

GMA12 Joint Planning

Considerations for Estimating Drawdowns
Beyond a 50-year Planning Horizon
and
Assessing Drawdown Impact using the
SP/QC/CW GAM

6/26/2025

Outline

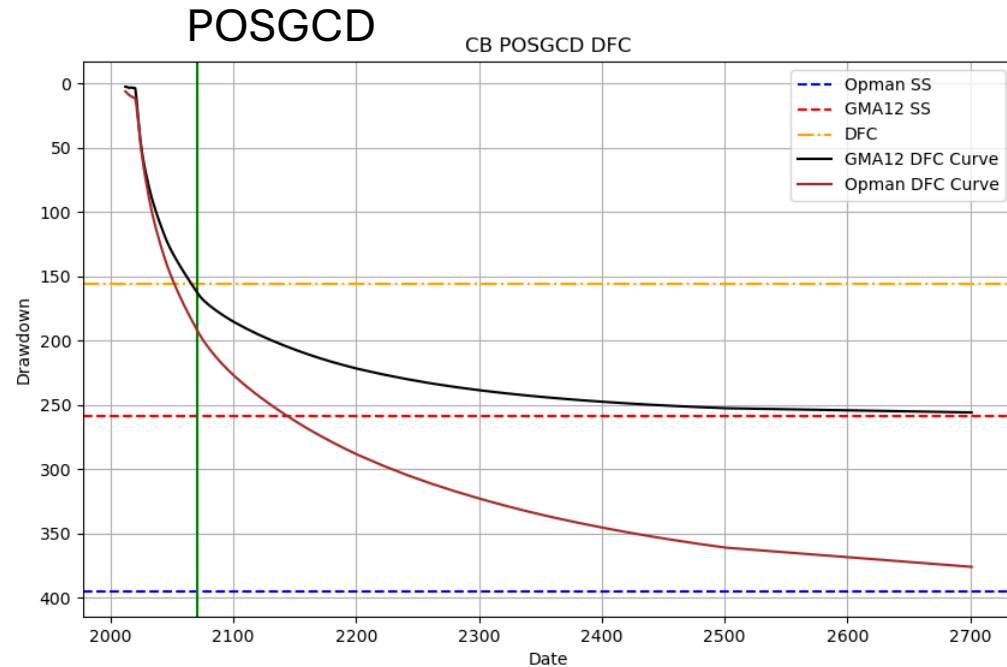
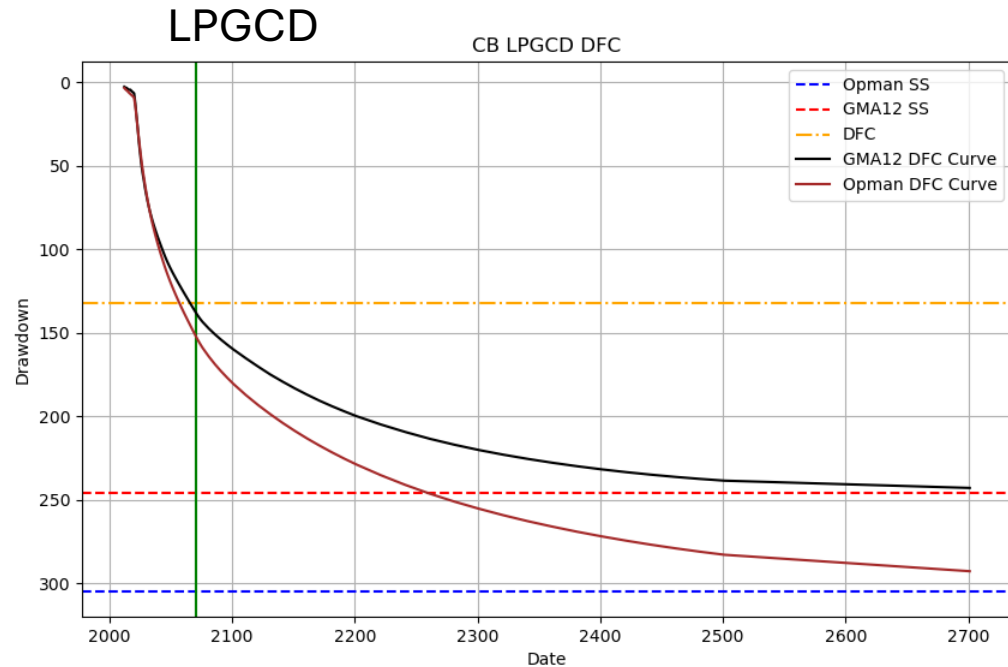
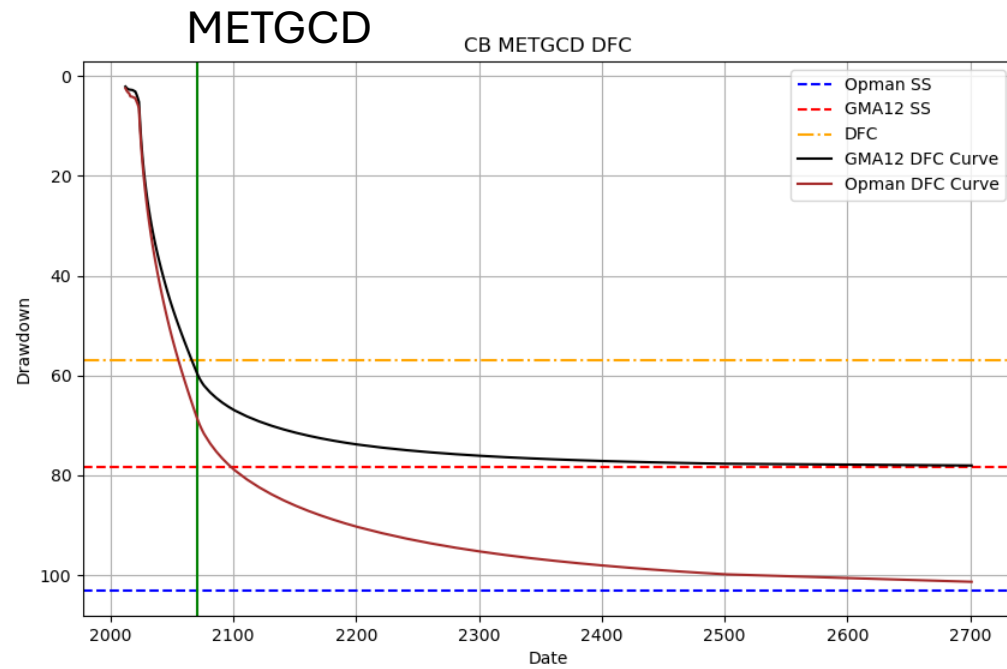
- Comparison OPMAN vs GMA 12 GAM
 - Steady state – DFC drawdown
 - Transient – DFC drawdown
- Tally of wells meeting the following criteria:
 - Pump Setting (≤ 15 ft above)
 - Top of Screen (≤ 40 ft above)
 - Bottom of screen (≤ 105 ft above)
- **Drawdown in the GMA 12 model is underpredicted**

Explanations

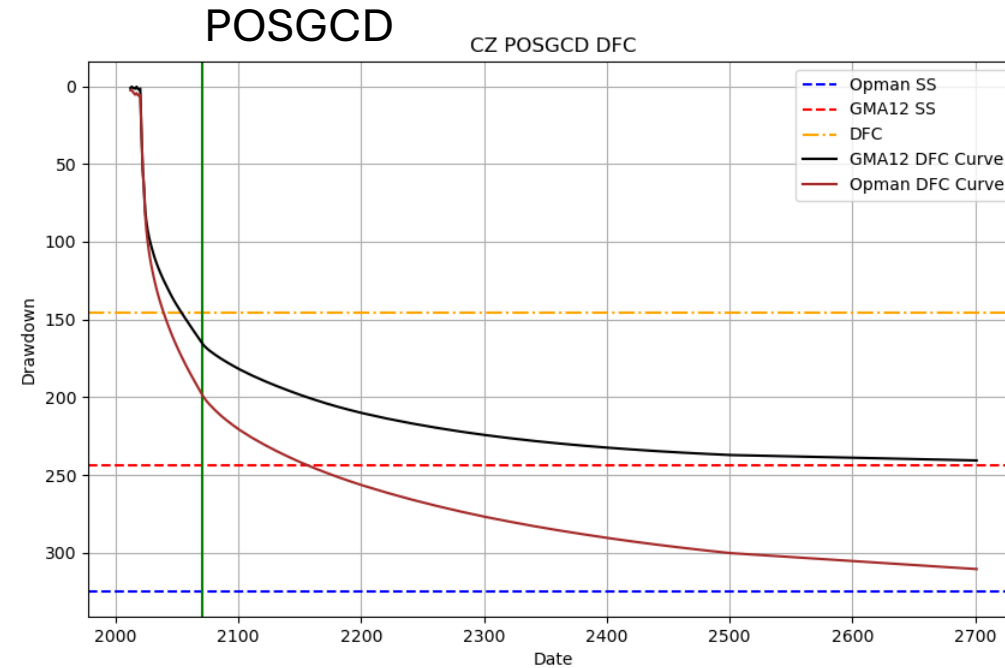
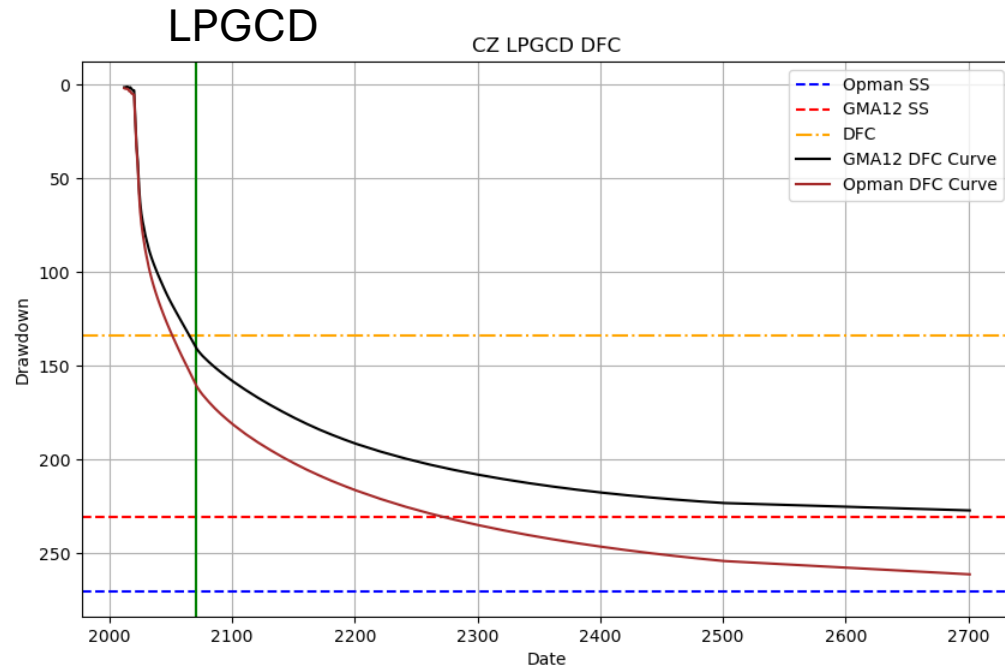
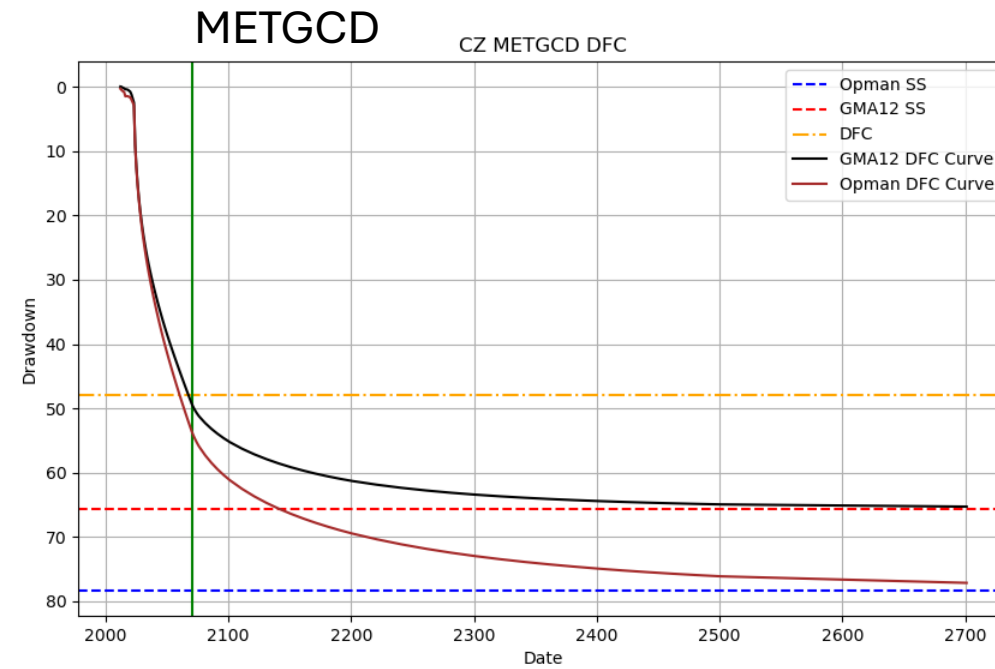
- GMA 12 GAM
 - PS- 19
 - 2010 to 2022 pumping updated
- Wells Considered
 - METGCD, LPGCD, FCGCD provided well database
 - POSGCD included only wells with screen
 - FCGCD provided 23 wells, only 1 are in OPMAN model domain
 - Well database was homogenized and compiled into one dataset
 - Aquifer's were assigned by comparing the screen elevations to model node tops and bottoms
 - Wells in more than one layer were assigned the layer with the largest amount of screen
- Pump Setting Count
 - WL within 15 feet
 - All GCD/Each GCD*
 - Pump may need to be lowered and is at risk for cavitation
- Top of Screen Count
 - WL within 40 feet
 - All GCD/Each GCD*
 - Production interval is thinning and well approaching dewatering conditions
- Bottom of Screen Count
 - WL within 105 ft
 - All GCD/Each GCD*
 - There is 105 ft or less of water in the production interval assuming screen is less than 105 ft, well interval is fully saturated but the buffer for continued operation is thin

* BVGCD was not included³

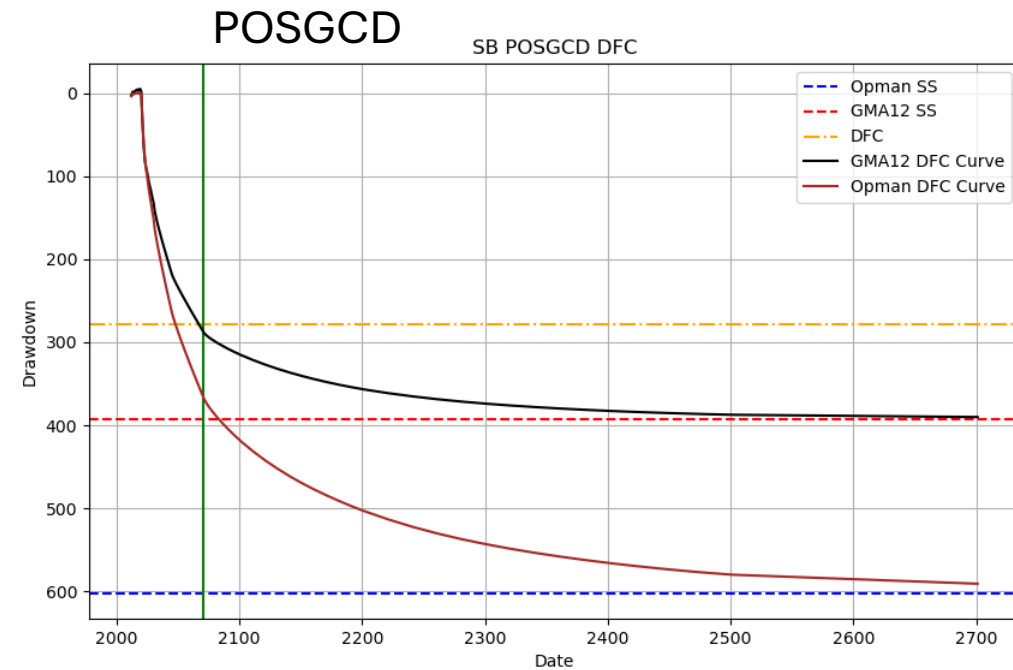
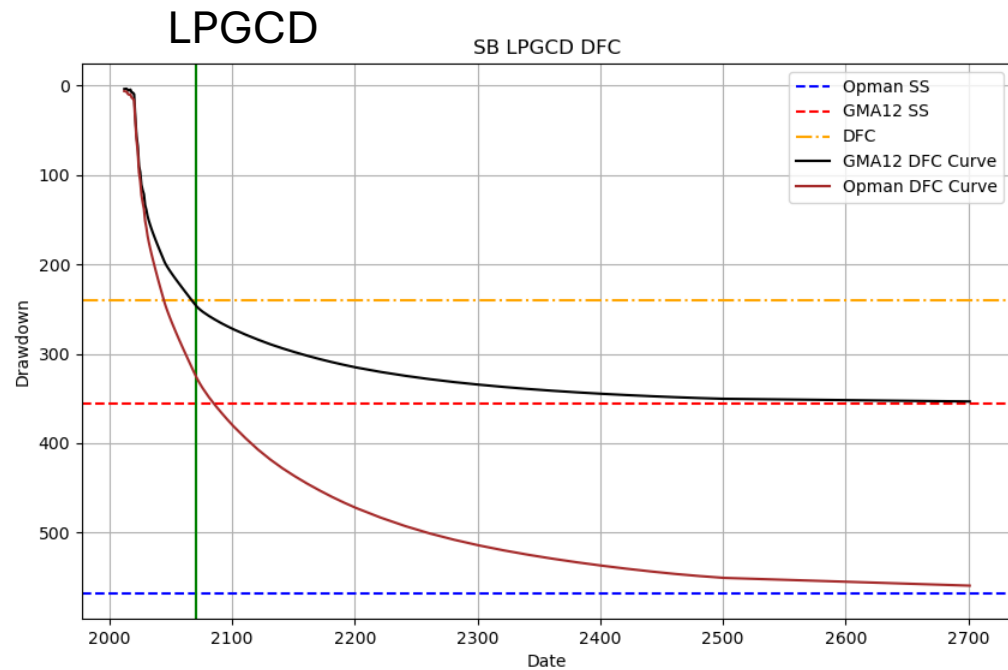
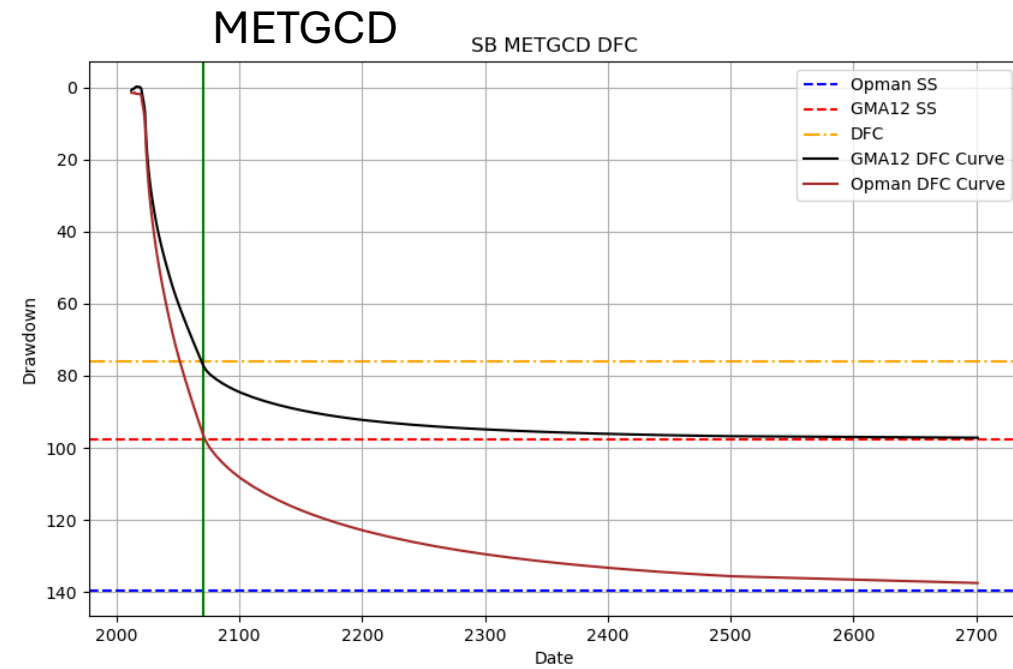
Calvert Bluff



Carrizo

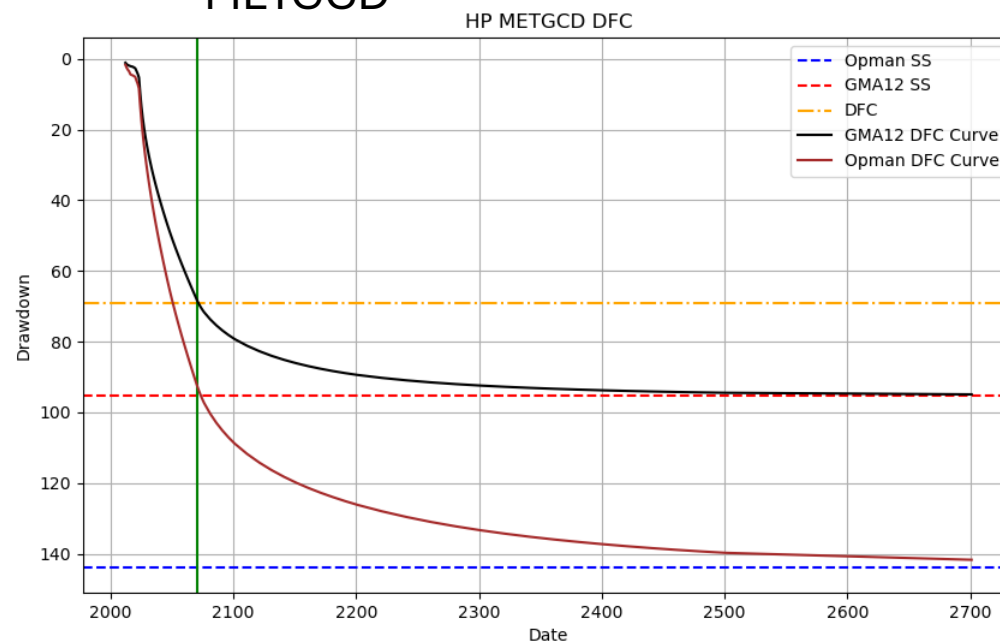


Simsboro

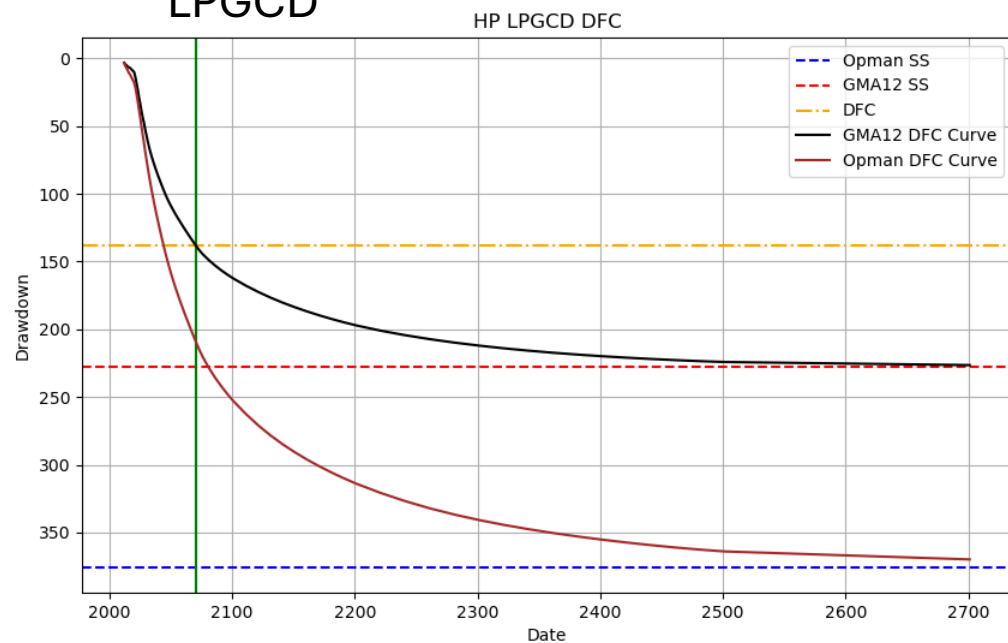


Hooper

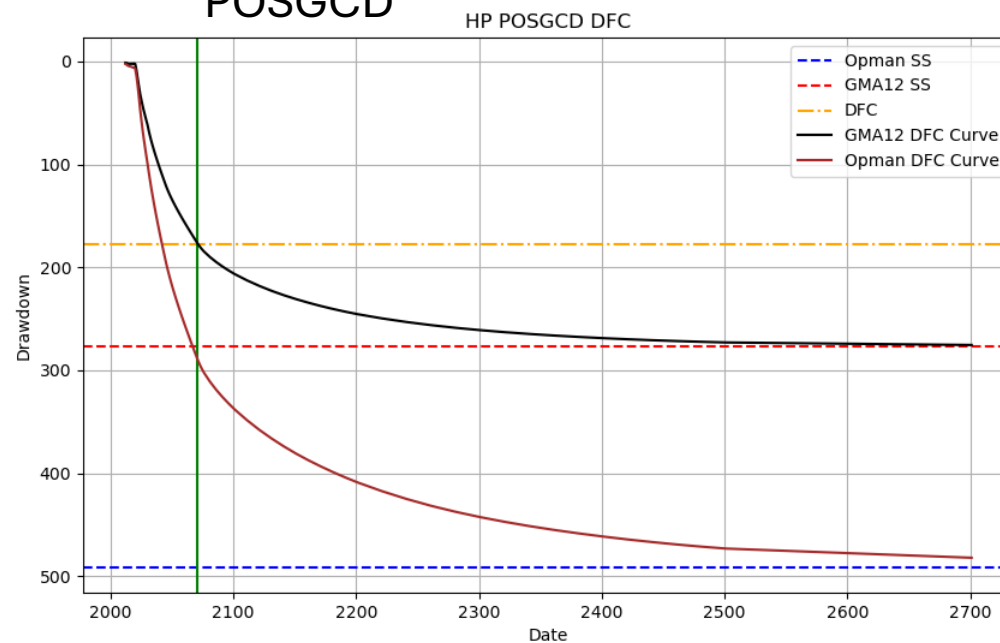
METGCD



LPGCD



POSGCD



Flag Analysis – All units in Carrizo-Wilcox Aquifer

RAW				
County	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Bastrop	1,559	1,557	1,557	975
Burleson	7,636	5,826	5,826	1,353
Fayette	23	20	20	0
Freestone	2,281	2,267	2,267	1,811
Lee	541	500	499	248
Leon	1,630	1,614	1,614	1,176
Madison	1,299	1,283	1,283	1,106
Milam	2,999	2,254	2,254	748

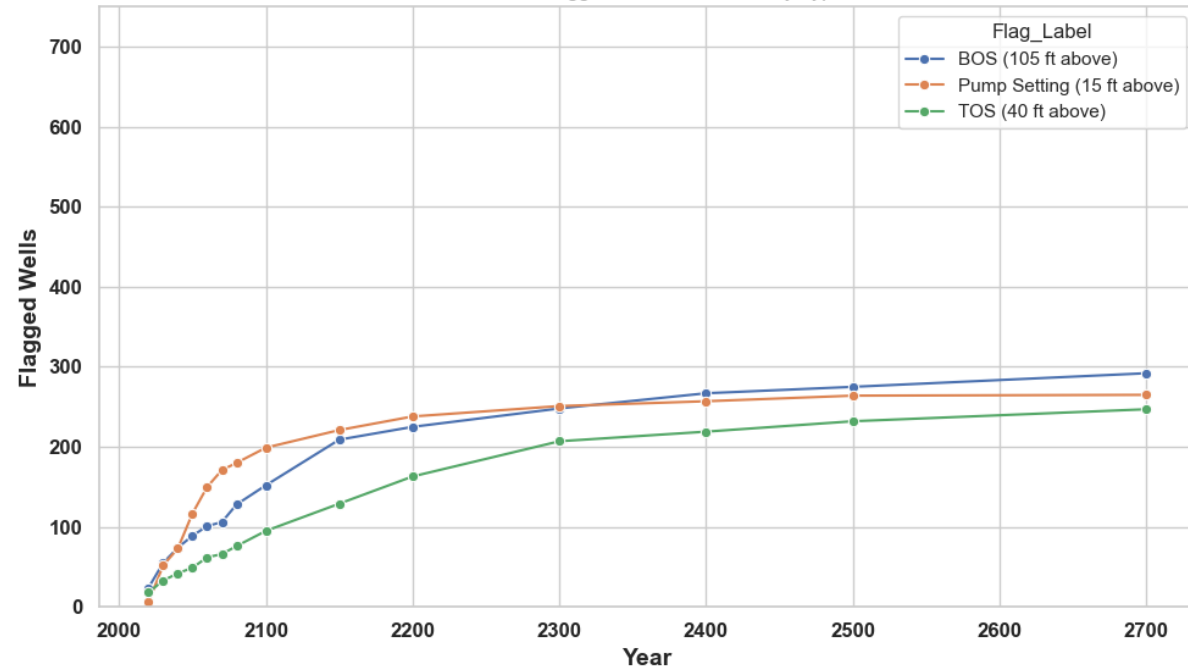
*Only counting POSGCD wells with screen information

Carrizo

OPMAN –Flagged Wells

OPMAN				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,357	2,163	2,163	1,435
Carrizo	833	760	760	448
Hooper	1,537	1,416	1,416	780
Simsboro	1,613	1,419	1,419	814
Total	6,340	5,758	5,758	3,477

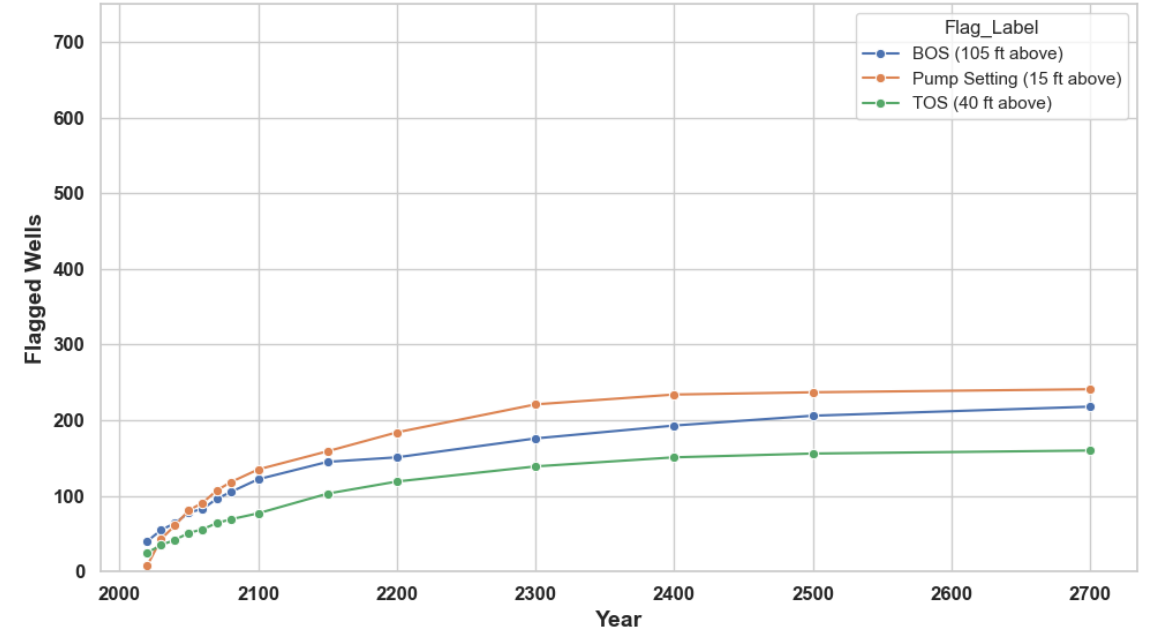
Carrizo – Flagged Wells Over Time by Type



GMA12 –Flagged Wells

GMA12				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,497	2,251	2,251	1,493
Carrizo	853	773	773	449
Hooper	1,548	1,431	1,431	783
Simsboro	1,385	1,260	1,260	775
Total	6,283	5,715	5,715	3,500

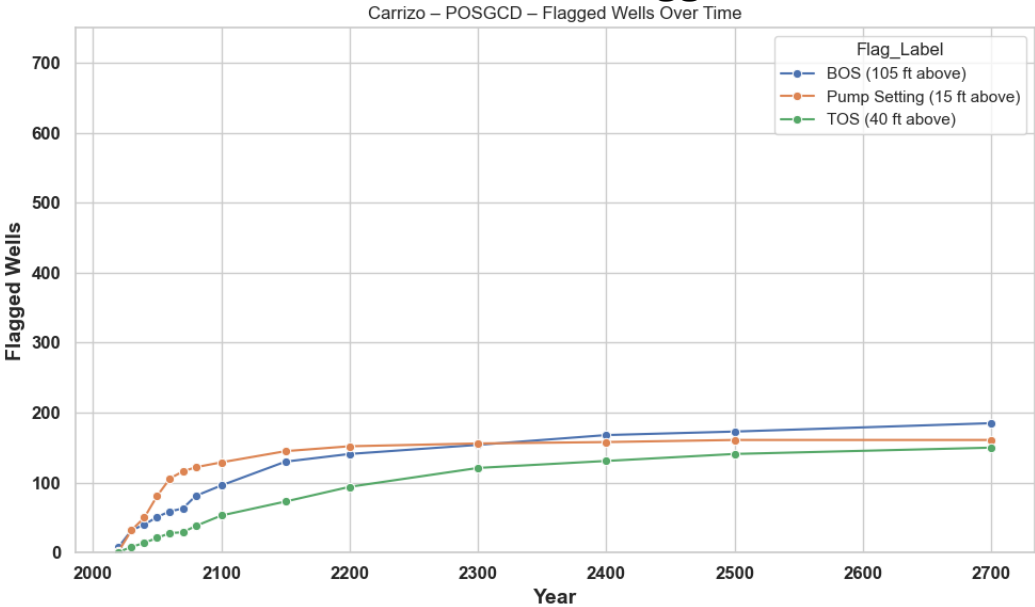
Carrizo – Flagged Wells Over Time by Type



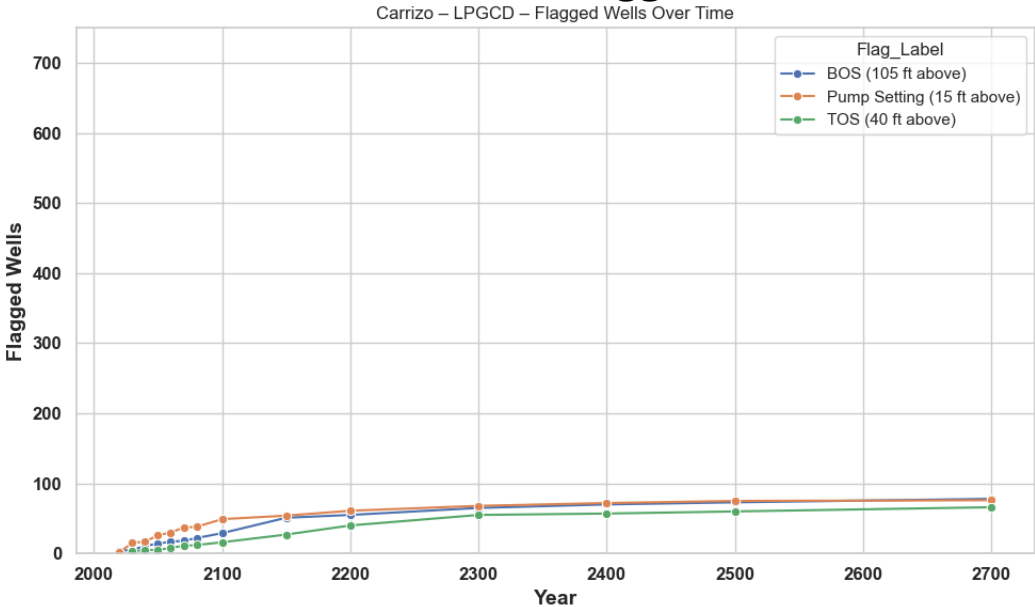
Carrizo

Aquifer	GCD	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	LPGCD	469	469	469	277
Carrizo	LPGCD	179	179	179	101
Hooper	LPGCD	288	288	288	185
Simsboro	LPGCD	264	264	264	135
Calvert Bluff	METGCD	1,134	1,134	1,134	900
Carrizo	METGCD	248	248	248	175
Hooper	METGCD	515	515	515	387
Simsboro	METGCD	636	636	636	540
Calvert Bluff	POSGCD	753	559	559	258
Carrizo	POSGCD	406	333	333	172
Hooper	POSGCD	734	613	613	208
Simsboro	POSGCD	713	519	519	139

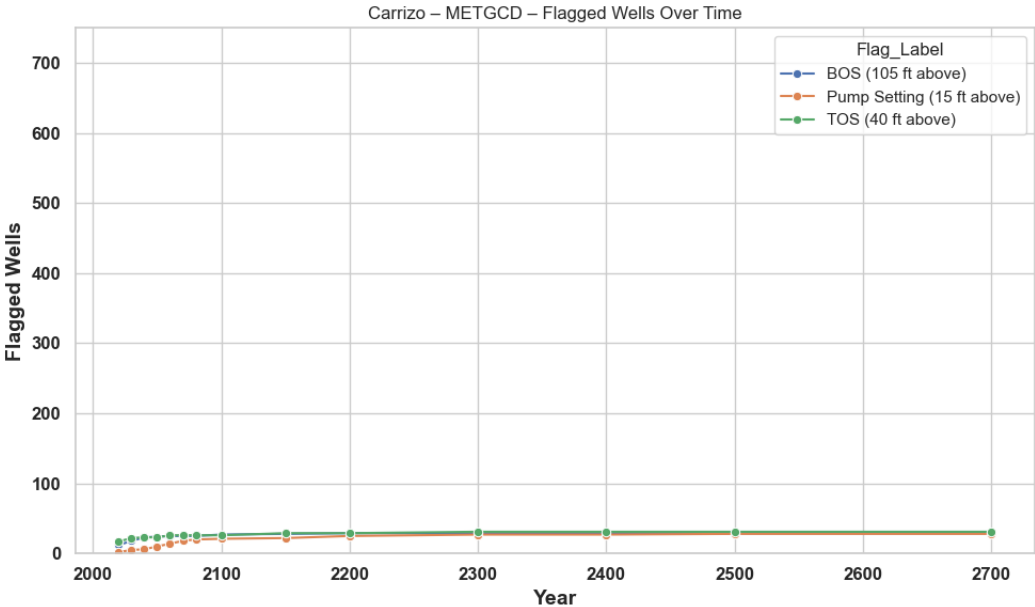
OPMAN – POSGCD Flagged Wells



OPMAN – LPGCD Flagged Wells



OPMAN – METGCD Flagged Wells



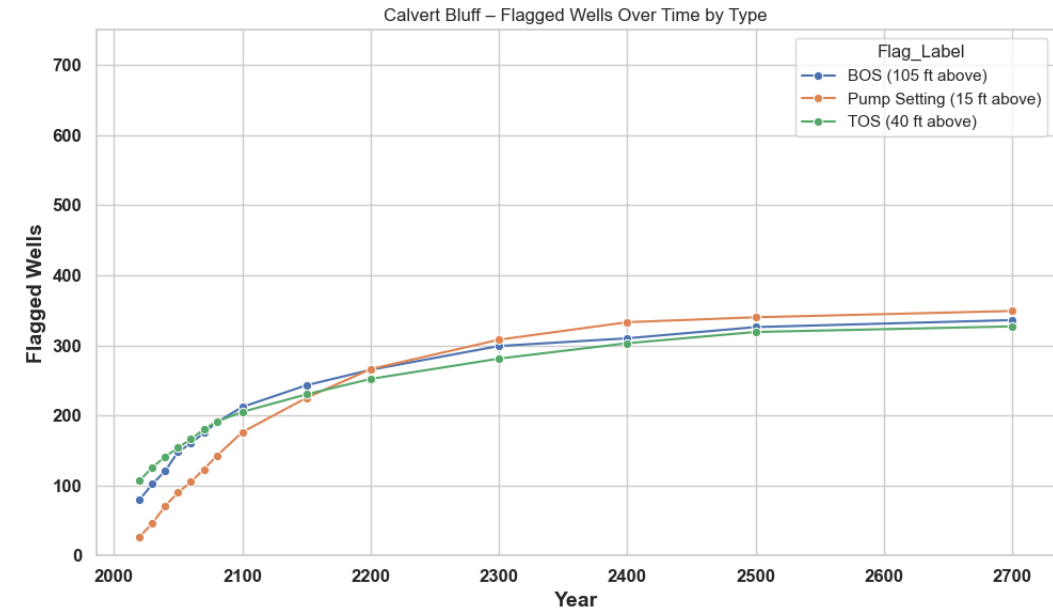
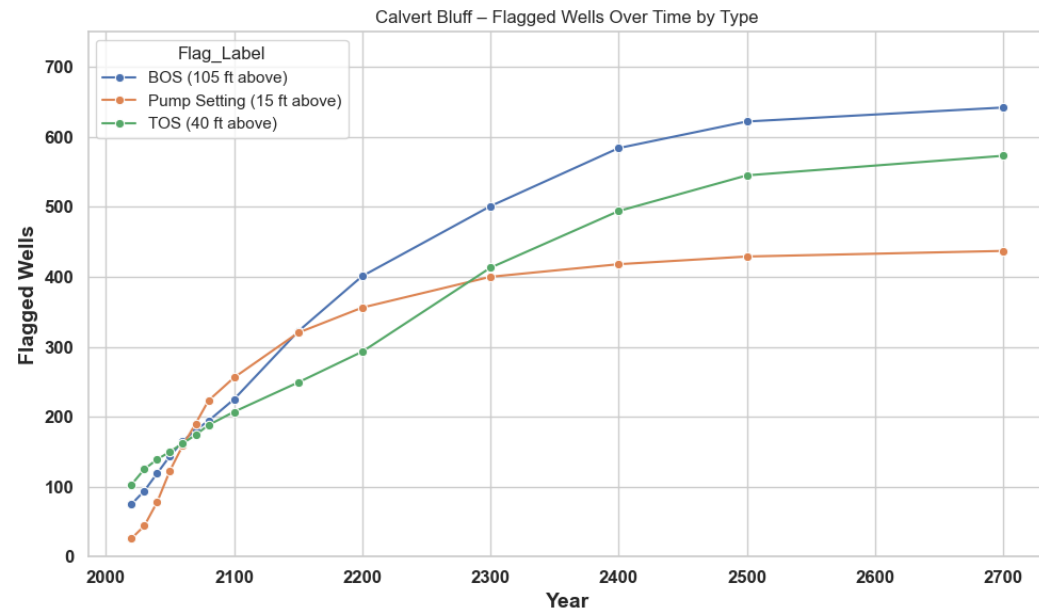
Calvert Bluff

OPMAN –Flagged Wells

OPMAN				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,357	2,163	2,163	1,435
Carrizo	833	760	760	448
Hooper	1,537	1,416	1,416	780
Simsboro	1,613	1,419	1,419	814
Total	6,340	5,758	5,758	3,477

GMA12 –Flagged Wells

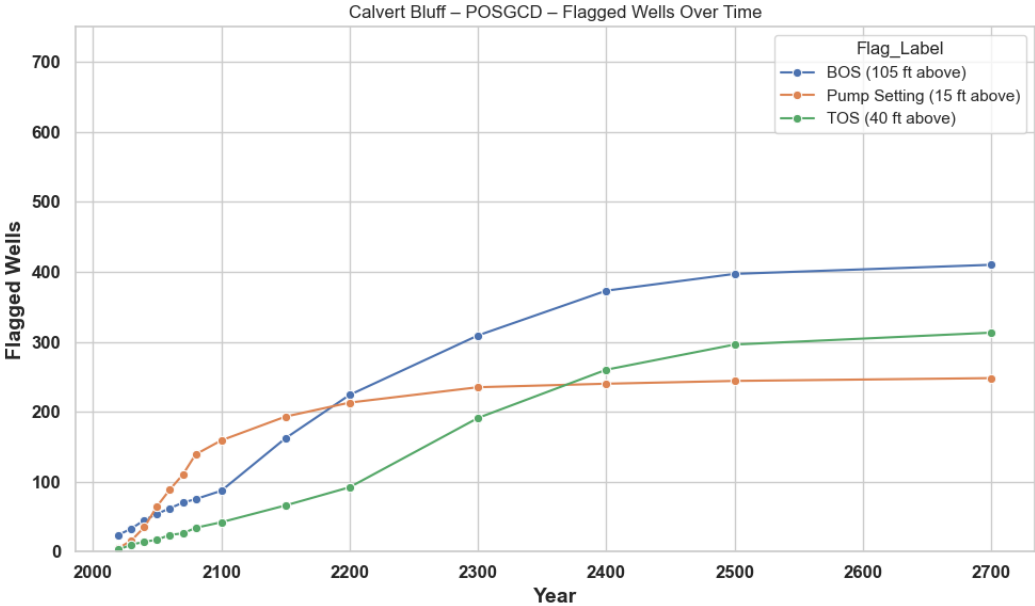
GMA12				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,497	2,251	2,251	1,493
Carrizo	853	773	773	449
Hooper	1,548	1,431	1,431	783
Simsboro	1,385	1,260	1,260	775
Total	6,283	5,715	5,715	3,500



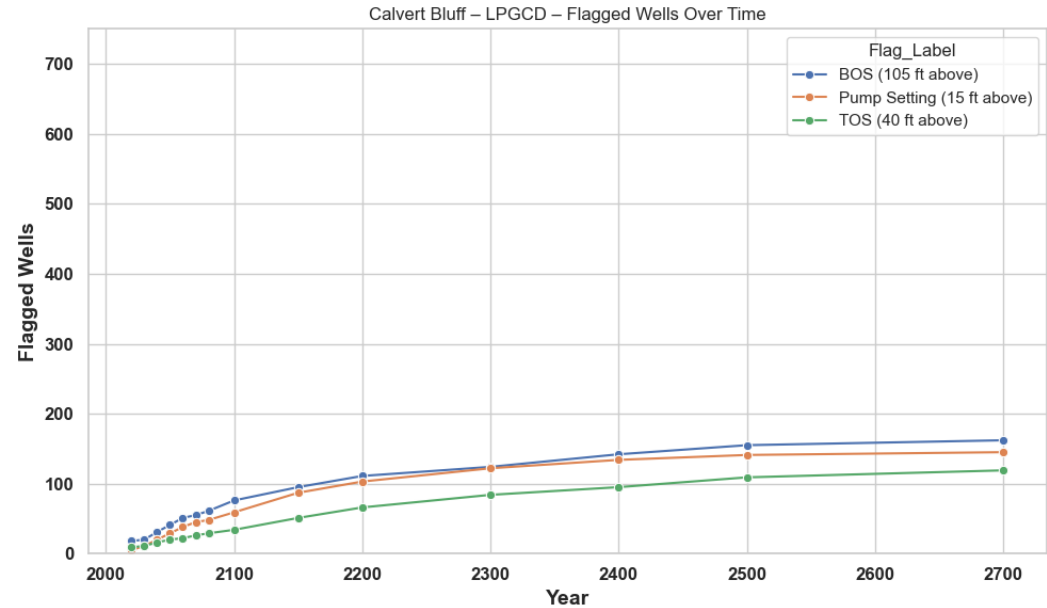
Calvert Bluff

Aquifer	GCD	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	LPGCD	469	469	469	277
Carrizo	LPGCD	179	179	179	101
Hooper	LPGCD	288	288	288	185
Simsboro	LPGCD	264	264	264	135
Calvert Bluff	METGCD	1,134	1,134	1,134	900
Carrizo	METGCD	248	248	248	175
Hooper	METGCD	515	515	515	387
Simsboro	METGCD	636	636	636	540
Calvert Bluff	POSGCD	753	559	559	258
Carrizo	POSGCD	406	333	333	172
Hooper	POSGCD	734	613	613	208
Simsboro	POSGCD	713	519	519	139

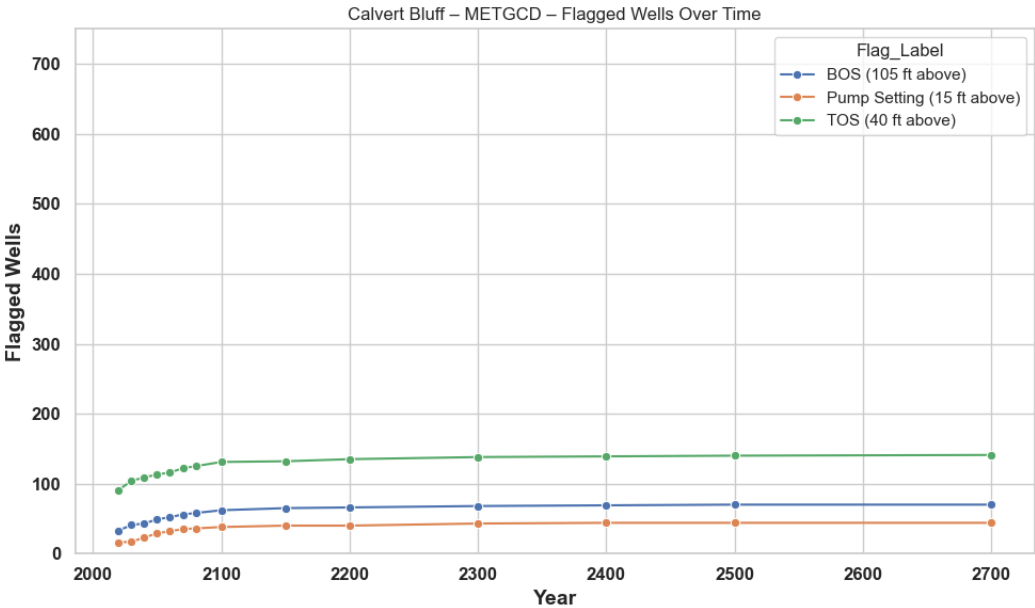
OPMAN – POSGCD Flagged Wells



OPMAN – LPGCD Flagged Wells



OPMAN – METGCD Flagged Wells



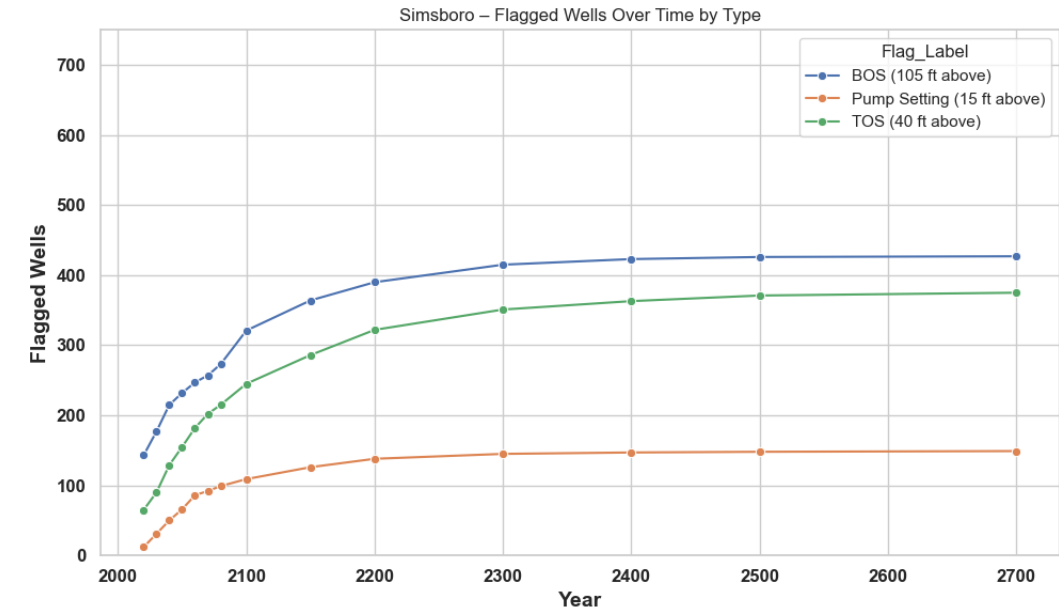
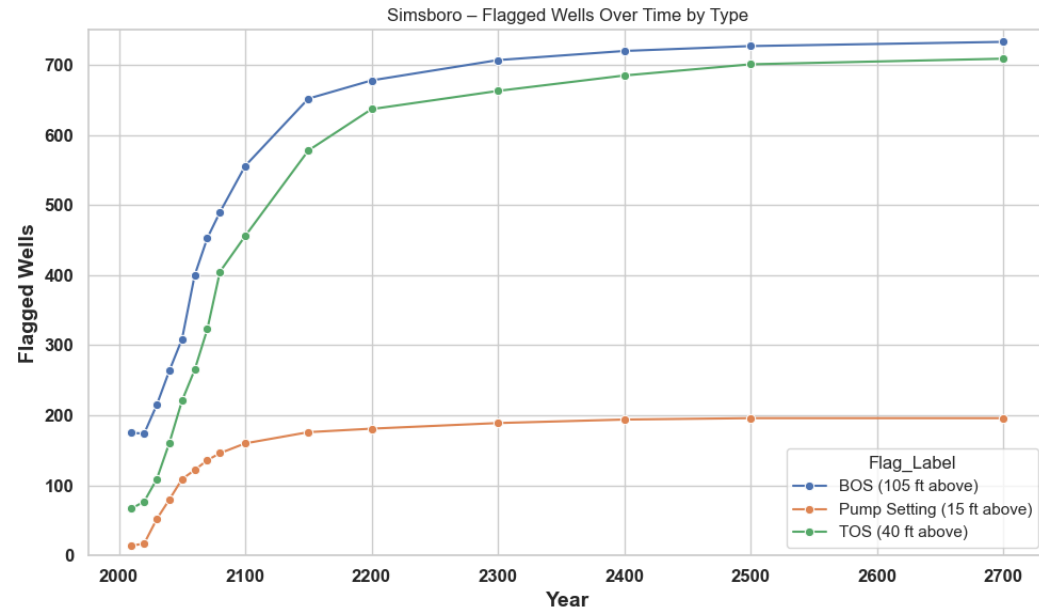
Simsboro

OPMAN –Flagged Wells

OPMAN				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,357	2,163	2,163	1,435
Carrizo	833	760	760	448
Hooper	1,537	1,416	1,416	780
Simsboro	1,613	1,419	1,419	814
Total	6,340	5,758	5,758	3,477

GMA12 –Flagged Wells

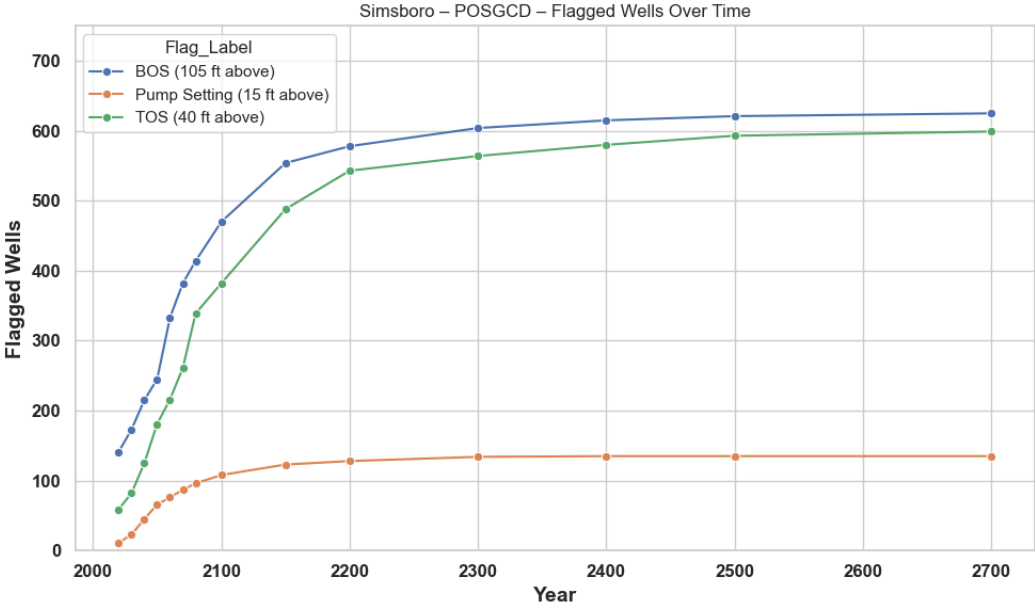
GMA12				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,497	2,251	2,251	1,493
Carrizo	853	773	773	449
Hooper	1,548	1,431	1,431	783
Simsboro	1,385	1,260	1,260	775
Total	6,283	5,715	5,715	3,500



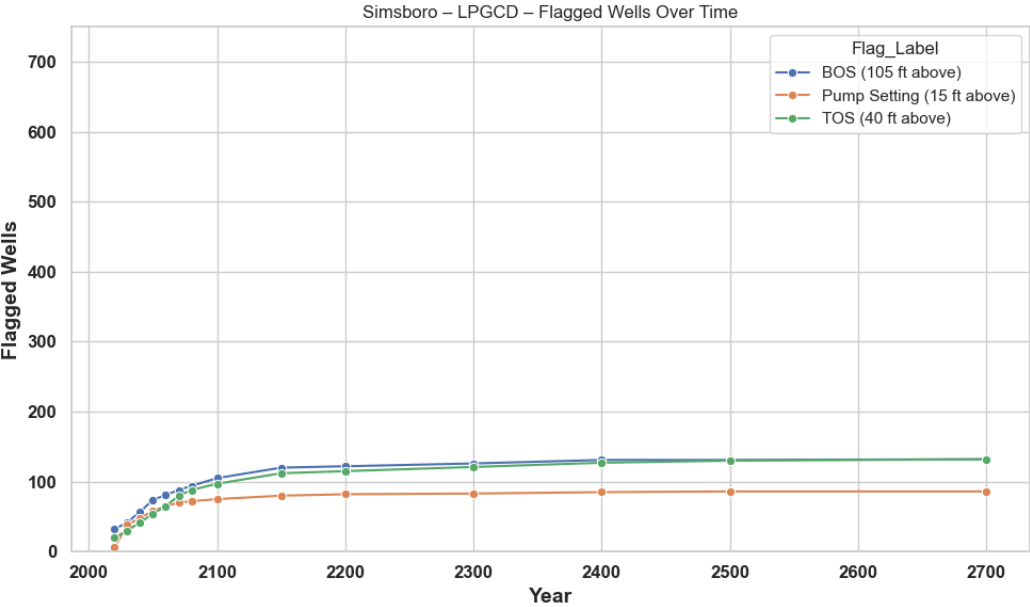
Simsboro

Aquifer	GCD	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	LPGCD	469	469	469	277
Carrizo	LPGCD	179	179	179	101
Hooper	LPGCD	288	288	288	185
Simsboro	LPGCD	264	264	264	135
Calvert Bluff	METGCD	1,134	1,134	1,134	900
Carrizo	METGCD	248	248	248	175
Hooper	METGCD	515	515	515	387
Simsboro	METGCD	636	636	636	540
Calvert Bluff	POSGCD	753	559	559	258
Carrizo	POSGCD	406	333	333	172
Hooper	POSGCD	734	613	613	208
Simsboro	POSGCD	713	519	519	139

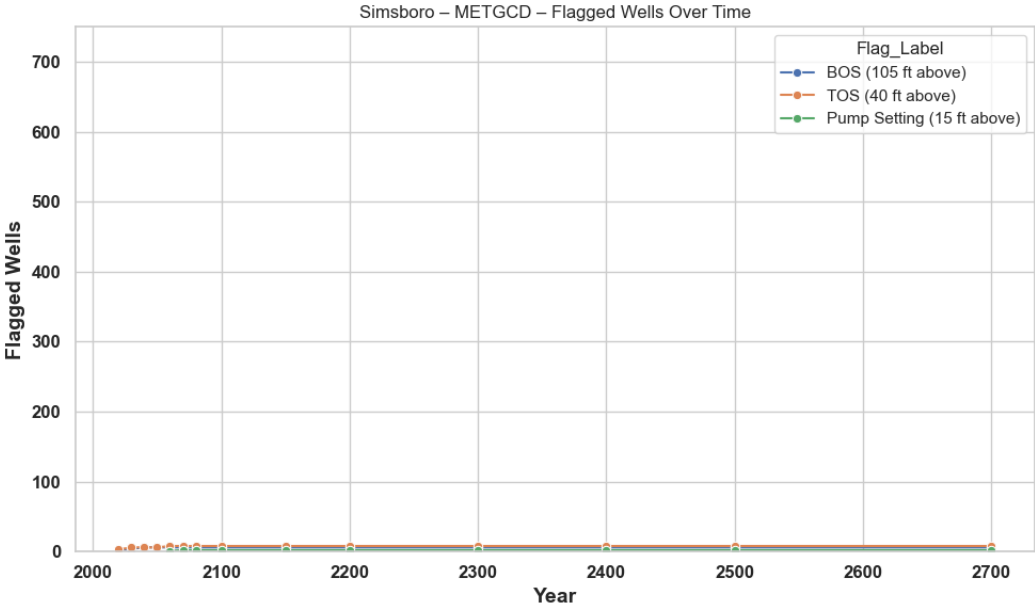
OPMAN – POSGCD Flagged Wells



OPMAN – LPGCD Flagged Wells



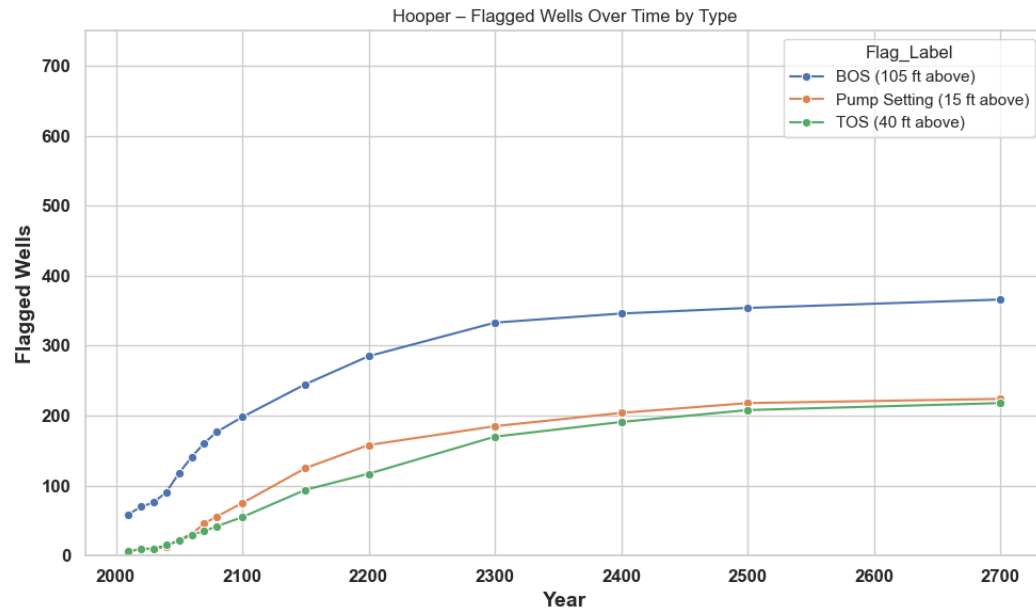
OPMAN – METGCD Flagged Wells



Hooper

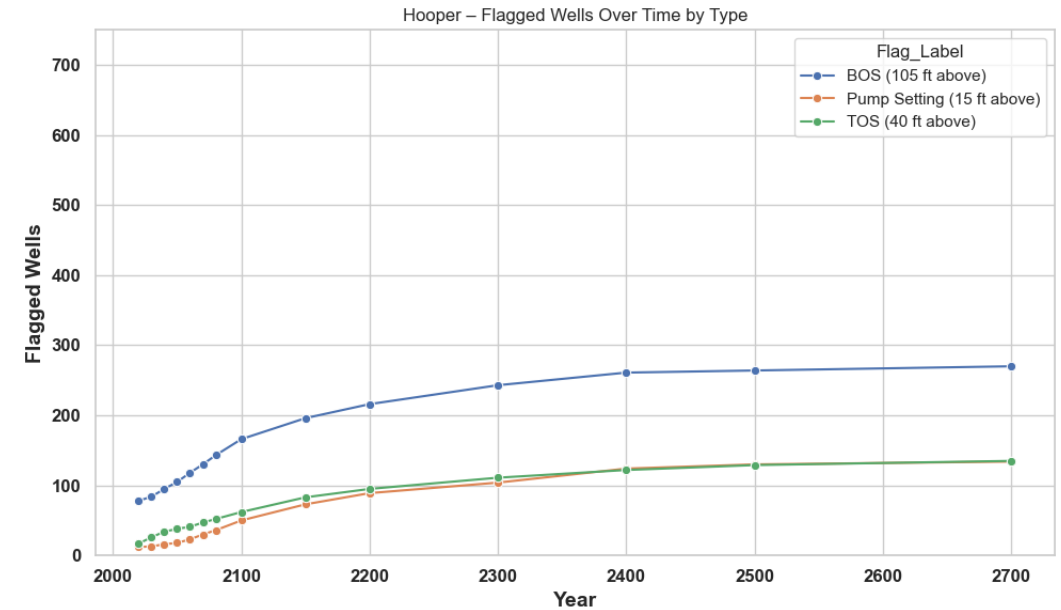
OPMAN –Flagged Wells

OPMAN				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,357	2,163	2,163	1,435
Carrizo	833	760	760	448
Hooper	1,537	1,416	1,416	780
Simsboro	1,613	1,419	1,419	814
Total	6,340	5,758	5,758	3,477



GMA12 –Flagged Wells

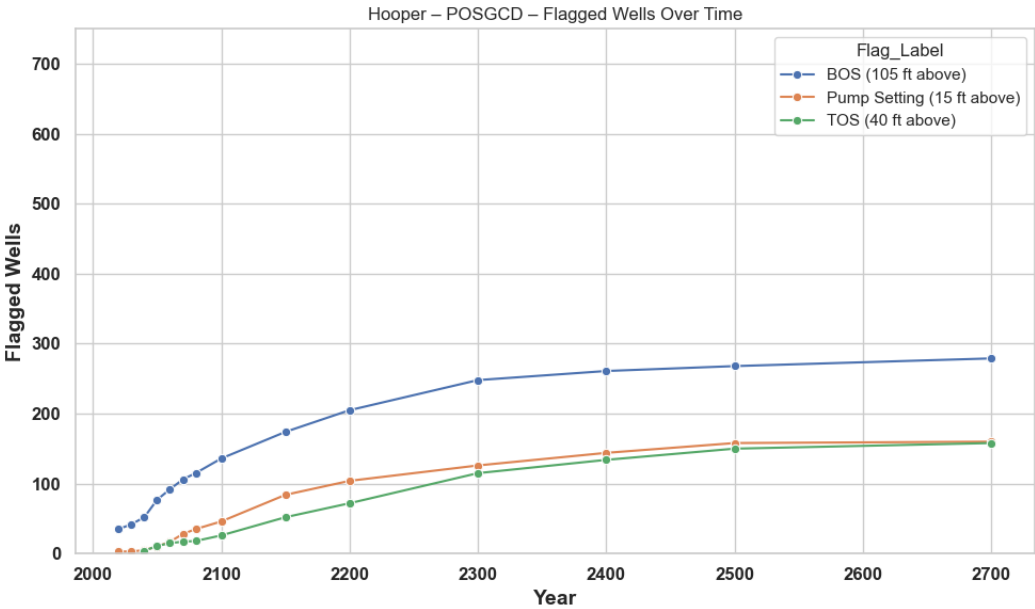
GMA12				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,497	2,251	2,251	1,493
Carrizo	853	773	773	449
Hooper	1,548	1,431	1,431	783
Simsboro	1,385	1,260	1,260	775
Total	6,283	5,715	5,715	3,500



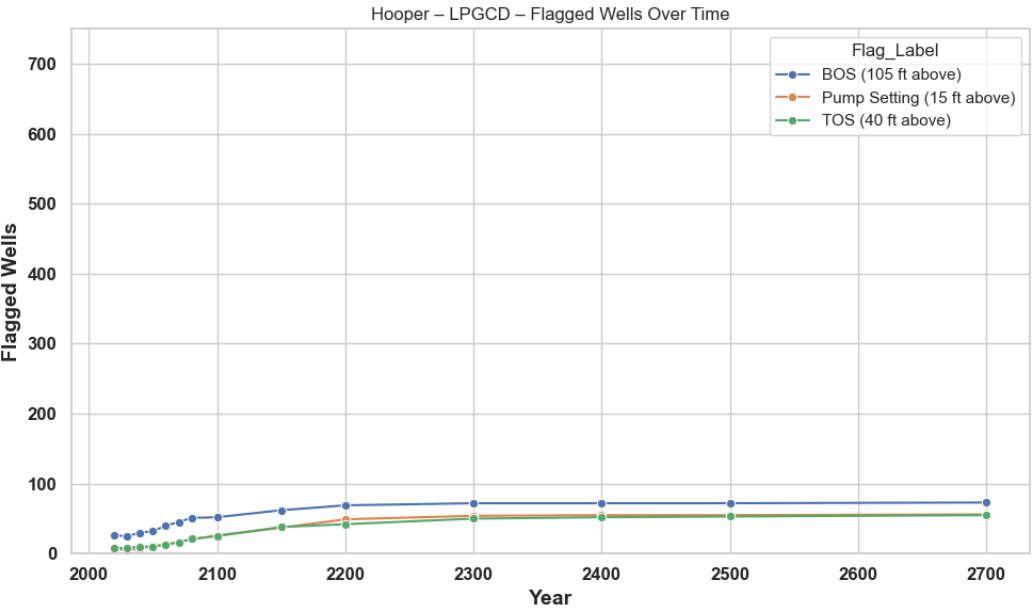
Hooper

Aquifer	GCD	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	LPGCD	469	469	469	277
Carrizo	LPGCD	179	179	179	101
Hooper	LPGCD	288	288	288	185
Simsboro	LPGCD	264	264	264	135
Calvert Bluff	METGCD	1,134	1,134	1,134	900
Carrizo	METGCD	248	248	248	175
Hooper	METGCD	515	515	515	387
Simsboro	METGCD	636	636	636	540
Calvert Bluff	POSGCD	753	559	559	258
Carrizo	POSGCD	406	333	333	172
Hooper	POSGCD	734	613	613	208
Simsboro	POSGCD	713	519	519	139

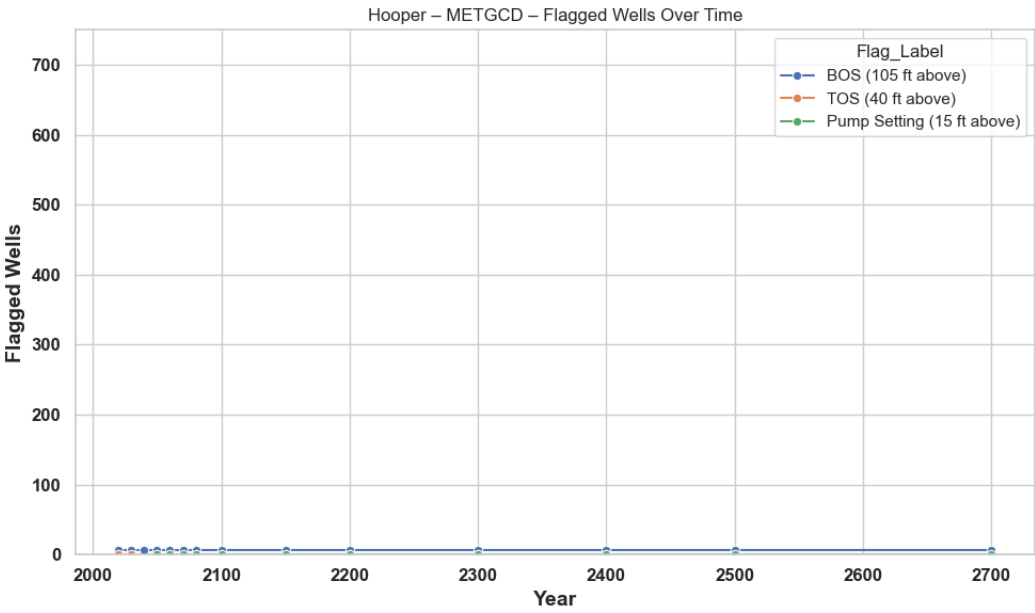
OPMAN – POSGCD Flagged Wells



OPMAN – LPGCD Flagged Wells



OPMAN – METGCD Flagged Wells



Summary of Flags for All Aquifers and GCDs

GMA12 – Wells by Aquifer

Aquifer	pump_flag_2070	scrn_b_flag_2070	scrn_t_flag_2070	pump_flag_2200	scrn_b_flag_2200	scrn_t_flag_2200	pump_flag_2300	scrn_b_flag_2300	scrn_t_flag_2300
Calvert Bluff	123	175	180	266	265	252	308	299	281
Carrizo	107	96	64	184	151	119	221	176	139
Hooper	30	130	47	89	216	95	104	243	111
Simsboro	92	257	202	138	390	322	145	415	351

Aquifer	pump_flag_2070	scrn_b_flag_2070	scrn_t_flag_2070	pump_flag_2200	scrn_b_flag_2200	scrn_t_flag_2200	pump_flag_2300	scrn_b_flag_2300	scrn_t_flag_2300
Calvert Bluff	5%	7%	7%	11%	11%	10%	12%	12%	11%
Carrizo	13%	11%	8%	22%	18%	14%	26%	21%	16%
Hooper	2%	8%	3%	6%	14%	6%	7%	16%	7%
Simsboro	7%	19%	15%	10%	28%	23%	10%	30%	25%

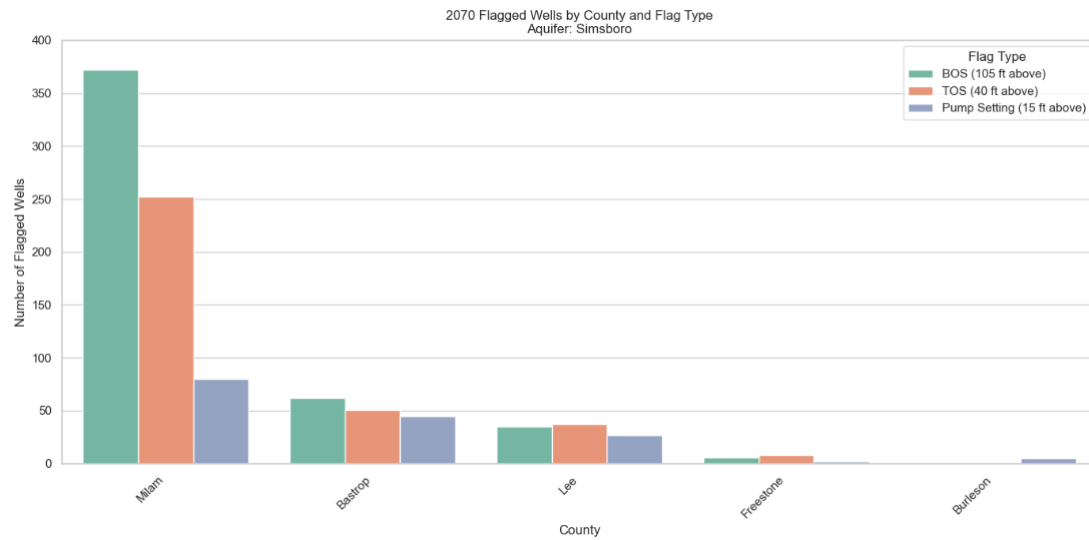
OPMAN – Wells by Aquifer

Aquifer	pump_flag_2070	scrn_b_flag_2070	scrn_t_flag_2070	pump_flag_2200	scrn_b_flag_2200	scrn_t_flag_2200	pump_flag_2300	scrn_b_flag_2300	scrn_t_flag_2300
Calvert Bluff	190	181	174	356	401	293	400	501	413
Carrizo	171	106	66	238	225	163	251	248	207
Hooper	46	158	33	154	281	114	181	327	165
Simsboro	159	476	349	212	706	666	219	736	693

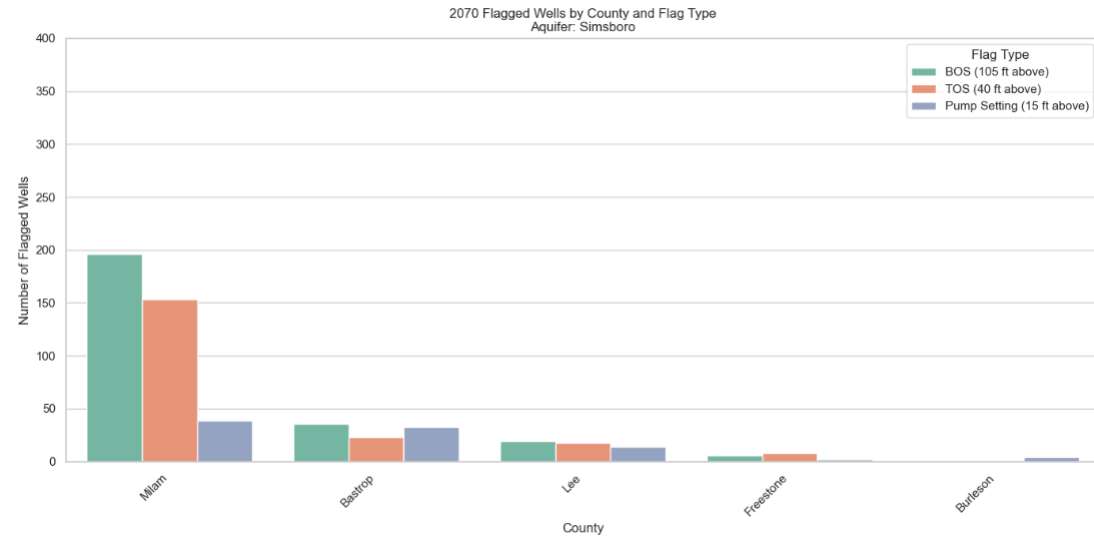
Aquifer	pump_flag_2070	scrn_t_flag_2070	scrn_b_flag_2070	pump_flag_2200	scrn_b_flag_2200	scrn_t_flag_2200	pump_flag_2300	scrn_b_flag_2300	scrn_t_flag_2300
Calvert Bluff	8%	7%	8%	15%	17%	12%	17%	21%	18%
Carrizo	21%	8%	13%	29%	27%	20%	30%	30%	25%
Hooper	3%	2%	10%	10%	18%	7%	12%	21%	11%
Simsboro	10%	22%	30%	13%	44%	41%	14%	46%	43%

Summary of Flags for 2070 Simsboro

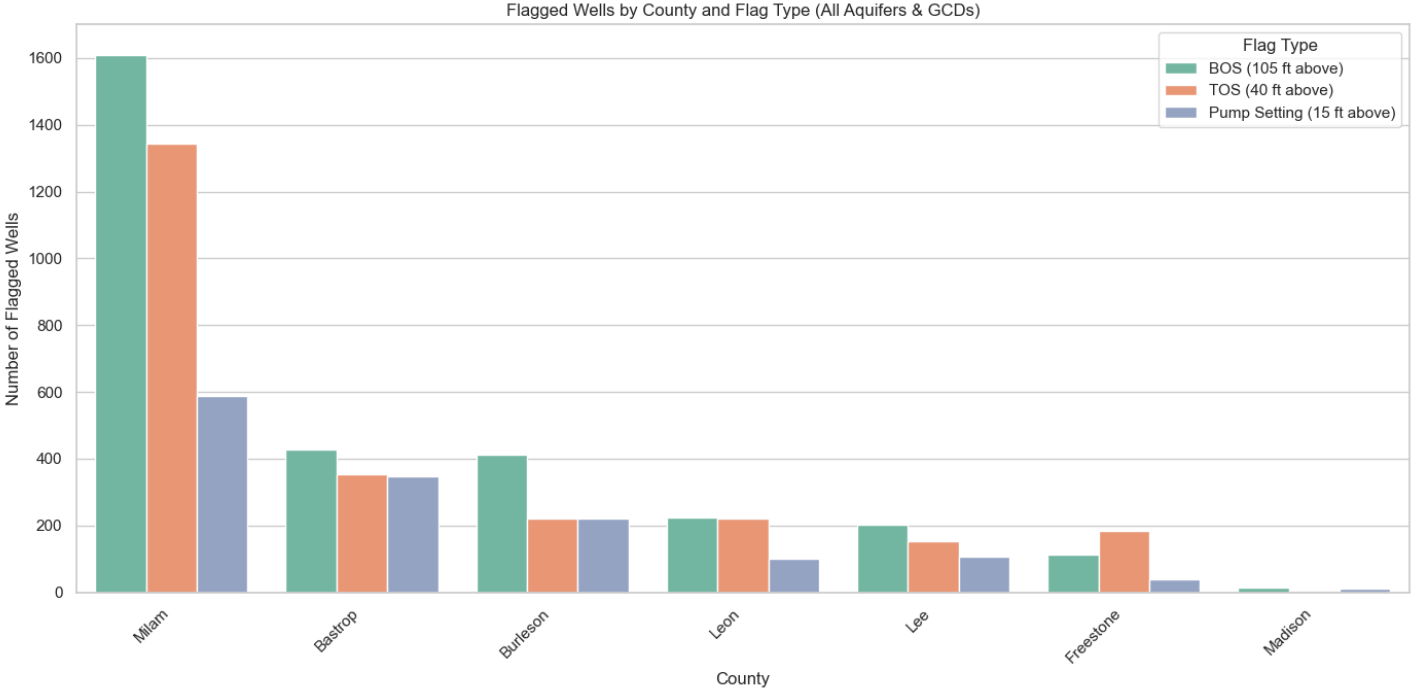
OPMAN



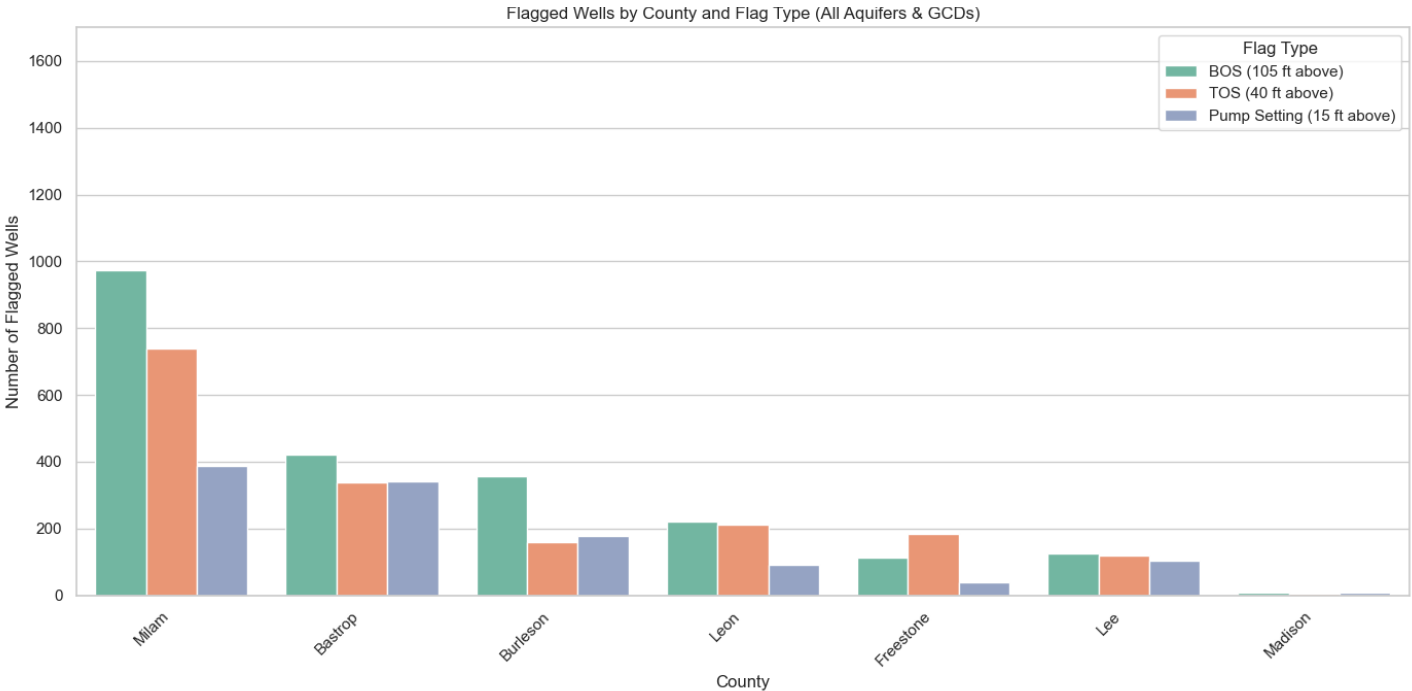
GMA12



OPMAN



GMA12



Summary

- Results from the OPMAN model suggests that GMA 12 GAM underpredicts drawdown
- About 17% of Carrizo wells and 8% of Simsboro wells will need to have their pumps lower by 2070
- Milam County is predicted to have the greatest impact from pumping in the Simsboro
- For some GCDs and aquifers, a significant impacts can accumulate for more than 100 years after 2070

Questions

Flag Analysis – Total Wells By Aquifer

GMA12 – Wells by Aquifer

GMA12					
Aquifer	Total_Wells	Total Depth	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,499	617	2,253	2,253	1,495
Carrizo	854	359	773	773	449
Hooper	1,555	603	1,434	1,434	783
Queen City	2,088	928	1,755	1,754	810
Recklaw	310	111	252	252	97
Simsboro	1,388	399	1,263	1,263	777
Sparta	1,739	971	1,455	1,455	574
Weches	173	101	124	124	31
Total	10,606	4,089	9,309	9,308	5,016

OPMAN – Wells by Aquifer

OPMAN					
Aquifer	Total_Wells	Total Depth	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,358	561	2,164	2,164	1,436
Carrizo	834	333	760	760	448
Hooper	1,543	615	1,418	1,418	780
Queen City	2,181	976	1,838	1,837	841
Recklaw	247	77	190	190	78
Simsboro	1,617	520	1,423	1,423	816
Sparta	1,745	976	1,462	1,462	578
Weches	177	104	127	127	29
Total	10,702	4,162	9,382	9,381	5,006

Flag Analysis – Total Wells by County

GMA12 – Wells by County

GMA12 County	Total_Wells	Total Depth	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Anderson	1	0	1	1	0
Bastrop	1,529	2	1,529	1,529	957
Brazos	12	1	1	1	1
Burleson	3,269	2,539	2,541	2,541	671
Fayette	4	4	4	4	0
Freestone	2,183	0	2,170	2,170	1,743
Lee	454	16	414	413	190
Leon	1,614	0	1,598	1,598	1,167
Limestone	2	0	2	2	2
Madison	434	0	418	418	360
Milam	2,452	1,955	1,955	1,955	684
Robertson	10	5	5	5	4
Williamson	2	2	2	2	0
Total	11,966	4,524	10,640	10,639	5,779

OPMAN – Wells by County

OPMAN County	Total_Wells	Total Depth	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Anderson	1	0	1	1	0
Bastrop	1,511	2	1,511	1,511	944
Brazos	12	1	1	1	1
Burleson	3,269	2,539	2,541	2,541	670
Fayette	4	4	4	4	0
Freestone	2,186	0	2,173	2,173	1,745
Lee	455	16	415	414	191
Leon	1,614	0	1,598	1,598	1,167
Limestone	2	0	2	2	2
Madison	434	0	418	418	360
Milam	2,543	2,023	2,023	2,023	690
Robertson	10	5	5	5	4
Williamson	2	2	2	2	0
Total	12,043	4,592	10,694	10,693	5,774

Flag Analysis – Anaylzed Wells by Aquifer

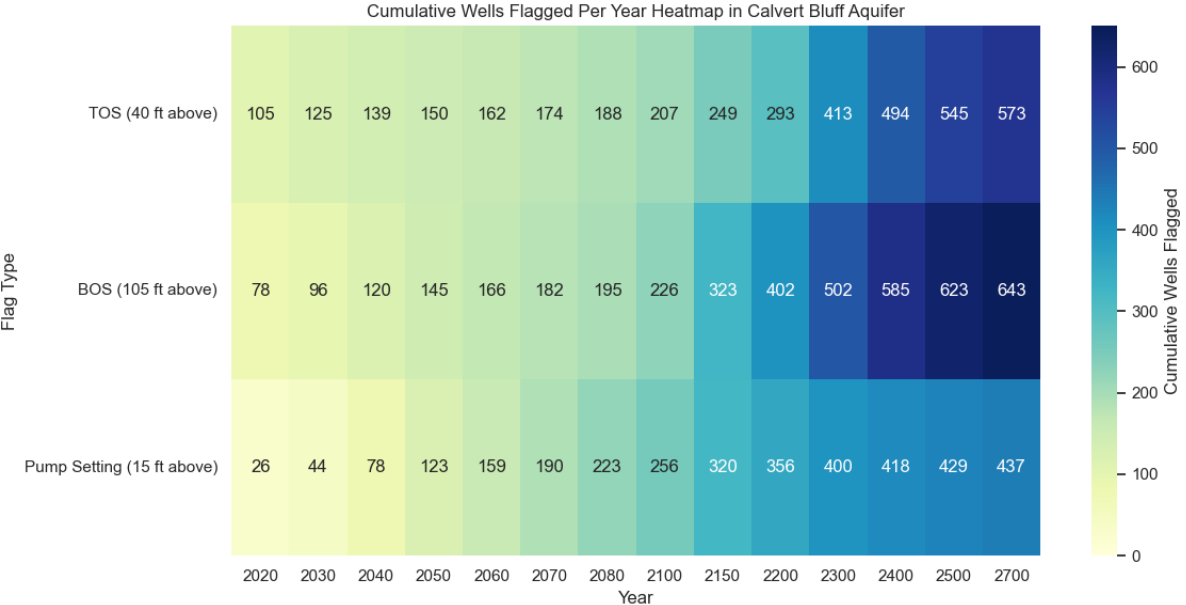
GMA12 – Wells by Aquifer

GMA12				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,497	2,251	2,251	1,493
Carrizo	853	773	773	449
Hooper	1,548	1,431	1,431	783
Simsboro	1,385	1,260	1,260	775
Total	6,283	5,715	5,715	3,500

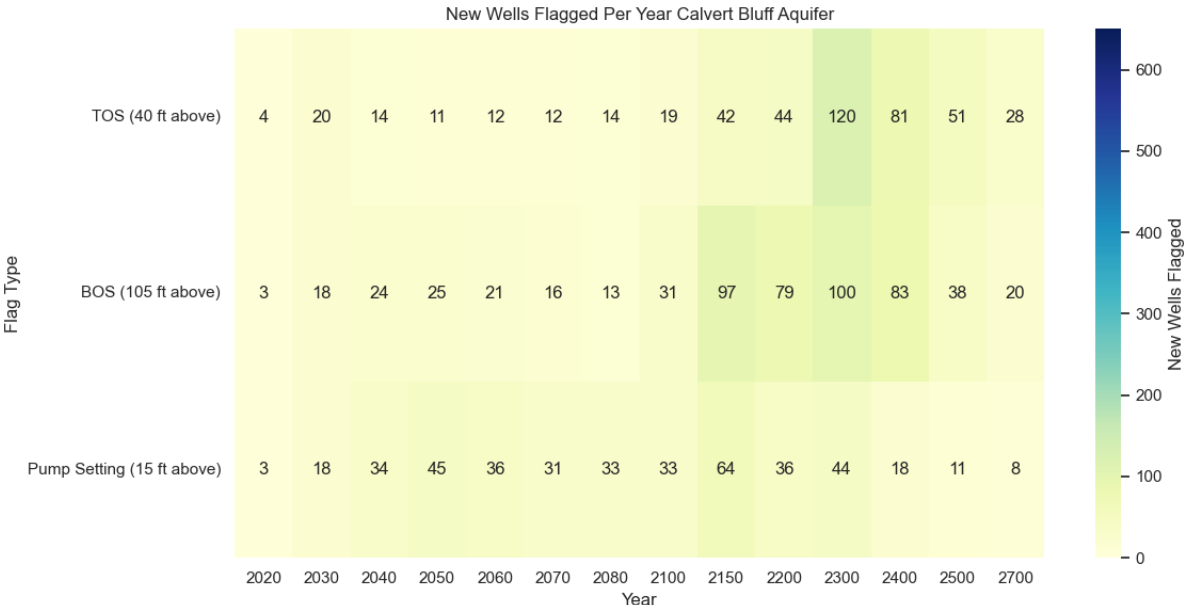
OPMAN – Wells by Aquifer

OPMAN				
Aquifer	Total Wells	TOS (40 ft above)	BOS (105 ft above)	Pump (15 ft above)
Calvert Bluff	2,357	2,163	2,163	1,435
Carrizo	833	760	760	448
Hooper	1,537	1,416	1,416	780
Simsboro	1,613	1,419	1,419	814
Total	6,340	5,758	5,758	3,477

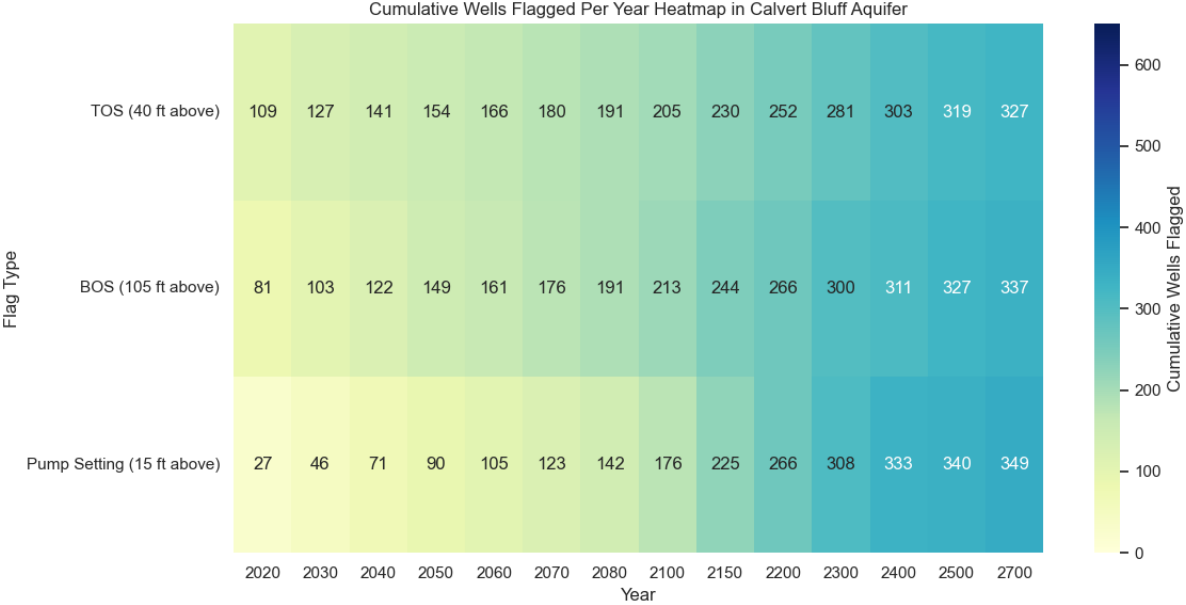
OPMAN – Cumulative Well Count



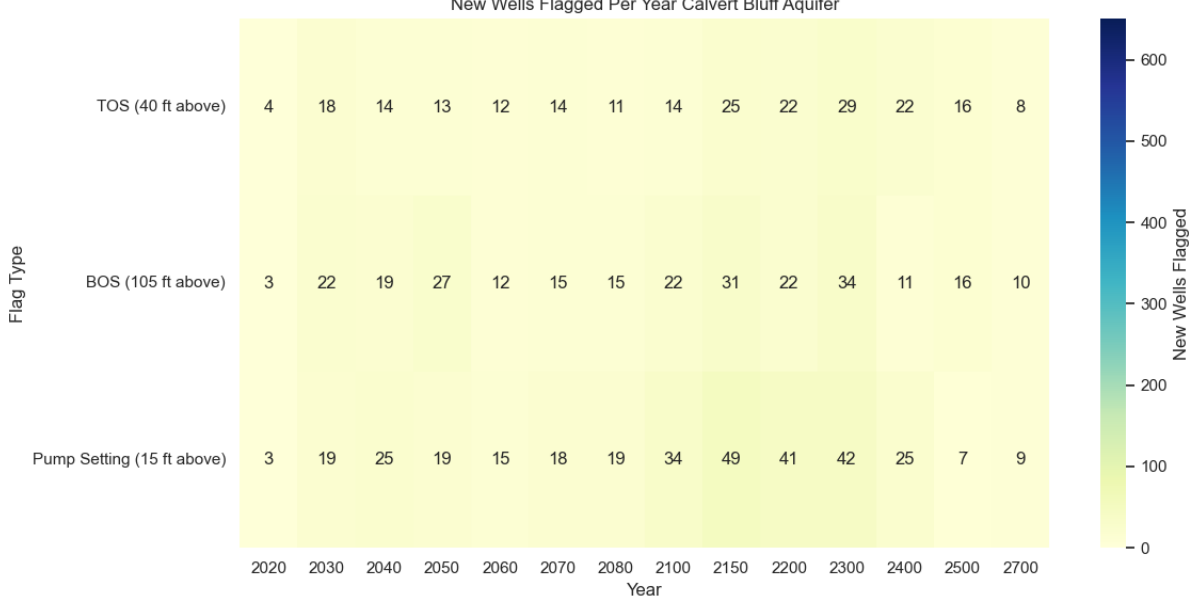
OPMAN – New Wells Per Year



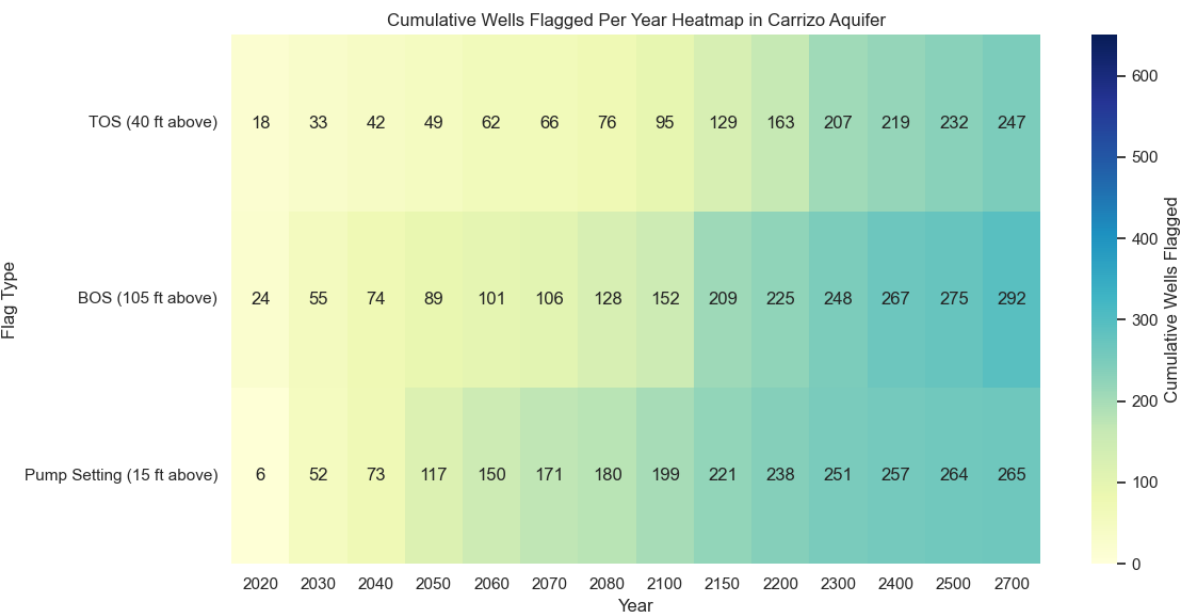
GMA12 – Cumulative Well Count



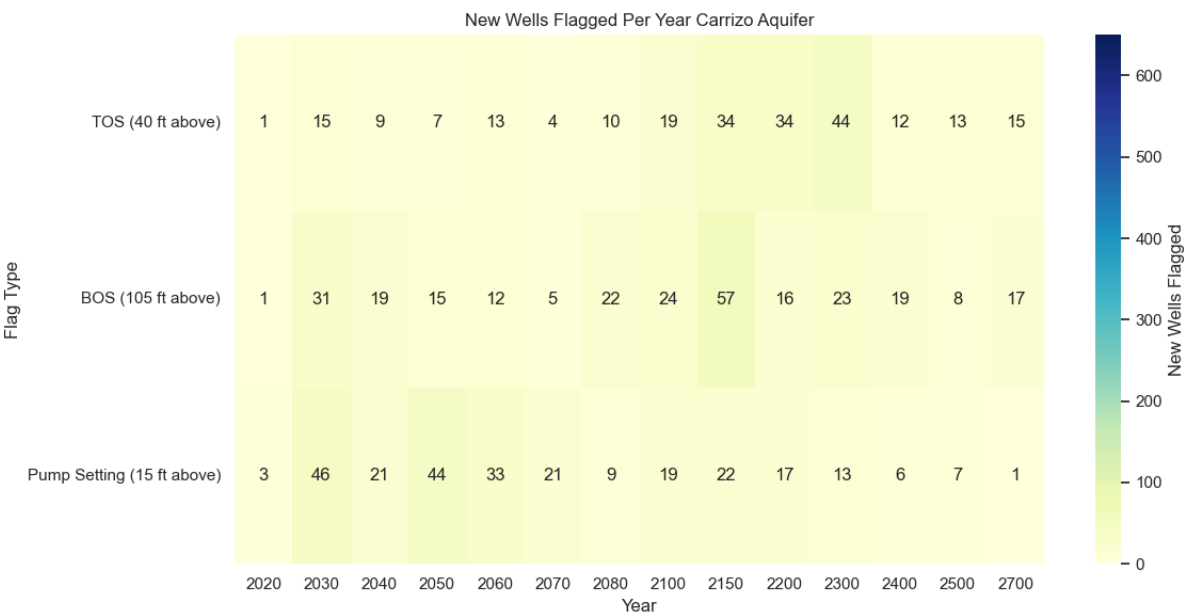
GMA12 – New Wells Per Year



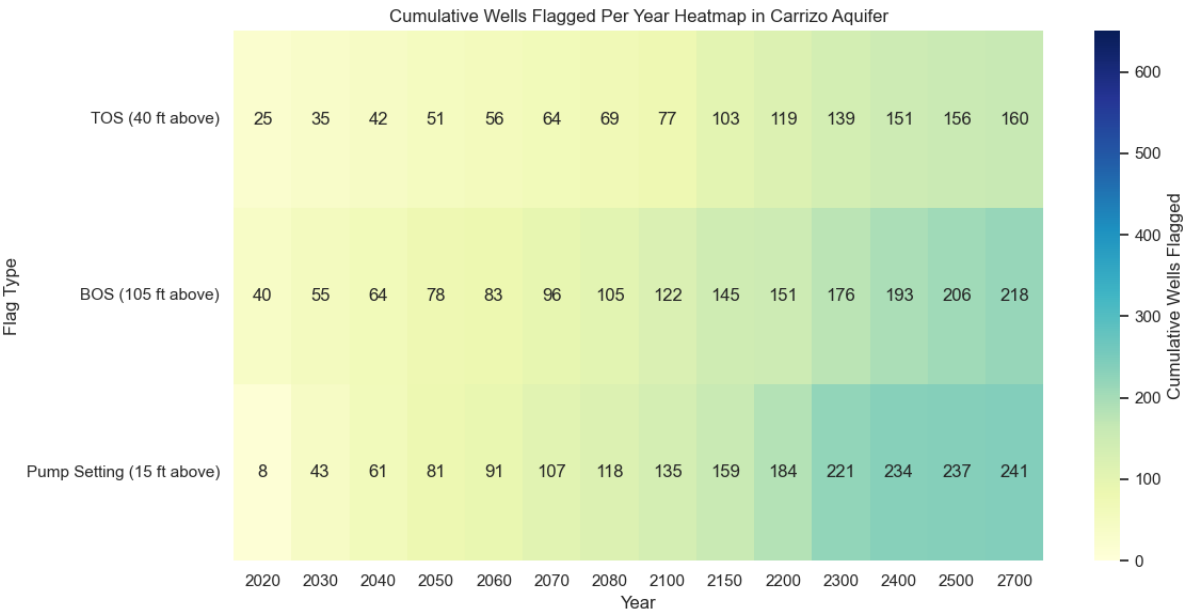
OPMAN – Cumulative Well Count



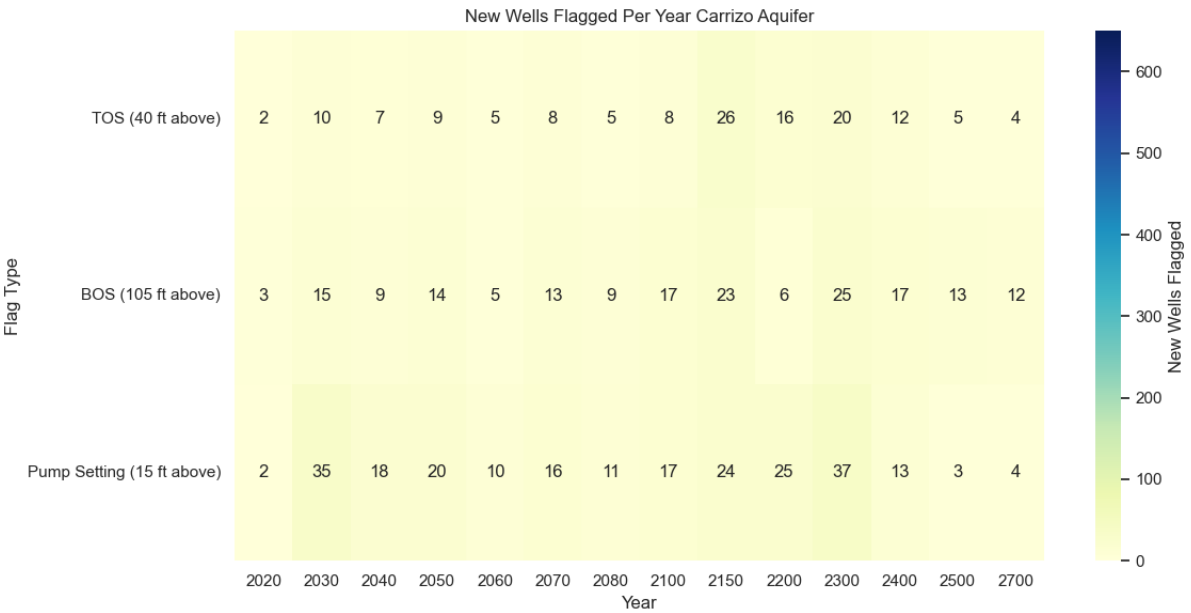
OPMAN – New Wells Per Year



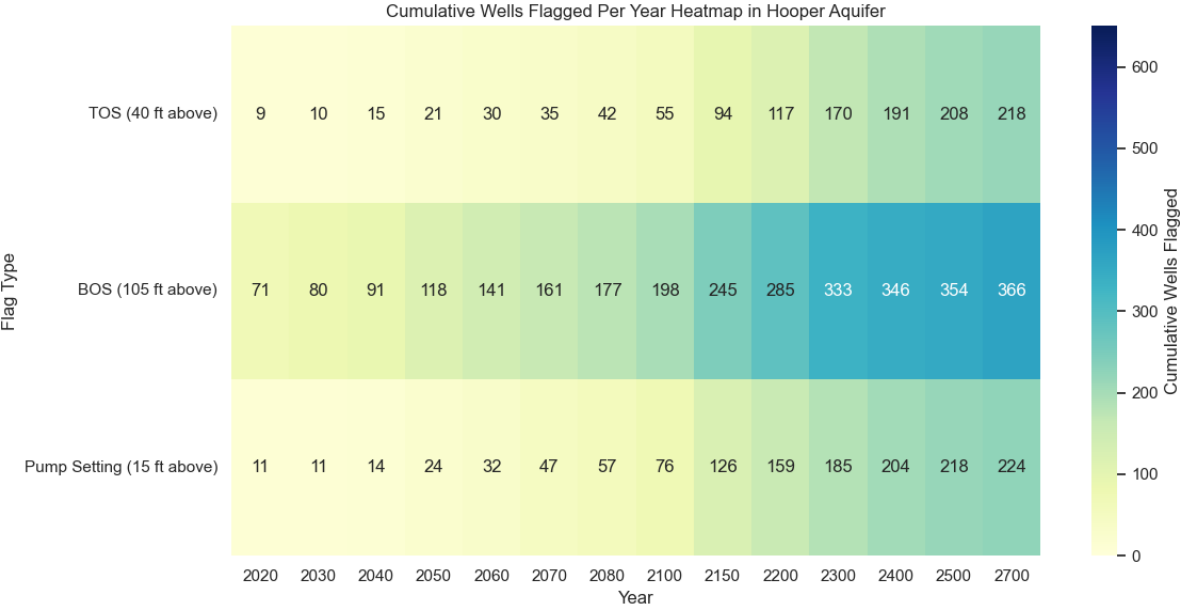
GMA12 – Cumulative Well Count



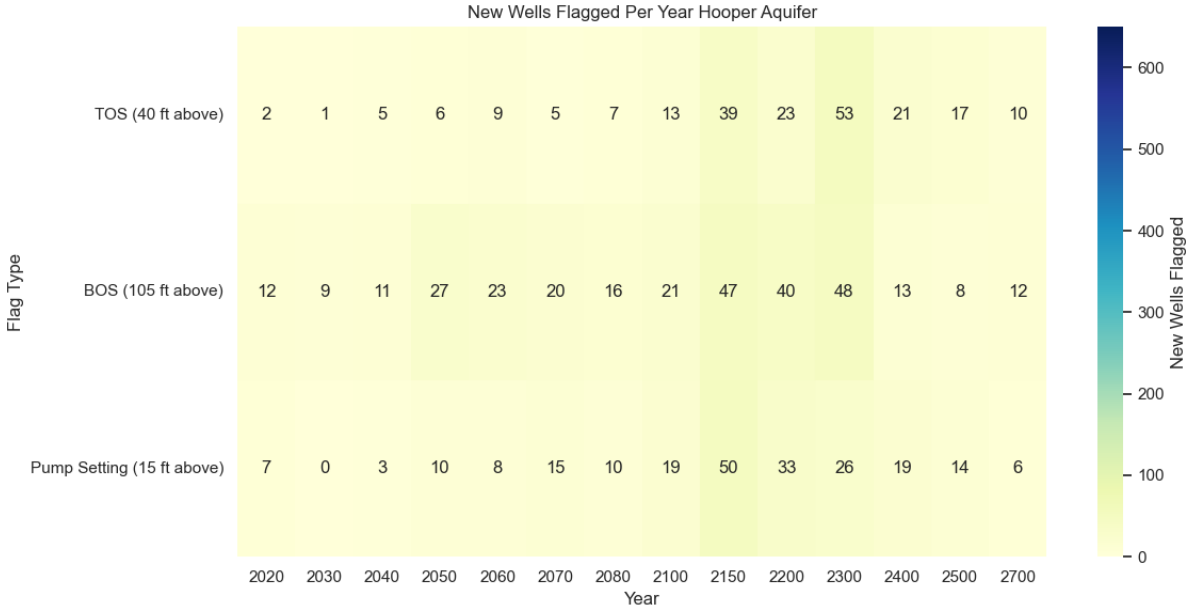
GMA12 – New Wells Per Year



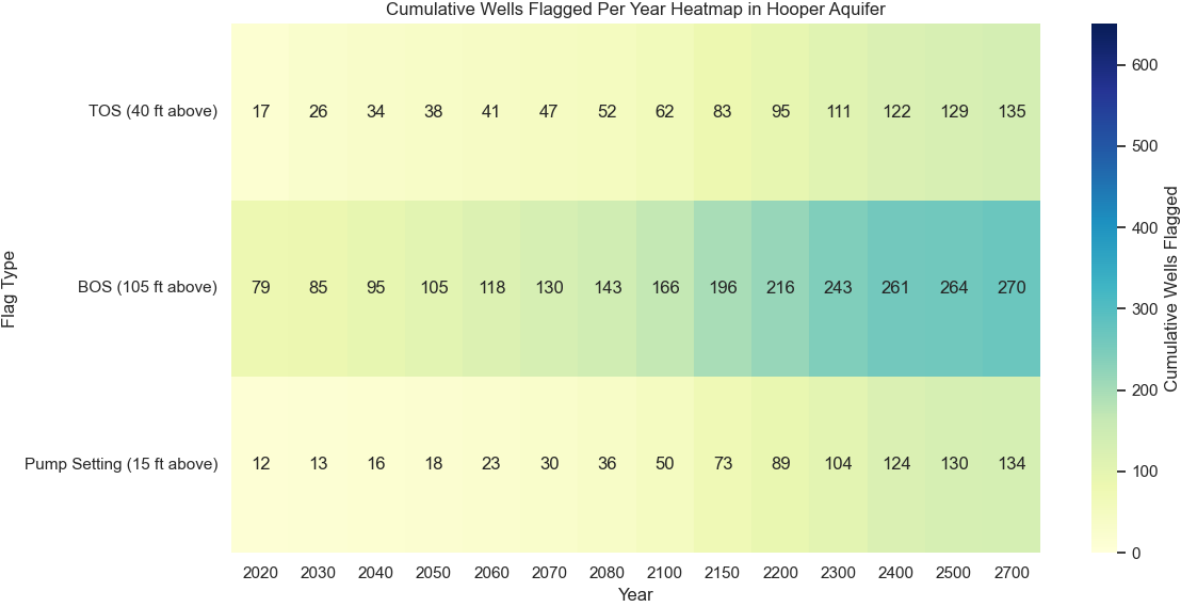
OPMAN – Cumulative Well Count



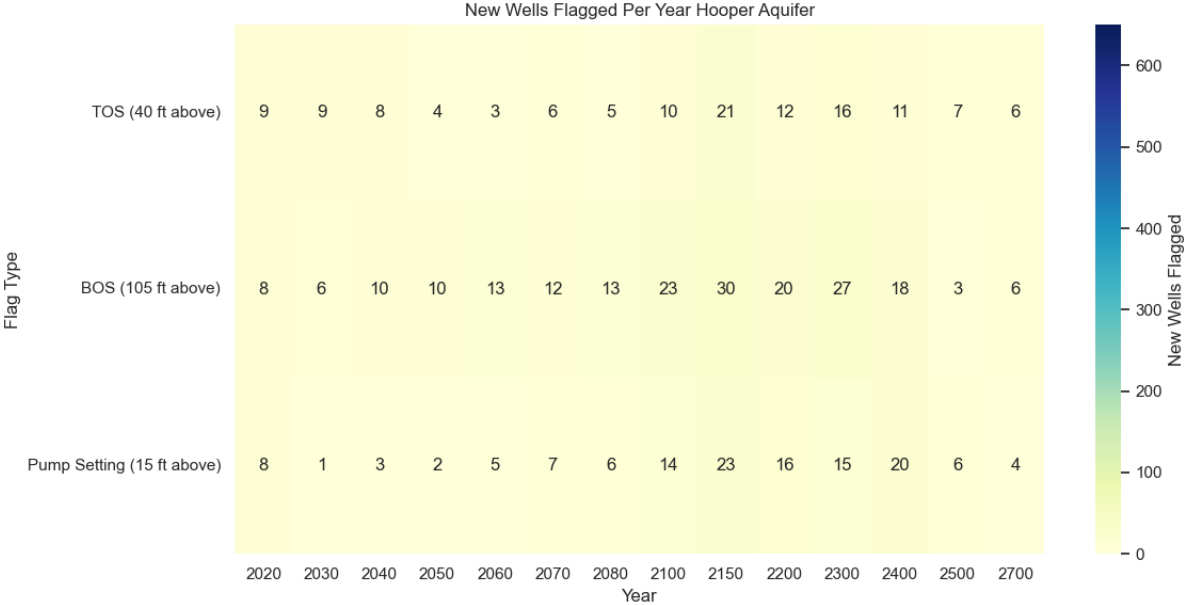
OPMAN – New Wells Per Year



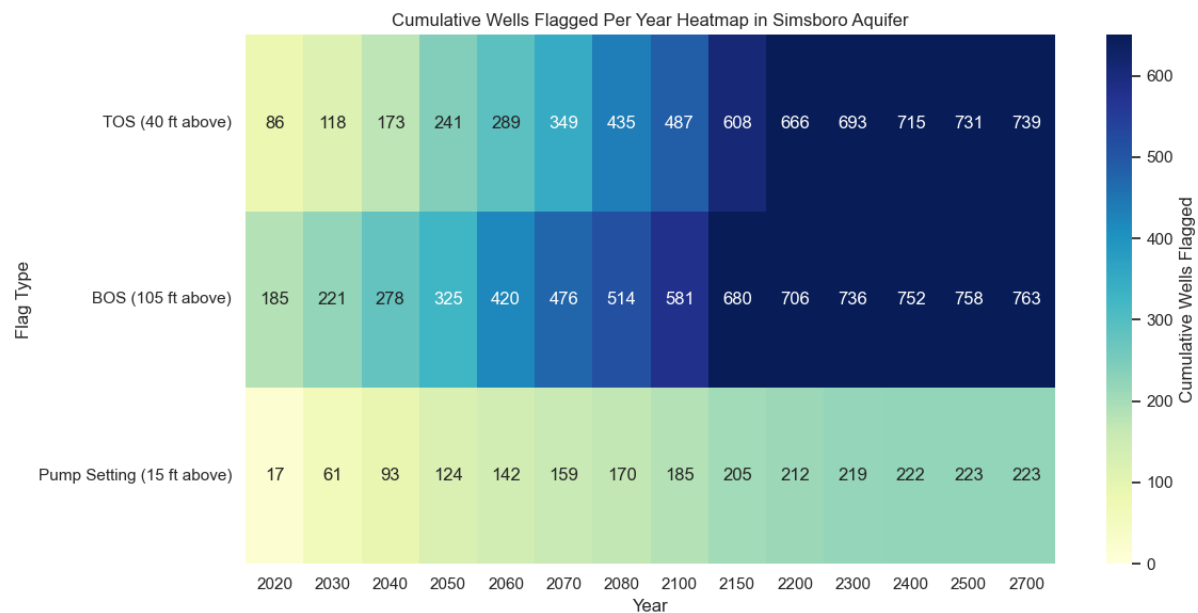
GMA12 – Cumulative Well Count



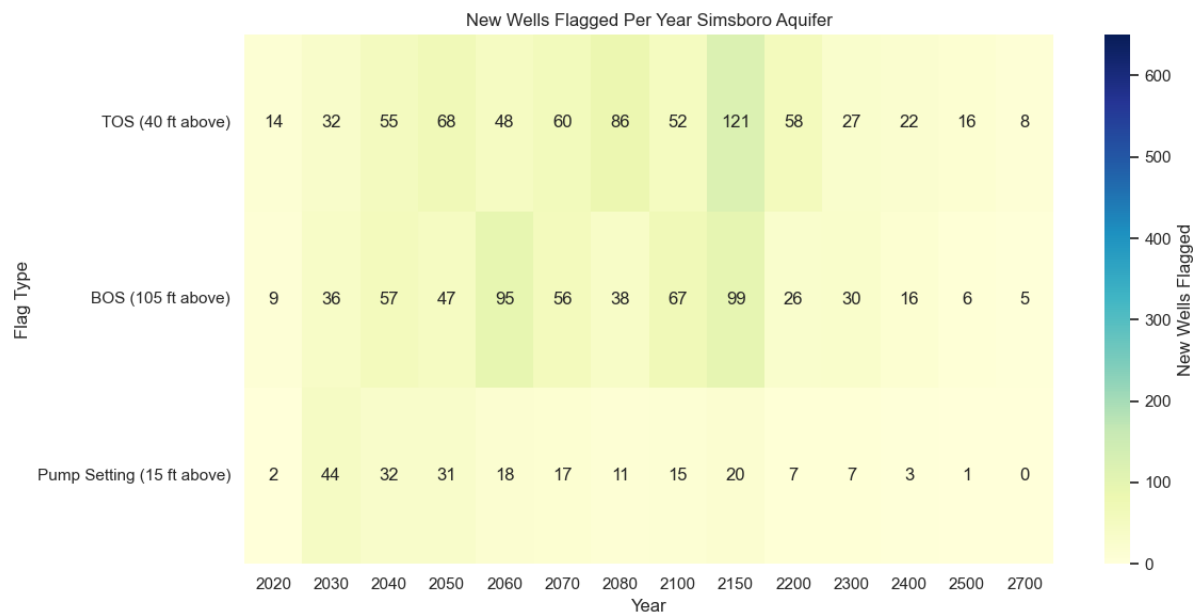
GMA12 – New Wells Per Year



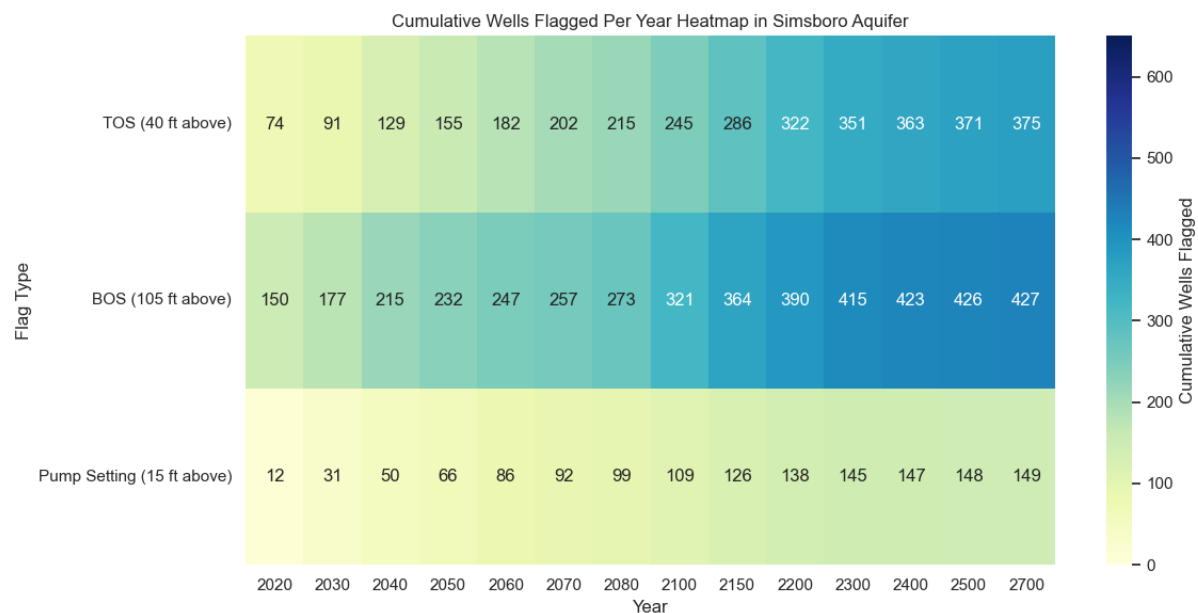
OPMAN – Cumulative Well Count



OPMAN – New Wells Per Year



GMA12 – Cumulative Well Count



GMA12 – New Wells Per Year

