSA"), from liability for any and all claims for personal injury, illness, death, property damage, or any other claim, including but not limited to claims arising out of the negligence of the GSA that relates to or results from the provision of a temporary interim water supply to the Property.

It is expressly agreed that the GSA shall not be liable for any injuries or any damages to the Water Users, or the property of such persons, or be subject to any claim, demand, damages or causes of action arising out of or relating to any use of the interim temporary water supply, and well inspections by the GSA, regardless of whether the negligence of the GSA caused or contributed to the injury or damage. This waiver and release of claims is intended to be as broadly interpreted as allowed under California law but does not include gross negligence or willful misconduct by the GSA.

By signing this waiver and release the Water User is agreeing to waive all rights that they may have under the provisions of section 1542 of the Civil Code of California, which reads in part as follows:

> "A general release does not extend to claims that the creditor or releasing party does not know or suspect to exist in his or her favor at the time of executing the release and that, if known by him or her would have materially affected his or her settlement with the debtor or released party."
> _________ (Water User's initials)

The Water User acknowledges that if the GSA ultimately accepts the claim and provides mitigation measures, the well subject to the claim is not eligible for future mitigation and the Water User releases the GSA from future claims regarding such well.

The Water User executing this waiver and release of liability hereby agrees to hold the GSA harmless from all claims which may be made by or on behalf of the Water User, and to indemnify the GSA from any such claims to the fullest extent allowed under California law. This express indemnification provision specifically includes reimbursement for all attorneys' fees and litigation costs incurred by the GSA or on their behalf as a result of any such claim. Neither this Agreement nor the provision (or offering) of temporary, emergency water supplies hereunder constitutes any admission of liability or wrongdoing, or an agreement or admission of any duty, fact, matter, or contention whatsoever.

Signature:__________________ Date: ______________ Signature:__________________ Date: ______________