Economic Impacts to Domestic & Livestock Wells from proposed DFC

For this report, Andy Wier, a Director for the Simsboro Aquifer Water Defense Fund [SAWDF] undertook to map the location of domestic and livestock wells throughout GMA-12 along with the specific drawdown predicted from two pumping files run in the new GAM 2020; DFCRun3 and S-12.

DFCRun3 represents the best implementation of the 2017 pumping file [PS-12] modified to run in the new GAM 2020. S-12 is the pumping file adopted by GMA-12 in March 2021 to produce the proposed DFCs currently under discussion.

> *The results show that impacts to domestic and livestock wells will double under the proposed DFCs, with more than **50% of Carrizo-Wilcox wells requiring mitigation by 2070**. The economic impact will result in **more than one billion dollars in mitigation costs, loss of income and reduced property values**.*

Data on Domestic & Livestock Wells in GMA-12

The GPS coordinates, well depth [feet below the surface], proposed use [Domestic, Stock], and county for wells within GMA-12 were downloaded from two databases on the TWDB website:

- Groundwater Database [https://www.twdb.texas.gov/groundwater/data/gwdbrpt.asp]
    - 5,507 records
    - Wells in the GWDB have an assigned aquifer formation
- Submitted Drillers Reports (SDR) Database
    - 14,475 records
    - Wells in the SDRDB only have well depth and not an assigned aquifer formation
    - [https://www.twdb.texas.gov/groundwater/data/drillersdb.asp]

Mr. Wier combined the two data sets into one file, retaining the assigned aquifer formation and filtering for only domestic or livestock wells within the GMA-12 boundaries and member GCD counties.

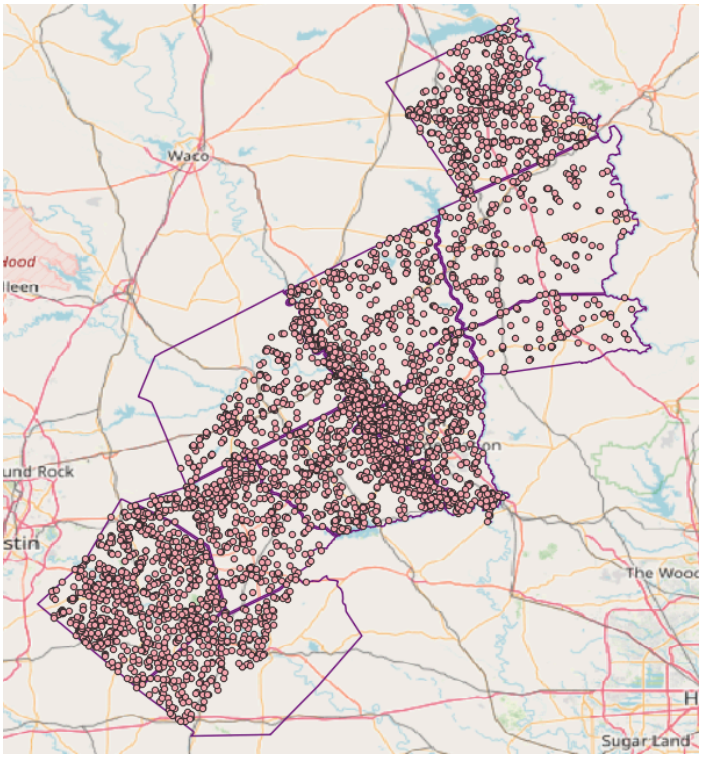

Figure 1 Domestic & Livestock wells in GMA-12

Analysis using Geographic Information Systems [GIS]

Mr. Wier used open-source geographic information system [GIS] software, QGIS [version 3.10], to visualize the data for this report. Shapefiles for the aquifers, outcrops, and Modflow Grid used in the GAM 2020 were downloaded from the TWDB Geodatabase. The Modflow grid uses mean sea level [msl] for the top and bottom of each aquifer formation.

The well depths in the data set were expressed as "feet below the surface." To convert the wells depths to msl, Mr. Wier downloaded a Lidar elevation map to get precise msl elevations for each well location. Using the following formula, wells depths were converted to msl.

- Lidar elevation [msl] – well depth [ft. below surface] = msl well depth

Wells from the SDRDB do not have an assigned aquifer formation. Using the msl well depth, it is possible to roughly calculate which formation a domestic/livestock well may be completed in:

- Top of Aquifer [msl] – 60 ft > well depth [msl] > Bottom of Aquifer [msl]

Basically, we are asking the question, "Is this well drilled at least 60 feet into a known aquifer formation, but does not go past the bottom of the aquifer formation?" If yes, what is the aquifer formation?

GWDB wells were included in this calculation to compare the results against the assigned aquifer formation. The rough calculation had a 10- 13% error rate. That is to say, the rough calculation identified the same aquifer formation as the GWDB database 87-90% of the time.

GMA-12 Wells [within GAM 2020]		Domestic Stock	Percent
	Sparta	733	16%
	Queen City	1,008	23%
	Carrizo	355	10%
Wilcox Group	Clavert Bluff	1,345	51%
	Simsboro	362	
	Hooper	687	
	TOTAL	4,490	100%

Figure 2 GMA-12 Domestic & Livestock Wells by aquifer formation

GAM 2020 Results
The results from DFCRun3 were supplied by consulting hydrologist George Rice. The results from S-12 were downloaded from TWDB website under GMA-12 [PS_12_GAM_03162021.zip].

The GAM produces a predicted head [msl] for each Modflow cell of an aquifer formation. Mr. Wier extracted the predicted heads for 2020, 2030, 2040, 2050, 2060, and 2070 for the following aquifer formations in the GAM:

- Sparta
- Queen City
- Carrizo
- Calvert Bluff
- Simsboro
- Hooper

The heads for each aquifer formation in 2010 is a standard file loaded into the GAM. Using this file, Mr. Wier calculated the predicted drawdown in each Modflow cell of each aquifer formation for the decades above.

Mr. Wier joined the predicted drawdown data to each domestic/livestock well mapped in GMA-12. This data was exported to FileMaker Pro database software. [Mr. Wier is a FileMaker Pro developer.] Using database tools, Mr. Wier filtered the data for any well predicted to suffer a drawdown of 50 feet, or more, by 2070 and summarized the results by GCD and aquifer formation. [see attached spreadsheet tables]

Economic Impact

Mr. Wier applied three economic impacts to each affected well.

1. **Loss of income** - Census data indicates that the median income within GMA-12 is $50,000/ year. Mr. Wier estimated a loss of 2 months income $9,400 when a well needs to be mitigated. Members of GMA-12, especially LPGCD and POSGCD, are acutely aware of the recent failure of more than 100 wells in Burleson and Lee counties. SAWDF interviewed many landowners who are having to mitigate their wells and asked about the disruption the loss of water had on their daily lives. Many have had to wait more than a month to have their well repaired. During that time, they have incurred additional expenses to supply themselves and/or livestock with fresh water.

2. **Mitigation** - The major cost of mitigating a domestic well depends on how deep a well pump must be set. Depth determines the strength of the pump needed and accompanying pipe size and wire gauge to power the pump. Cost escalates the deeper you go. Using data from recent mitigation Mr. Wier created a sliding scale of mitigation costs related to the predicted drawdown in each well mapped in GMA-12:
    a. 50-74.9 ft $3,500
    b. 75-99.9 ft $4,750
    c. 100-124.9 ft $6,000
    d. 125-149.9 ft $7,250
    e. 150-174.9 ft $8,500
    f. 175-199.9 ft $9,750
    g. > 200 ft $11,000
3. **Loss of Property Value** - Chapter 36 of the Texas Water Code defines groundwater are real property. Land with groundwater rights sells for twice the value of land available without groundwater rights.
   To try and estimate the loss in property value due to predicted drawdown, Mr. Wier employed two strategies.
    a. *Average property size* - Mr. Wier surveyed two abstracts in rural areas of Bastrop County and recorded the acreage for 192 properties. The average property size was 49 acres.
    b. *Minimum value for an acre-foot of groundwater* - The LCRA paid close to $3,000/ surface acre for water rights in the Griffith League Ranch in Bastrop County. Some water leases in west Texas pay $2,482/ac-ft/yr. Leases for groundwater in Gonzalez County pay $1,033/surface acre. Within GMA-12, Blue Water/Vista Ridge leases pay landowners an average of $46/ac-ft/yr for water produced while Blue Water sells the same ac-ft of water to San Antonio Water System [SAWS] for $960. Settlements and jury awards push groundwater values to $25,000-196,000/surface acre! *[Groundwater Valuation in Texas: The Comparable Transactions Method; Gabriel Collins, J.D.; Rice University's Baker Institute for Public Policy, 03-20-2018]*

       A comparison of values requires a comparable metric, which we fail to have. A minimum value of $46 acre-foot was used to calculate losses in property value due to predicted drawdowns.

Blue Water/Vista Ridge leases

In the 50-year time span of the proposed DFCs, Vista Ridge will pay approximately $115 million in royalties on leases in Burleson County. This income has been added on a separate line under POSGCD economic impacts.

Inflation

Last, inflation is a reality in any economic impact study. The average inflation rate from 2010 thru 2020 is 2.25%. This has been added to the calculation to get a better idea of potential impacts on GMA-12 member districts.

Economic Impacts to Domestic & Livestock Wells from proposed DFC

GMA-12 Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	733	124	17%	(53,148,525)	202	28%	(95,736,743)
Queen City	1,008	115	11%	(47,127,700)	93	9%	(33,392,219)
Carrizo	355	216	61%	(133,288,976)	255	72%	(205,823,280)
Clavert Bluff	1,345	289	21%	(115,952,652)	775	58%	(406,635,328)
Simsboro	362	150	41%	(78,198,403)	256	71%	(227,954,765)
Hooper	687	24	3%	(9,786,978)	155	23%	(72,919,355)
TOTAL	**4,490**	**918**	**20%**	**$ (437,503,235)**	**1,736**	**39%**	**$ (1,042,461,690)**
Annual Inflation	2.25%						

Economic Impacts to Domestic & Livestock Wells from proposed DFC

LPGCD Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	149	-	0%	-	-	0%	-
Queen City	310	81	26%	(31,984,493)	56	18%	(20,402,872)
Carrizo	139	117	84%	(74,416,129)	100	72%	(74,826,421)
Clavert Bluff	486	84	17%	(32,121,489)	264	54%	(149,422,057)
Simsboro	164	41	25%	(20,229,246)	107	65%	(107,481,890)
Hooper	257	3	1%	(1,357,218)	73	28%	(32,194,634)
TOTAL	**1,505**	**326**	**22%**	**$ (160,108,575)**	**600**	**40%**	**$ (384,327,874)**

POSGCD Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	136	8	6%	(2,724,881)	17	13%	(6,938,209)
Queen City	206	-	0%	-	-	0%	-
Carrizo	90	80	89%	(50,215,226)	87	97%	(100,605,368)
Clavert Bluff	219	134	61%	(56,513,872)	217	99%	(129,270,354)
Simsboro	65	48	74%	(24,073,800)	63	97%	(55,595,177)
Hooper	159	20	13%	(7,880,733)	77	48%	(38,337,642)
Blue Water Leases				115,000,000			115,000,000
TOTAL	**875**	**290**	**33%**	**$ (26,408,511)**	**461**	**53%**	**$ (215,746,750)**

BVGCD Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	163	58	36%	(25,522,614)	129	79%	(66,482,236)
Queen City	190	2	1%	(663,581)	25	13%	(8,653,685)
Carrizo	35	11	31%	(5,255,230)	23	66%	(11,945,432)
Clavert Bluff	264	69	26%	(26,665,372)	198	75%	(93,073,743)
Simsboro	99	61	62%	(33,895,357)	79	80%	(62,294,926)
Hooper	112	1	1%	(549,028)	5	4%	(2,387,078)
TOTAL	**863**	**202**	**23%**	**$ (92,551,183)**	**459**	**53%**	**$ (244,837,101)**

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METGCD Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	179	-	0%	-	5	3%	(2,147,881)
Queen City	270	-	0%	-	-	0%	-
Carrizo	90	7	8%	(2,615,977)	44	49%	(17,499,897)
Clavert Bluff	376	2	1%	(651,919)	96	26%	(34,869,174)
Simsboro	34	-	0%	-	7	21%	(2,582,773)
Hooper	159	-	0%	-	-	0%	-
TOTAL	**1,108**	**9**	**1%**	**$ (3,267,896)**	**152**	**14%**	**$ (57,099,725)**

FCGCD Wells [within GAM]	Domestic / Stock Wells	DFCRun3			S-12		
		# w/ DD >= 50'	%	Economic Impact	# w/ DD >= 50'	%	Economic Impact
Sparta	106	58	55%	(24,901,031)	51	48%	(20,168,418)
Queen City	32	32	100%	(14,479,626)	12	38%	(4,335,661)
Carrizo	1	1	100%	(786,414)	1	100%	(946,161)
Clavert Bluff	-	-	0%	-	-	0%	-
Simsboro	-	-	0%	-	-	0%	-
Hooper	-	-	0%	-	-	0%	-
TOTAL	**139**	**91**	**65%**	**$ (40,167,070)**	**64**	**46%**	**$ (25,450,240)**