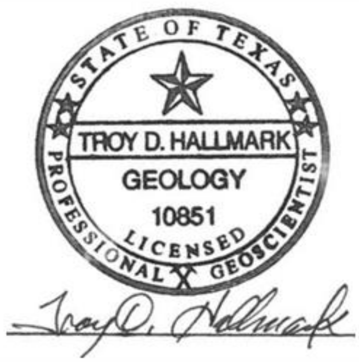
NORTH PLAINS GROUNDWATER Conservation District

Hydrology & Groundwater Resources 2023-2024

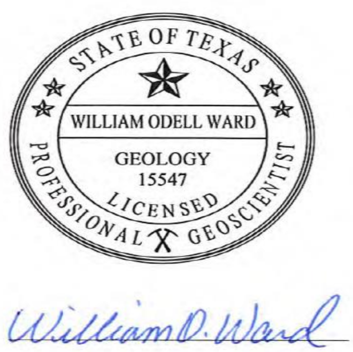
Seventeenth Edition

District & Aquifer Information
Aquifer Recharge
Annual Groundwater Production
Groundwater Production & G.A.M. Comparison
Water Table Levels & Declines
Water Quality Analyses
Average Depth to Water Maps
Average Groundwater Decline Maps
Average Saturated Thickness Maps

Document Compiled by:
Dale Hallmark, P.G.
Independent Consultant
dalehall@email.com



The Professional Geoscientist Seal's use and the signature was authorized by Troy D. Hallmark, P.G. (# 10851) in August of 2024 and is valid solely while this "Hydrology and Groundwater Resources 2023-2024" document is maintained together in its entirety and has not been altered in any manner from the original document retained at the North Plains Groundwater Conservation District Office in Dumas, Texas.



Odell Ward P.G.

Responsible for field staff training, water level data collection, initial contour map creation and content edits.

The Professional Geoscientist Seal's use and the signature was authorized by Willian Odell Ward, P.G. (# 15547) in August of 2024.

North Plains Groundwater Conservation District
Mail: P.O. Box 795
603 East First Street
Dumas Texas 79029

Office Ph. 806-935-6401, Fax 806-935-6633
Publication Year 2023

Table of Contents

I. Introduction

The North Plains Groundwater Conservation District (NPGCD or District) manages groundwater resources in all or part of eight counties in the Northern Texas Panhandle and is governed by an elected seven-member Board of Directors. The Board established the District's mission, "maintaining our way of life through conservation, protection, and preservation of our groundwater resources" and achieves this mission through the development of long-range management plans, creating and enforcing rules, being actively involved in regional and state water planning, undertaking conservation demonstrations projects, and providing public outreach and education programs.

To further advance its management strategies the District promotes new conservation management methods and technologies, cooperates with private, corporate and government entities to promote the conservation, protection, and preservation of the area's critically important groundwater resources. The District manages and operates information collection programs, undertakes scientific investigations, and offers well GPM testing and water quality analysis services as part of its on-going efforts to monitor aquifer conditions.

Information collected by the District and other agencies is broadly summarized in this "Hydrology and Groundwater Resources" report. District's staff prepared maps for this report showing the District boundaries, estimated depth to water, estimated average annual water level declines, estimated aquifer saturated thickness and maps showing District monitor well locations. This report summarizes the number of active and inactive wells, the number of new wells drilled, measured annual groundwater production, and provides a broad overview of general water quality.

II. Definitions

Cretaceous- A geological period corresponding to 65-144 million years ago.

DFC- (Desired Future Condition) a goal set by the District Board of Directors specifying the condition that an Aquifer will be in at a specified time in the future.

GAM- (Groundwater Availability Model) a predictive numerical computer model of Aquifers that the Texas Water Development Board maintains and operates.

Heterogeneous- Consisting of dissimilar elements or parts; not homogeneous.

Jurassic- A geological period corresponding to 144-208 million years ago.

Inter-formational Flow- A flow of water from one formation into another formation.

Intra-formational Flow- A flow of water from one part of a formation into another part of the same formation.

MAG- (Managed Available Groundwater) a groundwater volume results of a GAM based on specified DFC's.

Permian- A geological period corresponding to 245-286 million years ago.

Pliocene- A geological period corresponding to 2.5 to 5.3 million years before the present.

Recharge- The process whereby water is added to an aquifer either through natural or artificial means. Recharge normally refers to rainfall infiltrating an aquifer through a recharge zone.

Red-Bed- a geological strata consisting primarily of red to orange clays and silts in place below the base of the Ogallala Aquifer.

Saturated Thickness - The distance from the top of an aquifer to the base of the aquifer where the pore spaces are filled with water.

Triassic- A geological period corresponding to 208-245 million years ago.

Unconformably (Unconformity) - the surface between successive strata representing a missing interval in the geologic time record.

III. District Boundaries

The North Plains Groundwater Conservation District is in the Texas Panhandle, north of the city of Amarillo and North of the Canadian River. The District consists of approximately 7,390 square miles which includes all of Dallam, Hansford, Lipscomb, Ochiltree and Sherman counties, as well as part of Hartley, Hutchinson and Moore counties.

The original (1954/1955) area of the District included part of Hartley, Moore and Hutchinson counties and all of Sherman, Hansford and Ochiltree counties. Other areas have annexed into the District over time.

Map 1: District boundaries including areas that annexed into the District over time.

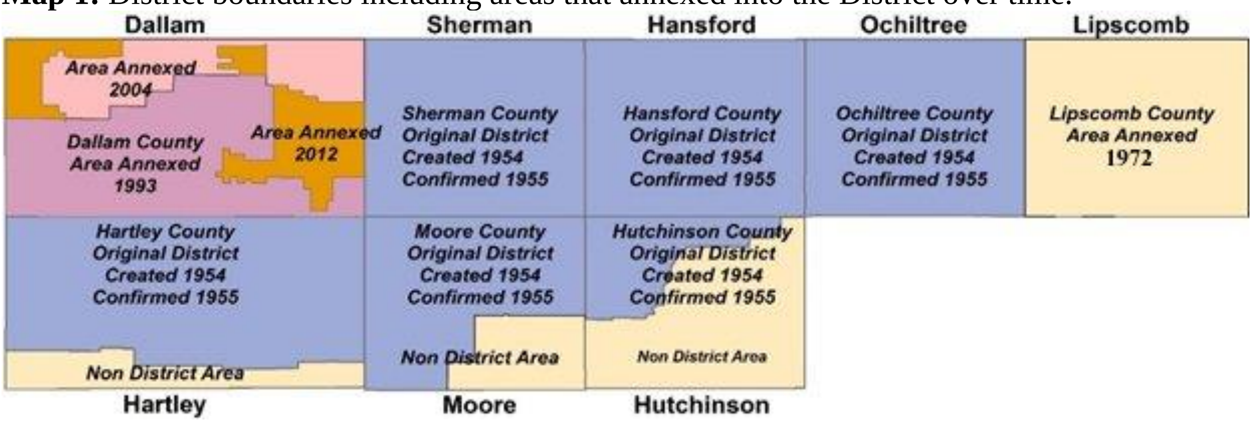


Table 1: County area and percent of each county within the NPGCD.

County	County Area (Sq. Mi.)	Estimated Area in District (Sq. Mi.)	Approximate Number of Acres	Percent of County in the District
Dallam	1505	1505	963,200	100 %
Hansford	907	907	580,480	100 %
Hartley	1463	1244	796,160	83.56 %
Hutchinson	894	278	177,920	30.55 %
Lipscomb	934	934	597,760	100 %
Moore	914	699	447,360	76.51 %
Ochiltree	907	907	580,480	100 %
Sherman	916	916	586,240	100 %
Totals	**8440 Sq. Mi.**	**7390 Sq. Mi.**	**4,729,600 Acres**	

IV. General Geology and Hydrology

Ogallala Aquifer

The Ogallala Aquifer extends from the northern United States into the Texas Panhandle and West Texas and is the primary source of water within the District. The aquifer consists of sands, gravel, silts, and clay sediments that were deposited as part of ancient river systems from about three million to about six million years ago during the Neogene geologic period. An ancient land surface separates the Ogallala from much older strata below of the Permian, Triassic, Jurassic, and Cretaceous geologic periods which range in age from 65 million years to 286 million years. This ancient land surface is called an unconformity and represents between six million years and 65 million years of missing geologic strata in the area.

South of the District, the Canadian River has totally or partially eroded through the Ogallala along much of its length and separates the North Plains from the South Plains. Water-bearing units of Cretaceous and Jurassic ages combine to form the Rita Blanca (a minor aquifer) in the western part of Dallam and Hartley counties. Underlying these aquifers and much of the Ogallala are Triassic age (Dockum Aquifer) sediments and Red Bed strata. The Dockum is a minor, confined to semi-confined aquifer located under Dallam, Hartley and far western Sherman and Moore counties. The water bearing strata is generally locally referred to as the Santa Rosa. For this document, the Ogallala Aquifer is considered to consist of the Ogallala formation and any underlying, potable water-bearing geologic units hydraulically connected with it.

Red Bed (Base of the Aquifer)

Throughout much of the District, the Ogallala aquifer is underlain by "Red Bed". The geology consists of mixed deposits of reddish to orange clay, sands and gravel. The reddish color is caused by staining from the oxides of iron containing minerals. In some areas, the red bed may be absent and in other areas may be several hundred feet thick.

V. Aquifer Thickness or Saturated Material

Saturated thickness maps depict the vertical distance from the water level to the bottom of the aquifer. The saturated thickness of the Ogallala Aquifer ranges from less than 30 feet to over 350 feet and has an estimated average thickness (Table 2) of 163 feet within the District. Saturated thicknesses are calculated every other year and use data from District monitor wells. Other calculation methods will give differing results.

Table 2: 2020-2024 Estimated average aquifer thickness by county (District Area only).

Dallam	Hartley	Sherman	Moore	Hansford	Hutchinson	Ochiltree	Lipscomb
158 ft.	144 ft.	142 ft.	139 ft.	193 ft.	155 ft.	172 ft.	202 ft.

Next scheduled update: Summer of 2025.

VI. Aquifer Recharge, Inflows and Outflows

Surface water and precipitation provide minimal annual recharge to the Ogallala aquifer especially when compared to aquifer withdrawals. District-wide average recharge estimates vary slightly but tend to be below one third of an inch per year. Other inflows and outflows, from and to streams and lateral inflows and outflows tend to be somewhat equal. Some areas of the District however may experience significant local recharge.

The recharge information below (Tables 3,4 and 5) are from the Texas Water Development Board's (TWDB) Groundwater Availability Model Run 17-008. The GAM run was requested by the District for use in the 2018 District Management Plan.

Table 3: Summarized recharge, inflows and out flows to the Ogallala Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Ogallala Aquifer	137,029
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Ogallala Aquifer	26,368
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	50,186
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	94,559
Estimated net annual volume of flow between each aquifer in the district	From Ogallala Aquifer to Rita Blanca and Dockum Aquifers	3,807

TABLE 4: Summarized inflows and outflows to the Dockum Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Dockum Aquifer	49
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Dockum Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	4,097
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	2,293
Estimated net annual volume of flow between each aquifer in the district1	From Dockum Aquifer to Ogallala and Rita Blanca Aquifers	1,997

TABLE 5: Summarized inflows and outflows to the Rita Blanca Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Rita Blanca Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Rita Blanca Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Rita Blanca Aquifer	902
Estimated annual volume of flow out of the district within each aquifer in the district	Rita Blanca Aquifer	229
Estimated net annual volume of flow between each aquifer in the district	From Ogallala Aquifer to Rita Blanca Aquifer	2,909
	From Dockum Aquifer to Rita Blanca Aquifer	555

VII. Annual Groundwater Production and Modeled Available Groundwater

Municipal, Commercial, Industrial, and Agriculture water user groups reported 1,651,075 acre-feet groundwater production in the North Plains Groundwater Conservation District in 2023. Production by County in acre-feet is as follows:

Table 6: Production by County in acre-feet

County	2023 Production (Acre-feet)
Dallam	317,059
Hartley	373,495
Moore	196,489
Sherman	301,707
Hansford	217,323
Hutchinson	88,108
Lipscomb	48,574
Ochiltree	108,320
GMA -1 West	1,189,750
GMA -1 East	462,325
TOTAL	**1,651,075**

District groundwater production is lower than the 5-year historical production average by approximately 33,100 acre-feet. The table below represents annual groundwater production in acre-feet from 2019 to 2023 collectively from all aquifers in the District.

Table 7: Annual groundwater production in acre-feet from 2019 to 2023

County	2019	2020	2021	2022	2023	Average
Dallam	303,200	342,700	339,500	372,900	317,059	335,072
Hartley	349,200	402,200	408,500	418,900	373,495	390,459
Moore	157,700	199,400	195,300	221,200	196,489	194,018
Sherman	255,400	328,400	326,300	369,300	301,707	316,211
Hansford	162,300	195,100	194,800	258,700	217,323	205,645
Hutchinson	68,400	79,400	79,100	100,600	88,108	88,122
Lipscomb	43,400	54,500	55,300	63,200	48,574	52,995
Ochiltree	81,800	105,200	99,200	138,700	108,320	106,644
GMA-West	1,065,500	1,272,700	1,269,600	1,382,300	1,189,750	1,235,770
GMA-East	355,900	434,200	428,400		462,325	462,325
Total	**1,421,400**	**1,706,900**	**1,698,000**	**1,943,500**	**1,651,075**	**1,684,175**

The District's 2023 total groundwater production was 336,225 acre-feet lower than what stakeholders reported in 2011. The West Management Zone production declined 330,350 acre-feet, the East Management Zone showed a collective decline of 5,875 acre-feet production in 2023 when compared to 2011. The dataset for Dallam County is incomplete because the district did not require stakeholders in the annexed portion of the county to report groundwater until 2012. A table comparing 2023 groundwater production to 2011 in acre-feet is as follows:

.

Table 8: Comparing 2023 groundwater production to 2011 in acre-feet.

County	2023	2011	Compared
Dallam	317,059	369,400	-52,341
Harley	373,495	485,400	-111,905
Moore	196,489	267,500	-71,011
Sherman	301,707	396,800	-95,093
Hansford	217,323	233,700	-16,377
Hutchison	88,108	73,700	14,408
Lipscomb	48,574	51,200	-2,626
Ochiltree	108,320	109,600	-1,280
GMA West	**1,188,750**	**1,519,100**	**-330,350**
GMA East	**462,325**	**468,200**	**-5,875**
Total	**1,651,075**	**1,987,300**	**-336,225**

The district annually reviews groundwater production from the previous year and determines if there are conditions that may trigger District Rule 8.4 and District Rule 8.5 evaluation to reduce Allowable Annual Production. The determination in part is based on the Modeled Available Groundwater (MAG) measured in acre-feet to achieve the desired future conditions (DFCs) in the district. The District's board approved Texas Water Development Board GR16-029 MAG Report to compare all subsequent groundwater analyses by the district for implementing Chapter 8 of the District rules. TWDB GR16-029 MAG Report provides the model data for this assessment. The table below is a compilation of MAG for Dockum aquifer, Ogallala aquifer and Rita Blanca aquifer DFCs.

Table 9: Compilation of MAG for Dockum aquifer, Ogallala aquifer and Rita Blanca aquifer DFCs.

County	2020	2030	2040	2050	2060	2062
Dallam	401,663	301,393	239,759	181,074	127,048	117,442
Hartley	409,187	282,289	222,845	164,993	111,222	101,737
Moore	219,654	177,153	143,815	109,433	77,673	71,911
Sherman	398,183	349,022	281,817	212,871	148,647	136,869
Hansford	275,016	272,656	271,226	270,281	269,589	269,479
Hutchinson	62,803	64,522	65,652	66,075	66,027	65,956
Lipscomb	266,809	266,710	266,640	266,591	266,559	266,557
Ochiltree	243,778	243,932	244,002	244,051	244,082	244,085
GMA West	**1,428,687**	**1,109,857**	**888,236**	**668,371**	**464,590**	**427,959**
GMA East	**848,406**	**847,820**	**847,520**	**846,998**	**846,257**	**846,077**
Total	**2,277,093**	**1,957,677**	**1,735,756**	**1,515,369**	**1,310,847**	**1,274,036**

On February 28, 2023, the Texas Water Development board completed GAM Run 21-007 MAG Report related to the most recent GMA-1 joint planning cycle. In this run, the 2020 modeled amounts are less than the previous model run.

Table 10: GAM Run 21-007 MAG Report.

County	2020	2030	2040	2050	2060	2070	2080
Dallam	335,957	285,097	243,426	208,907	179,300	157,255	140,674
Hartley	368,048	282,022	218,805	180,224	154,319	133,600	117,183
Moore	144,904	145,144	138,146	126,680	110,916	92,639	77,341
Sherman	290,593	288,073	261,831	226,430	198,631	166,963	145,690
Hansford	297,486	295,700	281,612	264,290	247,744	229,800	211,464
Hutchinson	77,920	80,189	77,835	74,461	70,609	67,496	64,083
Lipscomb	251,489	270,819	263,478	249,968	235,561	218,975	201,984
Ochiltree	259,676	259,973	247,274	231,502	215,617	199,324	181,295
GMA West	**1,139,502**	**1,000,336**	**862,208**	**742,241**	**643,166**	**550,457**	**480,888**
GMA East	**886,571**	**906,681**	**870,199**	**820,221**	**769,531**	**715,595**	**658,826**
Total	**2,026,073**	**1,907,017**	**1,732,407**	**1,562,462**	**1,412,697**	**1,266,052**	**1,139,714**

Table 11: Comparison of 2023 annual production to the district 2020 MAG (GR16-029 MAG Report).

County	2020 MAG (GR16-029)	2023 Production	2023 Percent Difference between MAG & Production	Average Production 2019-2023	Average Percent Difference between MAG and Production 2019-2023
Dallam	401,663	317,059	-26.68%	335,072	-19.87%
Hartley	409,187	373,495	-9.56%	390,459	-4.80%
Moore	219,654	196,489	-11.79%	194,018	-13.21%
Sherman	398,183	301,707	-31.98%	316,221	-25.92%
Hansford	275,016	217,323	-26.55%	205,645	-33.73%
Hutchinson	62,803	88,108	28.72%	83,122	24.44%
Lipscomb	266,809	48,574	-449.28%	52,995	-403.46%
Ochiltree	243,778	108,320	-125.05%	106,644	-128.59%
GMA-West	**1,428,687**	**1,188,750**	**-20.18%**	**1,235,770**	**-15.61%**
GMA-East	**848,406**	**462,325**	**-83.51%**	**448,405**	**-89.21%**
Total	**2,277,093**	**1,651,075**	**-37.92%**	**1,684,175**	**-35.21%**

2022 Annual Production does not exceed the 2020 MAG (GR16-029 MAG Report). Therefore, there are no conditions that trigger District Rule 8.4 and District Rule 8.5 evaluation to reduce Allowable Annual Reduction. In contrast, the 2020 MAG (GR21-007) shows a substantial reduction from GR16-029. The chart below shows the same comparison for GR21-007 as in the table above (GR16-029).

Table 12: Comparison for GR21-007 as in the table above (GR16-029).

County	2020 MAG (GR21-007)	2023 Production	2023 Percent Difference between MAG & Production	Average Production 2019-2023	Average Percent Difference between MAG and Production 2019-2023
Dallam	335,957	317,059	-5.96%	335,072	-0.26%
Hartley	368,048	373,495	1.46%	390,459	5.74%
Moore	144,904	196,489	26.25%	194,018	25.31%
Sherman	290,593	301,707	3.68%	316,221	8.10%
Hansford	297,486	217,323	-36.89%	205,645	-44.66%
Hutchinson	77,920	88,108	11.56%	83,122	6.26%
Lipscomb	251,489	48,574	-417.74%	52,995	-374.55%
Ochiltree	259,676	108,320	-139.73%	106,644	-143.50%
GMA-West	**1,139,502**	**1,188,750**	**4.14%**	**1,235,770**	**7.79%**
GMA-East	**886,571**	**462,325**	**-91.76%**	**448,405**	**-97.72%**
Total	**2,026,073**	**1,651,075**	**-22.71%**	**1,684,175**	**-20.30%**

TWDB GAM Run 21-007 MAG Report estimate a straight-line decline over a 60-year period in pumping to achieve the joint planning DFC. TWDB MAG Summaries for GAM Run 21-007 are attached to this report. Whereas TWDB GAM Run 16-029 estimates a curved groundwater decline rate.

VIII. Depth to Water, Average Declines Based on Groundwater Production and Declines Observed in District Monitor Wells

Changes in the water table, calculated from monitor well measurements, vary from rises in the water level to declines that may locally exceed 8-12 feet per year. Each county in the District has areas experiencing little or no decline as well as areas of much greater decline. Declines are caused predominately by agricultural pumping and are influenced primarily by surface recharge of the aquifer and lateral flows into and out of the aquifer.

Recharge is affected by rainfall, surface runoff, evaporation and plant uptake, depth to water, soil porosity and the geologic substrata present. An aquifer characteristic that affects the speed an aquifer refills and consequently how much water a well can produce is intra-formational flow. Intra-formational flow is the flow of water from one part of an aquifer into another part of the same aquifer.

Table 13: Average yearly county declines in water levels calculated from groundwater production reports.

County	Average Annual Feet of Decline
Dallam	1.83
Hansford	2.08
Hartley	2.61
Hutchinson	2.75
Lipscomb	0.45
Moore	2.44
Ochiltree	1.04
Sherman	2.86

Average declines in water level are calculated values (Table 13) created using reported annual groundwater production and an estimated aquifer specific yield of 18 percent.

Average county declines and average declines observed in monitor wells differ because District monitor wells are predominately located near areas of high pumping. This bias in monitor well location tends to cause an over estimation of declines when used to calculate county averages.

***Table 14:** 2023-2024, Average depth to water and comparisons of average declines in **select** District water level monitor wells.

County	Avg. Depth to Water (Feet)	2024 Avg. Well Decline (Feet)	2023 Avg. Well Decline (Feet)	Current 5-Year Avg. Well Decline (Feet)	Previous 5-Year Avg. Well Decline (Feet)	Current 10-Year Avg. Well Decline (Feet)	Previous 10-Year Avg. Well Decline (Feet)
Dallam	287	2.30	2.33	2.35	2.59	2.53	2.53
Hansford	306	1.54	1.54	1.54	1.53	1.53	1.50
Hartley	375	2.38	3.36	3.35	3.28	3.33	3.25
Hutchinson	347	1.55	1.54	1.53	1.48	1.51	1.44
Lipscomb	158	.88	.88	.88	.86	.87	.82
Moore	356	1.80	1.81	1.82	1.87	1.85	1.68
Ochiltree	341	1.06	1.07	1.08	1.13	1.13	1.17
Sherman	326	2.85	2.82	2.79	2.58	2.67	2.46
District-wide	**317**	**1.80**	**1.92**	**1.92**	**1.92**	**1.93**	**1.86**

**The information in Table 14 is derived from statistical analyses of monitor well hydrographs created from current and historical information. The statistical analyses (indicating both rises and declines) may indicate the quality of information collected from some wells is less than optimal. Such data may be included in the calculations of declines and depth to water as it represents the best or in some cases the only information available.*

IX Active Production Wells within the District

District records indicate that there are over 18,000 wells that have been permitted or registered since the District was created in 1955. Currently there are 11,483 large active wells which include wells varying in production between 18 GPM to over 1,000 GPM. During 2024, the District issued 150 permits of all types from January through June.

Table 15: Summary of wells in the District and recent new well permits.

County	Active Production Wells	Capped Wells	Small Registered Wells	2023 Production Permits Issued	2024 Permits Issued Through June 2024
Dallam	2,772	282	834	96	30
Hansford	995	377	345	23	14
Hartley	2,830	233	478	102	56
Hutchinson	428	119	148	13	1
Lipscomb	307	57	279	1	1
Moore	1,410	286	621	21	14
Ochiltree	603	215	338	10	15
Sherman	2,138	238	343	55	19
Total	**11,483**	**1,807**	**3,386**	**321**	**150**

*Well count totals may vary over time due to differing database query techniques and as any errors are corrected.

X. District Monitor Wells

Typical District Monitor Well

The District monitors declines in groundwater levels by maintaining a network of water-level monitoring wells. Currently the District measures 436 wells (Table 13). Monitor wells are measured annually beginning in January and measurements are complete March or by mid-March at the latest. The information collected is analyzed, used to create maps and plays a vital role in making reasonable long-term management decisions based on the best available data.

As part of its water level monitoring program, the District may drill or install water level monitoring equipment in wells annually. The drilled wells are non-production wells dedicated solely to data collection which provide information of more accuracy, reliability, and consistency than other types of wells the District monitors. They are also readily available, if needed, for conducting aquifer tests that cannot be easily conducted using other well types.

Table 16: 2024 water level monitor wells by county.

County	Number of Monitor Wells
Dallam	70
Hartley	64
Sherman	63
Moore	62
Hansford	74
Hutchinson	26
Ochiltree	49
Lipscomb	47
Total	**453**

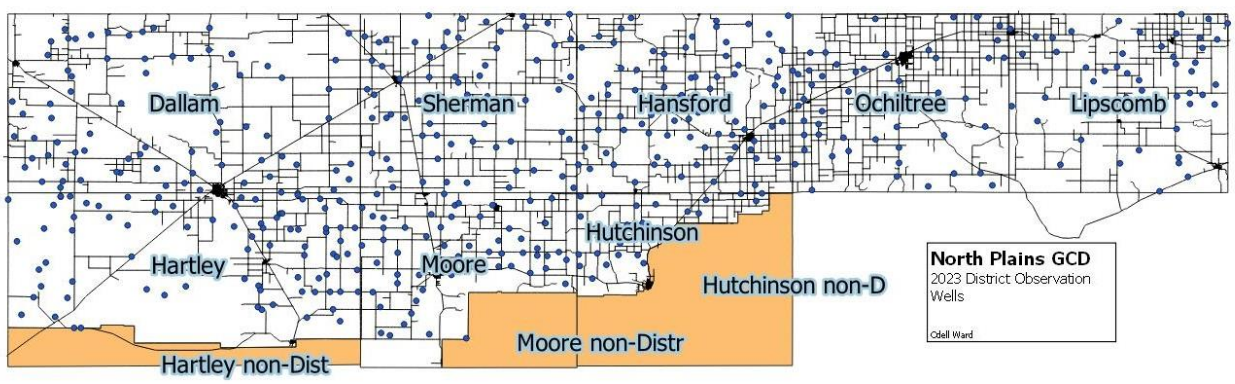
District monitor well under construction

XI. District Monitor Well Locations and On-line Interactive Maps

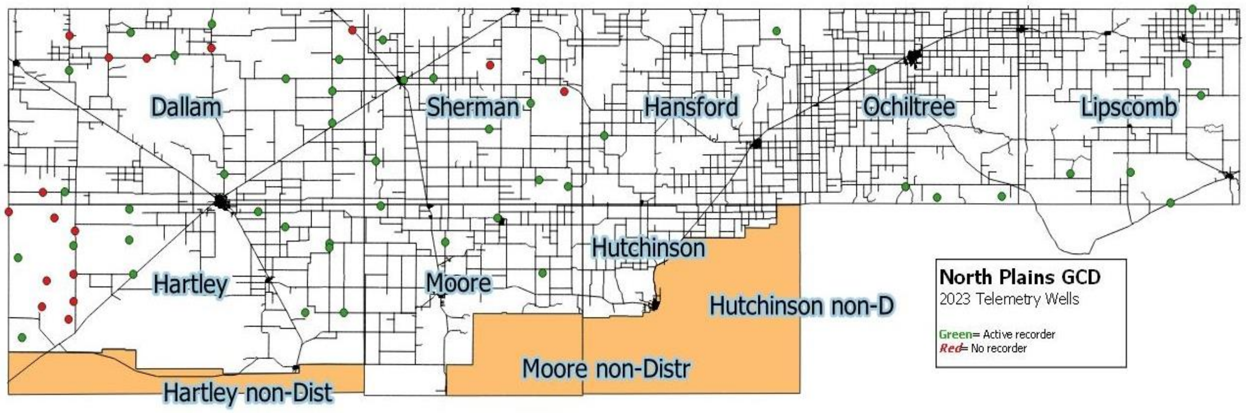
The District maintains a website where data from wells, monitor wells and recording equipment may be viewed. The map is always a work in progress and all data may not yet be available. More data and other map layers may become available as work on the on-line map progresses.

North Plains GCD Dashboard (lre-up.com)

Map 2: Map of private well locations from which the District annually measures water levels.



Map 3: District-owned water level monitor wells with and without recording equipment. (Red = No Recording Equipment Installed).



XII. Water Quality

The District's goals for groundwater is that future water supplies are of sufficient quantity and also of excellent quality. The District monitors groundwater chemistry by analyzing samples from select wells within the District and performing water quality analyses upon request from area residents.

District Natural Resource Specialist performing a water quality analysis.

The District may analyze water samples for the following parameters as necessary:
Total Hardness,
Chloride,
Conductivity,
Fluoride,
Iron,
Nitrate,
pH,
Sodium,
Sulfate,
Total Dissolved Solids,
The Presence or Absence of Coliform Bacteria.

Groundwater within the District is considered excellent although it is "hard" water and contains considerable calcium and some magnesium carbonate (hardness) (Table 14). The District also performs analyses to indicate the presence or absence of coliform bacteria. In the rare instance an analysis indicates the presence of coliform bacteria, the contamination source is often located within a few yards of the sampled well. Normally a well that tests positive for coliform bacteria can be decontaminated by eliminating the contaminate source, chlorinating the well, pipes and water storage equipment and then purging the well, pipes and water storage equipment.

Table 17: Typical mineral analyses in mg/L from wells within the District.

Parameter	Units	2021 Number of Analyses	2021 Average Analysis Result	2022 Number of Analyses	2022 Average Analysis Result	2023 Number of Analyses	2023 Average Analysis Result
Sulfate	mg/l	17	52.78	15	27.33	28	24.92
Nitrate	mg/l	17	3.04	15	1.186	28	0.92
Total Iron	mg/l	17	14.84	15	0.05	28	0.21
Chlorides	mg/l	17	19.28	15	33	28	21.25
Fluoride	mg/l	17	1.13	15	5.386	28	.044
Total Hardness	mg/l	**17**	**231.74**	**15**	188.466	**28**	**193**

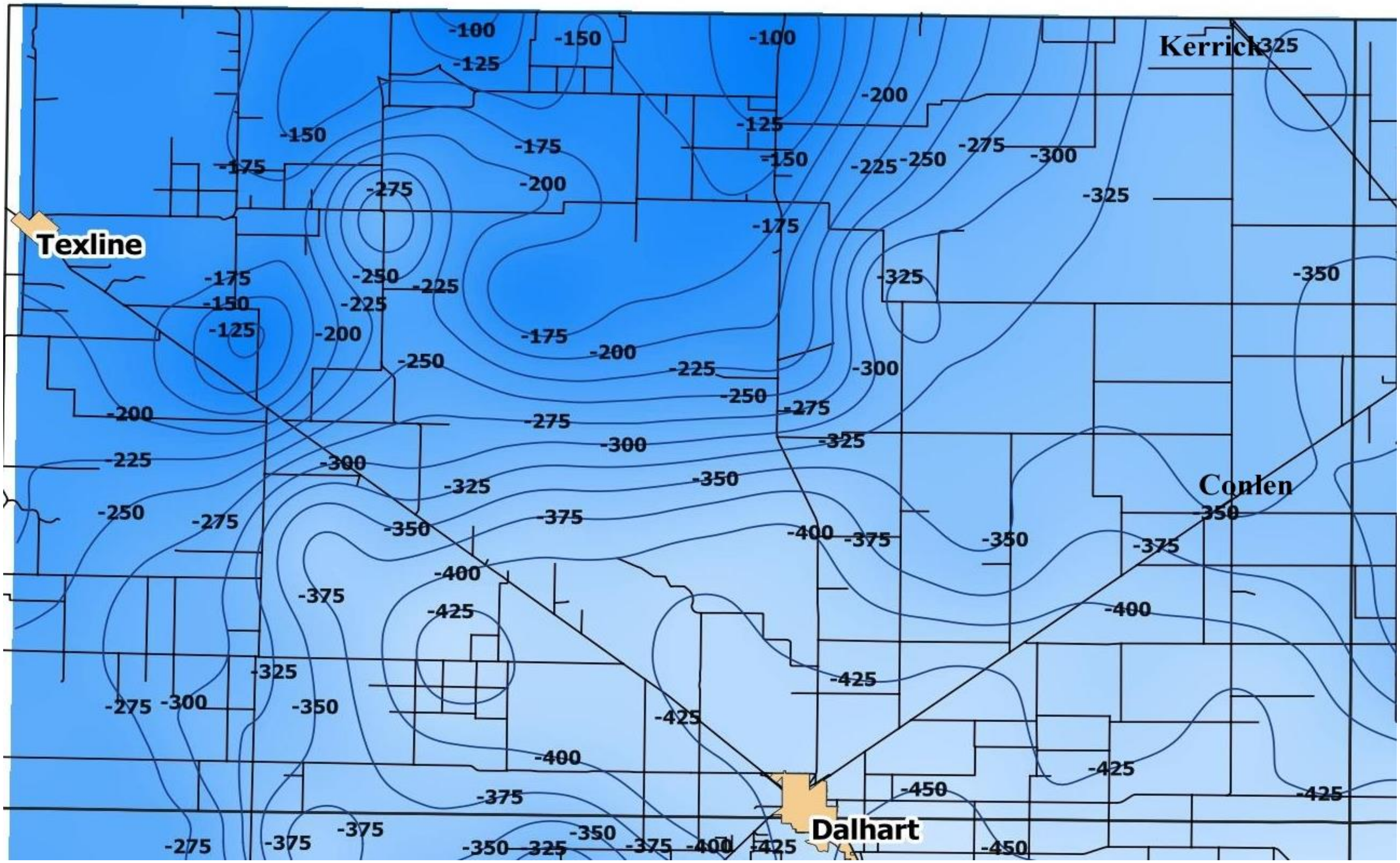
Table 17 shows the average mineral compositions in milligrams per liter as indicated from analyses of well water from within the District. The District samples random wells at the owner's request as well as annually analyzing a subset of wells from the District's monitoring well program. No meaningful conclusions may be drawn from the above table about potential changes in water quality over time as the values are not all derived from the same set of wells. District residents may request a groundwater analysis by contacting the district office. In most instances the analyses are free to district residents.

XIII. 2023-2024 Depth to Water from Land Surface

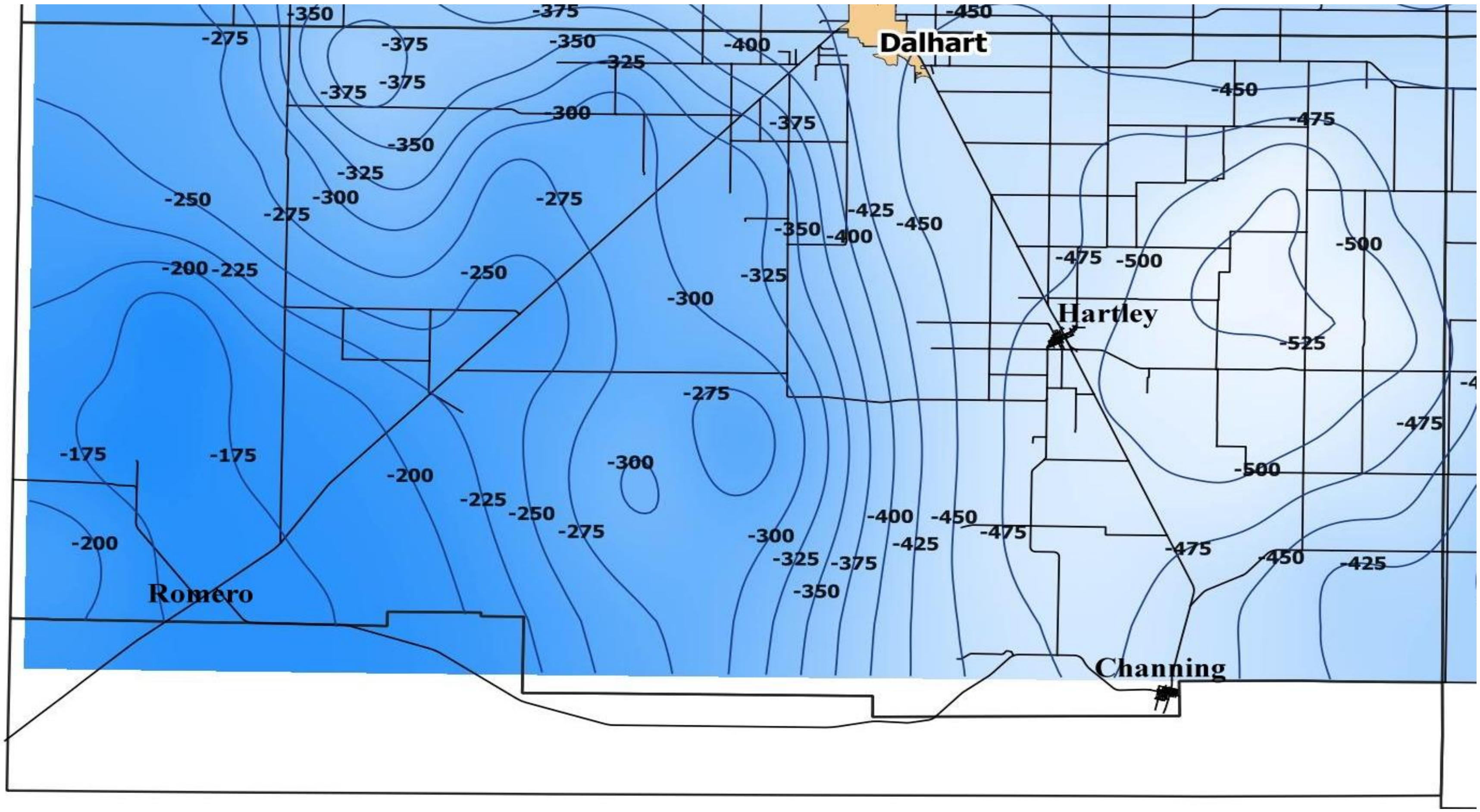
Maps depicting depth to water below land surface are created from statistical analyses of current and historical water level measurements. The most recent water level measurements were measured in January and February of 2024. Those water level measurements represent the depth to water at the end of the 2023 agricultural pumping season and prior to the beginning of the 2024 pumping season. It is valid to title the maps either 2023 or 2024 Depth to Water.

Accuracy: The accuracy of the depth to water is estimated to be equal to the contour interval, +/- 50 feet.

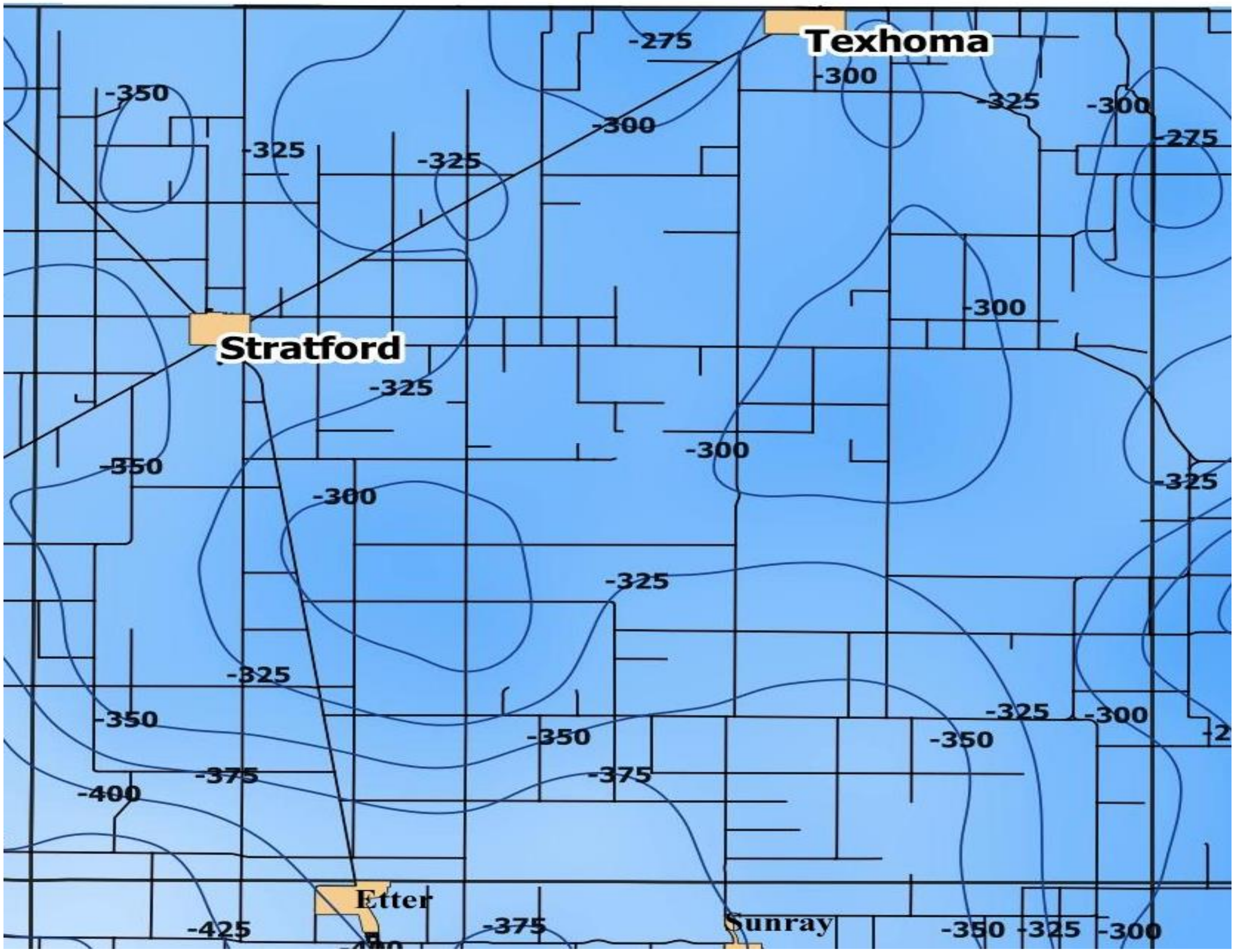
Map 4: **Dallam County;** **Depth to Water Ending 2023.**



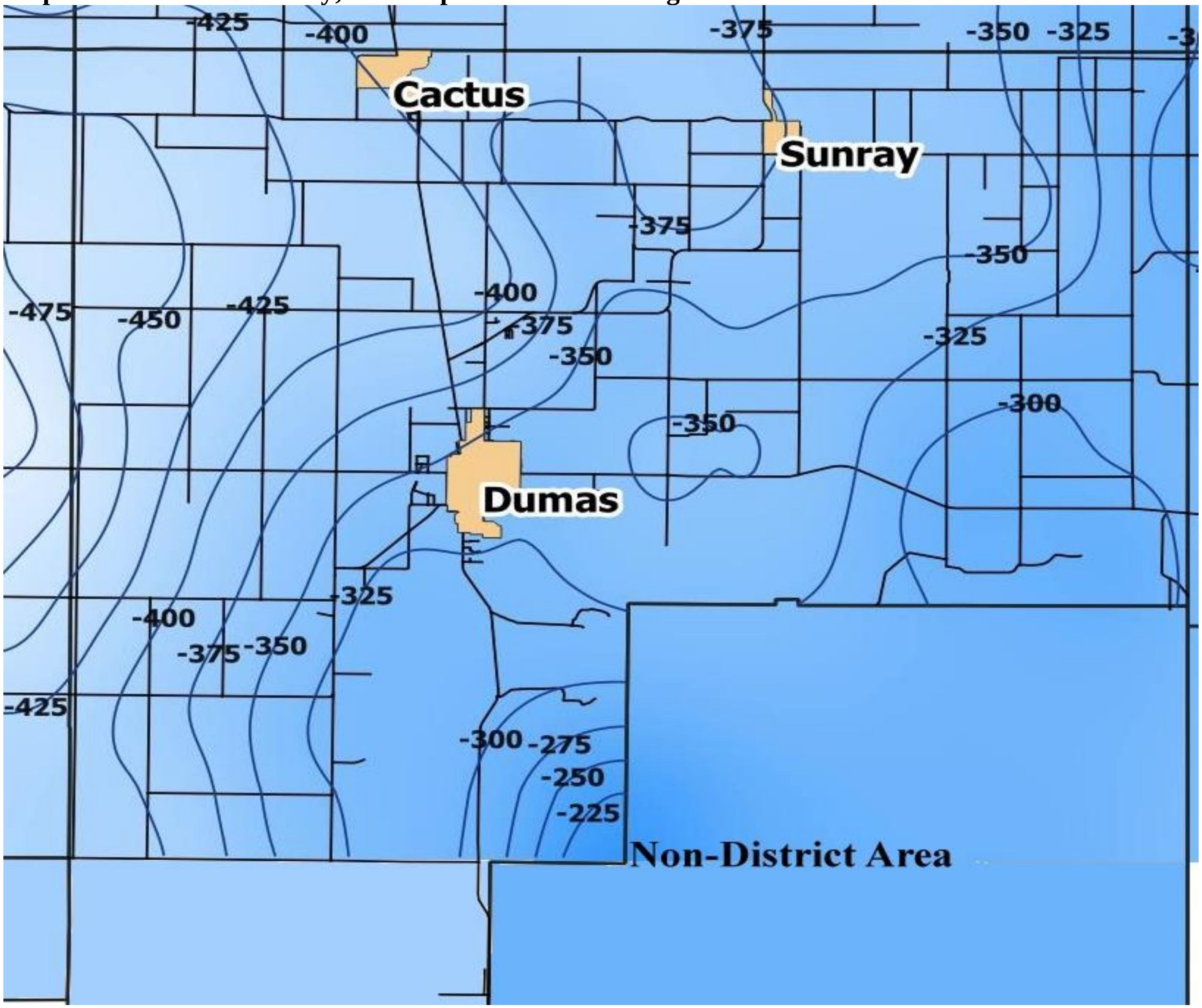
Map 5: Hartley County; Depth to Water Ending 2023.



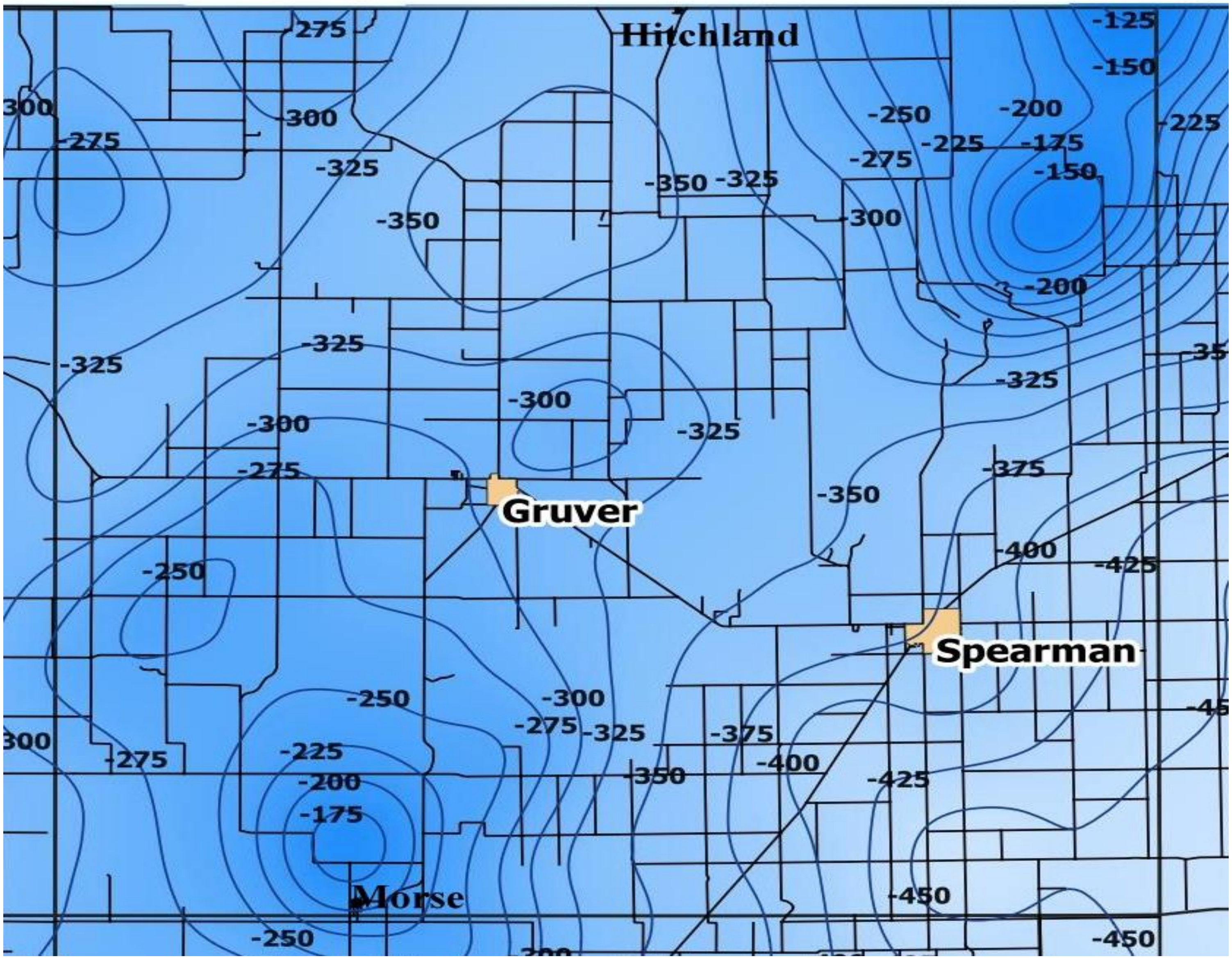
Map 6: Sherman County; Depth to Water Ending 2023.



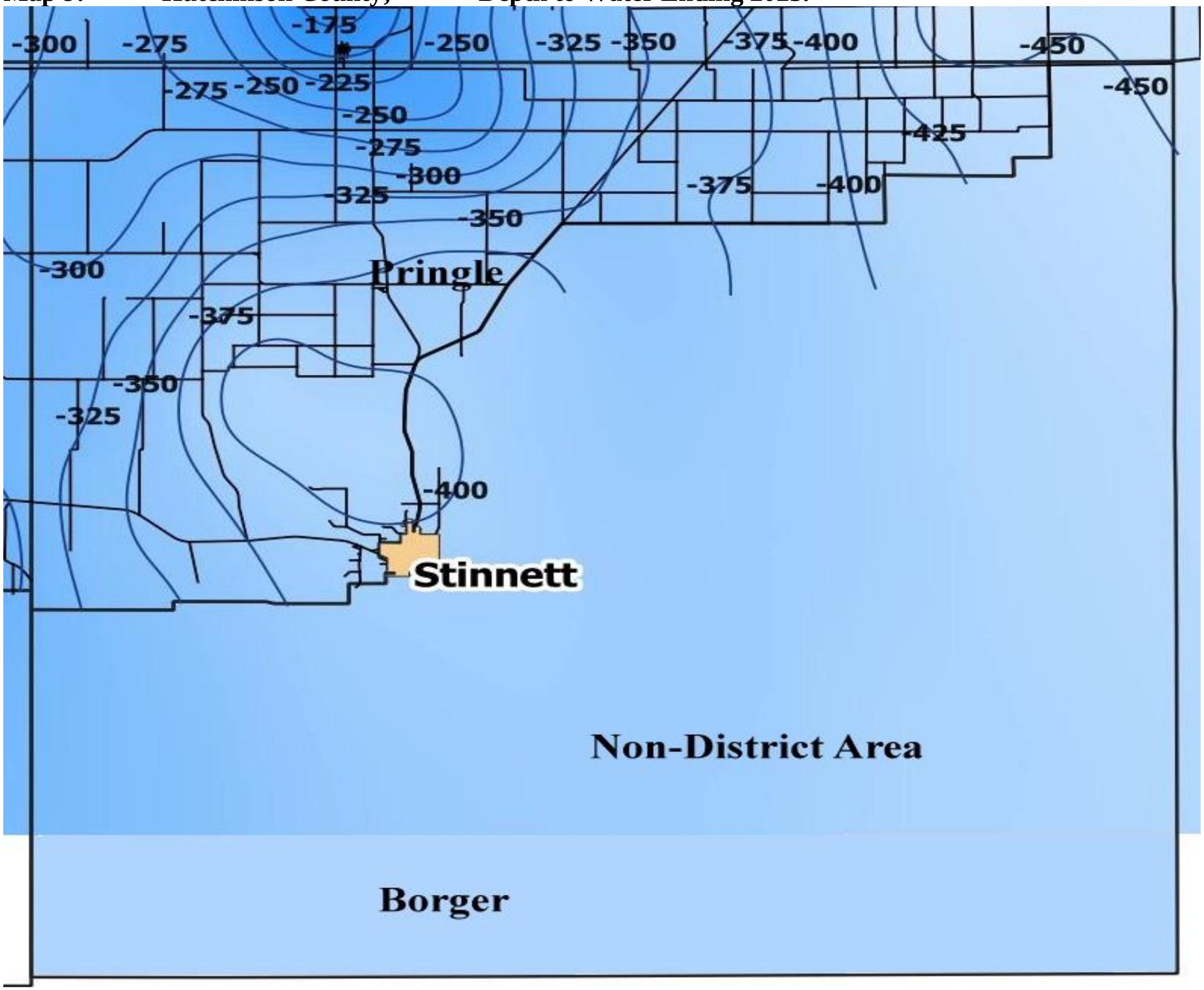
Map 7: Moore County; Depth to Water Ending 2023.



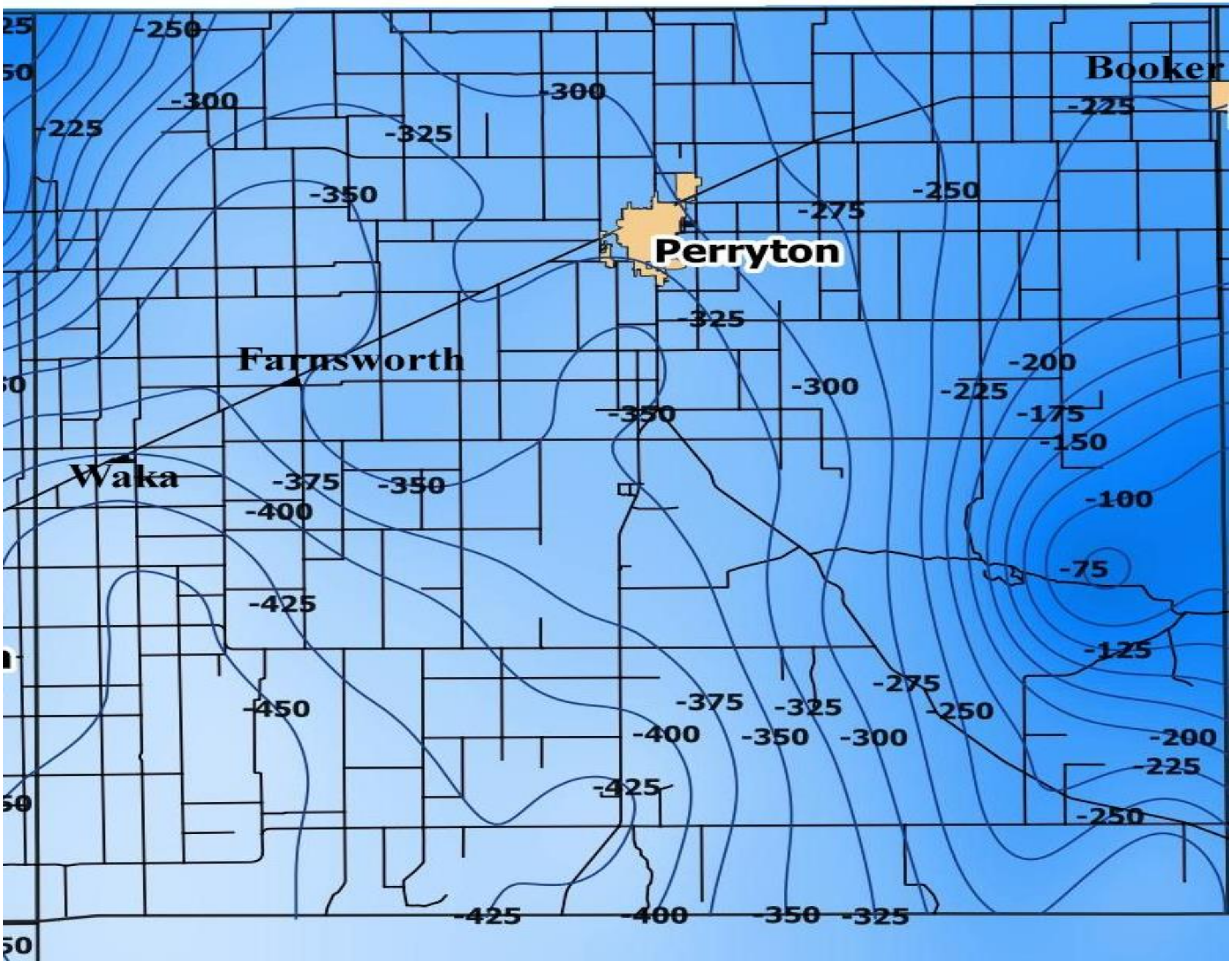
Map 8: Hansford County; Depth to Water Ending 2023.



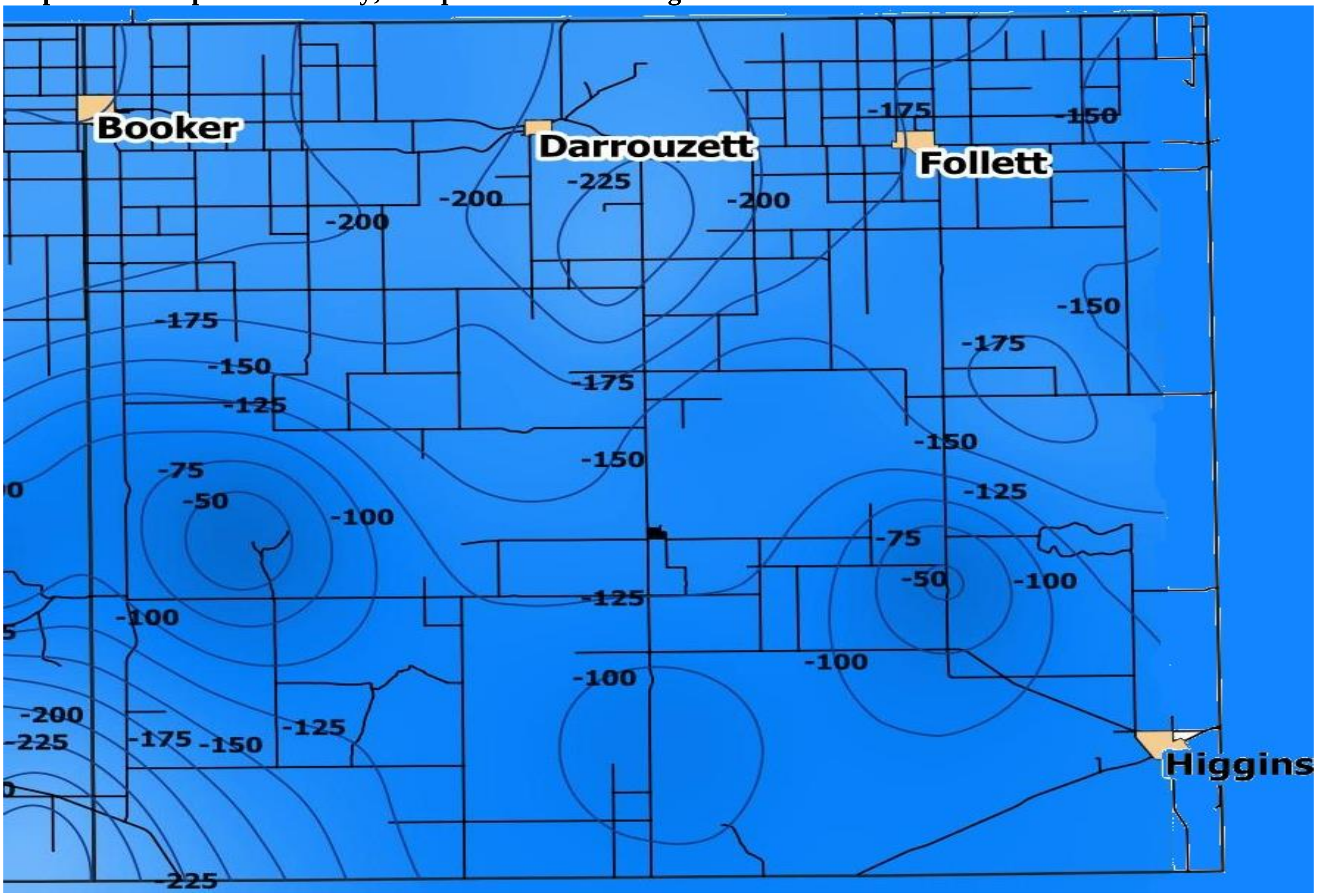
Map 9: Hutchinson County; Depth to Water Ending 2023.



Map 10: Ochiltree County; Depth to Water Ending 2023.



Map 11: Lipscomb County; Depth to Water Ending 2023.



XIV. Declines (from 2023 Pumping) in Monitor Wells by County

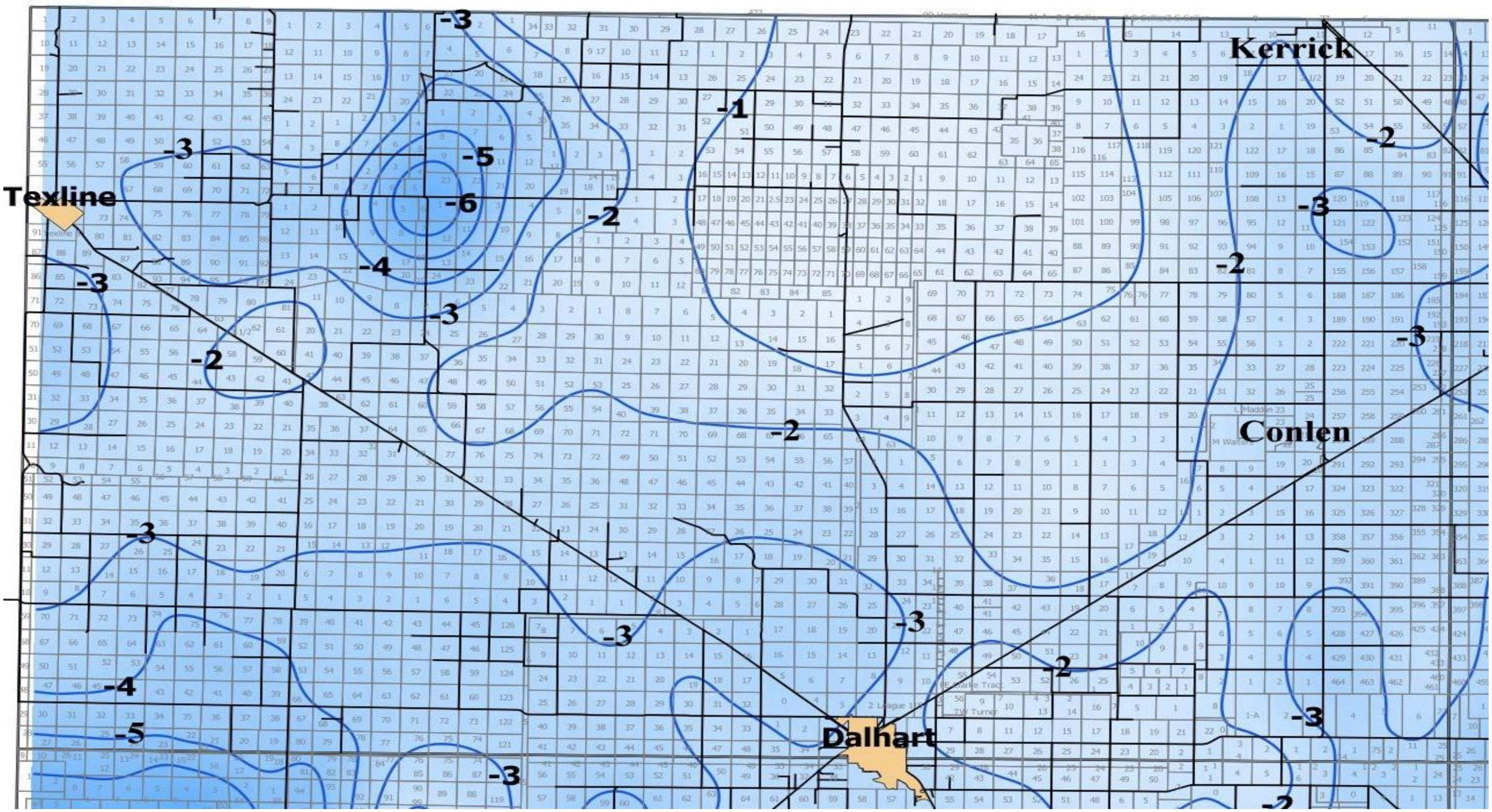
These maps do not include well measurements that indicate rises in water level. Rises may be valid for some specific areas but generally the statistical analyses do not indicate a high level of confidence in that data, therefore it is not used.

Maps depicting declines in monitor wells are created from a statistical analysis of current and historical water level measurements. The most recent water level measurements were taken in January and February of 2023. The declines represent declines resulting predominantly from the 2022 agricultural pumping season.

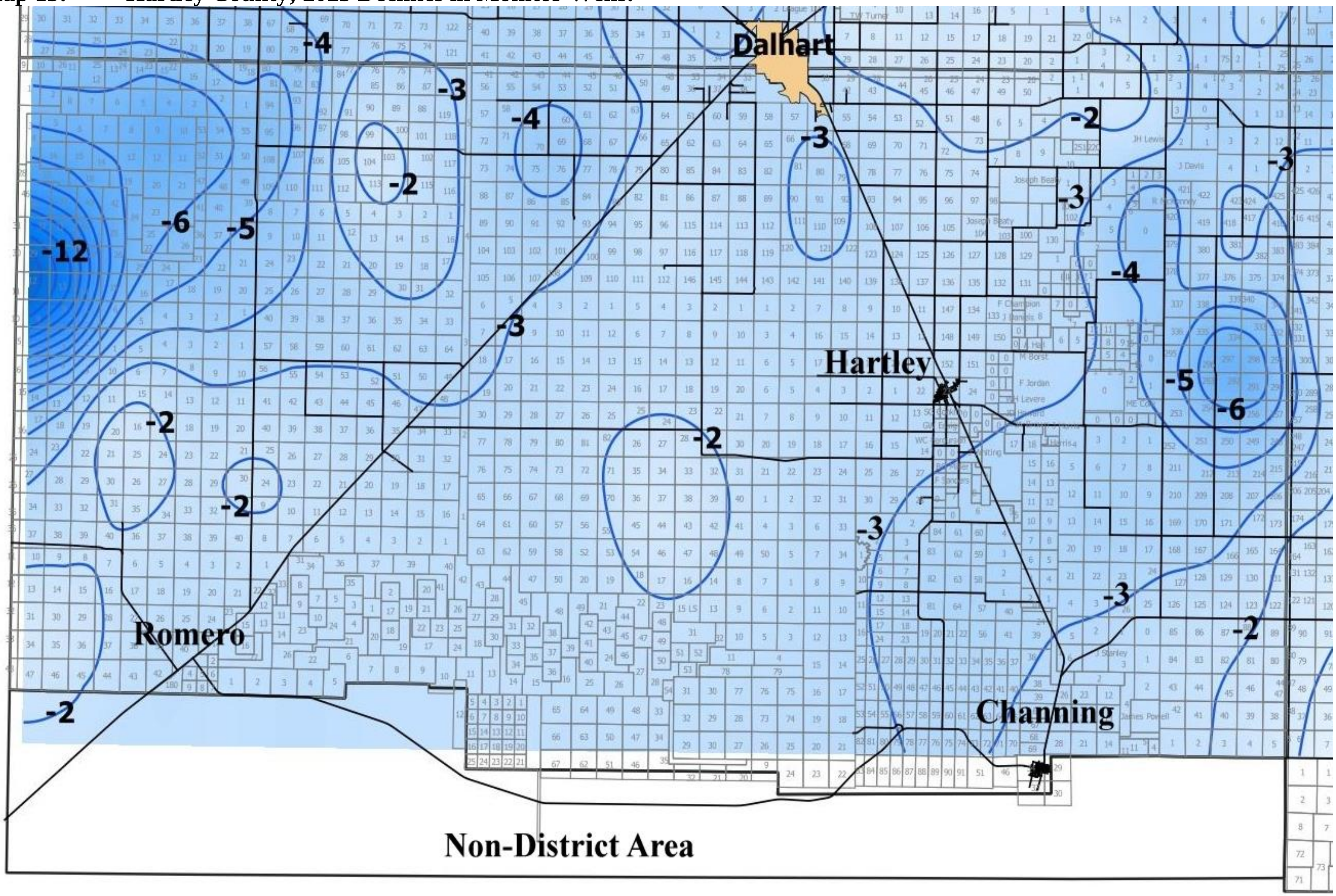
Declines are calculated using water level measurements taken from District monitor wells which are located primarily in high pumping areas. Consequently, these wells tend to show higher declines than what a true county-average-decline would show.

Accuracy: The accuracy of the decline maps is estimated to be +/- 2 feet.

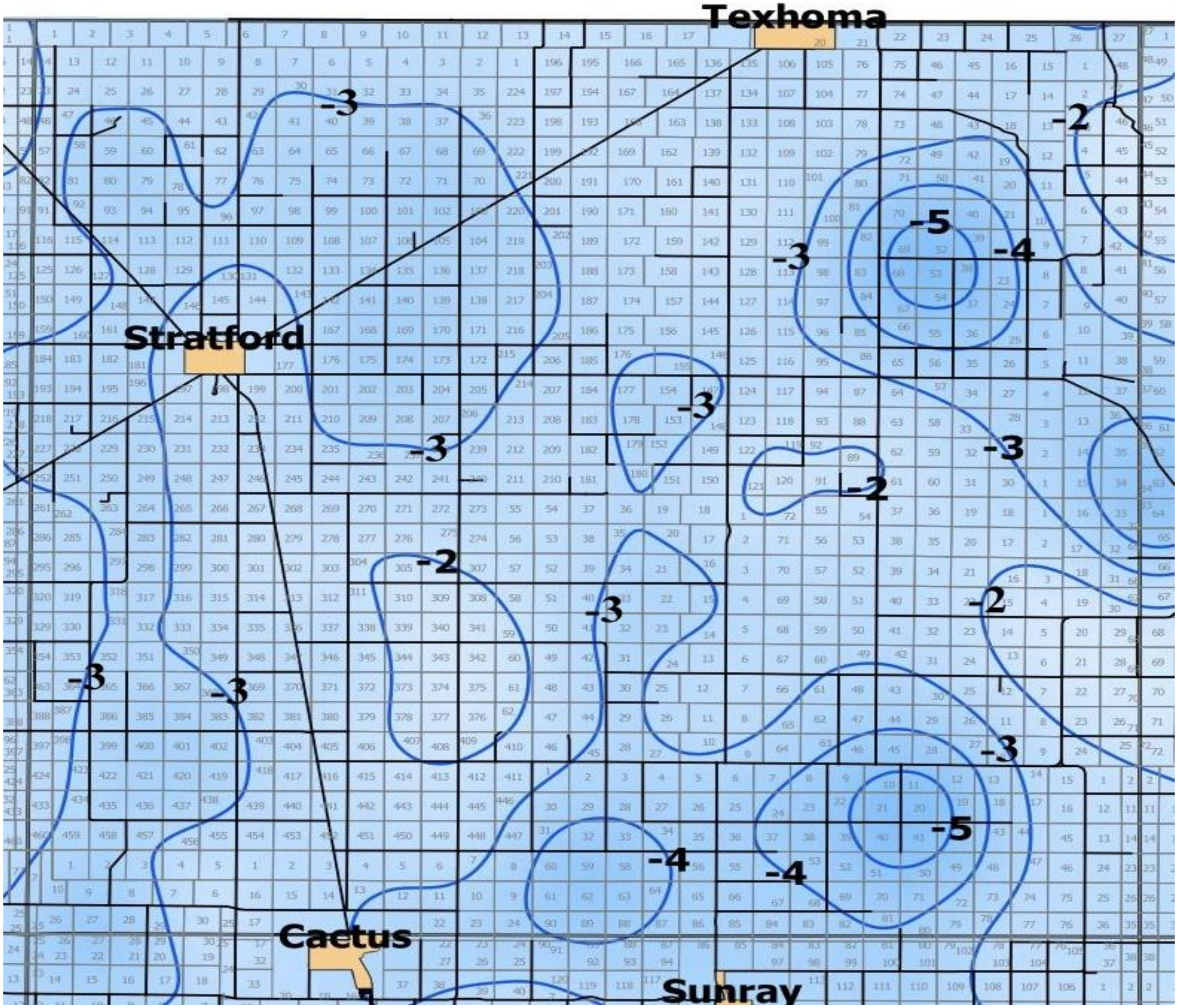
Map 12: **Dallam County; 2023 Declines in Monitor Wells.**



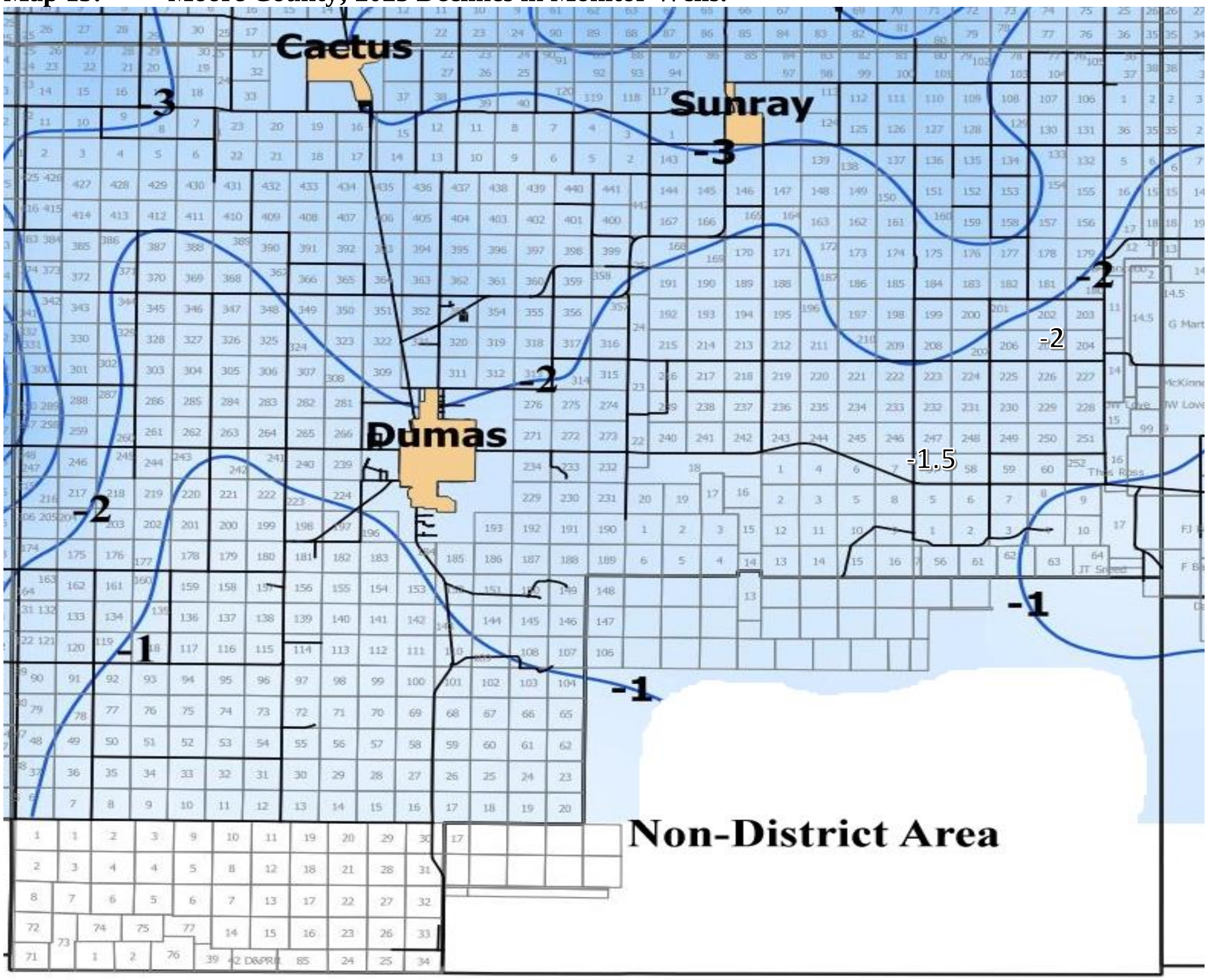
Map 13: Hartley County; 2023 Declines in Monitor Wells.



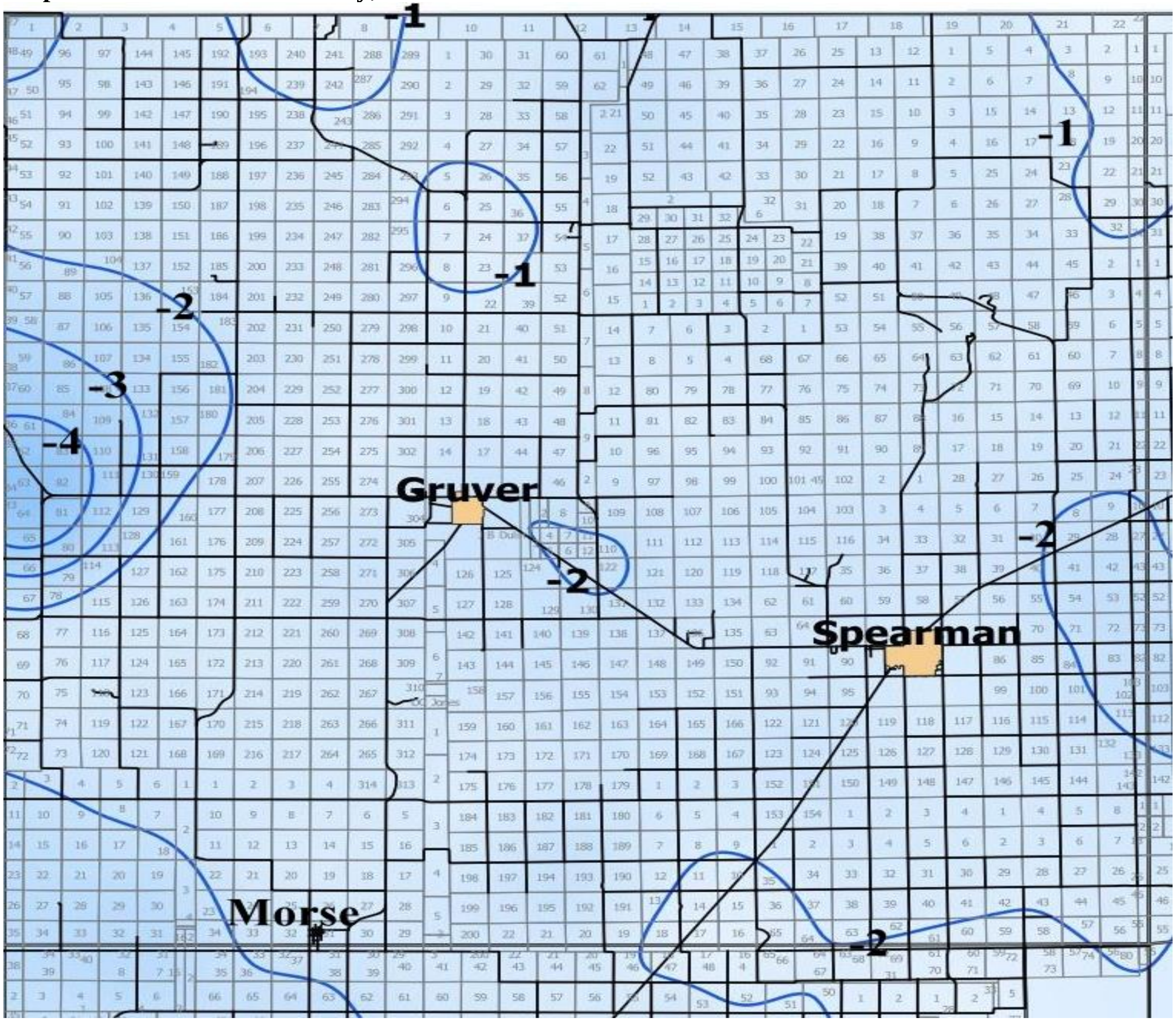
Map 14: Sherman County; 2023 Declines in Monitor Wells.



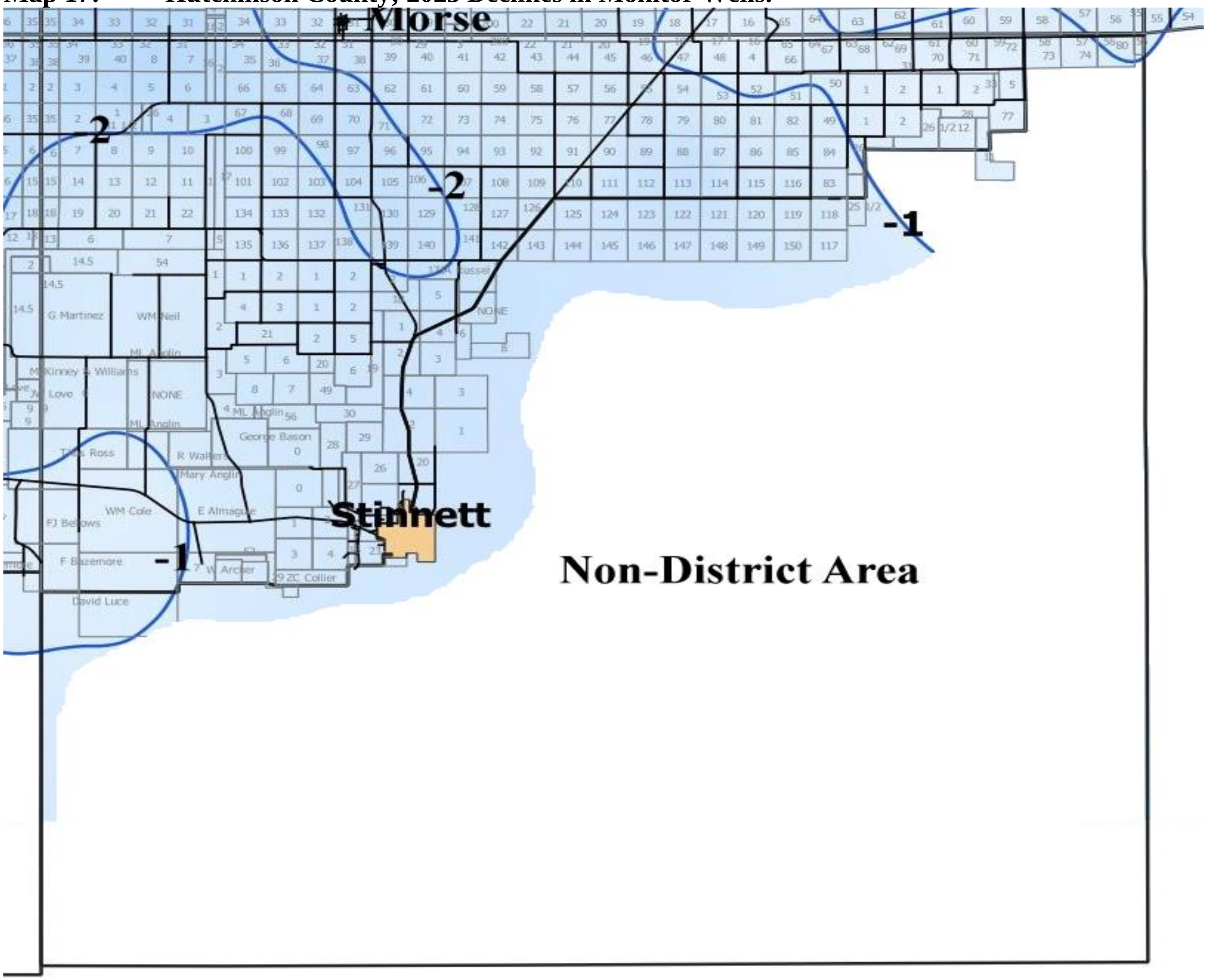
Map 15: Moore County; 2023 Declines in Monitor Wells.



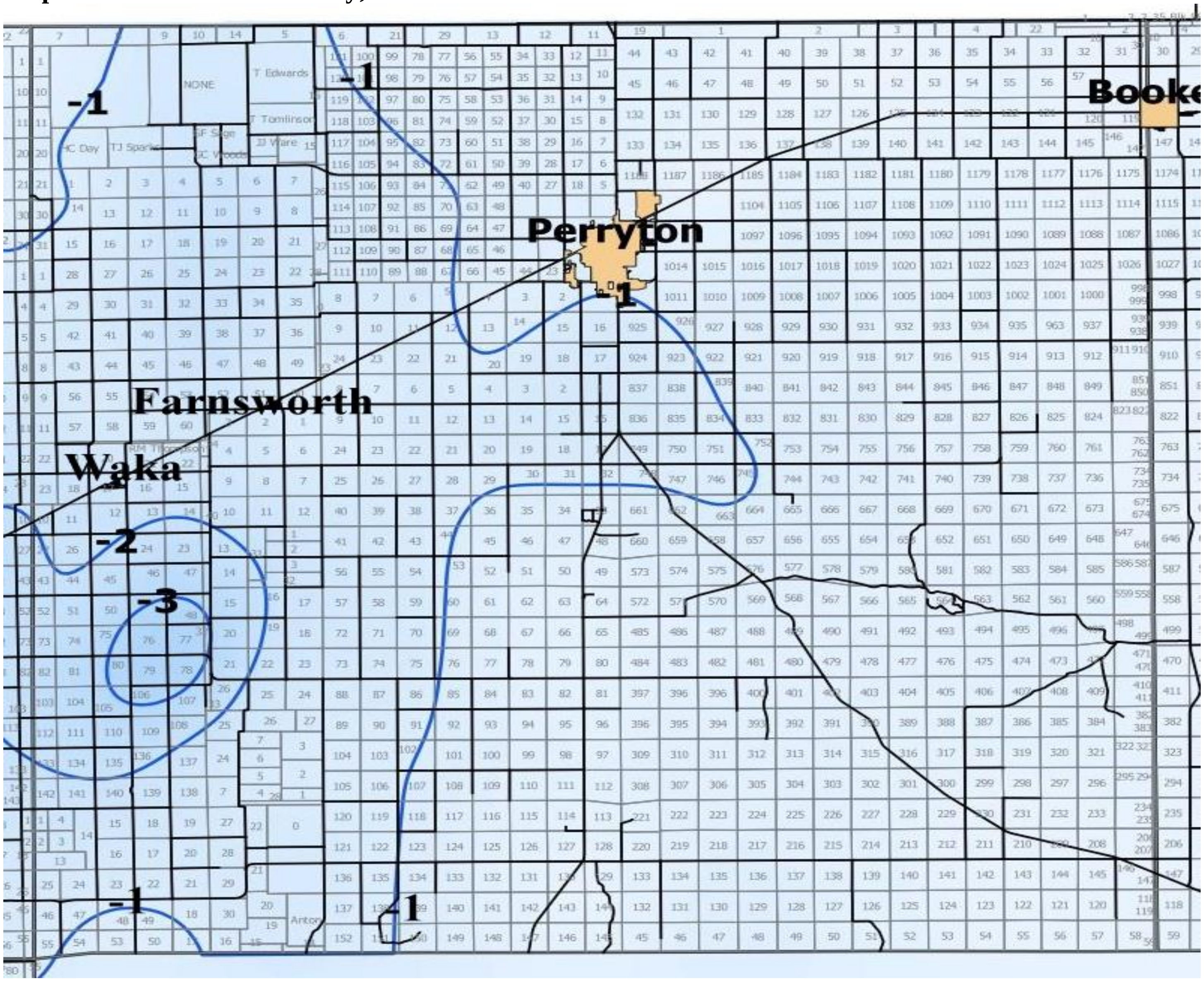
Map 16: Hansford County; 2023 Declines in Monitor Wells.



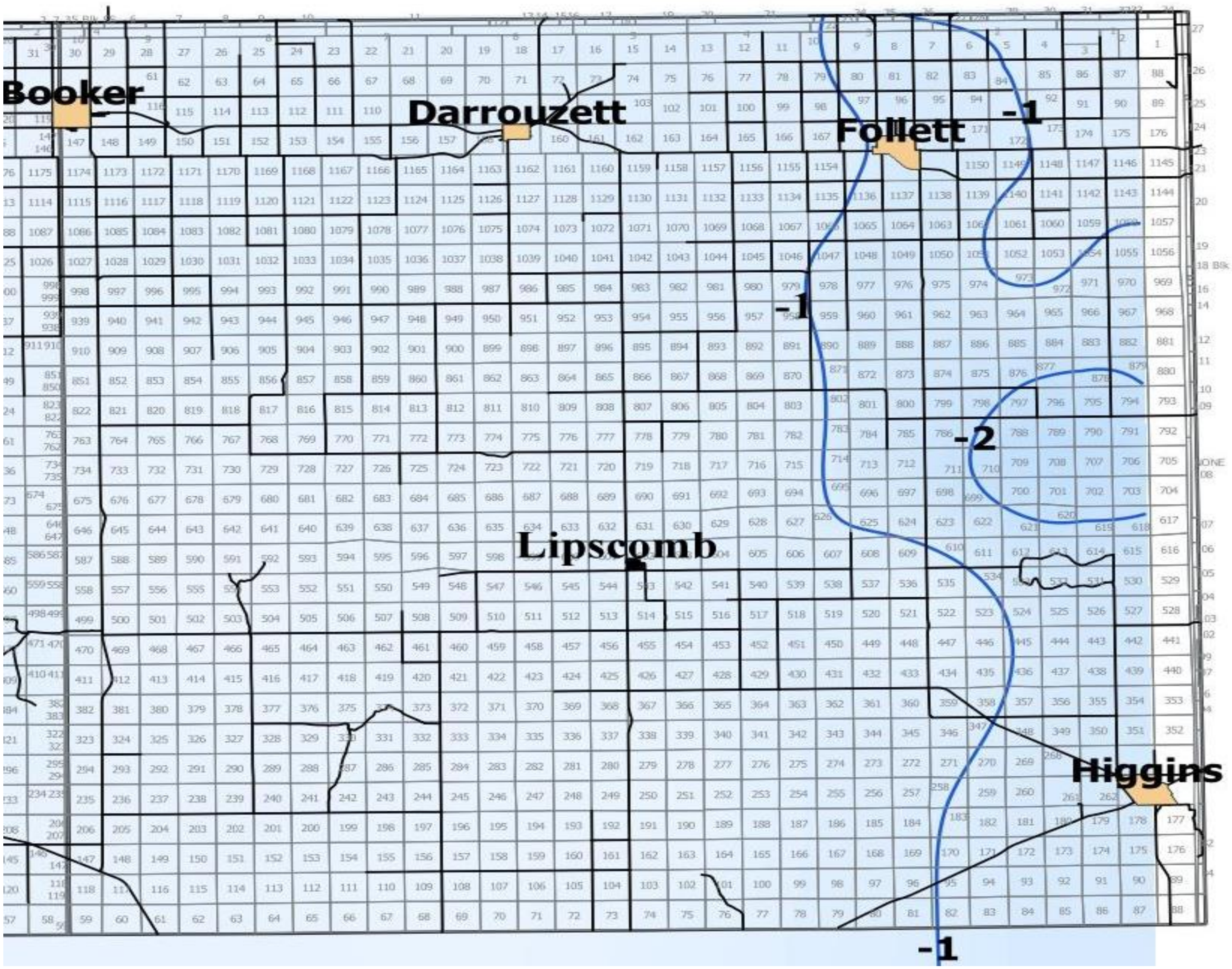
Map 17: Hutchinson County; 2023 Declines in Monitor Wells.



Map 18: **Ochiltree County; 2023 Declines in Monitor Wells.**



Map 19: Lipscomb County; 2023 Declines in Monitor Wells.



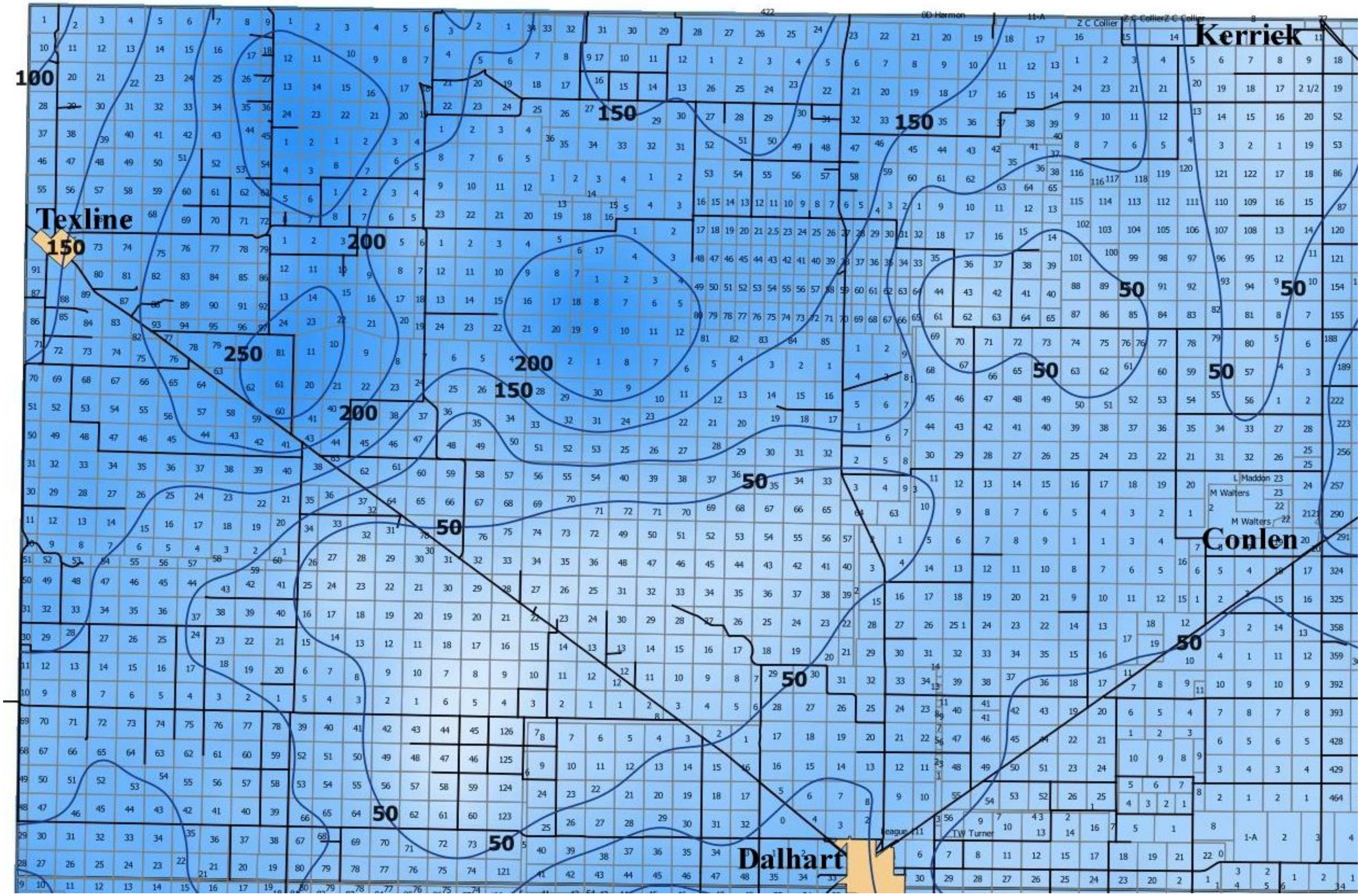
XV. 2023-2024 Estimated (Average) Saturated Thickness of the Ogallala Aquifer by County

Maps depicting estimated aquifer saturated thickness are created using geographical information mapping software and may be created by various methodologies. The most recent water measurements used in creating saturated thickness maps were taken in January, and February of 2024. The saturated material calculated represent the saturated material at the end of the 2023 pumping season and the beginning of the 2024 pumping season. The Saturated Thickness maps represent the saturated thickness at the beginning of 2024 and is considered reasonably accurate for a 3-5 year period.

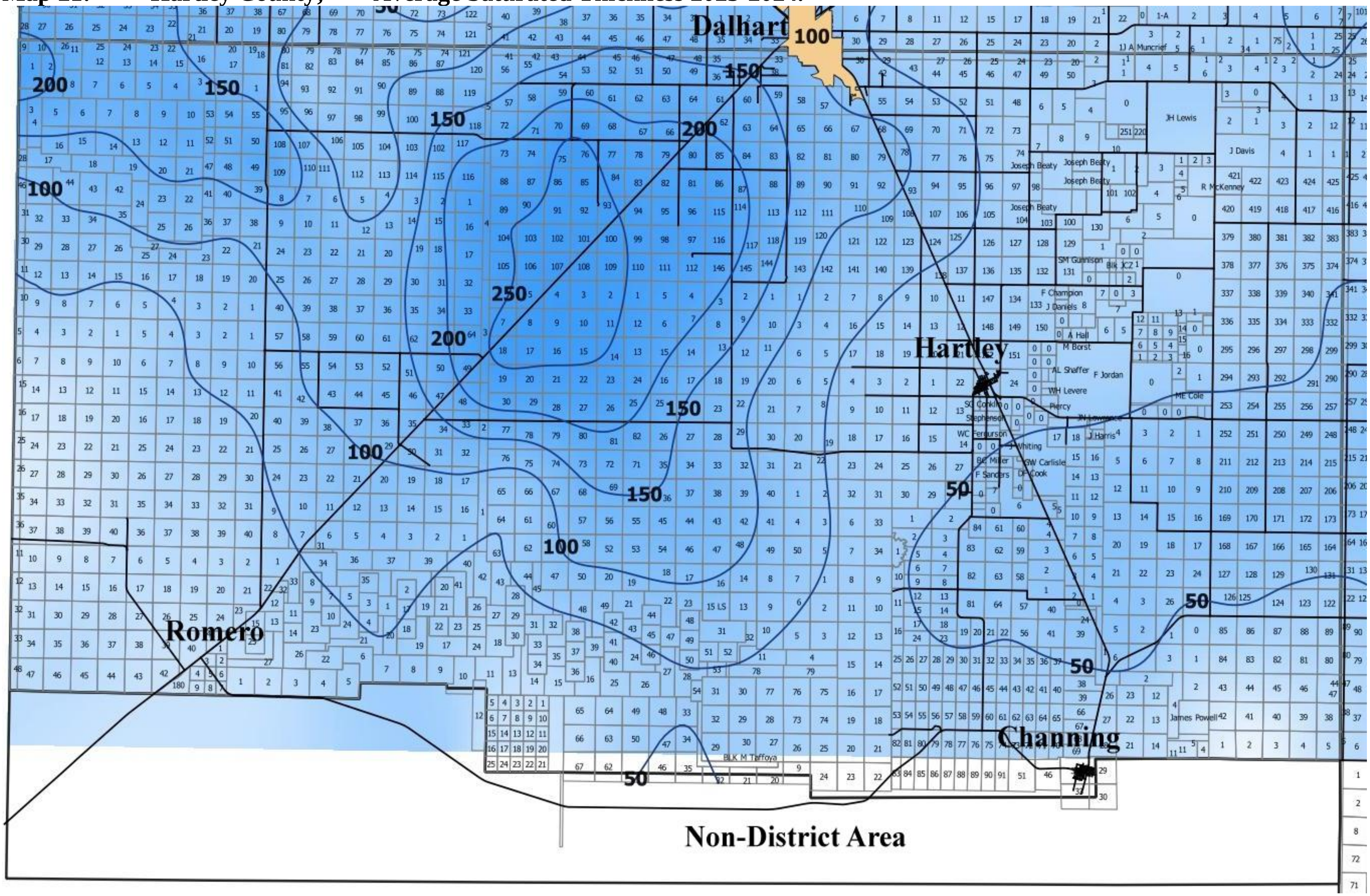
Estimated Saturated Thickness Maps are generally created every third year. The next set of estimated aquifer thickness maps are scheduled to be created by mid-late Summer of 2027.

Accuracy: Map accuracy is estimated to be equal to +/- 50 feet. In some areas data may have been included from the Rita Blanca or the Dockum Aquifers due to the uncertainty in delineating those boundaries. Inclusion of such data may increase the value of the saturated thickness of the Ogallala above what may be encountered in the field.

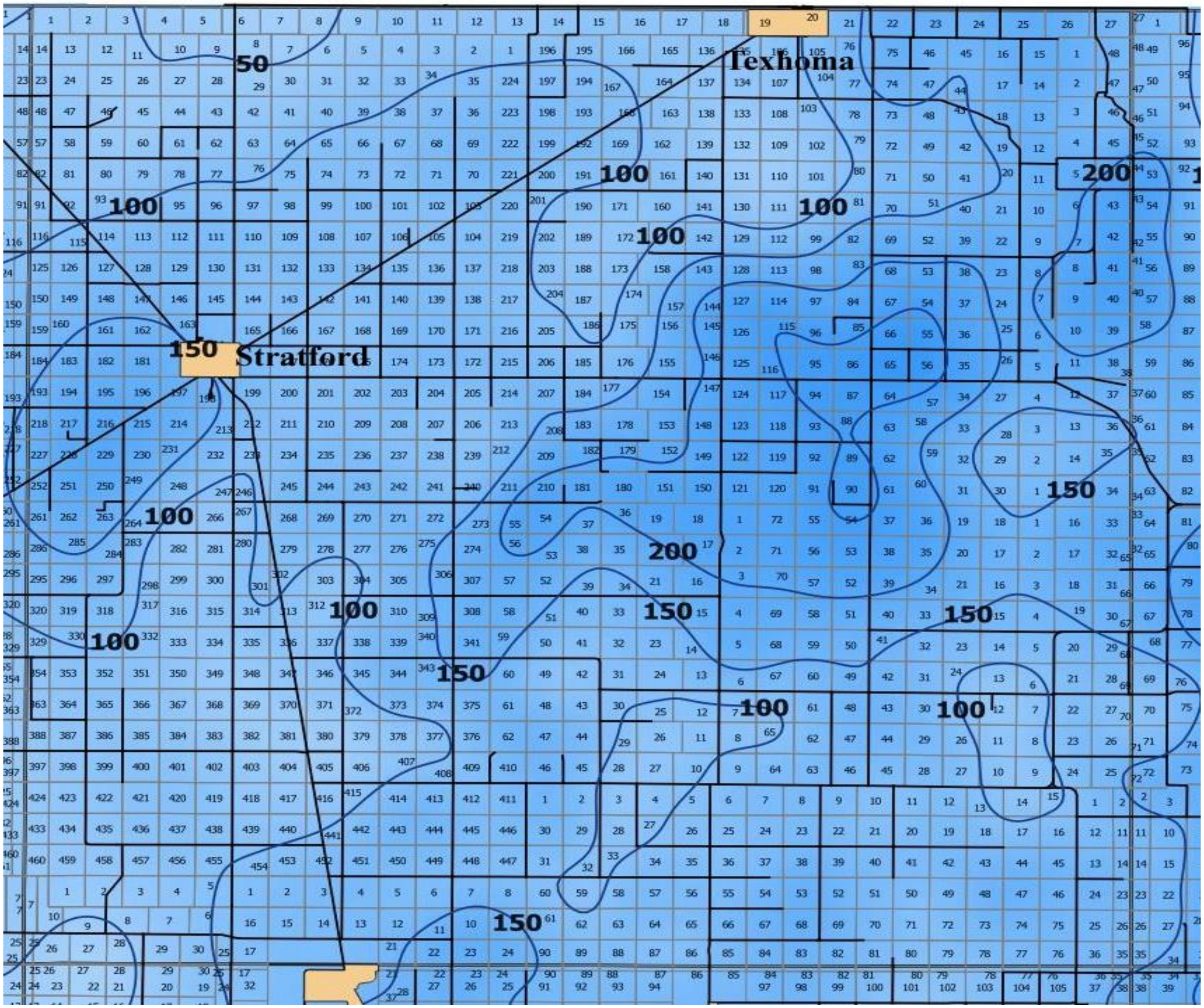
Map 20: Dallam County; Average Saturated Thickness 2023-2024.



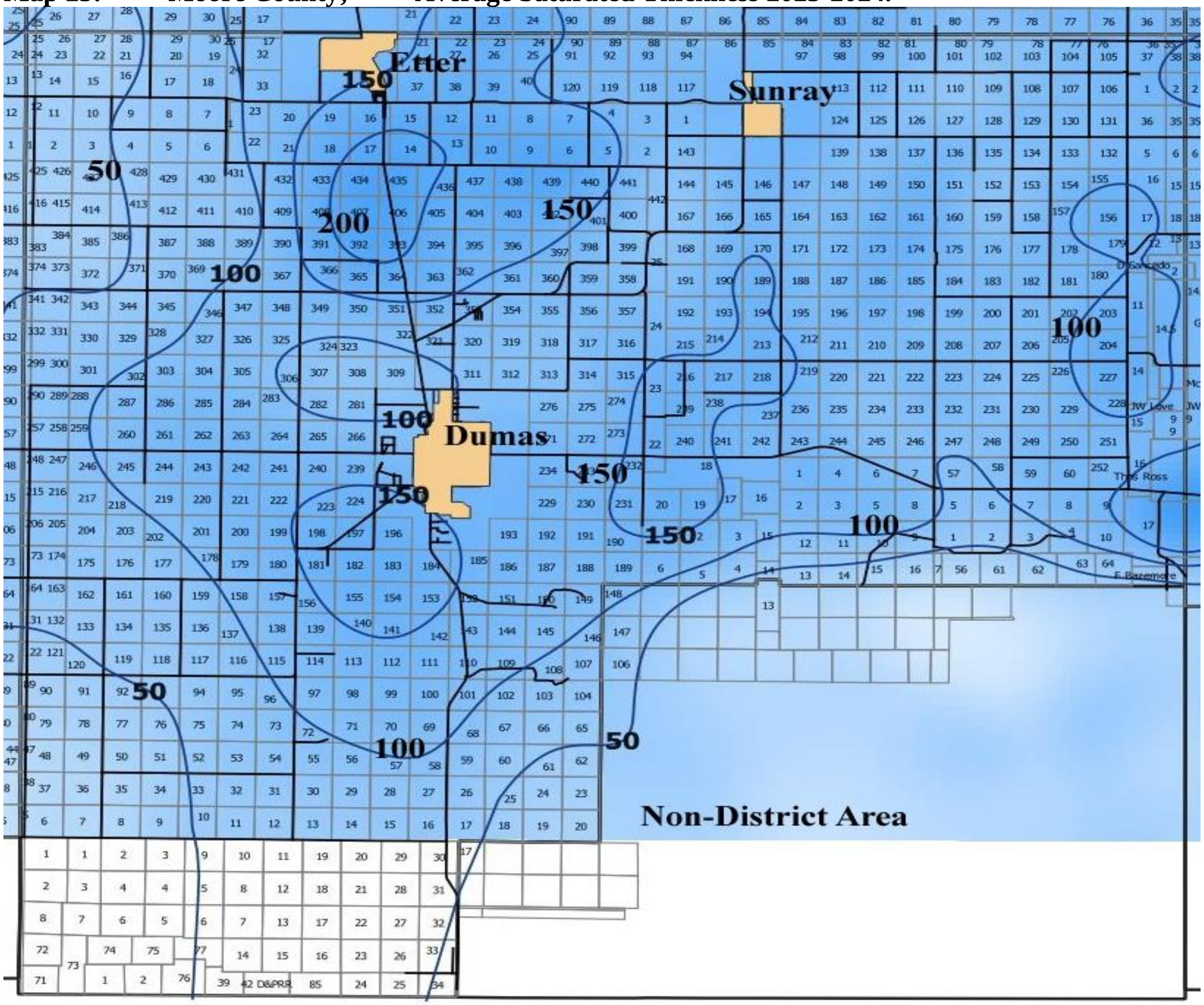
Map 21: Hartley County; Average Saturated Thickness 2023-2024.



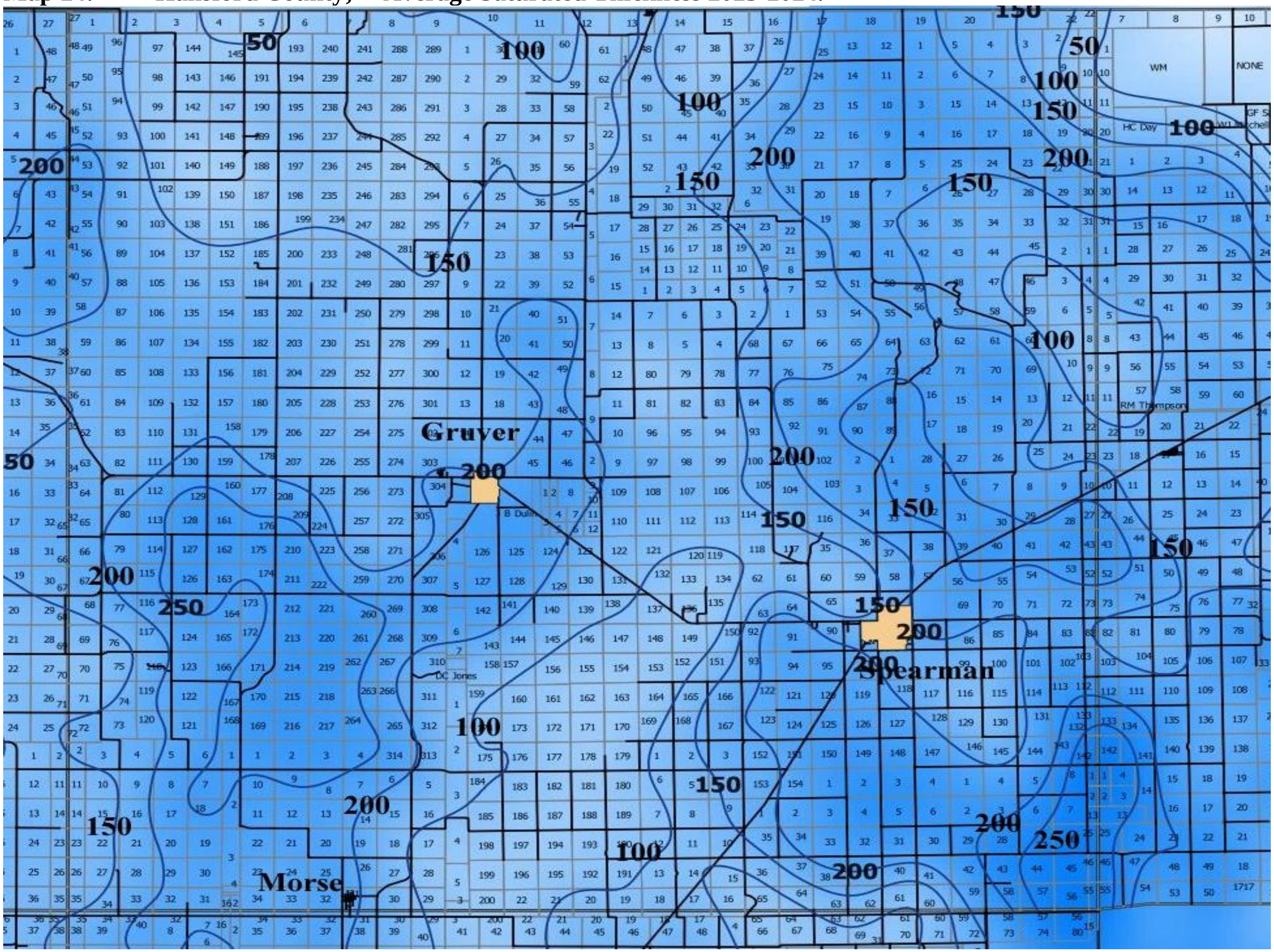
Map 22: Sherman County; Average Saturated Thickness 2023-2024.



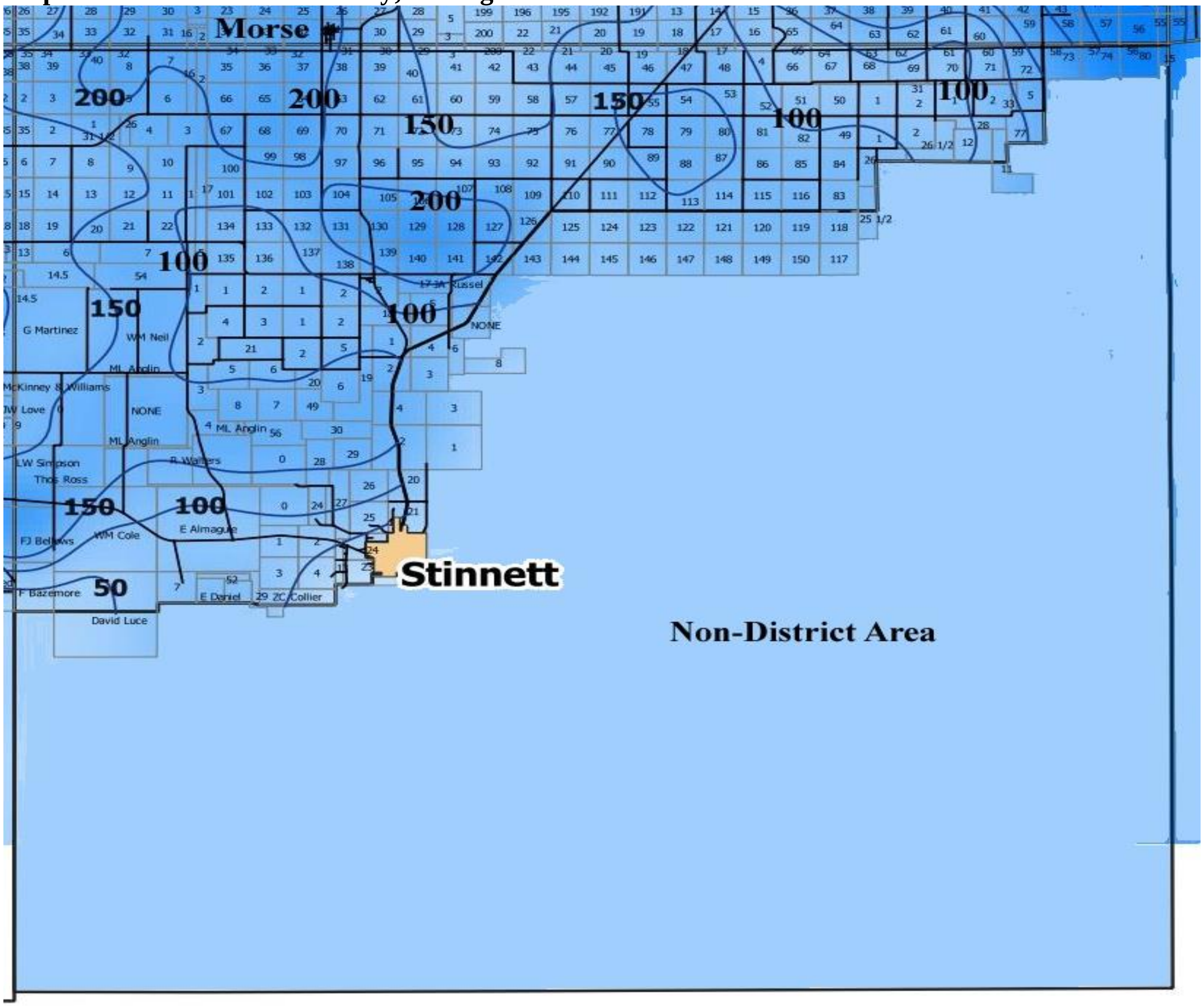
Map 23: Moore County; Average Saturated Thickness 2023-2024.



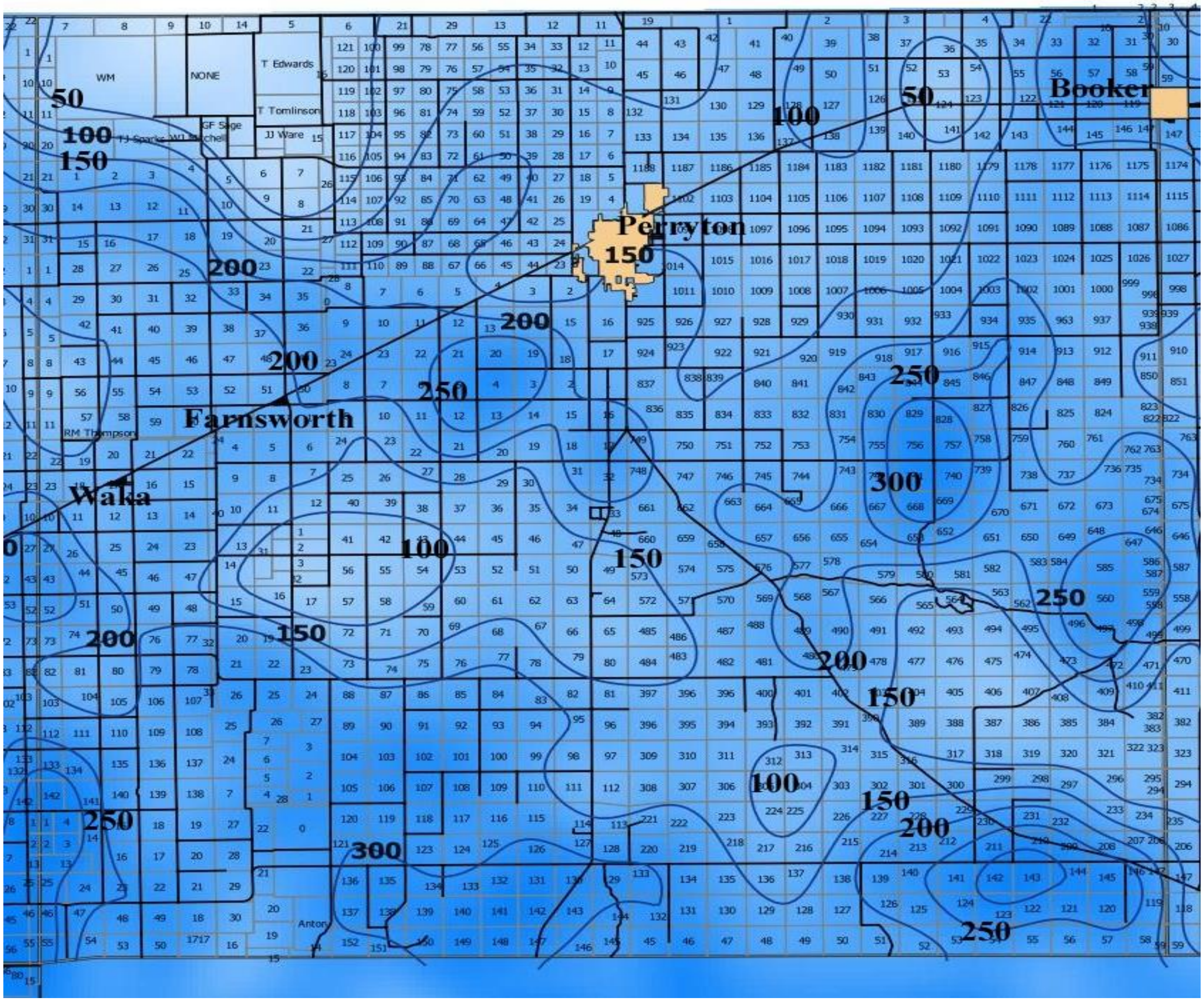
Map 24: **Hansford County; Average Saturated Thickness 2023-2024.**



Map 25: Hutchinson County; Average Saturated Thickness 2023-2024.



Map 26: Ochiltree County; Average Saturated Thickness 2023-2024.



Map 27: Lipscomb County; Average Saturated Thickness 2023-2024.

XVI. Contributors to Hydrology and Groundwater Resources 2023-2024

2024 North Plains Groundwater District Staff:

Barnes, Baylee	Conservation Outreach Specialist
Blackwell, Kristen	Administration Manager
Cadenhead, Braden	Natural Resource Specialist
Donley, Krystal	Administrative Assistant
Funk, Mitch	Natural Resource Specialist
Glazner, Paige	Conservation Outreach Assistant
Guthrie, Janet	General Manager
Holt, Dusty	Permitting Specialist/Finance Assistant
Orthman, Lou	Compliance Coordinator
Quiroz, Angel	Natural Resource Specialist
Schwertner, Curtis	Natural Resource Specialist
Tice, Casey	Production Coordinator
Robinett, Sherry	Admin Assistant
Ward, Odell	Aquifer Science Manager
Welch, Kirk	Assistant General Manager

North Plains Groundwater Conservation District
603 East First Street (Mail: P.O. Box 795)
Dumas Texas 79029
Office 806-935-6401, Fax 806-935-6633
Office Hours 8-12 AM, and 1-5 PM, Mon-Fri