GAM Task 11-010: Estimated Total Pumping in the Ogallala, Edwards-Trinity (High Plains), and Dockum Aquifers in High Plains Underground Water Conservation District No. 1

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GAM TASK 11-010: ESTIMATED TOTAL PUMPING IN THE OGALLALA, EDWARDS-TRINITY (HIGH PLAINS), AND DOCKUM AQUIFERS IN HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

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EXECUTIVE SUMMARY:

This report documents the total pumping information from Draft GAM Run 10-030 MAG, Draft GAM Run 10-019 MAG, and Draft GAM Run 10-035 MAG for the Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers divided by groundwater conservation district within each county in groundwater management areas 1 and 2. This information was compiled at the request of High Plains Underground Water Conservation District for use in updating its management plan.

PURPOSE:

In November and December 2010, the Texas Water Development Board released three draft groundwater availability model (GAM) runs containing information relating to High Plains Underground Water Conservation District No. 1: GAM Run 10-030 MAG for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 (Oliver, 2010c), GAM Run 10-019 MAG for the Dockum Aquifer in Groundwater Management Area 1 (Oliver, 2010b), and GAM Run 10-035 MAG for the Dockum Aquifer in Groundwater Management Area 2 (Oliver, 2010d). These reports contained draft information about the estimated total pumping required to meet the desired future conditions set by the groundwater conservation districts within groundwater management areas 1 and 2 for the Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers. In an email received on June 2, 2011, Mr. Jim Conkwright of High Plains Underground Water Conservation District No. 1 requested the information from the above reports divided by district within each county for use in updating the

district's management plan. In these reports, the total pumping was summarized separately by county and groundwater conservation district. However, because many counties are only partially within the jurisdictional area of High Plains Underground Water Conservation District, information about how pumping was allocated into the district within each county could not be directly obtained from these reports. This report presents the total pumping divided by groundwater conservation district within each county. These areas are shown in Figure 1. Note that, though there is also pumping in the Ogallala Aquifer in High Plains Underground Water Conservation District No. 1 in Groundwater Management Area 1, results for this area have not been included here because they have been reported previously in Draft GAM Run 09-026 (Oliver, 2010a).

RESULTS:

Tables 1 and 2 below show the estimated total pumping necessary to meet the desired future conditions in the Ogallala and Edwards-Trinity (High Plains) aquifers, respectively, in Groundwater Management Area 2 divided by county and groundwater conservation district between 2010 and 2060 from Draft GAM Run 10-030 MAG (Oliver, 2010c). Tables 3 and 4 below show the same information for the Dockum Aquifer from Oliver (2010b) and Oliver (2010d) for groundwater management areas 1 and 2, respectively.

As explained in the above reports, "total pumping" is distinct from "managed available groundwater" in that it includes uses of water both subject to permitting and exempt from permitting. Managed available groundwater, the amount available for permitting, is developed by subtracting the estimated amount of pumping exempt from permitting in each district from the estimated total pumping.

LIMITATIONS:

The groundwater model used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions

> rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES:

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Oliver, W., 2010a, Draft GAM Run 09-026 MAG, Texas Water Development Board Draft Managed Available Groundwater GAM Run Report, 19 p.

Oliver, W., 2010b, Draft GAM Run 10-019 MAG, Texas Water Development Board Draft Managed Available Groundwater GAM Run Report, 11 p.

Oliver, W., 2010c, Draft GAM Run 10-030 MAG, Texas Water Development Board Draft Managed Available Groundwater GAM Run Report, 14 p.

Oliver, W., 2010d, Draft GAM Run 10-035 MAG, Texas Water Development Board Draft Managed Available Groundwater GAM Run Report, 12 p.

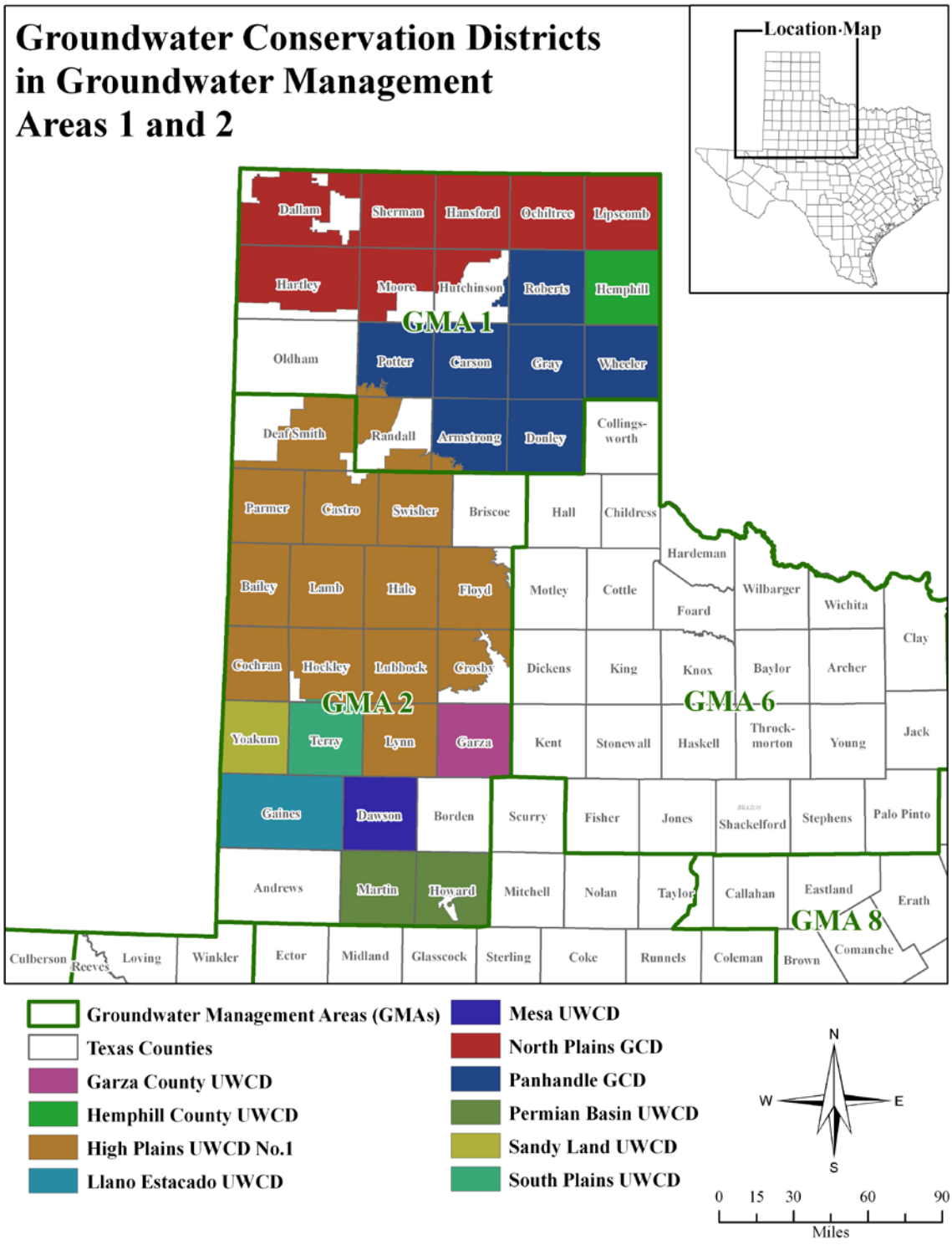

FIGURE 1: LOCATION MAP SHOWING THE GROUNDWATER CONSERVATION DISTRICTS (GCDS) WITHIN GROUNDWATER MANAGEMENT AREAS 1 AND 2. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

TABLE 1: ESTIMATED TOTAL ANNUAL PUMPING FOR THE OGALLALA AQUIFER FROM DRAFT GAM RUN 10-030 MAG (OLIVER, 2010C) SUMMARIZED BY COUNTY AND GROUNDWATER CONSERVATION DISTRICT WITHIN GROUNDWATER MANAGEMENT AREA 2 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

County	*Groundwater Conservation District*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Andrews	No District	17,638	15,135	13,719	12,055	10,057	7,418
Bailey	High Plains UWCD No. 1	62,538	41,283	34,907	30,064	24,021	21,429
Borden	No District	399	399	399	399	399	399
Briscoe	No District	33,622	26,457	19,722	14,220	13,037	11,933
Castro	High Plains UWCD No. 1	127,128	127,009	126,214	125,522	122,986	117,704
Castro	No District	294	294	294	294	294	294
Cochran	High Plains UWCD No. 1	48,345	36,208	33,641	30,696	28,084	25,371
Crosby	High Plains UWCD No. 1	123,807	123,807	123,807	123,807	123,807	123,807
Crosby	No District	11,056	10,875	10,875	10,875	10,875	10,875
Dawson	Mesa UWCD	201,610	198,108	185,881	161,615	135,454	93,780
Deaf Smith	High Plains UWCD No. 1	119,453	108,489	97,431	87,732	71,395	57,315
Deaf Smith	No District	9,714	9,677	9,437	9,325	8,987	8,616
Floyd	High Plains UWCD No. 1	154,548	148,944	144,939	138,045	129,471	124,023
Floyd	No District	422	422	422	338	338	338
Gaines	Llano Estacado UWCD	350,369	240,110	175,175	130,951	97,498	71,544
Garza	Garza County UWCD	19,203	19,073	18,942	18,812	18,032	17,121
Hale	High Plains UWCD No. 1	130,622	129,816	128,017	126,013	120,137	112,259
Hockley	High Plains UWCD No. 1	93,543	89,957	85,864	81,993	74,344	65,355
Hockley	No District	1,809	1,809	1,809	1,809	1,809	1,809
Hockley	South Plains UWCD	616	616	616	616	616	616
Howard	Permian Basin UWCD	2,833	2,833	2,529	2,529	2,529	2,518
Howard	No District	242	242	202	202	202	185
Lamb	High Plains UWCD No. 1	147,368	137,304	125,466	111,509	95,696	85,190
Lubbock	High Plains UWCD No. 1	124,519	120,044	115,348	108,699	100,762	91,073
Lynn	High Plains UWCD No. 1	104,023	103,760	102,974	100,620	92,965	84,468
Martin	Permian Basin UWCD	13,570	13,570	13,570	13,140	12,299	12,277
Parmer	High Plains UWCD No. 1	68,694	63,065	56,584	52,149	45,620	40,981
Swisher	High Plains UWCD No. 1	110,925	107,406	101,002	84,818	73,848	64,298
Terry	South Plains UWCD	205,659	196,222	134,609	87,098	53,905	33,647
Yoakum	Sandy Land UWCD	82,297	59,745	43,575	33,882	26,717	20,040
Total		2,366,866	2,132,679	1,907,970	1,699,827	1,496,184	1,306,683

TABLE 2: ESTIMATED TOTAL ANNUAL PUMPING FOR THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER FROM DRAFT GAM RUN 10-030 MAG (OLIVER, 2010C) SUMMARIZED BY COUNTY AND GROUNDWATER CONSERVATION DISTRICT WITHIN GROUNDWATER MANAGEMENT AREA 2 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

County	*Groundwater Conservation District*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Bailey	High Plains UWCD No. 1	279	279	279	279	279	279
Borden	No District	106	106	106	106	106	106
Cochran	High Plains UWCD No. 1	264	264	264	264	264	264
Dawson	Mesa UWCD	1,103	1,103	1,103	1,103	1,103	1,103
Floyd	High Plains UWCD No. 1	1,216	1,216	1,216	1,213	1,200	1,182
Gaines	Llano Estacado UWCD	85,058	46,202	30,316	22,997	16,523	12,904
Garza	Garza County UWCD	18	18	18	18	18	18
Hale	High Plains UWCD No. 1	3,523	3,523	3,523	3,523	3,523	3,419
Hockley	No District	0	0	0	0	0	0
Hockley	High Plains UWCD No. 1	96	96	96	96	96	96
Hockley	South Plains UWCD	0	0	0	0	0	0
Lamb	High Plains UWCD No. 1	164	164	164	164	164	164
Lubbock	High Plains UWCD No. 1	690	690	690	690	690	690
Lynn	High Plains UWCD No. 1	230	230	230	230	230	230
Terry	South Plains UWCD	982	982	945	945	945	945
Yoakum	Sandy Land UWCD	2,532	1,893	1,757	1,642	1,642	1,524
Total		96,261	56,766	40,707	33,270	26,783	22,924

TABLE 3: ESTIMATED TOTAL ANNUAL PUMPING FOR THE DOCKUM AQUIFER FROM DRAFT GAM RUN 10-019 MAG (OLIVER, 2010B) SUMMARIZED BY COUNTY AND GROUNDWATER CONSERVATION DISTRICT (GCD) WITHIN GROUNDWATER MANAGEMENT AREA 1 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

County	*Groundwater Conservation District*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Armstrong	High Plains UWCD No. 1	82	82	82	82	82	82
Armstrong	Panhandle GCD	500	500	500	500	500	500
Carson	Panhandle GCD	283	283	283	283	283	283
Dallam	North Plains GCD	3,044	3,044	3,044	3,044	3,044	3,044
Dallam	No District	990	990	990	990	990	990
Hartley	North Plains GCD	3,097	3,097	3,097	3,097	3,097	3,097
Hartley	No District	470	470	470	470	470	470
Moore	North Plains GCD	5,386	5,386	5,386	5,386	5,386	5,386
Moore	No District	9	9	9	9	9	9
Oldham	No District	2,972	2,972	2,972	2,972	2,972	2,972
Potter	High Plains UWCD No. 1	226	226	226	226	226	226
Potter	Panhandle GCD	1,454	1,454	1,454	1,454	1,454	1,454
Randall	High Plains UWCD No. 1	988	988	988	988	988	988
Randall	No District	1,131	1,131	1,131	1,131	1,131	1,131
Sherman	North Plains GCD	591	591	591	591	591	591
Total		21,223	21,223	21,223	21,223	21,223	21,223

TABLE 4: ESTIMATED TOTAL ANNUAL PUMPING FOR THE DOCKUM AQUIFER FROM DRAFT GAM RUN 10-035 MAG (OLIVER, 2010D) SUMMARIZED BY COUNTY AND GROUNDWATER CONSERVATION DISTRICT (GCD) WITHIN GROUNDWATER MANAGEMENT AREA 2 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

County	*Groundwater Conservation District*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Andrews	No District	850	850	850	850	850	850
Bailey	High Plains UWCD No. 1	1	1	1	1	1	1
Borden	No District	515	515	515	515	515	515
Briscoe	No District	231	231	231	231	231	231
Castro	No District	0	0	0	0	0	0
Castro	High Plains UWCD No. 1	1	1	1	1	1	1
Cochran	High Plains UWCD No. 1	0	0	0	0	0	0
Crosby	High Plains UWCD No. 1	3,798	3,798	3,798	3,798	3,798	3,798
Crosby	No District	311	311	311	311	311	311
Dawson	Mesa UWCD	31	31	31	31	31	31
Deaf Smith	High Plains UWCD No. 1	2,605	2,605	2,605	2,605	2,605	2,605
Deaf Smith	No District	2,107	2,107	2,107	2,107	2,107	2,107
Floyd	High Plains UWCD No. 1	1,659	1,659	1,659	1,659	1,659	1,659
Floyd	No District	25	25	25	25	25	25
Gaines	Llano Estacado UWCD	0	0	0	0	0	0
Garza	Garza County UWCD	613	613	613	613	613	613
Hale	High Plains UWCD No. 1	738	738	738	738	738	738
Hockley	High Plains UWCD No. 1	571	571	571	571	571	571
Hockley	No District	0	0	0	0	0	0
Hockley	South Plains UWCD	0	0	0	0	0	0
Howard	Permian Basin UWCD	569	569	569	569	569	569
Howard	No District	23	23	23	23	23	23
Lamb	High Plains UWCD No. 1	0	0	0	0	0	0
Lamb	No District	0	0	0	0	0	0
Lubbock	High Plains UWCD No. 1	15	15	15	15	15	15
Lynn	High Plains UWCD No. 1	5	5	5	5	5	5
Martin	Permian Basin UWCD	0	0	0	0	0	0
Parmer	High Plains UWCD No. 1	2	2	2	2	2	2
Swisher	High Plains UWCD No. 1	697	697	697	697	697	697
Terry	South Plains UWCD	0	0	0	0	0	0
Yoakum	Sandy Land UWCD	0	0	0	0	0	0
Total		15,367	15,367	15,367	15,367	15,367	15,367