

GAM run 03-36

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Texas Water Development Board
Groundwater Availability Modeling Section
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REQUESTOR:

Mr. H. P. "Bo" Brown, Jr., Chairman, Llano Estacado Regional Water Planning Group (LERWPG)

DESCRIPTION OF REQUEST:

The LERWPG requested that the Southern Ogallala Groundwater Availability Model (GAM) be run using the water demand projections for water user groups (WUGs) of LERWPG, as approved by the Texas Water Development Board on September 17, 2003 for the period of record through 2060. Through consultation with the consultant, HDR, hired by the LERWPG, we decided to modify only irrigation pumpage in the GAM run. This approximation was determined to be acceptable because more than 95 percent of all groundwater pumpage in the region is for irrigation. The projected demands are shown in Table 1. The requested output were water-level maps, maps of saturated thickness, and maps showing municipal areas with dry cells highlighted.

METHODS:

The pumpage for the model was changed to reflect the new irrigation demand values through 2060. Changes in pumping required making changes to the irrigation pumpage files which were then combined with all other pumping files to create the input file used by MODFLOW. A program was written to interpolate the new decadal pumping values to produce annual values. The annual pumpage was then distributed monthly throughout the year based on monthly historic usage.

After the model run, in order to compute the saturated thickness, the hydraulic heads for 2004, 2010, 2020, 2030, 2040, 2050, and 2060 were saved as database files to be imported into ArcGIS. In addition, each file was contoured in PMWIN, and the resulting water-level figures were exported to ArcGIS as a DXF file. These figures show the water levels for the years indicated above.

The database files were joined in ArcGIS with a file that contains the bottom elevations of the Ogallala aquifer. The bottom elevation was subtracted from each water-level file, and the result was contoured to create saturated thickness maps for each of the years indicated above.

PARAMETERS AND ASSUMPTIONS:

The recharge in the model represented average climatic conditions for the entire model run of 2001 to 2060. No change in pumpage was considered for the counties not included on the new projected demands table. All other parameters and assumptions agree with those discussed in the GAM final report (Blandford and others, 2003).

RESULTS:

A sampling of the results of the GAM run for LERWPG are shown in Figures 1 to 21. Figures 1 to 14 show water-level elevations of the Ogallala for 2004, 2010, 2020, 2030, 2040, 2050, and 2060. Also shown in the figures are metropolitan areas in the region. Figure A shows the outline of the Ogallala aquifer in the LERWPG area. Several counties are labeled for reference. Contour intervals are 100 feet and dry cells are indicated as missing cells within the model boundaries. Dry cells occur mostly in southern Parmer and northern Bailey counties with random occurrences across the model area during 2004. These areas expand through time with large parts of Castro, Parmer, Bailey, and Hale counties containing dry cells by 2060.

Figures 15 to 21 show the saturated thickness of the Ogallala aquifer for the years 2004 to 2060 by decade. The contour intervals are 50 feet and metropolitan areas are indicated in dark blue. The saturated thickness of the Ogallala aquifer continues to shrink through time with the thinnest section occurring in 2060.

REFERENCES:

Blandford, T. N., Blazer, D. J., Calhoun, K. C., Dutton, A. R., Naing, T., Reedy, R. C., and Scanlon, B. R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico: Numerical simulations through 2050: Final Report prepared by D. B. Stephens & Assoc, for the Texas Water Development Board

Llano Estacado Region -- Water Demand Projections

Table 1: Water Demands by County and Basin										
County	WUG Name	Basin Name	2000	2010	2020	2030	2040	2050	2060	
Water Use			ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	
BAILEY County										
Municipal	COUNTY-OTHER	BRAZOS	331	342	358	364	371	370	363	
Municipal	MULESHOE	BRAZOS	979	1,027	1,082	1,109	1,137	1,135	1,114	
Municipal	Total		1,310	1,369	1,440	1,473	1,508	1,505	1,477	
Manufacturing		BRAZOS	264	303	316	326	335	343	365	
Steam-Electric		BRAZOS	0	0	0	0	0	0	0	
Irrigation		BRAZOS	182,865	172,139	168,010	163,980	160,046	156,206	152,457	
Mining		BRAZOS	0	0	0	0	0	0	0	
Livestock		BRAZOS	1,723	2,824	3,856	3,962	4,074	4,192	4,318	
	TOTAL		186,162	176,635	173,622	169,741	165,963	162,246	158,617	
BRISCOE County										
Municipal	COUNTY-OTHER	RED	180	183	183	176	165	159	155	
Municipal	SILVERTON	RED	126	128	128	123	115	111	108	
Municipal	Total		306	311	311	299	280	270	263	
Manufacturing		RED	0	0	0	0	0	0	0	
Steam-Electric		RED	0	0	0	0	0	0	0	
Irrigation		RED	26,329	29,002	27,950	26,936	25,958	25,016	24,108	
Mining		RED	0	0	0	0	0	0	0	
Livestock		RED	317	325	334	343	353	363	374	
	TOTAL		26,952	29,638	28,595	27,578	26,591	25,649	24,745	
CASTRO County										
Municipal	COUNTY-OTHER	BRAZOS	208	222	234	240	243	241	237	
Municipal	COUNTY-OTHER	RED	247	263	278	285	288	286	281	
Municipal	DIMMITT	BRAZOS	975	1,041	1,103	1,137	1,159	1,150	1,130	
Municipal	HART	BRAZOS	223	238	251	258	262	260	256	
Municipal	Total		1,653	1,764	1,866	1,920	1,952	1,937	1,904	
Manufacturing		BRAZOS	1,637	1,923	2,082	2,213	2,337	2,445	2,617	
Manufacturing		RED	95	112	121	128	136	142	152	
Steam-Electric		BRAZOS	0	0	0	0	0	0	0	
Steam-Electric		RED	0	0	0	0	0	0	0	
Irrigation		BRAZOS	337,541	239,669	230,482	221,644	213,147	204,975	197,116	
Irrigation		RED	166,251	118,046	113,520	109,168	104,982	100,957	97,087	
Mining		BRAZOS	0	0	0	0	0	0	0	
Mining		RED	0	0	0	0	0	0	0	
Livestock		BRAZOS	2,631	3,599	4,417	4,623	4,842	5,074	5,321	
Livestock		RED	3,215	4,398	5,399	5,650	5,918	6,202	6,503	
	TOTAL	BRAZOS	343,215	246,692	238,569	230,115	221,990	214,145	206,677	
	TOTAL	RED	169,808	122,819	119,318	115,231	111,324	107,587	104,023	
	TOTAL		513,023	369,511	357,887	345,346	333,314	321,732	310,700	

Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
Water Use			ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
COCHRAN County									
Municipal	COUNTY-OTHER	BRAZOS	172	183	191	192	185	176	167
Municipal	COUNTY-OTHER	COLORADO	92	98	102	103	99	95	90
Municipal	MORTON	BRAZOS	499	535	560	565	547	521	496
Municipal	Total		763	816	853	860	831	792	753
Manufacturing		BRAZOS	0	0	0	0	0	0	0
Manufacturing		COLORADO	0	0	0	0	0	0	0
Steam-Electric		BRAZOS	0	0	0	0	0	0	0
Steam-Electric		COLORADO	0	0	0	0	0	0	0
Irrigation		BRAZOS	76,790	48,009	46,157	44,376	42,662	41,015	39,432
Irrigation		COLORADO	43,195	27,005	25,964	24,962	23,998	23,072	22,181
Mining		BRAZOS	16	14	10	8	6	4	2
Mining		COLORADO	1,704	1,448	1,022	852	639	426	256
Livestock		BRAZOS	544	697	861	900	941	984	1,030
Livestock		COLORADO	103	132	163	170	178	186	195
	TOTAL	BRAZOS	78,021	49,438	47,779	46,041	44,341	42,700	41,127
	TOTAL	COLORADO	45,094	28,683	27,251	26,087	24,914	23,779	22,722
	TOTAL		123,115	78,121	75,030	72,128	69,255	66,479	63,849
CROSBY County									
Municipal	COUNTY-OTHER	BRAZOS	202	210	217	220	222	220	217
Municipal	COUNTY-OTHER	RED	1	1	1	1	1	1	1
Municipal	CROSBYTON	BRAZOS	351	369	386	394	402	400	394
Municipal	LORENZO	BRAZOS	260	275	288	296	302	301	296
Municipal	RALLS	BRAZOS	290	304	315	322	325	323	318
Municipal	Total		1,104	1,159	1,207	1,233	1,252	1,245	1,226
Manufacturing		BRAZOS	5	6	6	6	6	6	6
Manufacturing		RED	0	0	0	0	0	0	0
Steam-Electric		BRAZOS	0	0	0	0	0	0	0
Steam-Electric		RED	0	0	0	0	0	0	0
Irrigation		BRAZOS	109,892	99,305	95,304	91,464	87,778	84,244	80,851
Irrigation		RED	2,243	2,027	1,945	1,867	1,792	1,719	1,650
Mining		BRAZOS	119	71	34	20	8	0	0
Mining		RED	70	41	20	11	5	0	0
Livestock		BRAZOS	293	299	304	311	318	326	333
Livestock		RED	2	2	3	3	3	3	3
	TOTAL	BRAZOS	111,412	100,839	96,854	93,033	89,361	85,820	82,415
	TOTAL	RED	2,316	2,071	1,969	1,882	1,801	1,723	1,654
	TOTAL		113,728	102,910	98,823	94,915	91,162	87,543	84,069

Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
Water Use			ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
DAWSON County									
Municipal	COUNTY-OTHER	BRAZOS	18	18	18	19	18	18	17
Municipal	COUNTY-OTHER	COLORADO	605	610	612	616	607	587	565
Municipal	LAMESA	COLORADO	2,486	2,540	2,573	2,602	2,603	2,529	2,433
Municipal	O'DONNELL	BRAZOS	17	17	17	17	17	17	16
Municipal	Total		3,126	3,185	3,220	3,254	3,245	3,151	3,031
Manufacturing		BRAZOS	0	0	0	0	0	0	0
Manufacturing		COLORADO	101	119	129	137	144	150	162
Steam-Electric		BRAZOS	0	0	0	0	0	0	0
Steam-Electric		COLORADO	0	0	0	0	0	0	0
Irrigation		BRAZOS	1,460	645	608	574	542	511	482
Irrigation		COLORADO	144,579	63,827	60,230	56,834	53,629	50,607	47,754
Mining		BRAZOS	0	0	0	0	0	0	0
Mining		COLORADO	2,728	1,624	779	455	195	0	0
Livestock		BRAZOS	1	1	1	1	1	1	1
Livestock		COLORADO	151	154	157	161	165	169	173
	TOTAL	BRAZOS	1,496	681	644	611	578	547	516
	TOTAL	COLORADO	150,650	68,874	64,480	60,805	57,343	54,042	51,087
	TOTAL		152,146	69,555	65,124	61,416	57,921	54,589	51,603
DEAF SMITH County									
Municipal	COUNTY-OTHER	CANADIAN	0	1	1	1	1	1	1
Municipal	COUNTY-OTHER	RED	572	743	932	1,100	1,243	1,286	1,305
Municipal	HEREFORD	RED	3,564	3,634	3,694	3,751	3,788	3,801	3,813
Municipal	Total		4,136	4,378	4,627	4,852	5,032	5,088	5,119
Manufacturing		CANADIAN	0	0	0	0	0	0	0
Manufacturing		RED	1,234	1,454	1,594	1,710	1,821	1,917	2,055
Steam-Electric		CANADIAN	0	0	0	0	0	0	0
Steam-Electric		RED	0	0	0	0	0	0	0
Irrigation		CANADIAN	0	0	0	0	0	0	0
Irrigation		RED	372,827	246,983	239,160	231,583	224,246	217,142	210,263
Mining		CANADIAN	0	0	0	0	0	0	0
Mining		RED	0	0	0	0	0	0	0
Livestock		CANADIAN	102	130	152	160	168	176	185
Livestock		RED	10,054	12,796	15,048	15,780	16,557	17,381	18,253
	TOTAL	CANADIAN	102	131	153	161	169	177	186
	TOTAL	RED	388,251	265,610	260,428	253,924	247,655	241,527	235,689
	TOTAL		388,353	265,741	260,581	254,085	247,824	241,704	235,875

Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	2000	2010	2020	2030	2040	2050	2060	
Water Use			ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	
HALE County										
Municipal	ABERNATHY	BRAZOS	461	486	508	526	531	525	514	
Municipal	COUNTY-OTHER	BRAZOS	1,109	1,144	1,187	1,207	1,203	1,184	1,161	
Municipal	COUNTY-OTHER	RED	0	0	0	0	0	0	0	
Municipal	HALE CENTER	BRAZOS	446	470	493	509	513	507	498	
Municipal	PETERSBURG	BRAZOS	276	289	304	313	316	312	306	
Municipal	PLAINVIEW	BRAZOS	4,078	4,288	4,490	4,605	4,635	4,577	4,488	
Municipal	Total		6,370	6,677	6,982	7,160	7,198	7,105	6,967	
Manufacturing		BRAZOS	2,605	2,993	3,188	3,339	3,482	3,604	3,840	
Manufacturing		RED	0	0	0	0	0	0	0	
Steam-Electric		BRAZOS	0	0	0	0	0	0	0	
Steam-Electric		RED	0	0	0	0	0	0	0	
Irrigation		BRAZOS	364,023	363,164	351,131	339,497	328,249	317,373	306,857	
Irrigation		RED	3,677	3,668	3,547	3,429	3,316	3,206	3,100	
Mining		BRAZOS	258	88	34	19	0	0	0	
Mining		RED	0	0	0	0	0	0	0	
Livestock		BRAZOS	1,525	2,148	2,688	2,795	2,910	3,031	3,160	
Livestock		RED	15	21	27	28	29	30	31	
	TOTAL	BRAZOS	374,781	375,070	364,023	352,810	341,839	331,113	320,824	
	TOTAL	RED	3,692	3,689	3,574	3,457	3,345	3,236	3,131	
	TOTAL		378,473	378,759	367,597	356,267	345,184	334,349	323,955	
HOCKLEY County										
Municipal	ANTON	BRAZOS	250	263	270	272	268	256	243	
Municipal	COUNTY-OTHER	BRAZOS	854	881	897	895	872	830	790	revised
Municipal	COUNTY-OTHER	COLORADO	40	41	42	42	41	39	37	
Municipal	LEVELLAND	BRAZOS	2,219	2,310	2,362	2,369	2,322	2,216	2,107	revised
Municipal	ROPESVILLE	BRAZOS	85	89	91	91	89	85	81	
Municipal	SMYER	BRAZOS	67	69	70	70	68	65	62	revised
Municipal	SUNDOWN	COLORADO	325	341	350	353	347	332	316	
Municipal	Total		3,840	3,994	4,082	4,092	4,007	3,823	3,636	
Manufacturing		BRAZOS	53	61	65	68	71	73	78	
Manufacturing		COLORADO	0	0	0	0	0	0	0	
Steam-Electric		BRAZOS	0	0	0	0	0	0	0	
Steam-Electric		COLORADO	0	0	0	0	0	0	0	
Irrigation		BRAZOS	157,496	107,099	102,910	98,887	95,018	91,304	87,734	
Irrigation		COLORADO	17,500	11,900	11,435	10,988	10,558	10,145	9,749	
Mining		BRAZOS	3,302	2,358	1,510	981	378	19	0	
Mining		COLORADO	1,114	796	509	331	127	6	0	
Livestock		BRAZOS	560	634	733	766	801	837	876	
Livestock		COLORADO	48	55	63	66	69	73	76	
	TOTAL	BRAZOS	164,886	113,764	108,908	104,399	99,887	95,685	91,971	
	TOTAL	COLORADO	19,027	13,133	12,399	11,780	11,142	10,595	10,178	

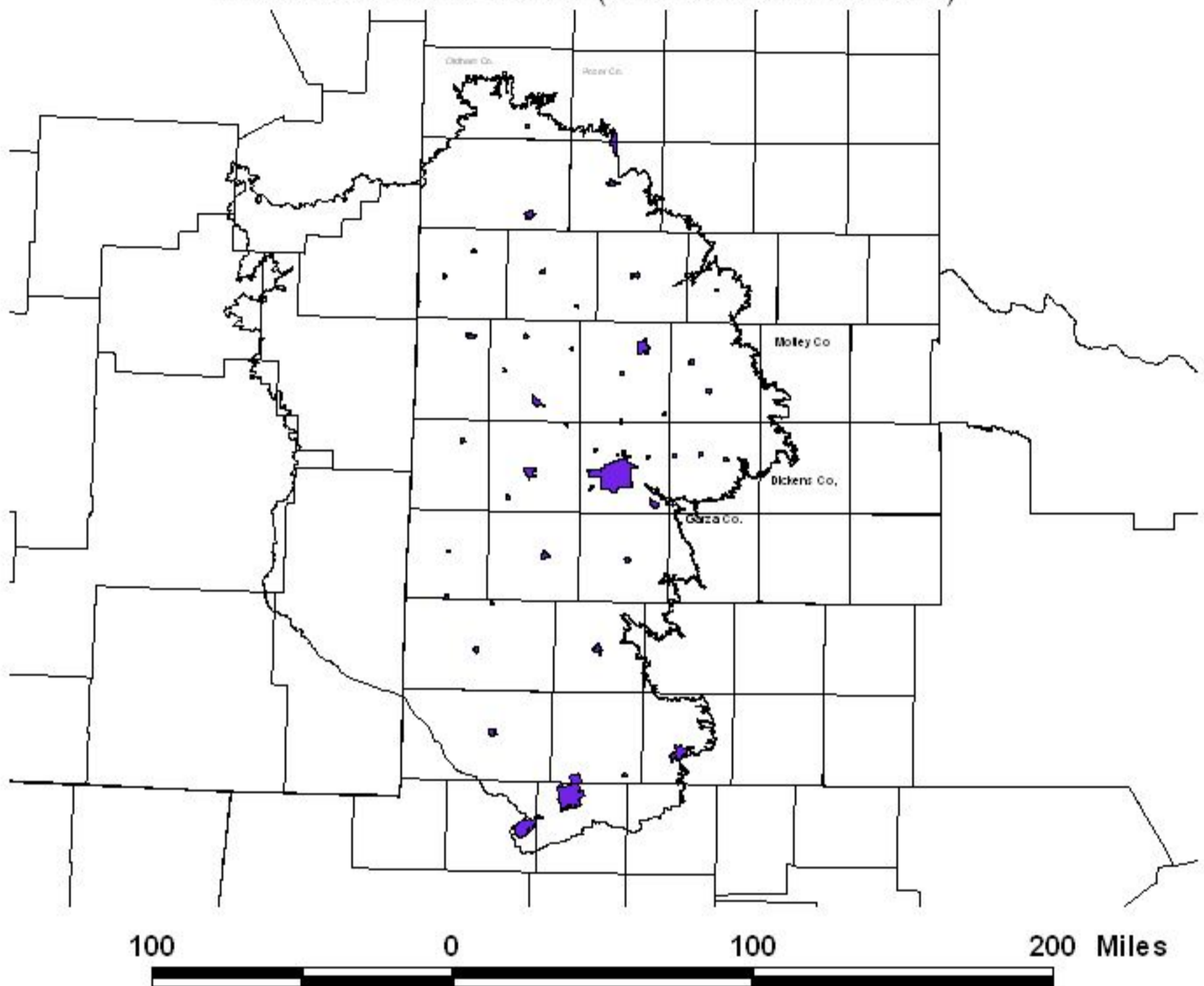
Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
Water Use			ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
PARMER County									
Municipal	BOVINA	BRAZOS	309	321	334	335	330	317	300
Municipal	COUNTY-OTHER	BRAZOS	287	297	305	304	298	286	270
Municipal	COUNTY-OTHER	RED	106	110	113	112	110	106	100
Municipal	FARWELL	BRAZOS	370	388	405	410	408	393	371
Municipal	FRIONA	RED	803	835	872	879	870	838	791
Municipal	Total		1,875	1,951	2,029	2,040	2,016	1,940	1,832
Manufacturing		BRAZOS	0	0	0	0	0	0	0
Manufacturing		RED	2,070	2,427	2,617	2,772	2,921	3,051	3,261
Steam-Electric		BRAZOS	0	0	0	0	0	0	0
Steam-Electric		RED	0	0	0	0	0	0	0
Irrigation		BRAZOS	294,969	243,430	240,846	238,289	235,759	233,256	230,779
Irrigation		RED	120,480	99,429	98,373	97,329	96,296	95,273	94,262
Mining		BRAZOS	0	0	0	0	0	0	0
Mining		RED	0	0	0	0	0	0	0
Livestock		BRAZOS	3,372	4,579	5,581	5,845	6,126	6,425	6,741
Livestock		RED	2,323	3,154	3,844	4,027	4,221	4,426	4,644
	TOTAL	BRAZOS	299,307	249,015	247,471	245,183	242,921	240,677	238,461
	TOTAL	RED	125,782	105,955	105,819	105,119	104,418	103,694	103,058
	TOTAL		425,089	354,970	353,290	350,302	347,339	344,371	341,519
SWISHER County									
Municipal	COUNTY-OTHER	BRAZOS	41	41	42	41	41	40	38
Municipal	COUNTY-OTHER	RED	207	211	211	211	207	202	193
Municipal	HAPPY	RED	107	109	110	111	110	108	103
Municipal	KRESS	BRAZOS	21	22	22	22	22	21	20
Municipal	KRESS	RED	80	82	82	83	81	79	76
Municipal	TULIA	RED	1,020	1,050	1,065	1,072	1,064	1,038	993
Municipal	Total		1,476	1,515	1,532	1,540	1,525	1,488	1,423
Manufacturing		BRAZOS	0	0	0	0	0	0	0
Manufacturing		RED	0	0	0	0	0	0	0
Steam-Electric		BRAZOS	0	0	0	0	0	0	0
Steam-Electric		RED	0	0	0	0	0	0	0
Irrigation		BRAZOS	73,834	66,689	63,892	65,929	65,552	65,178	64,805
Irrigation		RED	97,872	88,400	84,693	87,393	86,894	86,397	85,904
Mining		BRAZOS	0	0	0	0	0	0	0
Mining		RED	0	0	0	0	0	0	0
Livestock		BRAZOS	212	255	286	302	318	335	353
Livestock		RED	2,909	3,502	3,930	4,140	4,363	4,600	4,852
	TOTAL	BRAZOS	74,108	67,007	64,242	66,294	65,933	65,574	65,216
	TOTAL	RED	102,195	93,354	90,091	93,010	92,719	92,424	92,121
	TOTAL		176,303	160,361	154,333	159,304	158,652	157,998	157,337

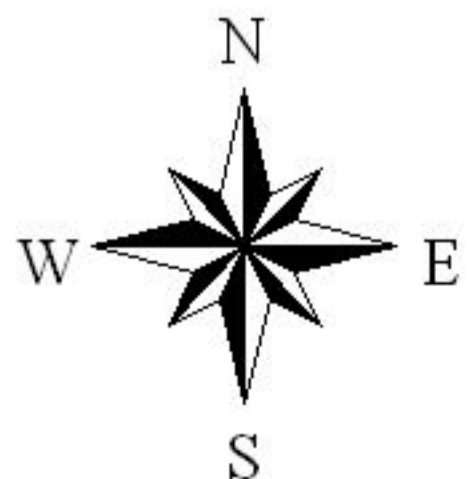
Llano Estacado Region -- Water Demand Projections

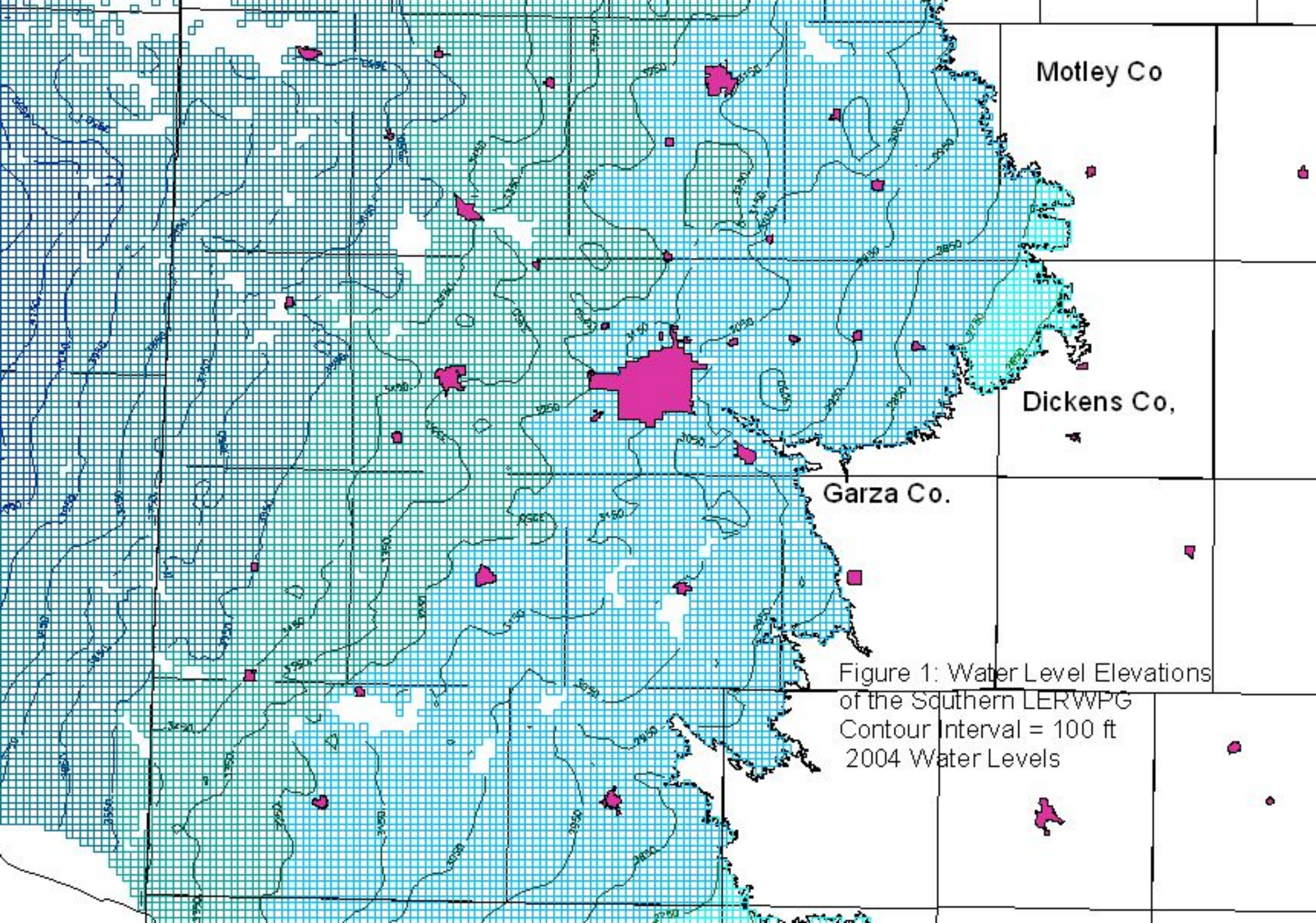
County Water Use	WUG Name	Basin Name	2000 ac-ft	2010 ac-ft	2020 ac-ft	2030 ac-ft	2040 ac-ft	2050 ac-ft	2060 ac-ft
	BASIN								
	CANADIAN Basin	Municipal	0	1	1	1	1	1	1
	CANADIAN Basin	Manufacturing	0	0	0	0	0	0	0
	CANADIAN Basin	Steam-Electric	0	0	0	0	0	0	0
	CANADIAN Basin	Irrigation	0	0	0	0	0	0	0
	CANADIAN Basin	Mining	0	0	0	0	0	0	0
	CANADIAN Basin	Livestock	102	130	152	160	168	176	185
	CANADIAN Basin	TOTAL	102	131	153	161	169	177	186
	RED Basin	Municipal	7,548	7,875	8,177	8,378	8,474	8,417	8,301
	RED Basin	Manufacturing	3,404	3,999	4,338	4,616	4,884	5,116	5,474
	RED Basin	Steam-Electric	0	0	0	0	0	0	0
	RED Basin	Irrigation	909,585	672,094	650,427	635,776	618,509	601,809	585,660
	RED Basin	Mining	85	50	24	14	6	0	0
	RED Basin	Livestock	20,032	25,480	29,937	31,362	32,876	34,482	36,183
	RED Basin	TOTAL							
	BRAZOS Basin	Municipal	68,499	71,548	73,708	74,315	73,668	73,641	72,420
	BRAZOS Basin	Manufacturing	6,558	7,659	8,281	8,786	9,267	9,678	10,362
	BRAZOS Basin	Steam-Electric	23,766	23,048	22,103	25,842	30,398	35,953	42,724
	BRAZOS Basin	Irrigation	2,497,120	1,977,352	1,907,861	1,845,808	1,783,840	1,724,278	1,667,010
	BRAZOS Basin	Mining	5,630	3,681	2,141	1,351	530	23	2
	BRAZOS Basin	Livestock	16,151	21,968	27,162	28,228	29,363	30,562	31,835
	BRAZOS Basin	TOTAL	2,617,724	2,105,256	2,041,256	1,984,330	1,927,066	1,874,135	1,824,353
	COLORADO Basin	Municipal	11,315	11,995	12,621	13,058	13,371	13,145	12,864
	COLORADO Basin	Manufacturing	102	120	130	138	145	151	163
	COLORADO Basin	Steam-Electric	1,852	2,597	3,718	4,346	5,113	6,047	7,186
	COLORADO Basin	Irrigation	941,172	695,692	660,211	626,548	594,610	564,308	535,557
	COLORADO Basin	Mining	15,721	12,593	8,115	4,994	2,316	705	256
	COLORADO Basin	Livestock	1,439	1,679	1,938	2,011	2,086	2,169	2,254
	COLORADO Basin	TOTAL	971,601	724,676	686,733	651,095	617,641	586,525	558,280
	REGION O	Municipal	87,362	91,419	94,507	95,752	95,514	95,204	93,586
	REGION O	Manufacturing	10,064	11,778	12,749	13,540	14,296	14,945	15,999
	REGION O	Steam-Electric	25,618	25,645	25,821	30,188	35,511	42,000	49,910
	REGION O	Irrigation	4,347,877	3,345,138	3,218,499	3,108,132	2,996,959	2,890,395	2,788,227
	REGION O	Mining	21,436	16,324	10,280	6,359	2,852	728	258
	REGION O	Livestock	37,724	49,257	59,189	61,761	64,493	67,389	70,457
	REGION O	TOTAL	4,530,081	3,539,561	3,421,045	3,315,732	3,209,625	3,110,661	3,018,437

Figure A: Outline of the Ogallala Aquifer
Included in the GAM (Blandford & others)



 **Municipal Areas**



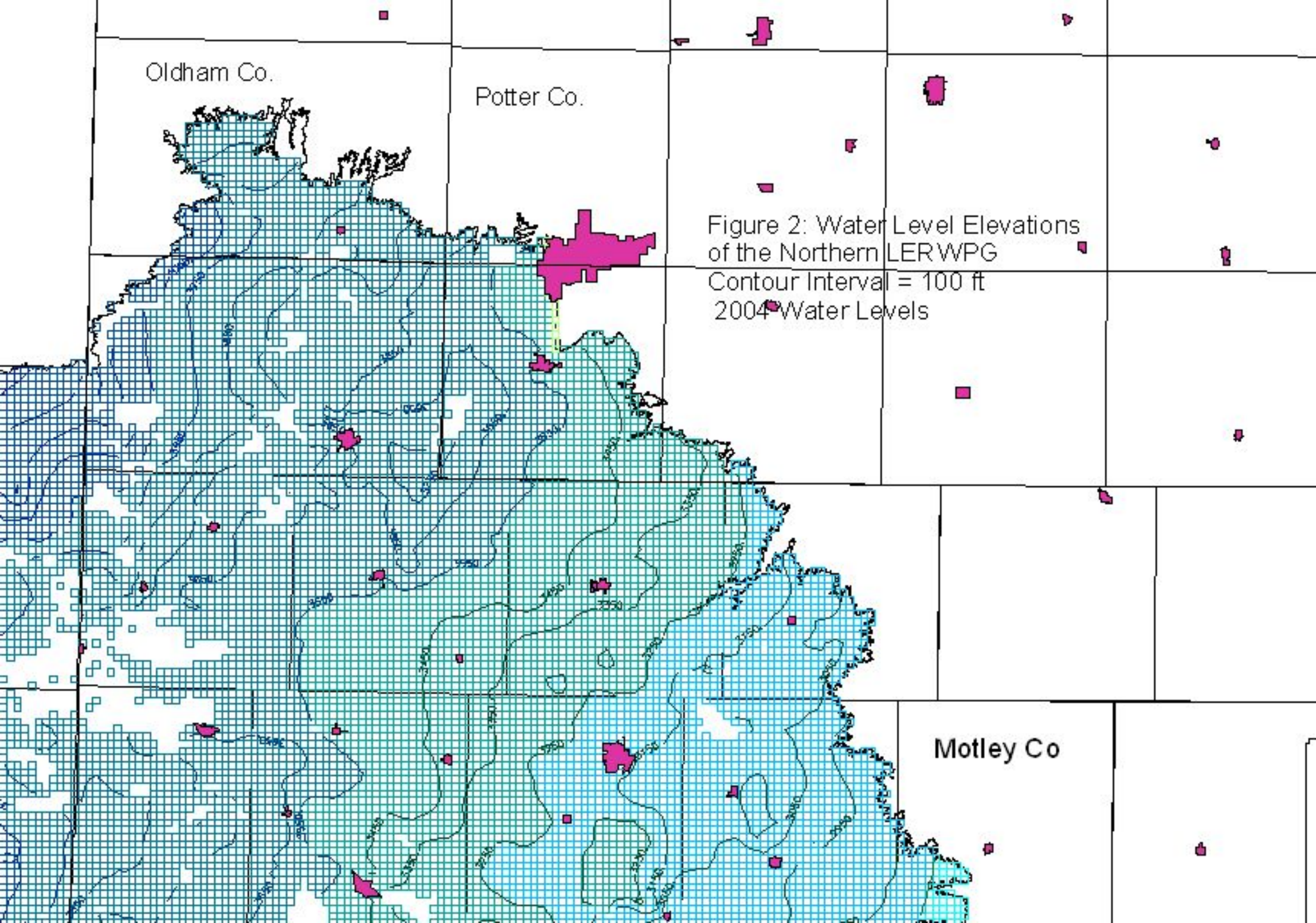


Motley Co

Dickens Co.,

Garza Co.

Figure 1: Water Level Elevations of the Southern LERWPG
Contour Interval = 100 ft
2004 Water Levels

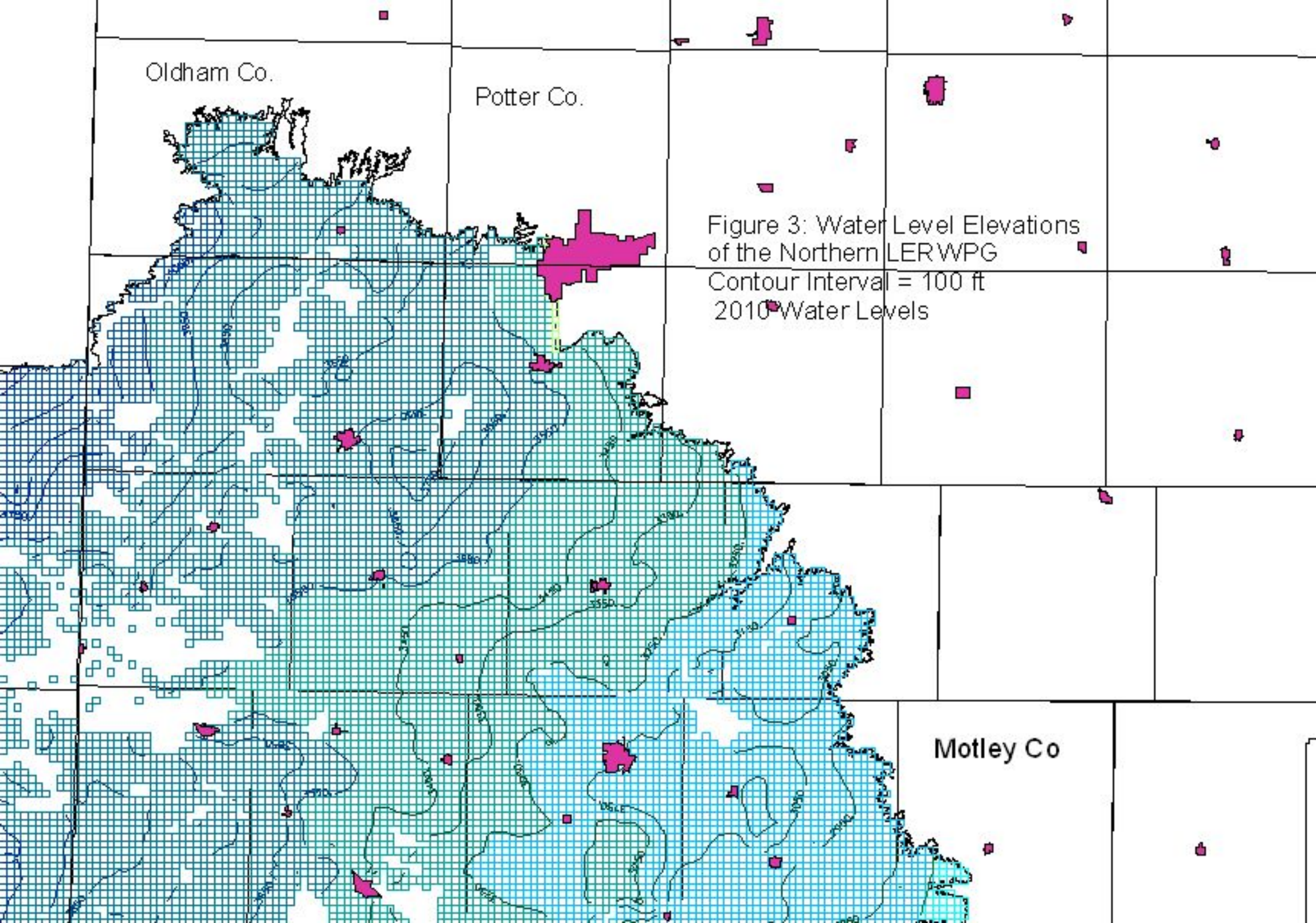


Oldham Co.

Potter Co.

Figure 2: Water Level Elevations
of the Northern LERWPG
Contour Interval = 100 ft
2004 Water Levels

Motley Co

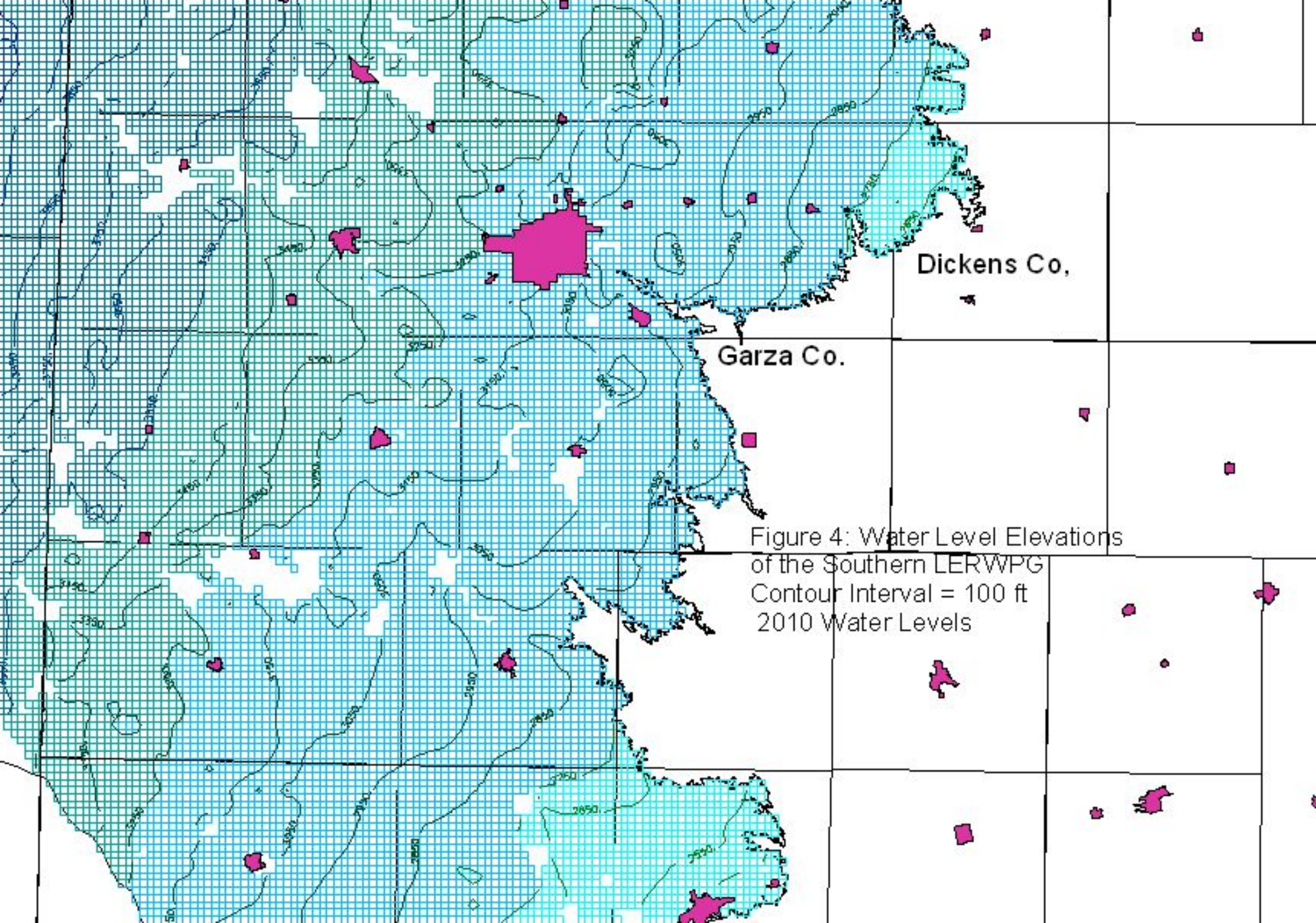


Oldham Co.

Potter Co.

Figure 3: Water Level Elevations of the Northern LERWPG
Contour Interval = 100 ft
2010 Water Levels

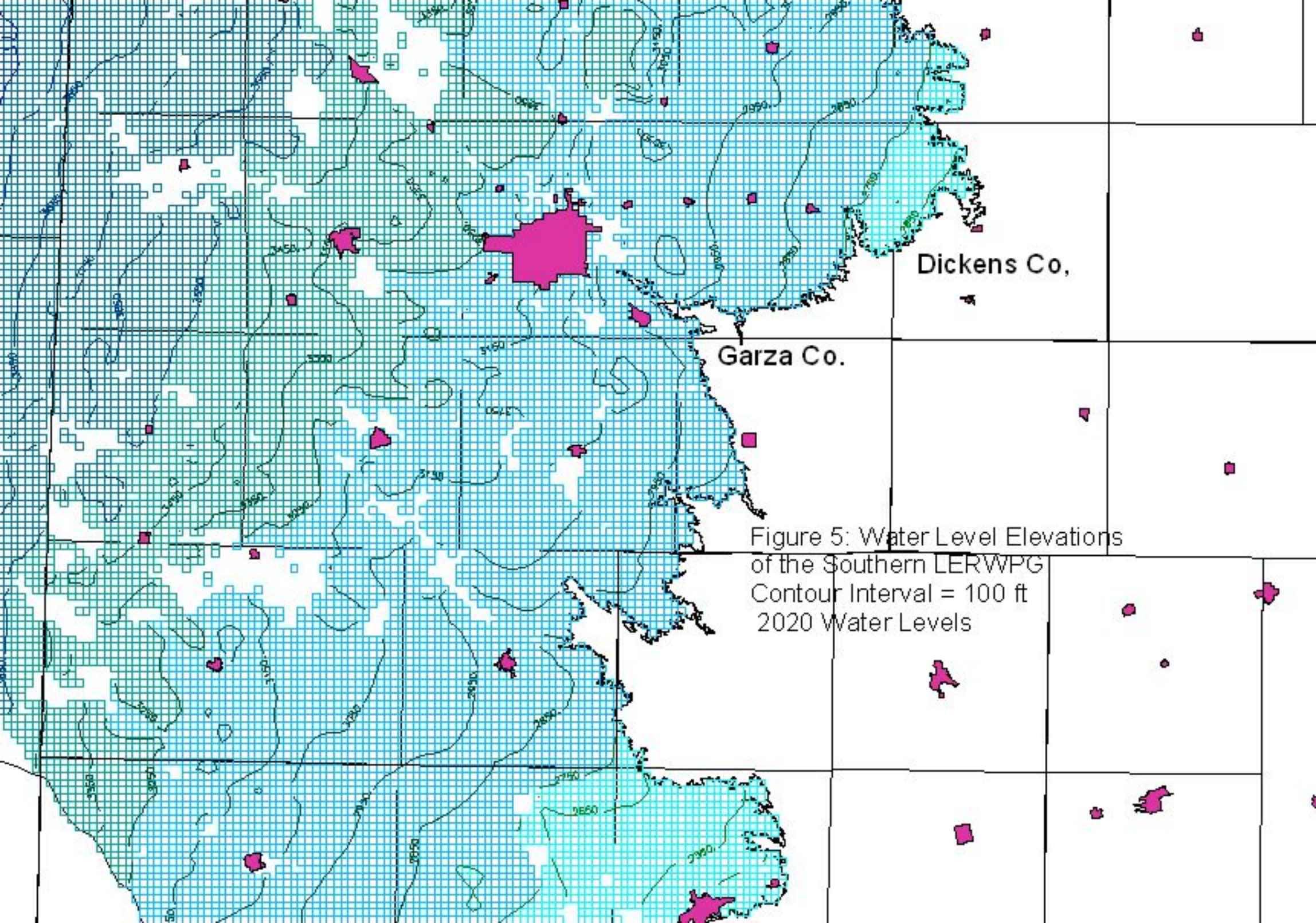
Motley Co



Dickens Co.

Garza Co.

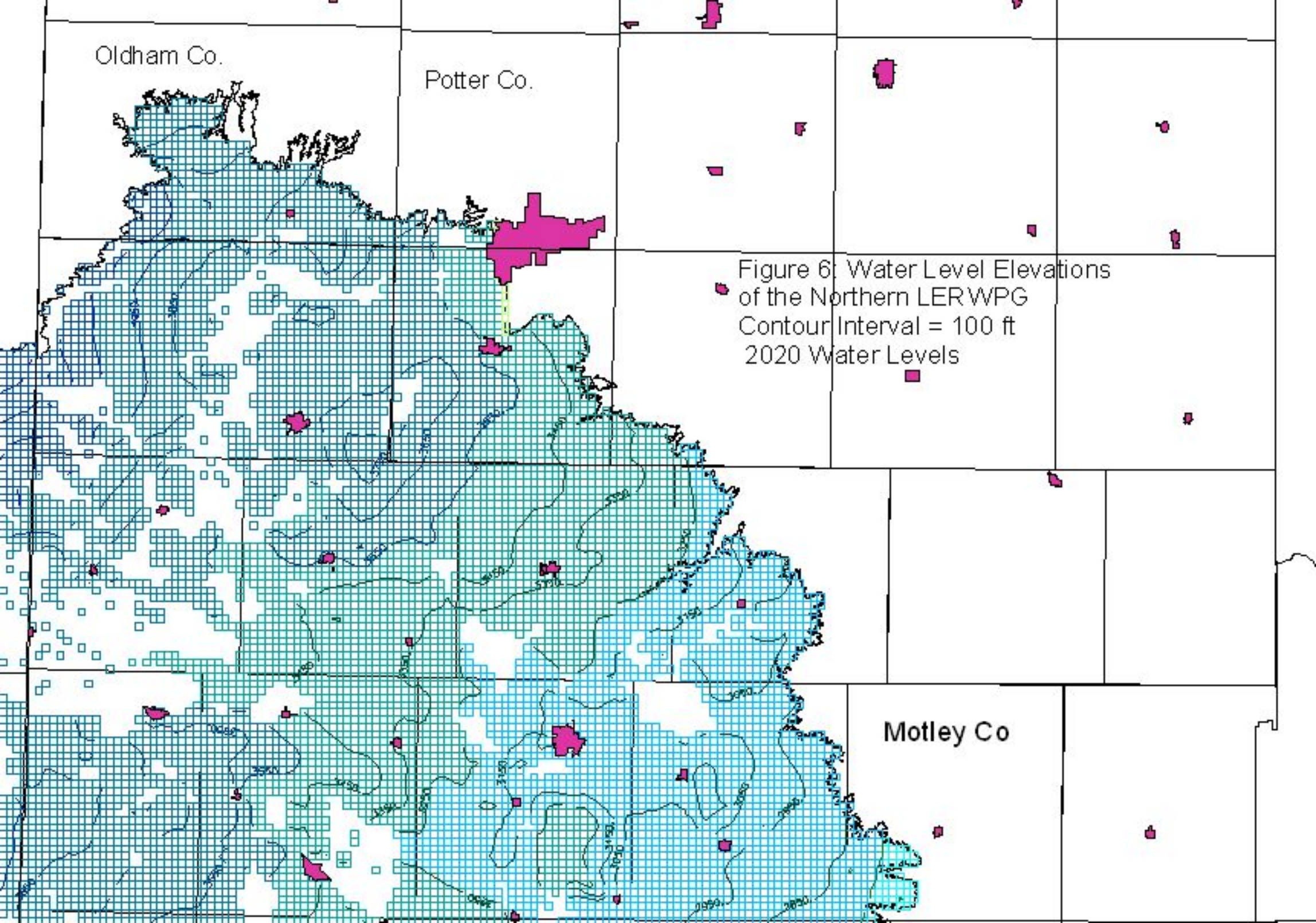
Figure 4: Water Level Elevations
of the Southern LERWPG
Contour Interval = 100 ft
2010 Water Levels



Dickens Co.

Garza Co.

Figure 5: Water Level Elevations
of the Southern LERWPG
Contour Interval = 100 ft
2020 Water Levels

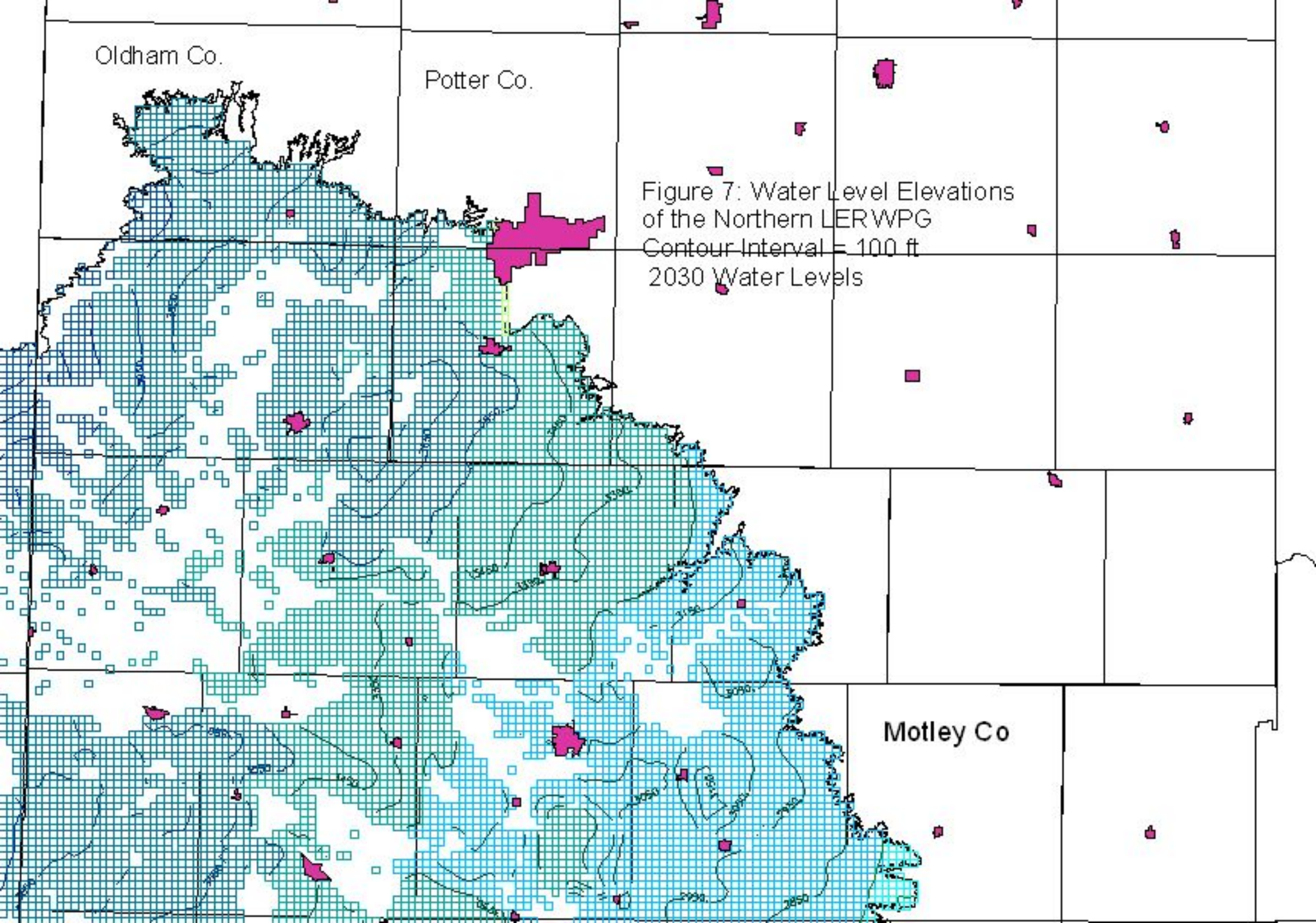


Oldham Co.

Potter Co.

Figure 6: Water Level Elevations
of the Northern LER WPG
Contour Interval = 100 ft
2020 Water Levels

Motley Co

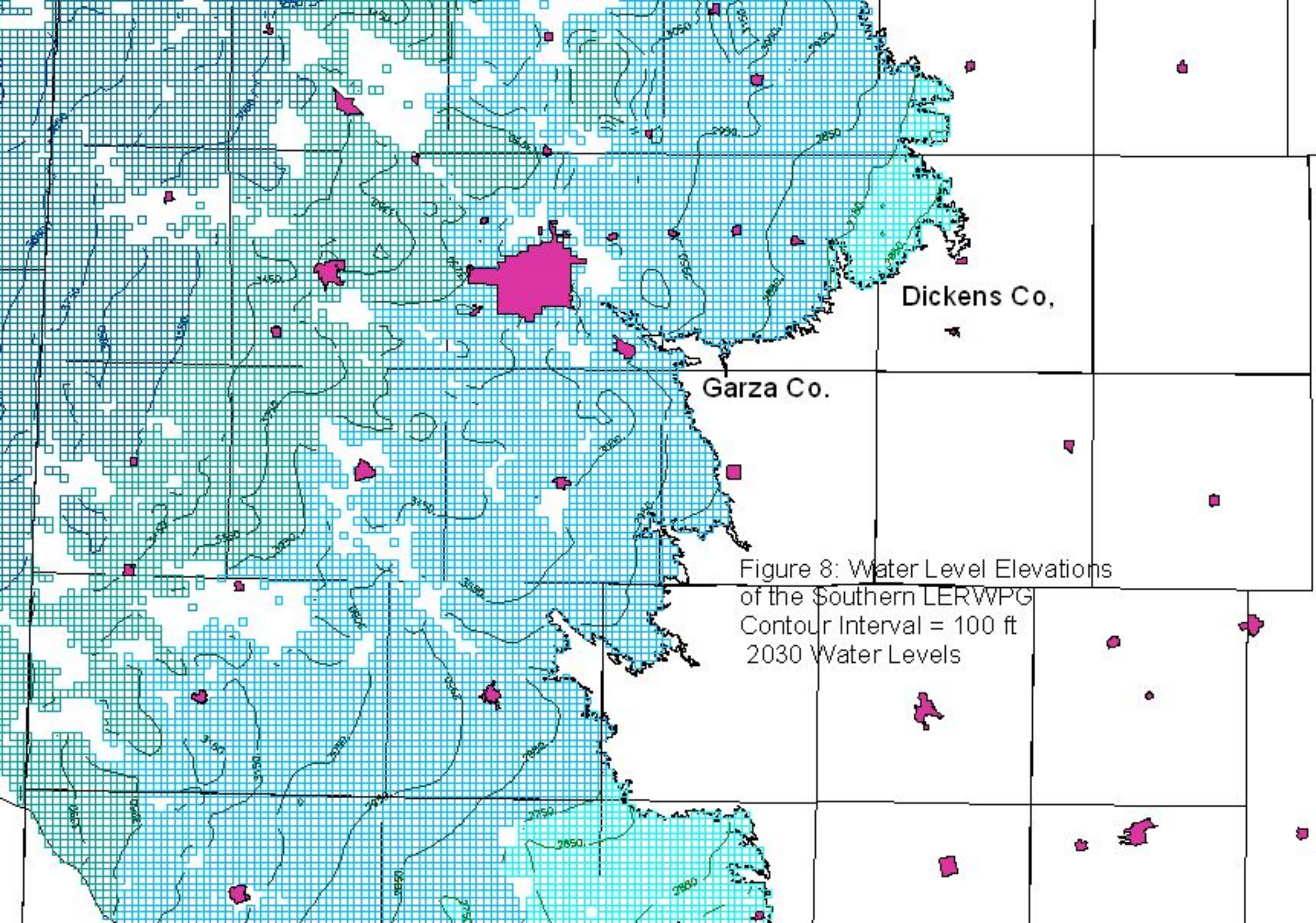


Oldham Co.

Potter Co.

Figure 7: Water Level Elevations
of the Northern LERWPG
Contour Interval = 100 ft
2030 Water Levels

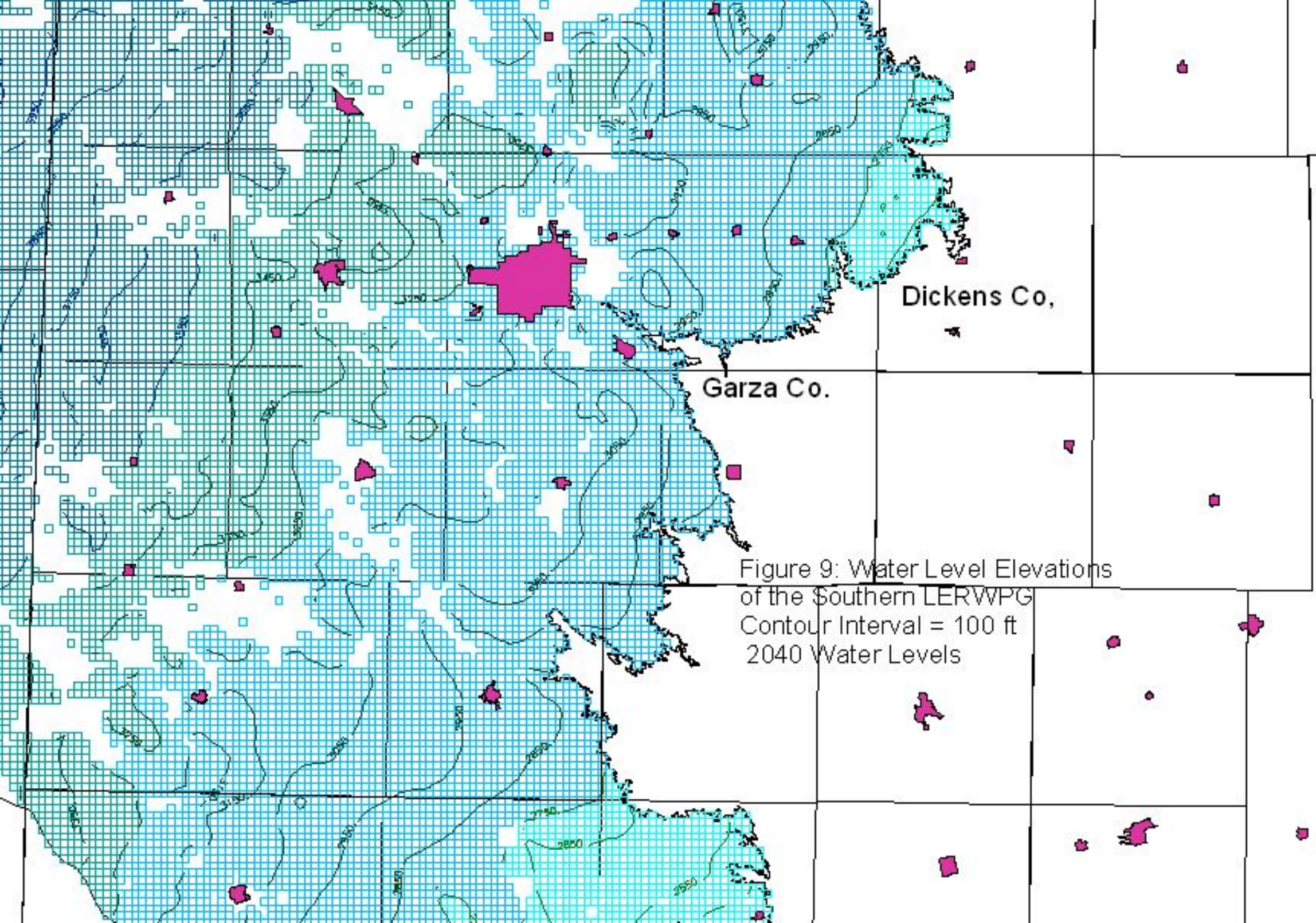
Motley Co



Dickens Co.

Garza Co.

Figure 8: Water Level Elevations
of the Southern LERWPG
Contour Interval = 100 ft
2030 Water Levels



Dickens Co.

Garza Co.

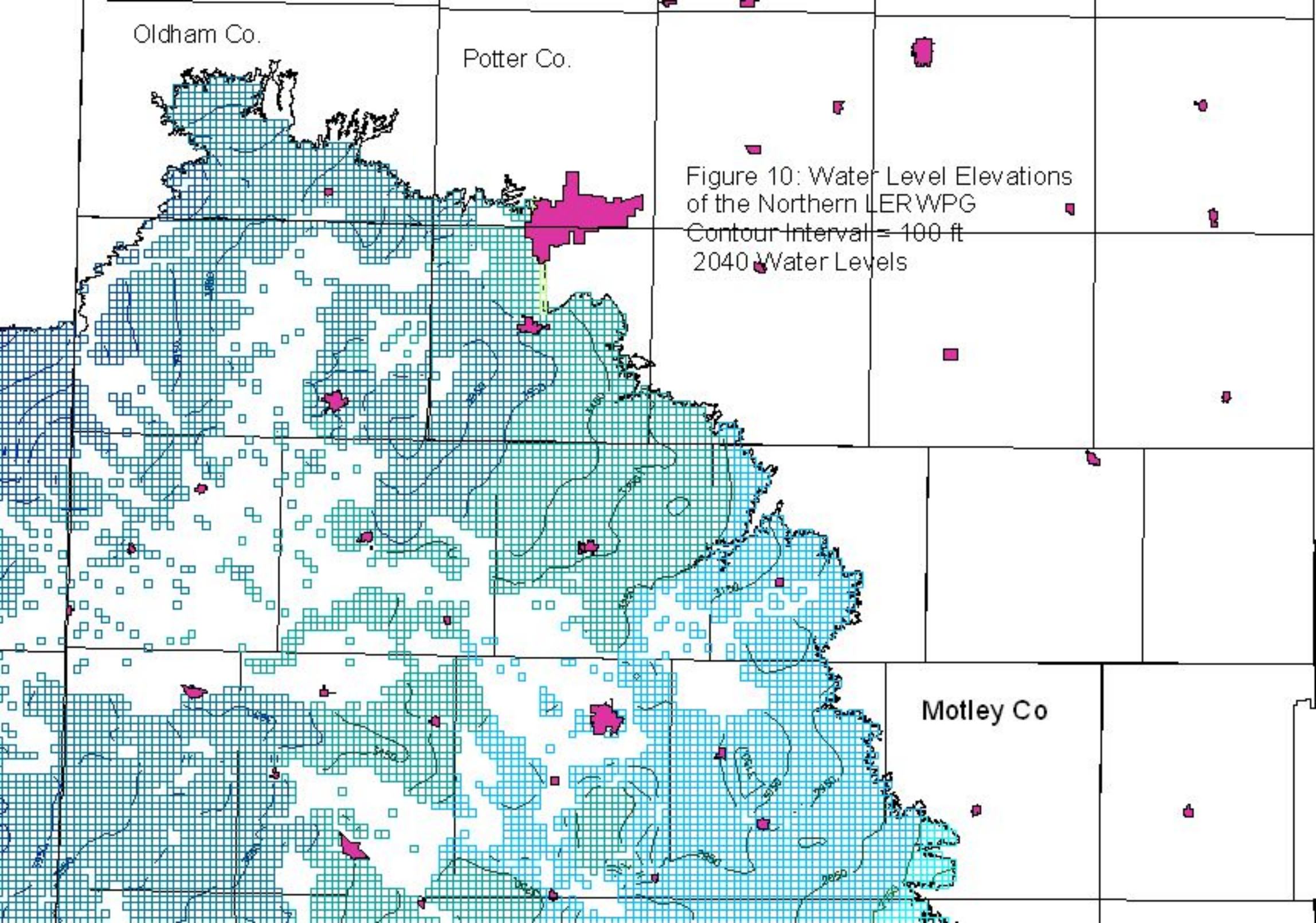
Figure 9: Water Level Elevations
of the Southern LERWPG
Contour Interval = 100 ft
2040 Water Levels

Oldham Co.

Potter Co.

Figure 10: Water Level Elevations of the Northern LERWPG
Contour Interval = 100 ft
2040 Water Levels

Motley Co

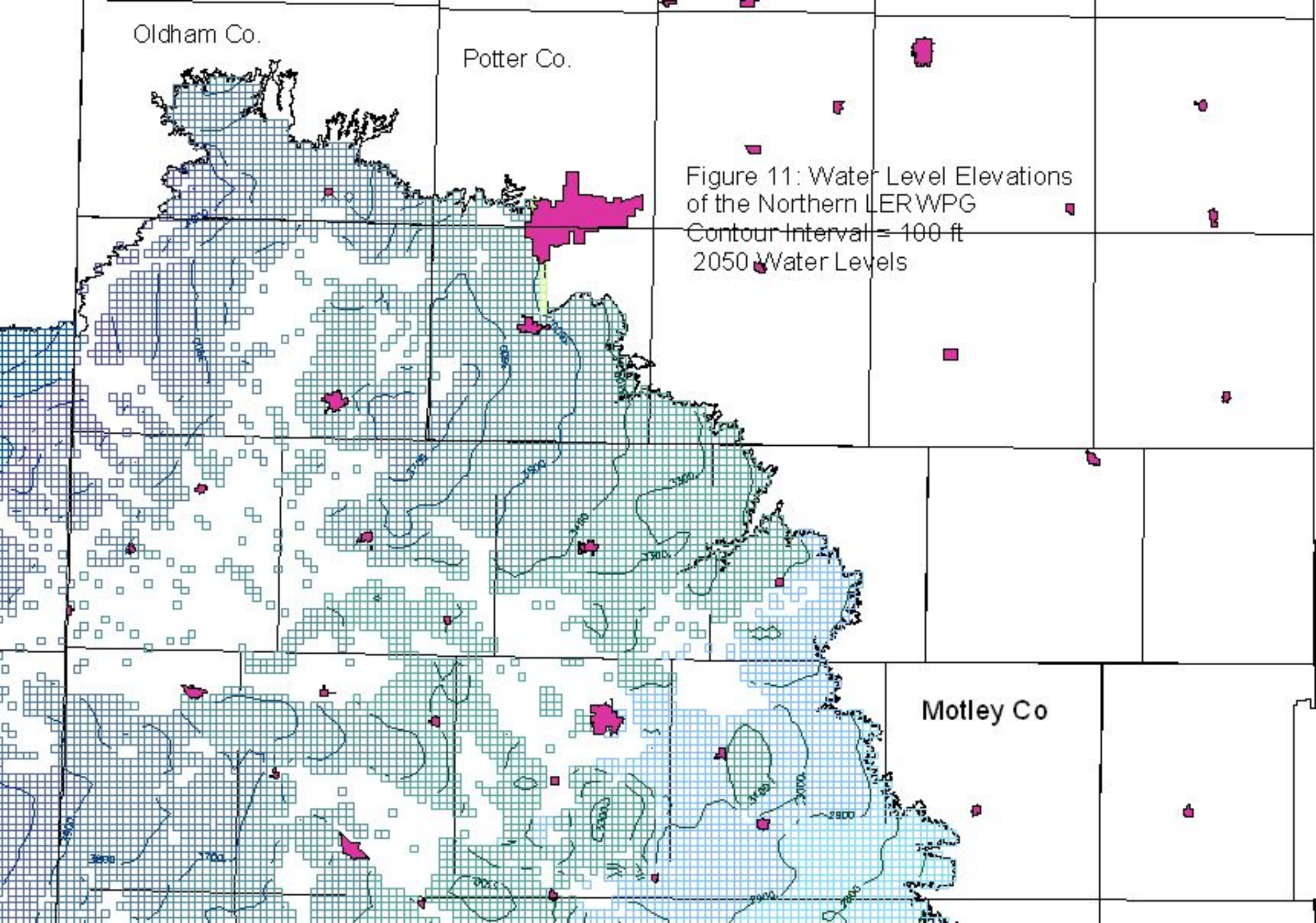


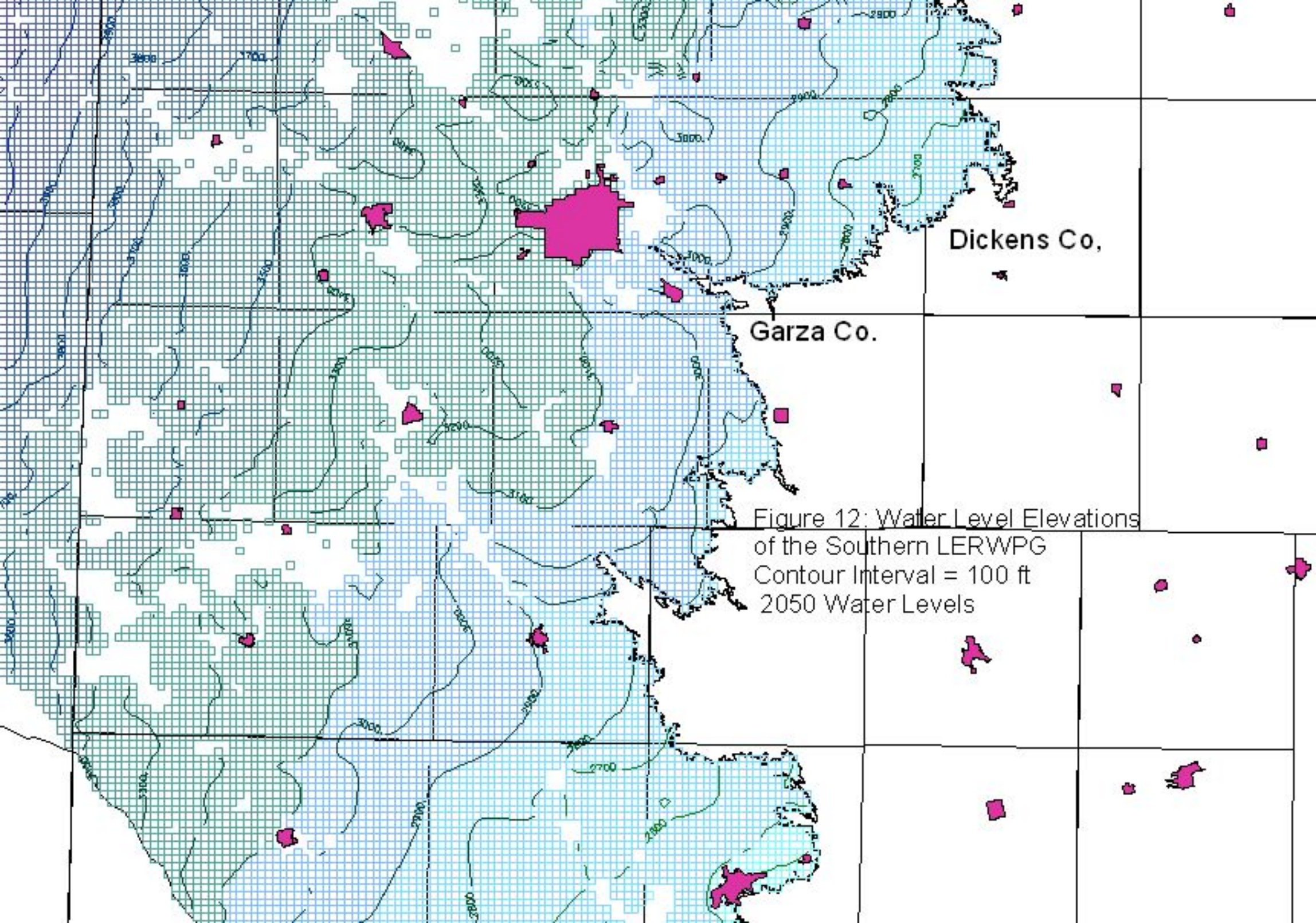
Oldham Co.

Potter Co.

Figure 11: Water Level Elevations of the Northern LERWPG
Contour Interval = 100 ft
2050 Water Levels

Motley Co





Dickens Co.

Garza Co.

Figure 12: Water Level Elevations
of the Southern LERWPG
Contour Interval = 100 ft
2050 Water Levels

Oldham Co.

Potter Co.

Figure 14: Water Level Elevations of the Northern LERWPG
Contour Interval = 100 ft
2060 Water Levels

Motley Co

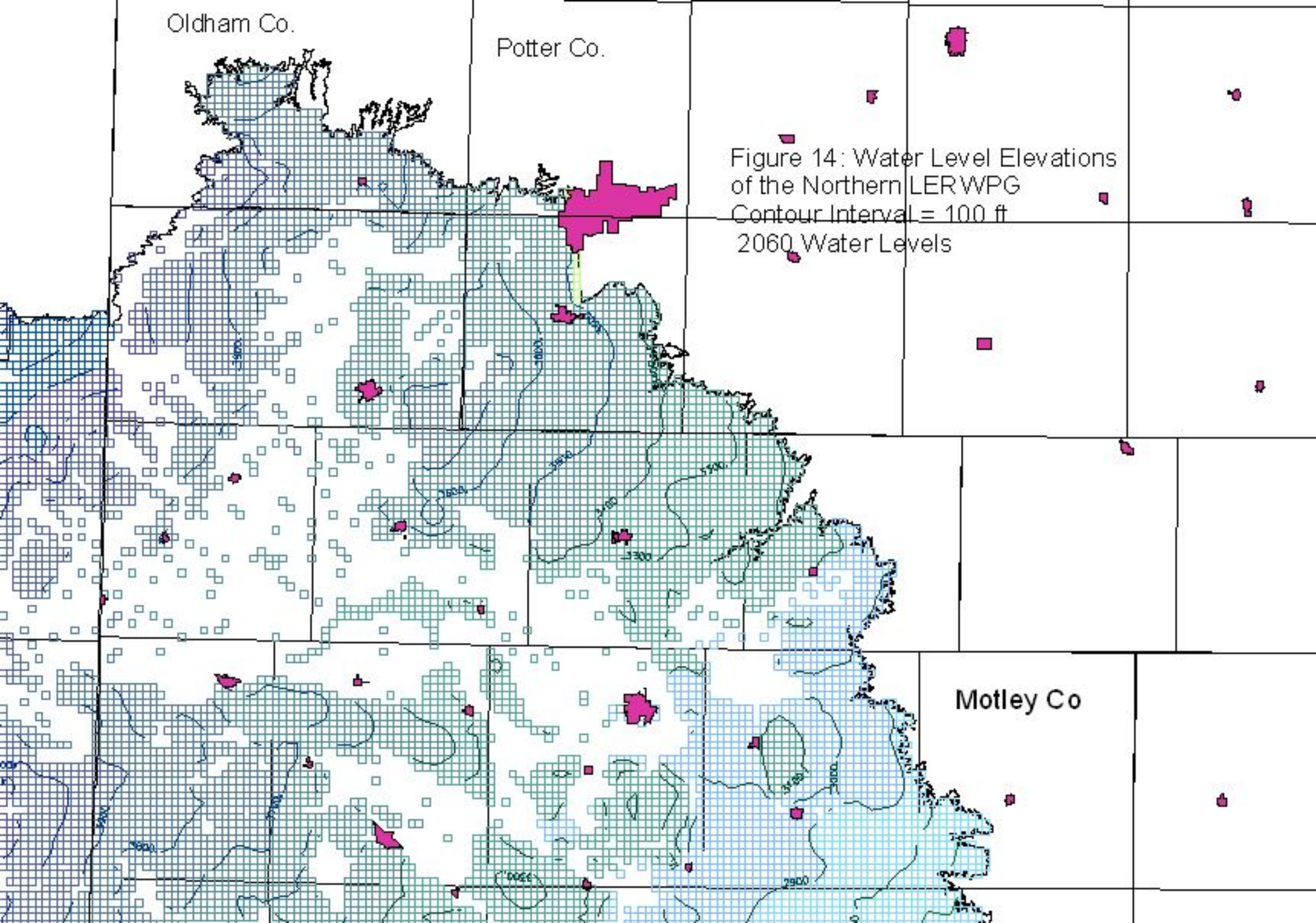


Figure 15: 2004 Saturated
Thickness -
Contour Interval = 50 ft

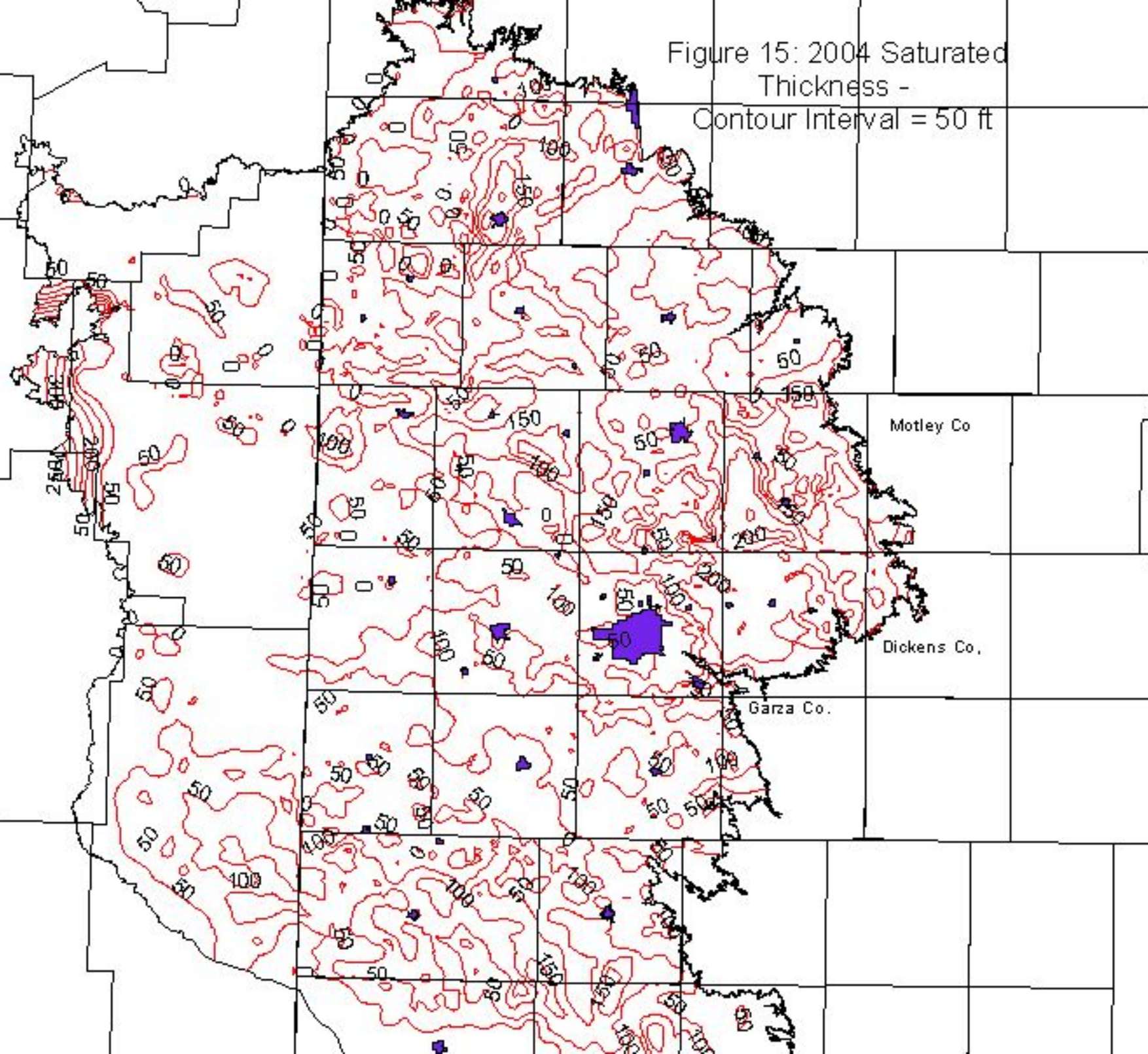


Figure 16: 2010 Saturated
Thickness -
Contour Interval = 50 ft

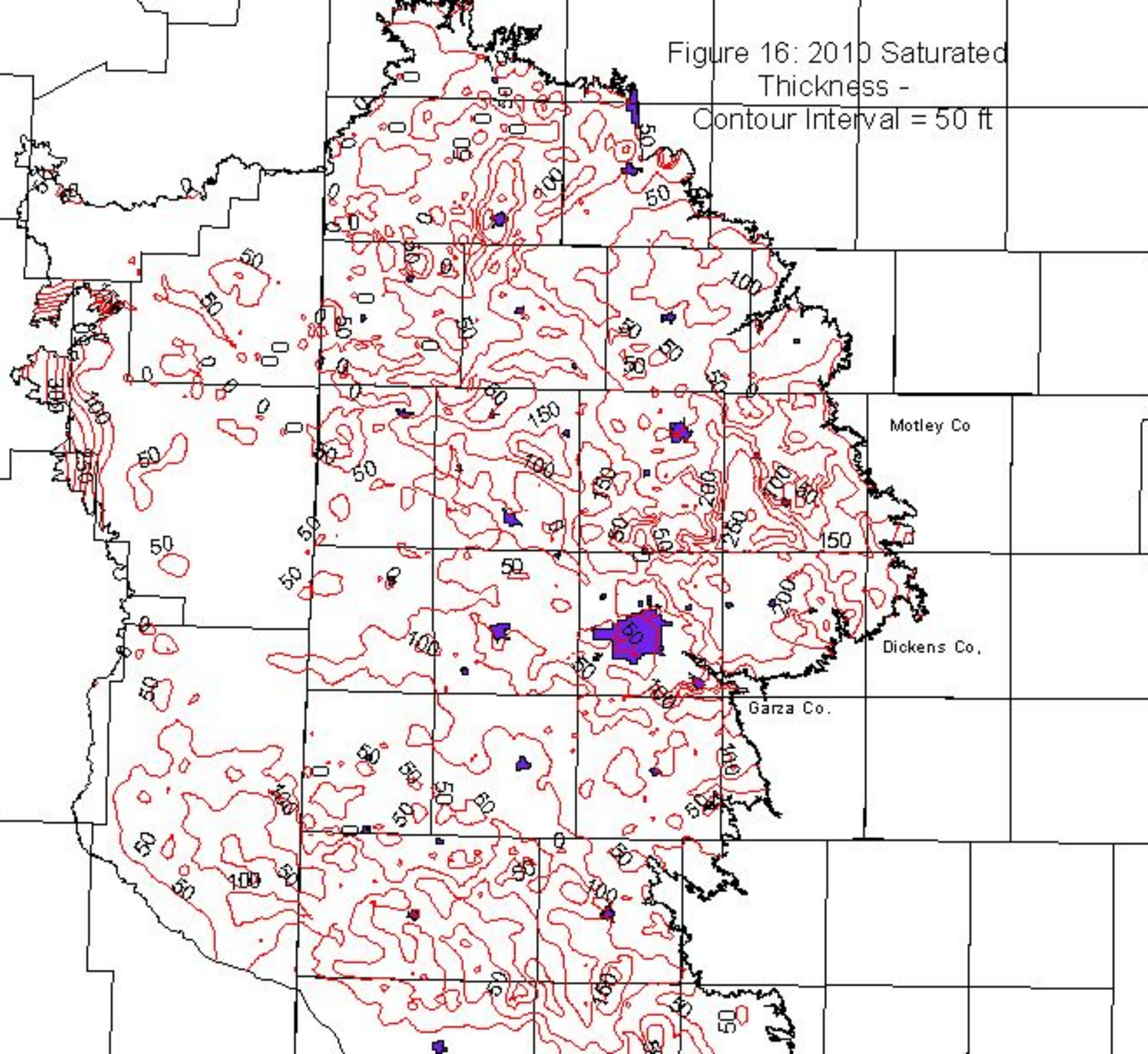


Figure 17: 2020 Saturated
Thickness -
Contour Interval = 50 ft

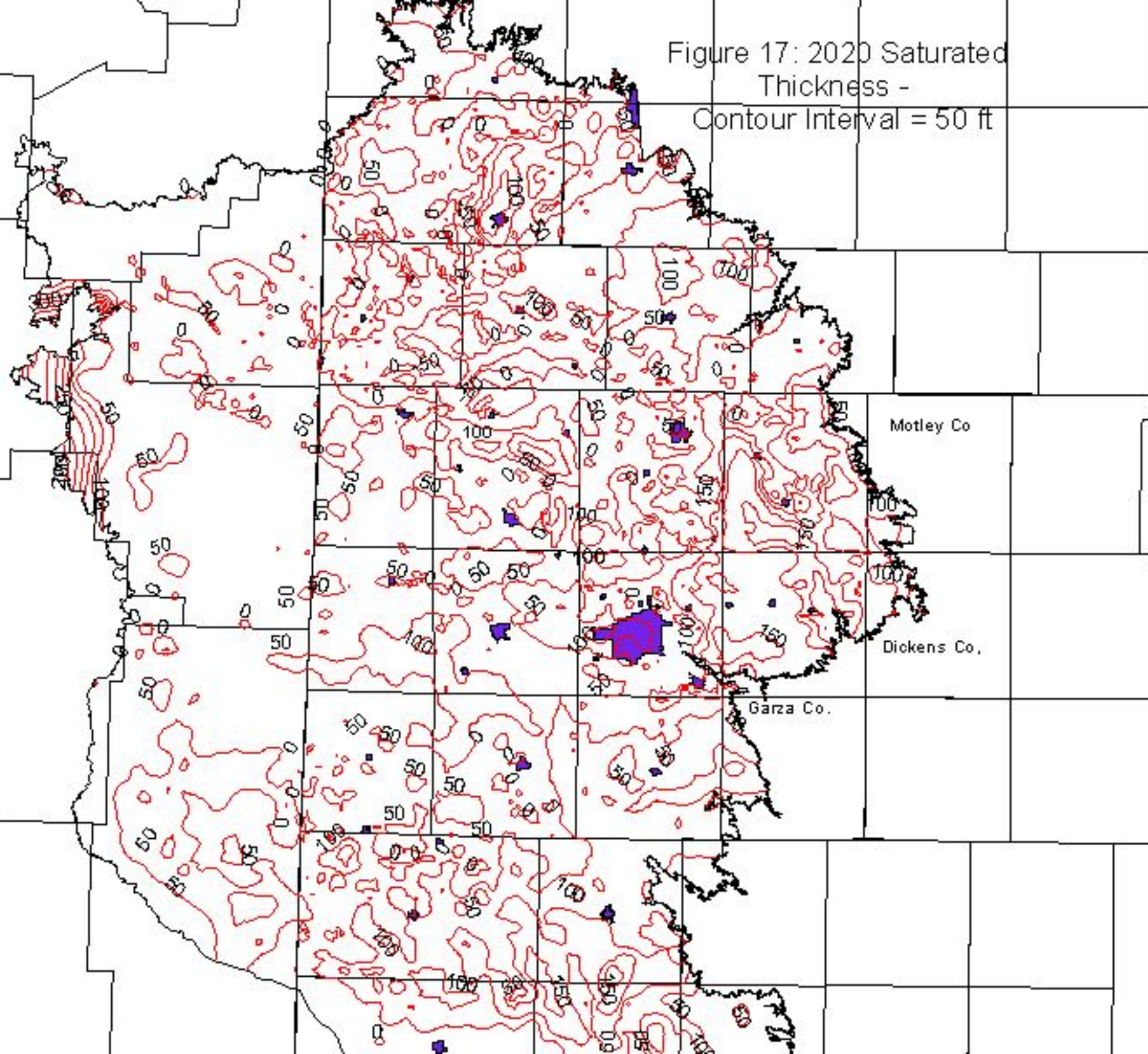


Figure 18: 2030 Saturated
Thickness -
Contour Interval = 50 ft

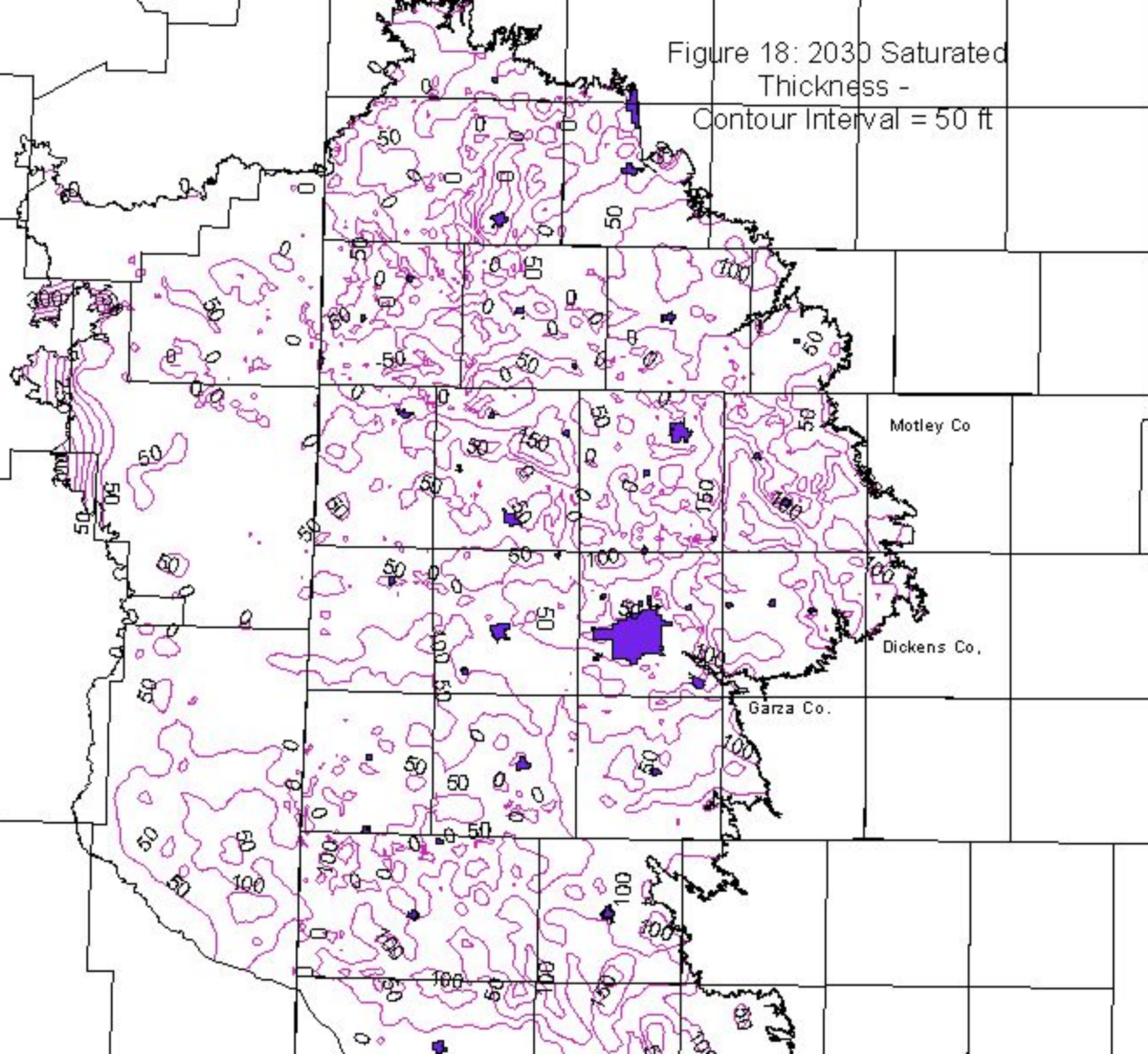


Figure 19: 2040 Saturated
Thickness -
Contour Interval = 50 ft

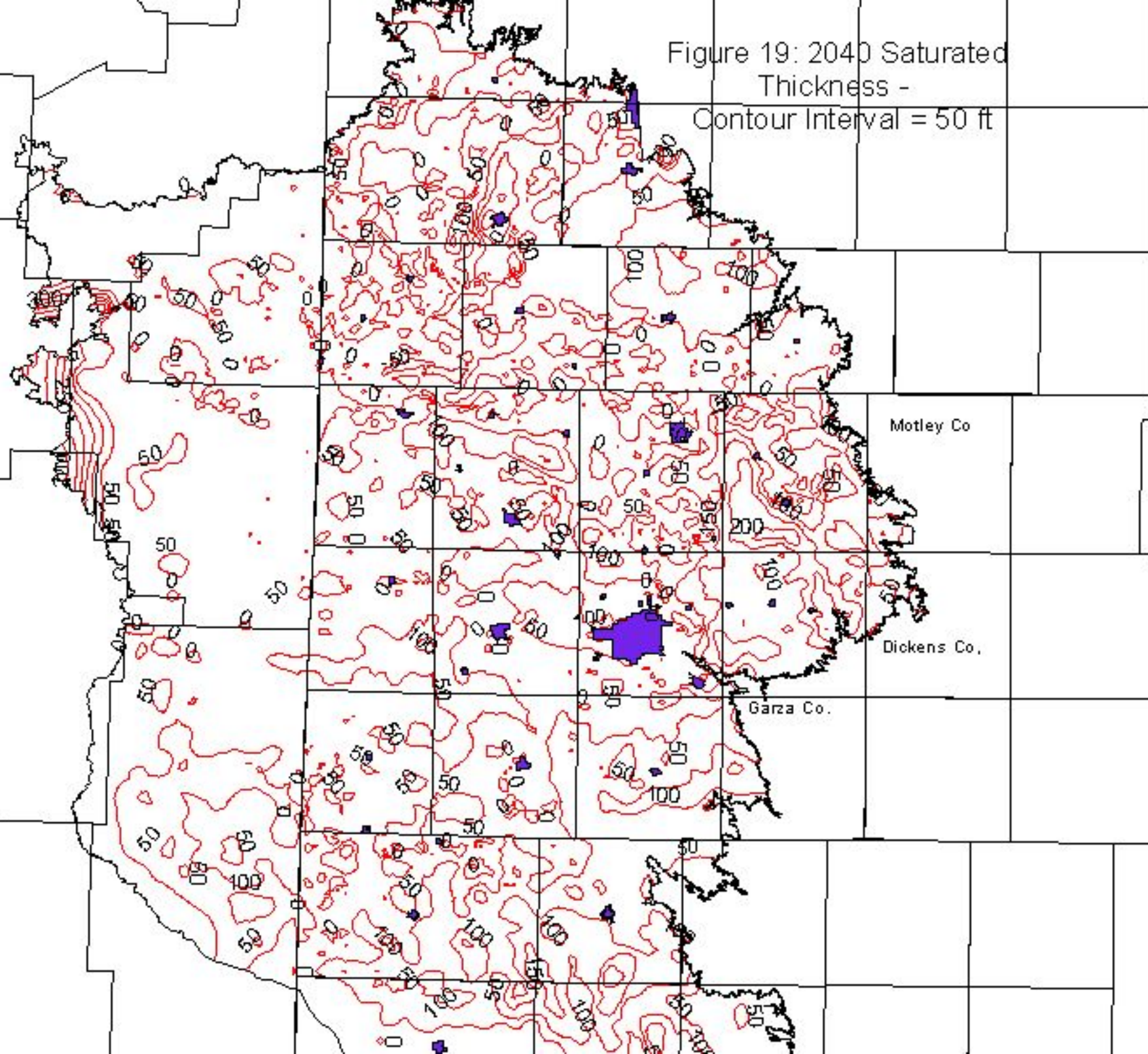


Figure 20: 2050 Saturated
Thickness -
Contour Interval = 50 ft

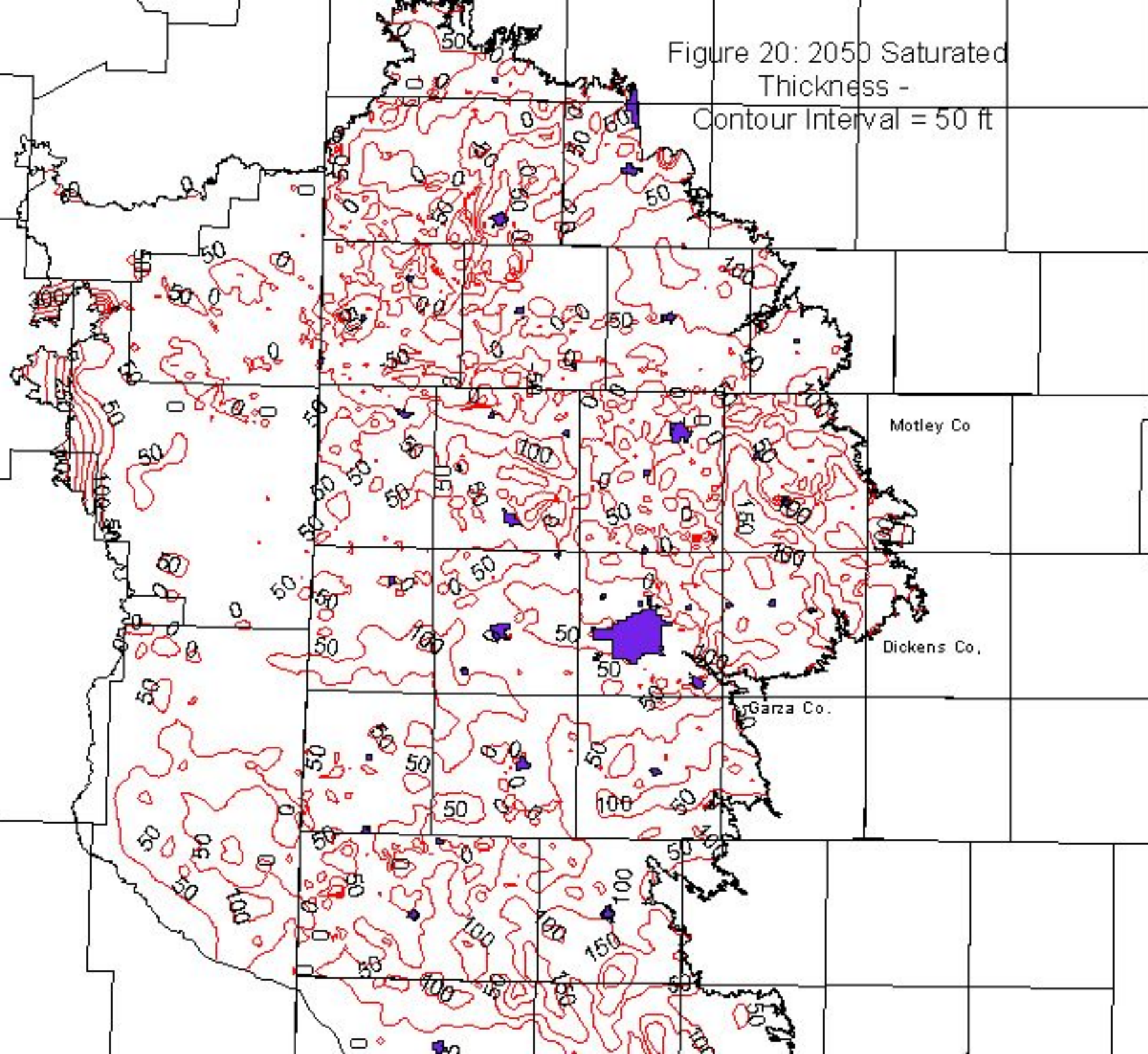


Figure 21: 2060 Saturated
Thickness -
Contour Interval = 50 ft

