

GAM run 03-22

by **Richard Smith**

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-0877
March 9, 2004

REQUESTOR:

Dr. Judy A. Reeves, and Mr. Jim Conkwright, General Manager, High Plains Underground Water Conservation District No.1

DESCRIPTION OF REQUEST:

Dr. Reeves and Mr. Conkwright requested the following information from the Groundwater Availability Model (GAM) for the southern part of the Ogallala aquifer and the GAM for the northern part of the Ogallala aquifer for the High Plains Underground Water Conservation District:

- Existing and projected usable water and volume of water in storage on an annual basis for the years 2003 through 2013 for average recharge and pumping conditions, and drought-of-record recharge and pumping conditions. This information was requested, by individual county, for the following counties within the District: Armstrong, Bailey, Castro, Cochran, Crosby, Deaf Smith, Floyd, Hale, Hockley, Lamb, Lubbock, Lynn, Parmer, Potter, and Randall.
- Usable water and volume of water in storage for only those portions of the following counties that are within the District's boundaries: Armstrong, Castro, Crosby, Deaf Smith, Floyd, Hockley, Lamb, Potter, and Randall.
- Average annual recharge rates and volumes by county and for the entire district.

METHODS:

To address the request, we:

- Ran the Groundwater Availability Model for the southern part of the Ogallala aquifer (Blandford and others, 2003) and the GAM for the northern part of the Ogallala aquifer (Dutton and others, 2000) for the projected period 2000 to 2050 with average recharge and queried the budget files for the High Plains Underground Water Conservation District No. 1 for 2003 to 2013; and
- Changed the pumpage and the recharge for 2010 to 2013 to reflect the drought; ran the model and computed the water budget and heads for 2003 to 2013. The pumpage used for the drought years is higher than the pumpage in the average recharge years and is based on projected pumpage values supplied by the district.

PARAMETERS AND ASSUMPTIONS:

The recharge in the model represents average climatic conditions for 1960 to 2000 and the same values were used for both (North and South) model runs (2001 to 2050). The pumpage was the same as the normal projected pumpage from the GAM final report. The pumpage during drought years (2010 to 2013) was increased to compensate for the decreased rainfall, and those pumpage values correspond to projected values supplied in the final report. Pumpage for the Northern model could not be changed, so it was left as is. All other parameters and assumptions agree with those discussed in the GAM final report (Blandford and others, 2003).

After the model run, in order to compute the volume of groundwater in each county-basin area, the hydraulic heads for 2003 to 2013 were saved as database files to be imported into ArcGIS. The bottom elevations for each cell (a square mile each) were subtracted from the hydraulic heads; multiplied by the specific yield to give a water volume per square foot. This value was multiplied by 5280² to give total volume in cubic feet and divided by 43,560 in order to convert the answer to acre-feet per cell. Finally, the cells for each county-basin area were summed to yield the final total volume in acre-feet. This total volume number is considered the useable water volume.

The amount of water pumped from each county-basin area was obtained from the PMWIN water budget files for each of the projected years.

RESULTS:

We prepared hydraulic head files and water budget tables for each year of 2003 to 2013 for average recharge conditions. Two years (2003 and 2004) of water volumes for each of the designated counties are shown in Table A. The remaining head files (2005 to 2013) were e-mailed to the High Plains Underground Water Conservation District No. 1, and the total water volumes for 2005 to 2013 were calculated by Dr. Judy Reeves. We also prepared hydraulic head files and water budget tables for drought conditions in the years 2010-2013. The hydraulic head files for drought conditions were also e-mailed to Dr. Reeves. Tables 1 through 15 show water budgets for runs with average recharge and predictive pumping. Tables 16 through 30 show water budgets for the same counties ending in a four year drought, 2010 to 2013.

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 for the Texas Water Development Board by Daniel B. Stephens & Associates, 2003.
- Dutton, A.R., Reedy, R.C., and Mace, R.E., 2001, Saturated thickness in the Ogallala aquifer in the Panhandle Water Planning Area – Simulation of 2000 through 2050 withdrawal projections: Final Report Prepared for the Panhandle Water Planning Group, Panhandle Regional Planning Commission by the Bureau of Economic Geology, 2001.

TABLES:

Table A: Computed water volumes for selected counties in the High Plains Underground Water Conservation District No. 1

High Plains Underground Water Conservation District No. 1		
County	Total water volume	
	for 2003 (acre-ft)	for 2004 (acre-ft)
Armstrong	497,101	476,214
Bailey	3,128,164	3,077,189
Castro	9,721,063	9,541,254
Cochran	3,497,116	3,475,891
Crosby	11,596,164	11,556,210
Deaf Smith	6,482,160	6,320,170
Floyd	12,958,750	12,897,158
Hale	10,343,157	10,129,136
Hockley	4,829,153	4,799,433
Lamb	8,551,028	8,271,425
Lubbock	7,857,059	7,771,684
Lynn	5,657,644	5,691,500
Parmer	3,467,863	3,271,801
Potter	209,989	207,052
Randall	3,354,445	3,294,347
Total	92,150,856	90,780,464

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs /seeps	Recharge	Total In	Total out	% Diff
2003	13	4,378	229	706	6,126	377	2,615	7,222	7,223	0.01
2004	9	4,291	270	665	6,126	377	2,615	7,177	7,177	0
2005	6	4,211	313	633	6,126	376	2,615	7,139	7,141	0.03
2006	4	4,140	356	607	6,127	375	2,615	7,111	7,112	0.01
2007	1	4,073	396	584	6,127	374	2,615	7,085	7,086	0.01
2008	0	4,013	433	562	6,127	373	2,615	7,062	7,062	0
2009	0	3,956	467	541	6,127	372	2,615	7,039	7,040	0.01
2010	0	3,905	498	521	6,127	371	2,615	7,018	7,019	0.01
2011	0	3,856	528	504	6,128	370	2,615	7,000	7,001	0.02
2012	0	3,814	557	488	6,129	368	2,615	6,986	6,985	0.01
2013	0	3,771	583	473	6,129	367	2,615	6,969	6,970	0.01

Table 1: Armstrong County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	35,640	1,885	647	7,570	26,979	1,883	69,545	72,077	72,073	0.01
2004	35,649	1,772	645	7,543	26,848	1,911	69,545	71,962	71,951	0.02
2005	35,693	1,681	643	7,520	26,716	1,940	69,545	71,869	71,868	0
2006	35,681	1,599	640	7,550	26,584	1,968	69,545	71,784	71,783	0
2007	35,673	1,524	636	7,580	26,452	1,997	69,545	71,706	71,702	0.01
2008	35,666	1,456	633	7,611	26,321	2,025	69,545	71,633	71,623	0.01
2009	35,683	1,395	629	7,641	26,189	2,054	69,545	71,568	71,566	0
2010	35,693	1,339	626	7,671	26,057	2,082	69,545	71,509	71,504	0.01
2011	35,725	1,287	622	7,700	25,916	2,111	69,545	71,454	71,452	0
2012	35,750	1,240	618	7,729	25,775	2,140	69,545	71,403	71,394	0.01
2013	35,788	1,194	615	7,758	25,634	2,168	69,545	71,353	71,348	0.01

Table 2: Bailey County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	184	192,127	2,001	5,782	247,405	0	59,226	253,355	253,370	0.01
2004	62	191,336	2,017	5,758	246,732	0	59,226	252,579	252,552	0.01
2005	0	189,926	2,023	5,749	245,360	0	59,143	251,092	251,110	0.01
2006	0	189,251	2,034	5,751	244,691	0	59,143	250,428	250,442	0.01
2007	0	188,509	2,040	5,686	244,022	0	59,143	249,692	249,708	0.01
2008	1	187,814	2,041	5,622	243,353	0	59,143	248,998	248,976	0.01
2009	1	187,101	2,037	5,608	242,683	0	59,143	248,281	248,292	0
2010	2	186,430	2,014	5,582	242,013	0	59,143	247,587	247,597	0
2011	2	183,215	2,010	5,545	238,688	0	58,994	244,219	244,234	0.01
2012	1	182,390	2,001	5,497	237,785	0	58,915	243,306	243,283	0.01
2013	9	180,404	1,988	5,437	235,674	0	58,709	241,101	241,120	0.01

Table 3: Castro County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	4,186	13,872	1,682	2,261	32,172	0	23,063	38,616	38,618	0
2004	4,050	13,501	1,673	2,281	31,817	0	22,983	38,157	38,148	0.02
2005	3,954	13,027	1,667	2,301	31,316	0	22,876	37,570	37,571	0
2006	3,893	12,613	1,661	2,320	30,833	0	22,772	37,046	37,046	0
2007	3,863	12,219	1,655	2,336	30,345	0	22,667	36,541	36,544	0.01
2008	3,809	11,758	1,649	2,351	29,739	0	22,495	35,903	35,898	0.01
2009	3,752	11,067	1,644	2,364	28,807	0	22,210	34,921	34,923	0.01
2010	3,690	10,767	1,639	2,375	28,360	0	22,018	34,424	34,426	0
2011	3,644	10,376	1,640	2,386	27,807	0	21,820	33,836	33,837	0
2012	3,610	10,119	1,639	2,397	27,484	0	21,739	33,497	33,491	0.02
2013	3,583	8,935	1,638	2,407	25,836	0	21,252	31,825	31,827	0

Table 4: Cochran County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	536	41,182	5,179	2,479	81,182	4,097	41,949	88,310	88,294	0.02
2004	525	40,724	5,221	2,427	80,854	4,078	41,949	87,893	87,883	0.01
2005	535	40,311	5,254	2,377	80,525	4,060	41,949	87,514	87,497	0.02
2006	523	39,914	5,286	2,372	80,196	4,042	41,949	87,149	87,133	0.02
2007	511	39,529	5,311	2,368	79,867	4,025	41,949	86,788	86,771	0.02
2008	501	39,142	5,329	2,364	79,538	4,008	41,949	86,419	86,411	0.01
2009	491	38,779	5,342	2,359	79,210	3,991	41,949	86,070	86,051	0.02
2010	483	38,410	5,352	2,355	78,881	3,974	41,949	85,710	85,693	0.02
2011	474	38,054	5,358	2,350	78,564	3,958	41,949	85,361	85,347	0.02
2012	467	37,702	5,360	2,346	78,248	3,942	41,949	85,010	85,002	0.01
2013	458	37,365	5,362	2,343	77,931	3,926	41,949	84,675	84,659	0.02

Table 5: Crosby County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	314	173,600	5,400	2,639	225,468	0	49,406	228,406	228,421	0.01
2004	185	171,606	5,332	2,606	223,156	0	49,028	225,966	225,947	0.01
2005	87	166,379	5,261	2,579	216,923	0	47,944	219,584	219,589	0
2006	81	162,692	5,183	2,553	212,510	0	47,257	215,132	215,145	0.01
2007	106	158,956	5,125	2,521	207,827	0	46,366	210,446	210,454	0
2008	137	155,098	5,076	2,482	203,139	0	45,607	205,781	205,758	0.01
2009	167	150,703	5,047	2,434	197,875	0	44,715	200,465	200,475	0.01
2010	183	148,186	5,014	2,364	194,800	0	44,138	197,337	197,347	0
2011	183	144,888	4,978	2,306	190,669	0	43,283	193,149	193,158	0
2012	183	141,390	4,934	2,236	186,459	0	42,573	188,897	188,877	0.01
2013	184	137,957	4,879	2,147	182,354	0	41,842	184,678	184,685	0

Table 6: Deaf Smith County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	2,123	58,023	4,014	4,661	92,098	4,082	40,936	102,973	102,964	0.01
2004	1,809	54,513	3,697	4,815	87,910	4,055	40,395	98,605	98,588	0.02
2005	1,561	53,008	3,443	4,967	86,028	4,027	40,140	96,591	96,583	0.01
2006	1,379	52,911	3,265	5,148	85,786	3,998	40,140	96,316	96,310	0.01
2007	1,225	51,679	3,098	5,315	84,212	3,970	39,954	94,731	94,722	0.01
2008	1,104	50,445	2,976	5,481	82,645	3,940	39,767	93,188	93,170	0.02
2009	1,004	49,193	2,879	5,643	81,087	3,910	39,580	91,652	91,645	0.01
2010	919	48,528	2,800	5,803	80,201	3,880	39,487	90,814	90,803	0.01
2011	844	47,871	2,726	5,946	79,348	3,850	39,397	89,994	89,988	0.01
2012	776	47,175	2,648	6,096	78,321	3,820	39,210	89,032	89,013	0.02
2013	720	47,090	2,575	6,249	78,107	3,789	39,210	88,875	88,866	0.01

Table 7: Floyd County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	87	217,513	7,775	3,398	293,647	0	71,848	297,137	297,132	0
2004	35	215,858	7,955	3,078	292,425	0	71,755	295,567	295,538	0.01
2005	21	214,681	8,106	2,810	291,705	0	71,755	294,541	294,536	0
2006	22	213,612	8,270	2,620	290,985	0	71,755	293,637	293,627	0
2007	39	212,613	8,412	2,462	290,266	0	71,755	292,780	292,768	0
2008	112	211,313	8,544	2,333	289,049	0	71,661	291,518	291,494	0.01
2009	123	210,363	8,667	2,229	288,330	0	71,661	290,691	290,682	0
2010	168	209,487	8,783	2,146	287,613	0	71,661	289,931	289,926	0
2011	288	208,755	8,883	2,075	286,934	0	71,661	289,300	289,297	0
2012	307	206,796	8,959	2,007	284,797	0	71,385	287,140	287,112	0.01
2013	291	205,964	9,008	1,942	284,122	0	71,385	286,357	286,355	0

Table 8: Hale County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	900	36,066	3,139	2,943	78,233	0	42,879	82,084	82,077	0.01
2004	813	35,652	3,117	2,947	77,797	0	42,799	81,568	81,557	0.01
2005	741	35,335	3,098	2,949	77,543	0	42,799	81,233	81,233	0
2006	691	34,950	3,080	2,945	77,113	0	42,721	80,751	80,749	0
2007	649	34,664	3,062	2,934	76,860	0	42,721	80,447	80,443	0.01
2008	618	34,376	3,045	2,904	76,607	0	42,721	80,142	80,129	0.02
2009	596	33,941	3,027	2,896	76,088	0	42,610	79,579	79,579	0
2010	565	33,478	3,009	2,887	75,528	0	42,497	78,983	78,980	0
2011	538	32,529	2,991	2,875	74,472	0	42,366	77,885	77,884	0
2012	514	32,231	2,974	2,856	74,189	0	42,366	77,571	77,558	0.02
2013	494	31,755	2,958	2,843	73,619	0	42,246	76,959	76,956	0

Table 9: Hockley County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	339	187,855	3,558	5,533	256,862	52	71,369	262,781	262,787	0
2004	336	184,310	3,756	5,395	253,023	52	70,753	258,819	258,805	0.01
2005	328	182,639	3,919	5,265	251,569	52	70,654	257,212	257,213	0
2006	322	180,229	4,051	5,138	249,094	52	70,320	254,600	254,605	0
2007	319	177,816	4,158	5,016	246,629	52	70,038	252,011	252,016	0
2008	319	175,149	4,231	4,897	243,675	52	69,582	248,962	248,942	0.01
2009	320	172,427	4,310	4,777	240,634	52	69,039	245,777	245,783	0
2010	323	168,793	4,377	4,656	236,423	52	68,281	241,450	241,454	0
2011	316	165,883	4,426	4,531	233,100	52	67,686	237,995	237,999	0
2012	325	161,390	4,458	4,404	227,625	52	66,574	232,422	232,406	0.01
2013	331	158,304	4,490	4,274	223,982	52	65,844	228,638	228,639	0

Table 10: Lamb County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	414	91,502	5,617	4,974	141,346	1,729	51,351	148,470	148,462	0.01
2004	420	90,394	5,616	4,956	140,157	1,715	51,260	147,270	147,248	0.02
2005	421	89,355	5,615	4,932	139,052	1,701	51,140	146,110	146,107	0
2006	419	88,055	5,615	4,905	137,601	1,687	50,941	144,610	144,613	0
2007	437	86,721	5,618	4,876	136,010	1,674	50,662	143,000	142,998	0
2008	428	85,562	5,618	4,845	134,767	1,661	50,542	141,722	141,702	0.01
2009	420	84,364	5,616	4,813	133,530	1,649	50,439	140,419	140,412	0.01
2010	426	83,255	5,611	4,780	132,368	1,636	50,347	139,213	139,210	0
2011	434	81,888	5,604	4,743	130,798	1,624	50,107	137,600	137,599	0
2012	447	80,545	5,598	4,703	129,234	1,612	49,872	136,015	135,996	0.01
2013	468	79,738	5,593	4,658	128,469	1,601	49,872	135,204	135,196	0.01

Table 11: Lubbock County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	35,640	1,885	647	7,570	26,979	1,883	69,545	72,077	72,073	0.01
2004	35,649	1,772	645	7,543	26,848	1,911	69,545	71,962	71,951	0.02
2005	35,693	1,681	643	7,520	26,716	1,940	69,545	71,869	71,868	0
2006	35,681	1,599	640	7,550	26,584	1,968	69,545	71,784	71,783	0
2007	35,673	1,524	636	7,580	26,452	1,997	69,545	71,706	71,702	0.01
2008	35,666	1,456	633	7,611	26,321	2,025	69,545	71,633	71,623	0.01
2009	35,683	1,395	629	7,641	26,189	2,054	69,545	71,568	71,566	0
2010	35,693	1,339	626	7,671	26,057	2,082	69,545	71,509	71,504	0.01
2011	35,725	1,287	622	7,700	25,916	2,111	69,545	71,454	71,452	0
2012	35,750	1,240	618	7,729	25,775	2,140	69,545	71,403	71,394	0.01
2013	35,788	1,194	615	7,758	25,634	2,168	69,545	71,353	71,348	0.01

Table 12: Lynn County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	242	161,869	2,409	977	207,604	0	44,539	208,817	208,822	0
2004	238	157,752	2,249	944	202,691	0	43,894	203,895	203,873	0.01
2005	239	150,253	2,138	915	193,757	0	42,518	194,909	194,911	0
2006	241	145,198	2,053	878	187,643	0	41,507	188,758	188,763	0
2007	244	140,635	1,917	835	182,106	0	40,631	183,182	183,185	0
2008	259	133,092	1,795	796	173,101	0	39,289	174,176	174,156	0.01
2009	279	122,908	1,715	754	161,169	0	37,576	162,199	162,202	0
2010	289	114,172	1,606	709	150,745	0	35,963	151,741	151,744	0
2011	294	109,783	1,535	666	145,316	0	34,959	146,277	146,276	0
2012	329	105,215	1,456	622	139,761	0	34,058	140,729	140,713	0.01
2013	346	100,516	1,357	573	134,076	0	33,122	134,995	134,994	0

Table 13: Parmer County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	0	4,767	362	1,419	3,870	0	160	5,289	5,289	0.01
2004	0	4,840	368	1,406	3,962	0	160	5,369	5,368	0.01
2005	0	4,904	373	1,382	4,055	0	160	5,438	5,437	0.02
2006	0	4,393	377	1,347	3,581	0	159	4,928	4,928	0.01
2007	0	3,092	378	1,299	2,328	0	157	3,628	3,627	0.01
2008	0	3,064	378	1,229	2,370	0	157	3,598	3,599	0
2009	0	2,999	378	1,122	2,411	0	157	3,534	3,534	0.01
2010	0	2,820	374	898	2,453	0	157	3,351	3,351	0.01
2011	0	2,780	365	796	2,505	0	157	3,301	3,301	0.02
2012	0	2,153	361	733	1,932	0	151	2,664	2,665	0.02
2013	9	2,107	360	641	1,967	0	151	2,617	2,617	0

Table 14: Potter County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2003	856	31,019	1,800	3,447	48,432	240	20,158	52,978	52,976	0
2004	582	30,518	1,790	3,425	48,202	245	20,158	52,467	52,455	0.02
2005	406	30,083	1,787	3,402	47,972	247	20,158	52,028	52,027	0
2006	288	29,520	1,789	3,375	47,467	247	20,065	51,374	51,376	0
2007	216	29,179	1,795	3,341	47,237	246	20,065	51,039	51,040	0
2008	180	28,710	1,805	3,299	46,771	245	19,988	50,503	50,494	0.02
2009	106	29,600	1,917	3,135	48,038	215	19,975	51,492	51,493	0
2010	96	29,238	1,941	2,926	47,920	211	19,975	51,154	51,153	0
2011	82	28,882	1,968	2,855	47,594	206	19,887	50,737	50,738	0
2012	69	28,749	1,997	2,824	47,528	201	19,887	50,634	50,621	0.02
2013	58	28,575	2,024	2,774	47,462	195	19,887	50,486	50,488	0

Table 15: Randall County water budget from the GAM of the southern part of the Ogallala aquifer for average recharge and pumping conditions. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	0	6,928	519	517	8,390	368	1,828	9,275	9,275	0
2011	0	6,944	584	488	8,503	366	1,828	9,356	9,357	0.01
2012	0	6,097	631	464	7,728	364	1,828	8,556	8,555	0.01
2013	0	4,527	654	448	6,200	362	1,828	7,009	7,010	0.01

Table 16: Armstrong County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	2,240	38,571	2,582	2,039	49,684	31	12,855	54,008	53,994	0.03
2011	2,184	35,249	2,379	2,055	45,874	31	12,528	50,156	50,144	0.02
2012	2,140	32,052	2,129	2,064	42,179	31	12,240	46,421	46,413	0.02
2013	2,174	23,538	1,965	2,059	33,039	30	11,800	37,303	37,302	0

Table 17: Bailey County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	66	235,932	1,509	5,777	273,348	0	41,736	279,177	279,191	0
2011	41	232,464	1,497	5,825	269,847	0	41,736	275,697	275,713	0.01
2012	18	229,404	1,488	5,787	266,602	0	41,536	272,429	272,408	0.01
2013	33	185,943	1,473	5,684	223,243	0	41,536	228,952	228,961	0

Table 18: Castro County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	1,431	24,269	1,596	2,244	37,677	0	15,481	41,346	41,352	0.02
2011	1,416	24,129	1,602	2,240	37,297	0	15,221	40,951	40,953	0
2012	1,392	20,316	1,607	2,236	33,018	0	14,727	36,649	36,646	0.01
2013	1,596	12,919	1,610	2,231	25,332	0	14,626	29,155	29,159	0.01

Table 19: Cochran County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	201	66,323	5,959	2,279	95,532	4,039	29,785	102,067	102,050	0.02
2011	195	71,258	6,062	2,281	100,608	4,005	29,785	107,105	107,089	0.01
2012	190	71,400	6,166	2,271	100,912	3,971	29,785	107,351	107,344	0.01
2013	195	44,239	6,086	2,248	73,698	3,951	29,785	80,110	80,092	0.02

Table 20: Crosby County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	104	193,083	4,635	2,089	226,075	0	30,554	228,272	228,268	0
2011	95	187,692	4,595	2,002	219,999	0	29,812	222,098	222,095	0
2012	88	182,669	4,573	1,881	214,633	0	29,376	216,618	216,602	0.01
2013	86	138,485	4,523	1,773	169,664	0	28,511	171,519	171,523	0

Table 21: Deaf Smith County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	22	86,447	2,573	6,565	106,193	3,907	27,665	116,685	116,686	0
2011	21	83,848	2,448	6,958	102,963	3,865	27,511	113,806	113,806	0
2012	19	77,770	2,335	7,277	96,419	3,824	27,445	107,550	107,540	0.01
2013	242	56,831	2,246	7,228	75,193	3,793	27,380	86,457	86,457	0

Table 22: Floyd County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	184	323,904	9,403	2,103	381,194	0	50,192	383,499	383,481	0
2011	259	314,905	9,852	2,004	372,481	0	49,999	374,757	374,744	0
2012	245	293,929	10,006	1,935	351,664	0	49,937	353,872	353,843	0.01
2013	232	214,068	9,730	1,869	271,497	0	49,815	273,613	273,598	0.01

Table 23: Hale County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	20	60,569	3,046	3,049	90,353	0	29,812	93,427	93,423	0
2011	28	62,468	3,035	3,027	92,093	0	29,649	95,152	95,148	0
2012	33	57,455	3,008	2,990	87,075	0	29,649	90,112	90,098	0.02
2013	88	36,721	2,961	2,958	66,283	0	29,649	69,331	69,329	0

Table 24: Hockley County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	0	223,269	4,176	4,520	270,269	0	47,335	274,779	274,790	0
2011	0	218,341	4,266	4,402	264,897	0	46,682	269,289	269,299	0
2012	0	208,270	4,302	4,257	254,226	0	45,917	258,489	258,483	0
2013	0	163,407	4,259	4,090	209,043	0	45,458	213,123	213,133	0

Table 25: Lamb County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	131	113,155	5,610	4,927	147,322	1,629	35,244	154,009	154,009	0
2011	128	118,465	5,626	5,017	152,248	1,613	34,911	159,002	159,005	0
2012	160	118,546	5,641	4,995	152,254	1,596	34,832	159,019	159,005	0.01
2013	338	79,314	5,548	4,860	112,843	1,580	34,754	119,615	119,621	0.01

Table 26: Lubbock County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	19,100	9,962	675	7,749	30,320	2,058	48,608	59,245	59,227	0.03
2011	18,830	11,213	671	7,784	31,792	2,067	48,608	60,492	60,474	0.03
2012	18,754	11,307	670	7,809	31,921	2,078	48,608	60,585	60,562	0.04
2013	20,518	4,611	668	7,752	23,512	2,090	48,608	53,888	53,872	0.03

Table 27: Lynn County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	48	156,128	1,530	1,452	182,396	0	26,232	183,890	183,896	0
2011	42	145,120	1,414	1,246	170,445	0	25,196	171,731	171,734	0
2012	39	138,325	1,271	1,010	163,023	0	24,490	164,085	164,072	0.01
2013	71	104,436	1,143	869	128,069	0	23,426	129,006	129,010	0

Table 28: Parmer County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	12	2,079	815	994	2,095	0	207	3,101	3,101	0.02
2011	12	2,000	790	888	2,096	0	207	2,998	2,997	0.03
2012	75	1,782	767	752	1,930	0	207	2,757	2,757	0.01
2013	133	1,572	746	702	1,690	0	207	2,525	2,525	0.01

Table 29: Potter County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Year	In-to-storage	Water from storage	X-flow In	X-flow out	Wells	Springs/seeps	Recharge	Total In	Total out	% Diff
2010	111	45,820	1,897	3,125	58,176	237	13,930	61,647	61,649	0
2011	97	45,224	1,970	3,005	57,793	231	13,930	61,124	61,126	0
2012	83	40,662	2,024	2,904	53,398	225	13,930	56,617	56,610	0.01
2013	71	31,639	2,054	2,817	44,516	220	13,930	47,623	47,624	0

Table 30: Randall County water budget from the GAM of the southern part of the Ogallala aquifer for drought of record recharge and pumping conditions in 2010 to 2013. Units = acre-feet/year

Notes:

1. In-to-storage refers to water put into storage
2. Water from storage refers to water withdrawn from storage
3. X-flow in refers to lateral flow into the county.
4. X-flow out refers to lateral flow out of the county.
5. Wells is for pumping input.
6. Total In = Water from storage + x-flow in + recharge
7. Total out = In-to-storage + x-flow out + wells + Springs/seeps

