GMA 9 Considerations of Drought of Record Relating to Determination of Desired Future Conditions

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GMA 9 Meeting

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During late August, 2008, GMA 9 Members have received a great deal of email, phone calls, resolutions, and letters from organizations and individuals who have apparently been informed that GMA 9 has ignored the Drought of Record during its deliberations and considerations of Desired Future Conditions

If this is so, then they have been provided with incorrect information.

The following is a short summary of GMA 9 considerations of the Drought of Record.

Early Steps

- GMA 9 held its first meeting on 9-20-05 in this very room.
- The earliest discussions included Drought of Record issues.
- The GMA 9 Committee designated a GMA 9 Technical Group and charged them with reviewing technical and scientific issues relating to GMA 9 hydrology and geology, including Drought of Record concerns.

Early Steps

- Technical Group members, many of whom are geologists, hydrologists, and groundwater management specialists reviewed current information such as Regional K,L, and J Water Plans (which are required to use drought of record conditions in their planning), the TWDB Hill Country Trinity GAM (which has a drought of record component), and local Groundwater Conservation District Rules and Management Plans (which incorporate Drought rules and restrictions). All of these have been developed with consideration of the Drought of Record. The Drought of Record was always a part of technical and scientific discussions.

Some Numbers to Consider

- 100 year average rainfall – 33”
- 1950-1956 average rainfall – 22”
- 1954-1956 average rainfall – 13.9”

- GAM Average Recharge Rate: based on the average rainfall between 1960-1990 x the recharge coefficient for each model cell
- GAM Drought of Record Recharge Rate: based on the average rainfall between 1950-1956 x the recharge coefficient for each model cell

Trial DFC GAM Run

- On May 31, 2007, based on concerns of some GCDs and comments from concerned citizens and organizations, GMA 9 requested a trial GAM Run from the TWDB. This trial run was to test the following DFC:

  "maintaining 90% of spring flow during the drought of record "

- The TWDB performed this run using Drought of Record recharge, and even made an additional run using average recharge. Both were done with the assumption of no pumping from wells in the Hill Country.

Trial DFC GAM Run

- The TWDB results were dramatic. The TWDB modelers came to this conclusion:

"A comparison of the results indicates that spring flow cannot be maintained at the requested level during the drought of record even without pumping. A new desired future condition of the Trinity Aquifer should be explored."

- GAM 9 then turned to the option of setting a DFC based on change in average drawdown.

Results from First Trial GAM Run

Springs	Name	Estimated flow (in gallons per minute)	Simulated flow (gpm) using average recharge	Simulated flow using drought of record recharge (in gallons per minute)	Percentage of simulated spring flow (drought of record)	Formation*	Model layer	Model cell (column, row, layer)
1		150	264	0	0	EDRDA	1	(9,30,1)
2	Bee Caves Spring	100	199	35	18	EDRDA	1	(15,33,1)
3	Lynx Haven Springs	100	111	57	51	EDRDA	1	(16,37,1)
4	Ellebracht Springs	2,500	532	113	21	EDRDA	1	(22,24,1)
5		310	366	155	42	EDRDA	1	(29,19,1)
6		480	324	0	0	EDRDA	1	(38,25,1)
7		100	136	80	59	EDRDA	1	(40,31,1)
8		20	253	135	53	GLRSU	2	(36,48,2)
9		75	110	58	52	GLRSL	3	(63,39,3)
10		50	0	0	0	GLRSL	3	(66,43,3)
11	Kenmore Ranch Spring #9	150	163	0	0	GLRSL	3	(64,49,3)
12	Edge falls Springs	300	364	0	0	GLRSL	3	(71,38,3)
13	Rebecca Springs	300	280	150	54	GLRSL	3	(80,40,3)
14	Jacob's Well Spring	500	433	6	1	GLRSL	3	(95,32,3)
15		25	20	9	45	GLRSL	3	(88,18,3)
16	Bassett Spring	50	53	0	0	GLRSU	2	(97,21,2)
17		50	51	25	50	GLRSU	2	(97,12,2)
18		9,000	324	240	74	EDRDA	1	(29,16,1)
19	Cold Spring	5,000	506	322	64	GLRSL	3	(44,56,3)

Table 1: Springs and drain locations with flows in gallons per minute. The locations are numbered in the first column and are located on Figure 2.

***Formation description as per TWDB Groundwater Database.**
EDRDA = Edwards Group and associated limestone
GLRSL = Lower Member of the Glen Rose Limestone
GLRSU = Upper Member of the Glen Rose Limestone
CCRK = Cow Creek Limestone

UT Graduate Student Policy Research Project 2007-2008

- One component of this multi-semester project was to assist GMA 9 members with multiple GAM runs to evaluate various DFCs, drawdown, and pumpage scenarios.
- The students developed a “wrapper” for the GAM which allowed quick trial runs in order to more easily determine what DFC might or might not work and give some idea of what drawdown and pumpage might be expected under various situations.

UT Graduate Student Policy Research Project

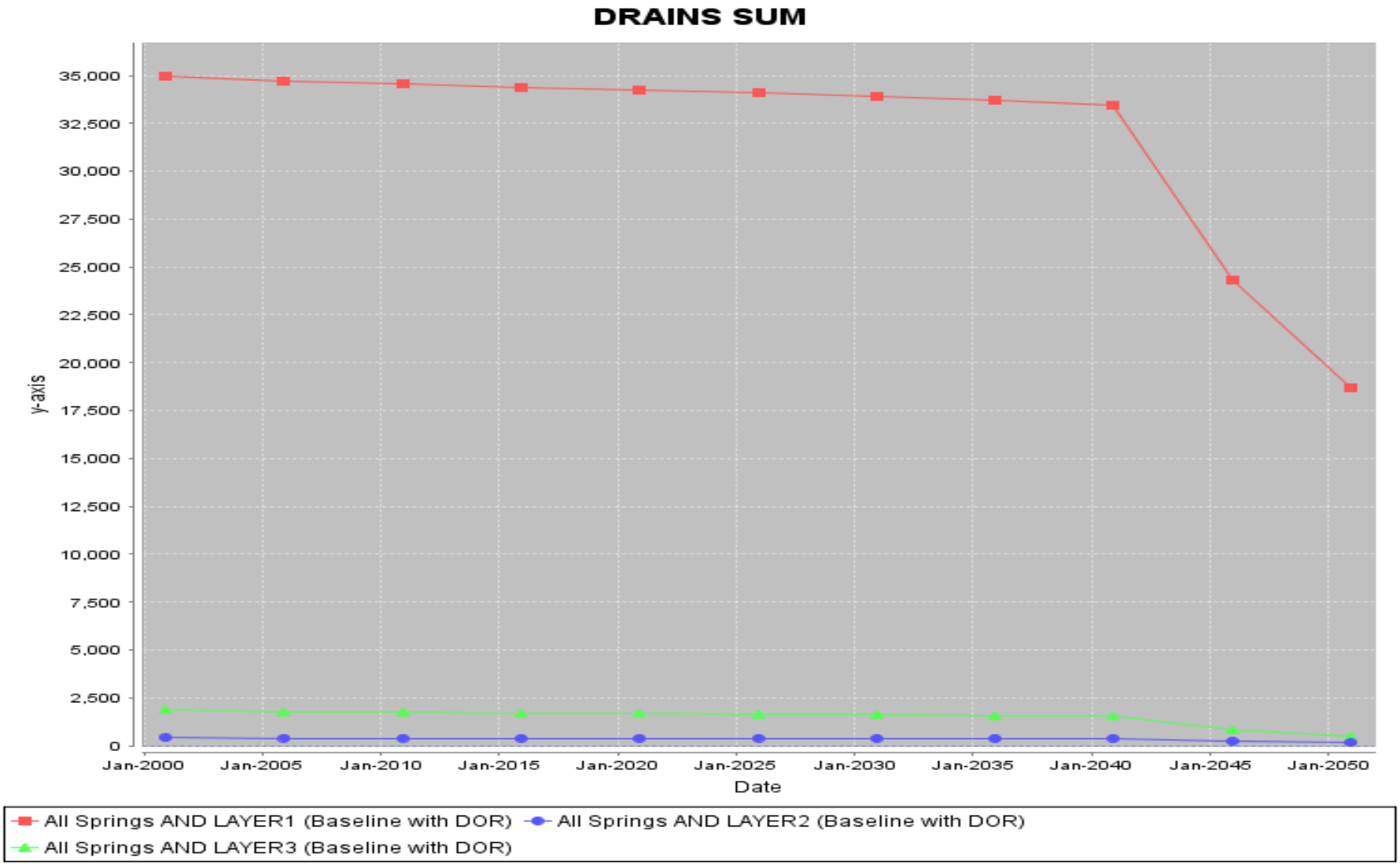
- During this process, the GCDs prepared current estimated groundwater demands and provided a spreadsheet to the students and the TWDB.
- By comparing the current demands with the demands projected by the GAM, it was possible to change pumping demand inputs to the model and test the resulting drawdown.

Trinity Aquifer Current Demands Compared to GAM Baseline Demands

GCD	Permitted Pumpage ac/ft	Permitting in Process or estimated ac/ft	Estimated Exempt Pumpage ac/ft	Misc. ac/ft	Agriculture ac/ft	Total Current **Demand** ac/ft	TWDB Report 353 2010 Hill Country Trinity GAM Upper + Middle **Baseline** Total Demand ac/ft	Current Demand divided by GAM Baseline = Percentage	**Notes:**
Bandera	469		2,859			3,328	3,556	**0.936**	23,000 population estimate, 111gpd based on City of Bandera and Lake Hills PWS records
Trinity Glen Rose	11,900	2,000	1,000	3,000	200	18,100	7,533	**2.403**	Misc.= Military Base usage
Blanco-Pedernales	750	250	592			1,592	616	**2.584**	Blanco Co. = 10,000 population less 4,000 on PWS = 6000 private well users.
Comal Co.	n/a	n/a	n/a	n/a	n/a	n/a	6,250	**n/a**	NO GCD
Gillespie Co.	n/a	n/a	n/a	n/a	n/a	n/a	1,270	**n/a**	Gillespie County not in GMA 9
Hays-Trinity	2,125		2,560		152	4,837	6,487	**0.746**	
Cow Creek	3,200		2,550	250		6,000	5,160	**1.163**	
Headwaters	4,063	500	2,128	1,965	37	8,693	2,584	**3.364**	Misc.= Kerrville use in Drought
Medina	175		190			365	269	**1.357**	Looking to permit between 365 and 7500 ac/ft
Travis Co.	n/a	n/a	n/a	n/a	n/a	n/a	3,386	**n/a**	NO GCD
Uvalde Co.	n/a	n/a	n/a	n/a	n/a	n/a	58	**n/a**	Uvalde County not in GMA 9
EAA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	No Trinity Aquifer regulatory authority
BSEACD	n/a	n/a	n/a	n/a	n/a	5,327	n/a	**n/a**	Estimate 4,000 people using Trinity wells divided by 2.2 persons per well = 1818 wells
Totals	**22,682**	**2,750**	**11,879**	**5,215**	**389**	**48,242**	**37,169**	**1.298**	

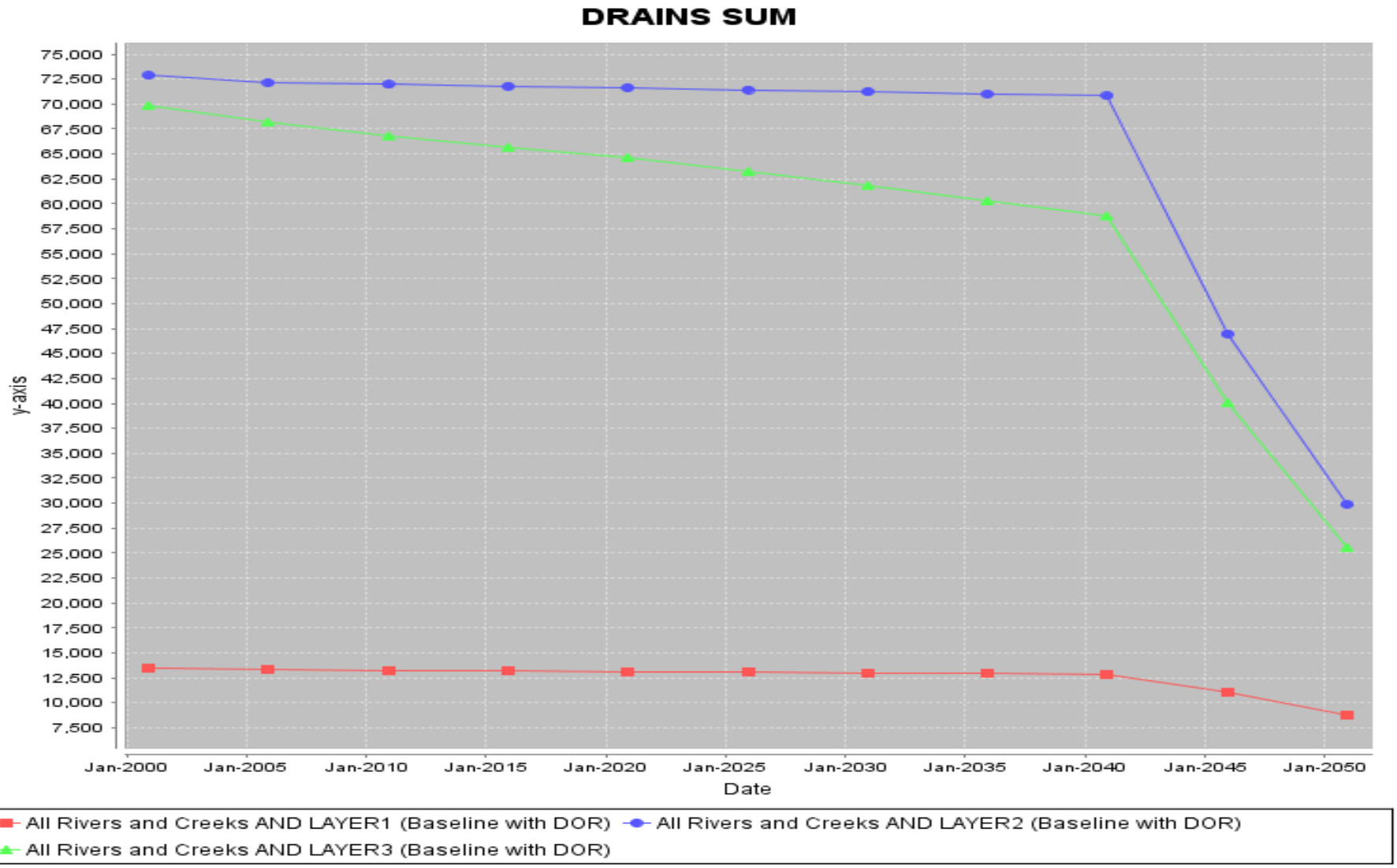
Sample Trial GAM Runs

GAM Spring Flow with DOR



Sample Trial GAM Runs

Creek and River GAM Baseline Flow with DOR



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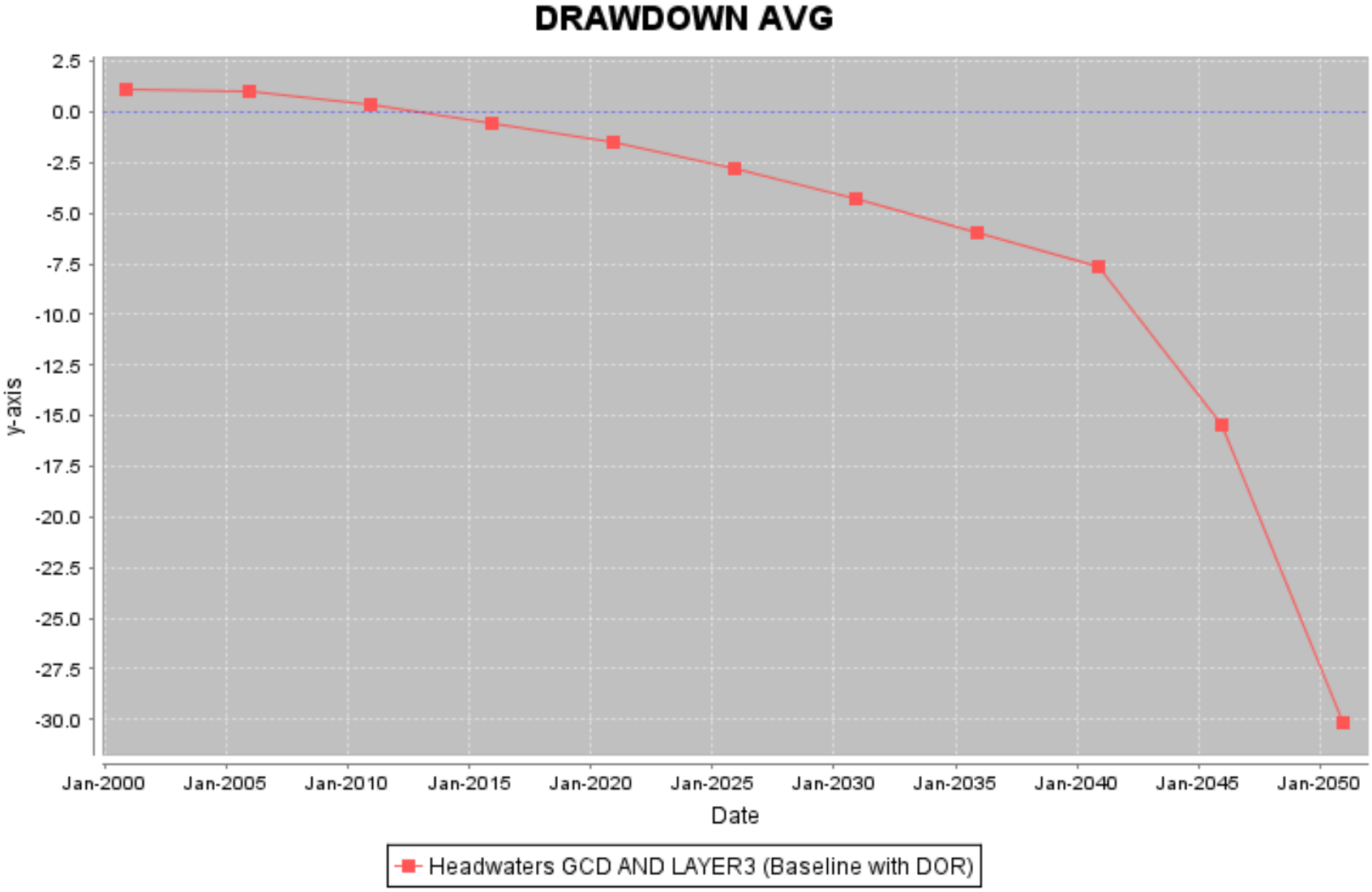
- The students conducted two work sessions to test the wrapper, train GCD staff, and try various scenarios.
- During the work sessions, it became apparent that, when working with the drought of record, most of the runs would fail due to excessive number of dry cells. It was decided to create a second version of the wrapper without the drought of record.

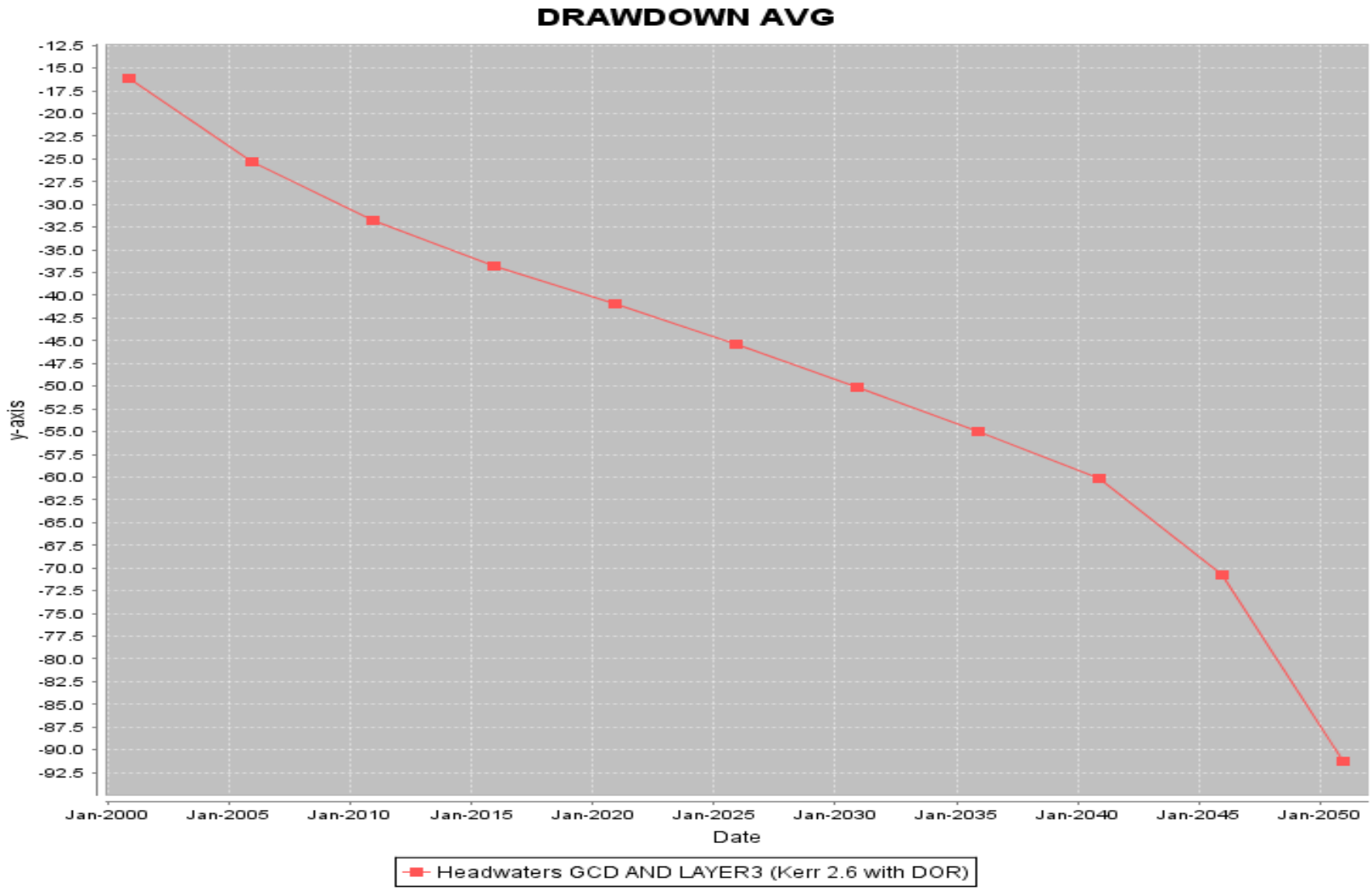
Sample Trial GAM Runs

Kerr County Middle Trinity TWDB GAM Baseline with DOR



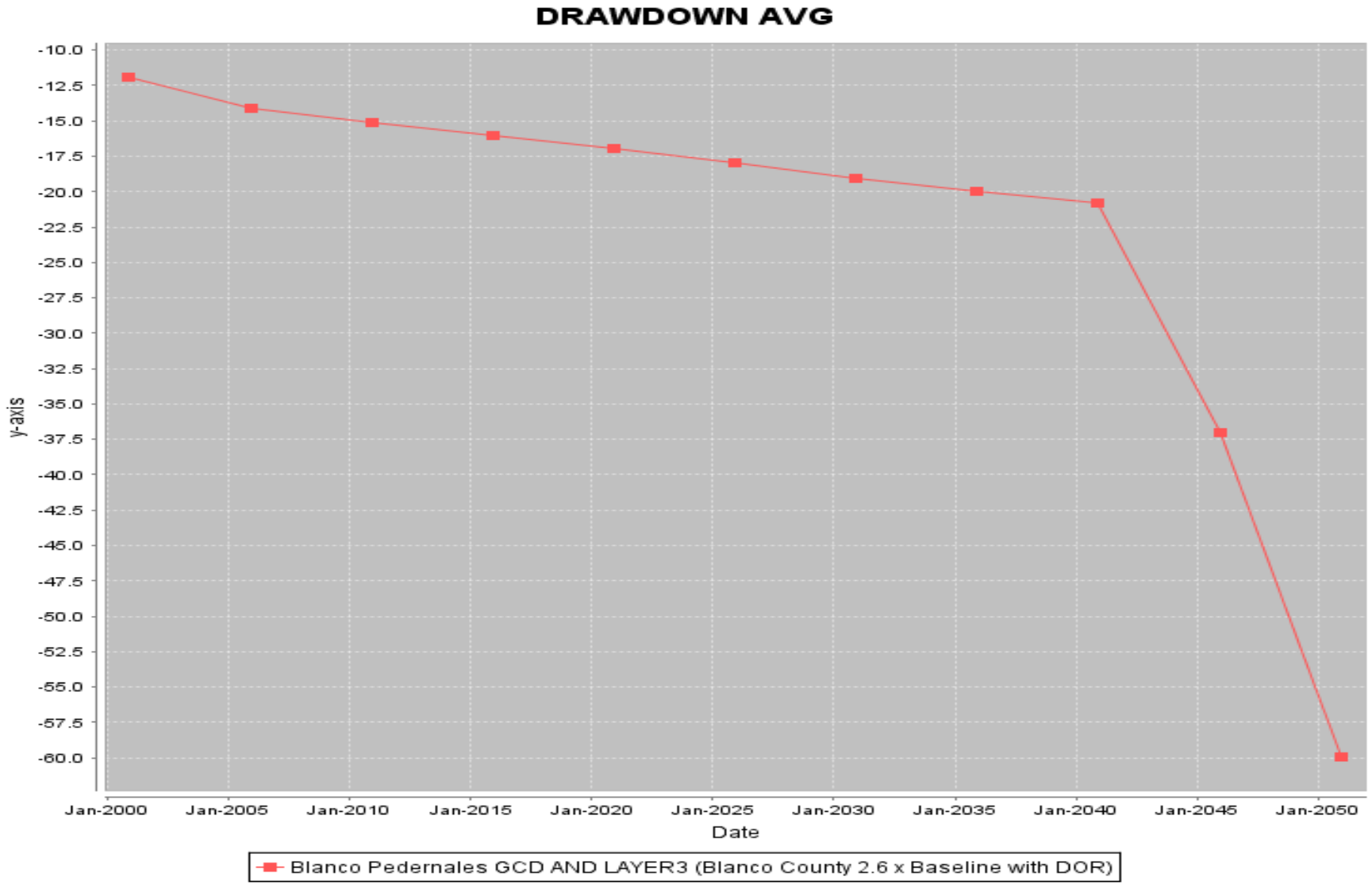
Sample Trial GAM Runs

Kerr County 2.6 x Baseline with DOR



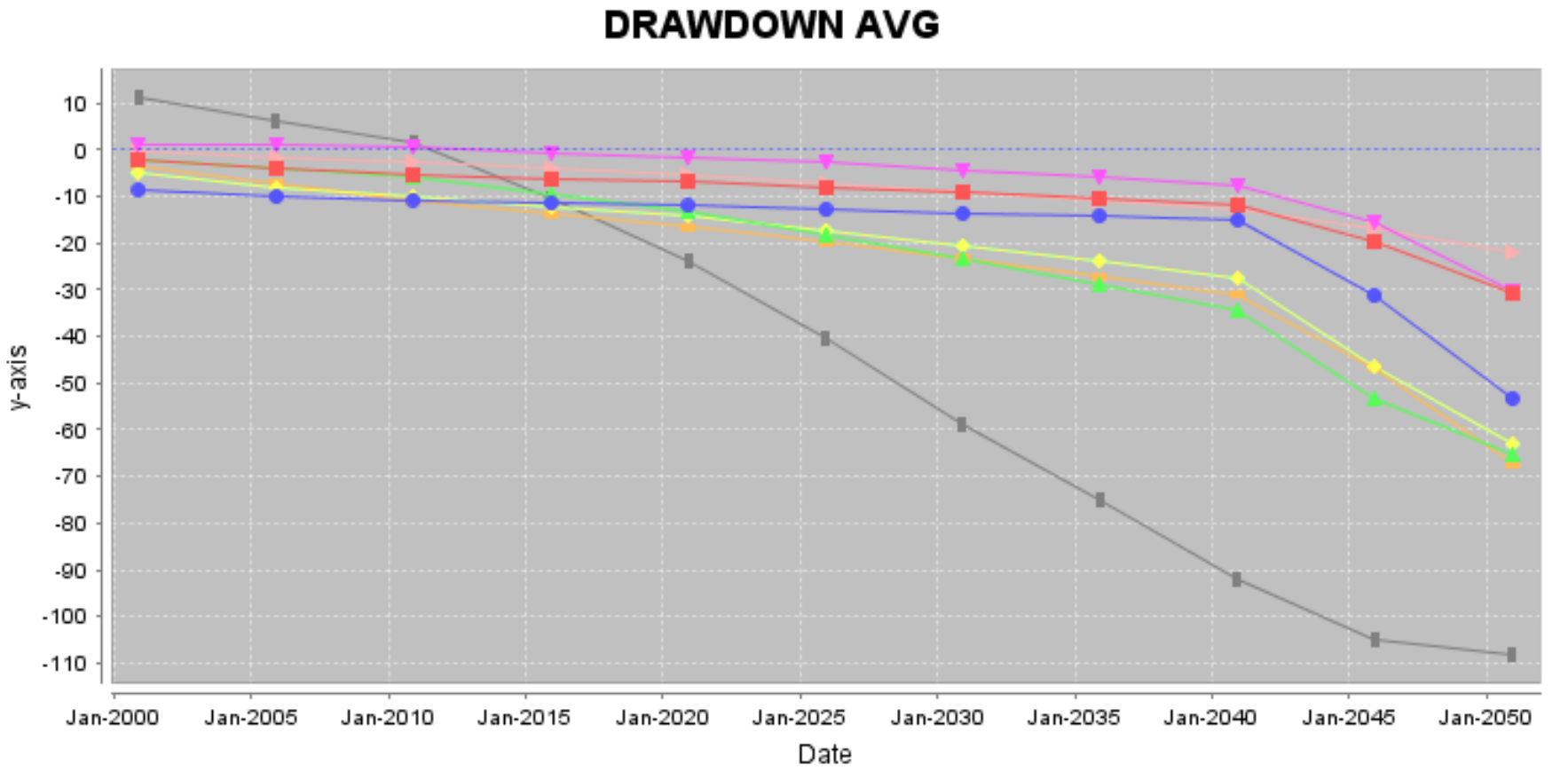
Sample Trial GAM Runs

Blanco County 2.6 x Baseline with DOR



Sample Trial GAM Runs

GMA 9 GAM Baseline Drawdown with DOR



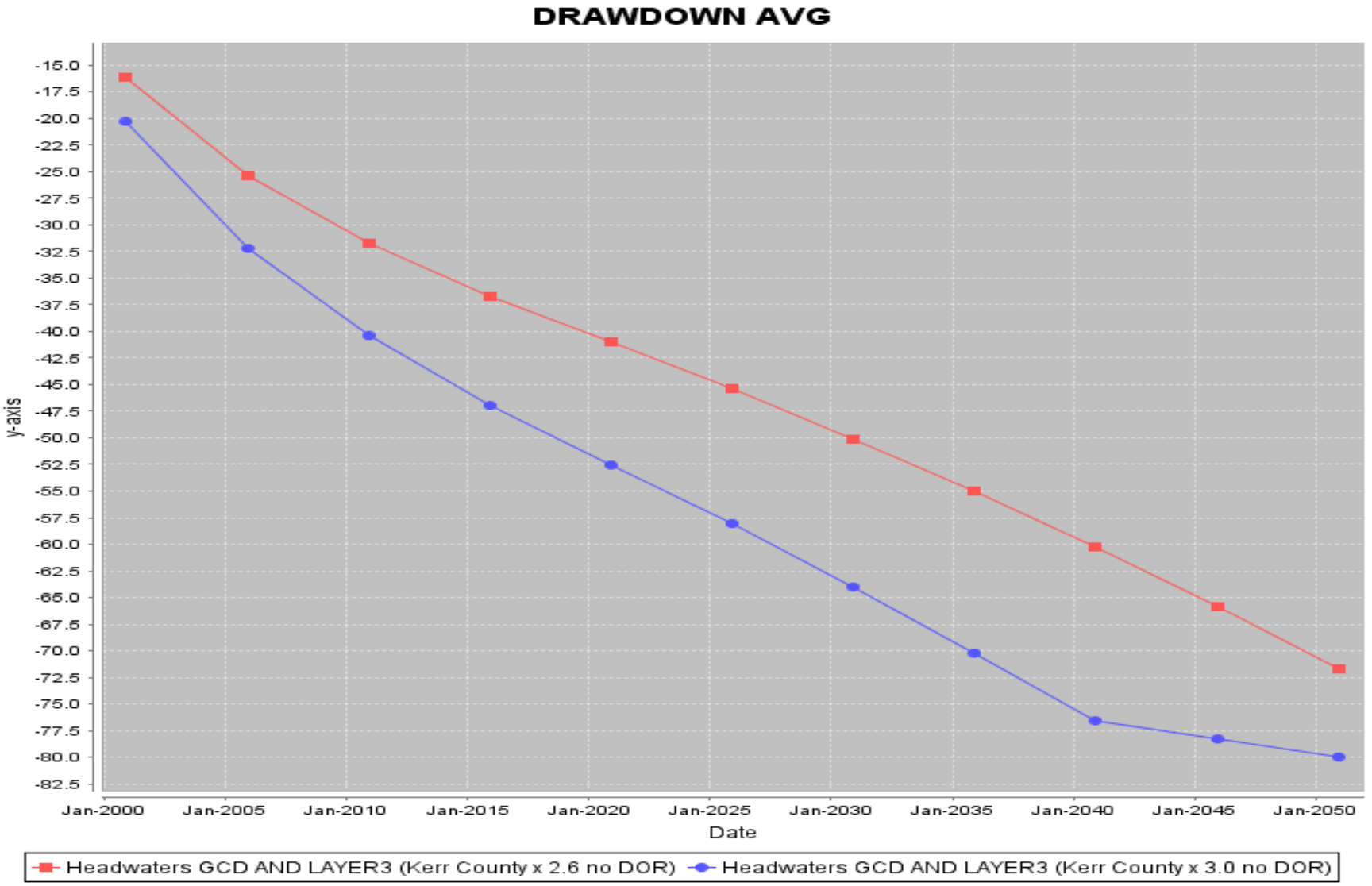
UT Graduate Student Policy Research Project

- The wrapper version without the Drought of Record almost always converged and therefore provided useful results.

- GMA 9 based its most recent Trial GAM Runs on the results of trial runs such as those in the following two slides.

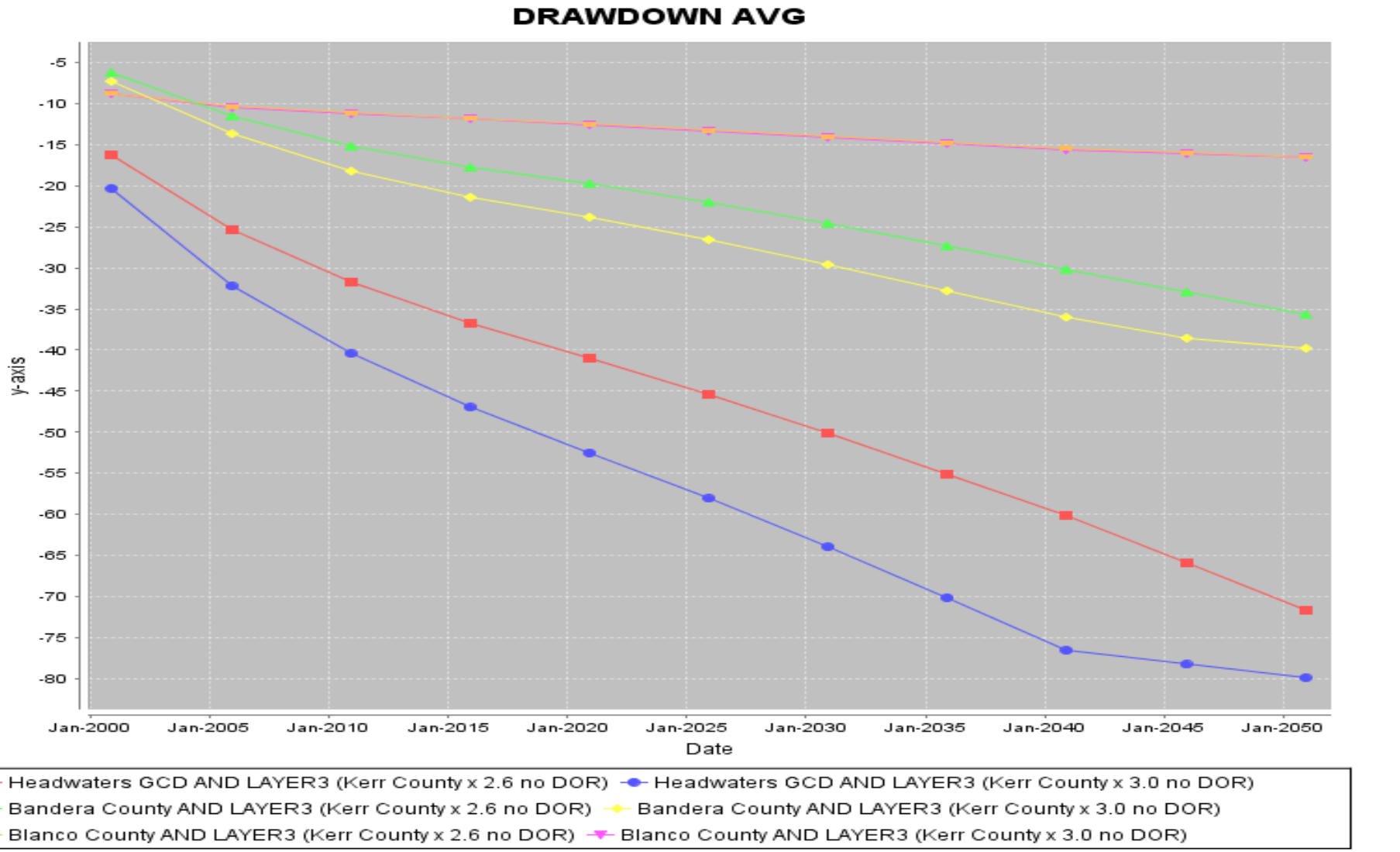
Sample Trial GAM Runs

Kerr County 2.6 and 3.0 x Baseline without DOR



Sample Trial GAM Runs

Kerr (2.6 and 3.0 x Baseline) without DOR
and effect on Bandera and Blanco Counties (both at TWDB Baseline)



How to Manage the Drought of Record

- Now that we were getting some useable and realistic drawdown and pumpage situations from the GAM, we needed to develop a means of drought planning and groundwater management during the Drought of Record.
- The Hill County Trinity GAM is incapable of incorporating the drought rules of the GCDs. These rules normally have several drought stages with corresponding severity of pumpage restrictions, priorities, and other restrictions.

How to Manage the Drought of Record

- After considerable review, discussion, and meetings, in light of the fact that the GCDs have developed, implemented, and are enforcing various drought management rules, drought trigger mechanisms, prioritization of use, pumpage reduction requirements and other restrictions, the GMA 9 Committee has come to the following conclusions:

Conclusions

- DFCs (and the subsequent MAGs) must be understandable, realistic, implementable, and achievable.
- Use of the Drought of Record in GAM runs incorporating current pumpage demands will provide results that are unrealistic, technically problematic, and unacceptable.
- DFCs based on current pumpage demands and average recharge rates (omitting the Drought of Record) can provide MAG results that are appropriate, manageable, have fewer technical problems, and will meets the needs of existing aquifer users while still allowing for some level of growth.
- The best way to plan for and manage drought at this point in time is through local GCD management plans & rules.