GMA 12

Preliminary Modeling Results for the Sparta, Queen City, and Carrizo-Wilcox Aquifers

by

GMA 12 Consultant Team

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INTERA (POSGCD and METGCD)
Ground Water Consultants (BVGCD)

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Runs Done

- All runs- estimated historic pumpage for 2011 to 2018
- S-1- Full permitted pumpage for 2020 to 2070. *Half of total permitted pumpage in 2019.*
- S-2- Anticipated ramp up of pumpage for 2019 to 2070. 2070 pumpage either the total permitted or estimated total demand based on demand projections.

Runs Done (cont.)

- S-3- Same as S-2 except only increasing to half of total permitted pumpage in 2070
- S-4 to S-6- The same as S-1 to S-3 except with reduced recharge:
  - Recharge for 2026 to 2030 is 75 percent of average
  - Recharge for 2051 to 2060 is 75 percent of average
  - Recharge for rest of predictive simulation is average historic recharge

Pumpage

- Details on pumpage assumptions reviewed at last GMA 12 meeting
- Some review and minor adjustments will be needed before proceeding with DFC runs.
- Pumping for non-GCD areas did not change for all six simulations

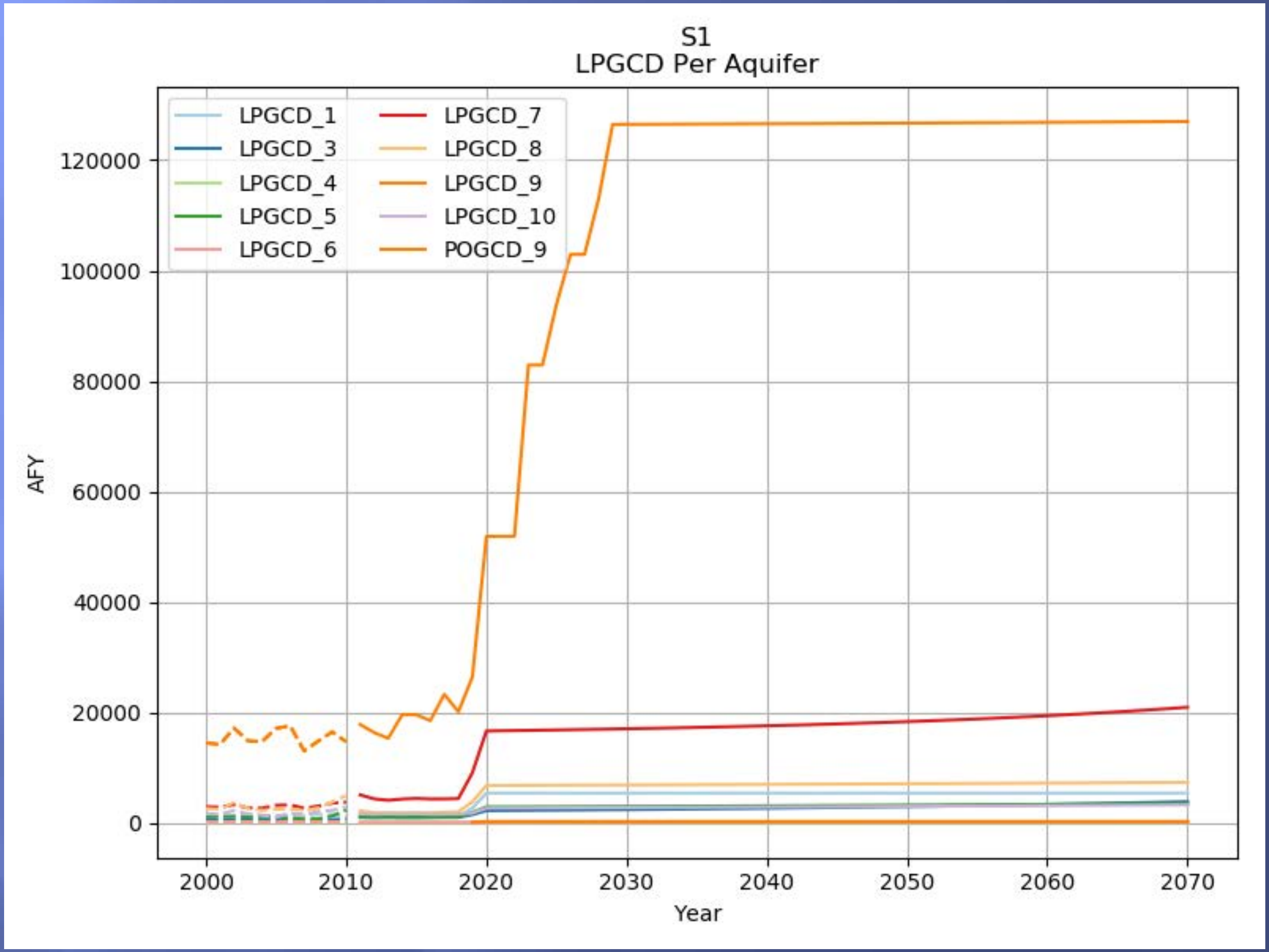
Pumpage (cont.)

- Pumping in southern non-GMA 12 areas:
  - Total pumping estimated over time by water use type
  - Pumping distributed to wells and area using the same approach used during model calibration
- Pumping for northern non-GMA 12 areas:
  - Total pumping over time based on current MAGs
  - Pumping locations same as in 2010, amount of pumping per county was adjusted based on a multiplier calculated by dividing the total annual pumping for the year by total pumping for the year 2010

Model Layers- Aquifer

- Layer 1- Colorado and Brazos River Alluvium
- Layer 2- Shallow flow systems
- Layer 3- Sparta Aquifer
- Layer 4- Weches Formation
- Layer 5- Queen City Aquifer
- Layer 6- Reklaw Formation
- Layer 7- Carrizo Aquifer
- Layer 8- Calvert Bluff Aquifer
- Layer 9- Simsboro Aquifer
- Layer 10- Hooper Aquifer

Lost Pines GCD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LPGCD Per Aquifer
LPGCD_1
LPGCD_3
LPGCD_4
LPGCD_5
LPGCD_6
LPGCD_7
LPGCD_8
LPGCD_9
LPGCD_10
POGCD_9
AFY
120000
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60000
40000
20000
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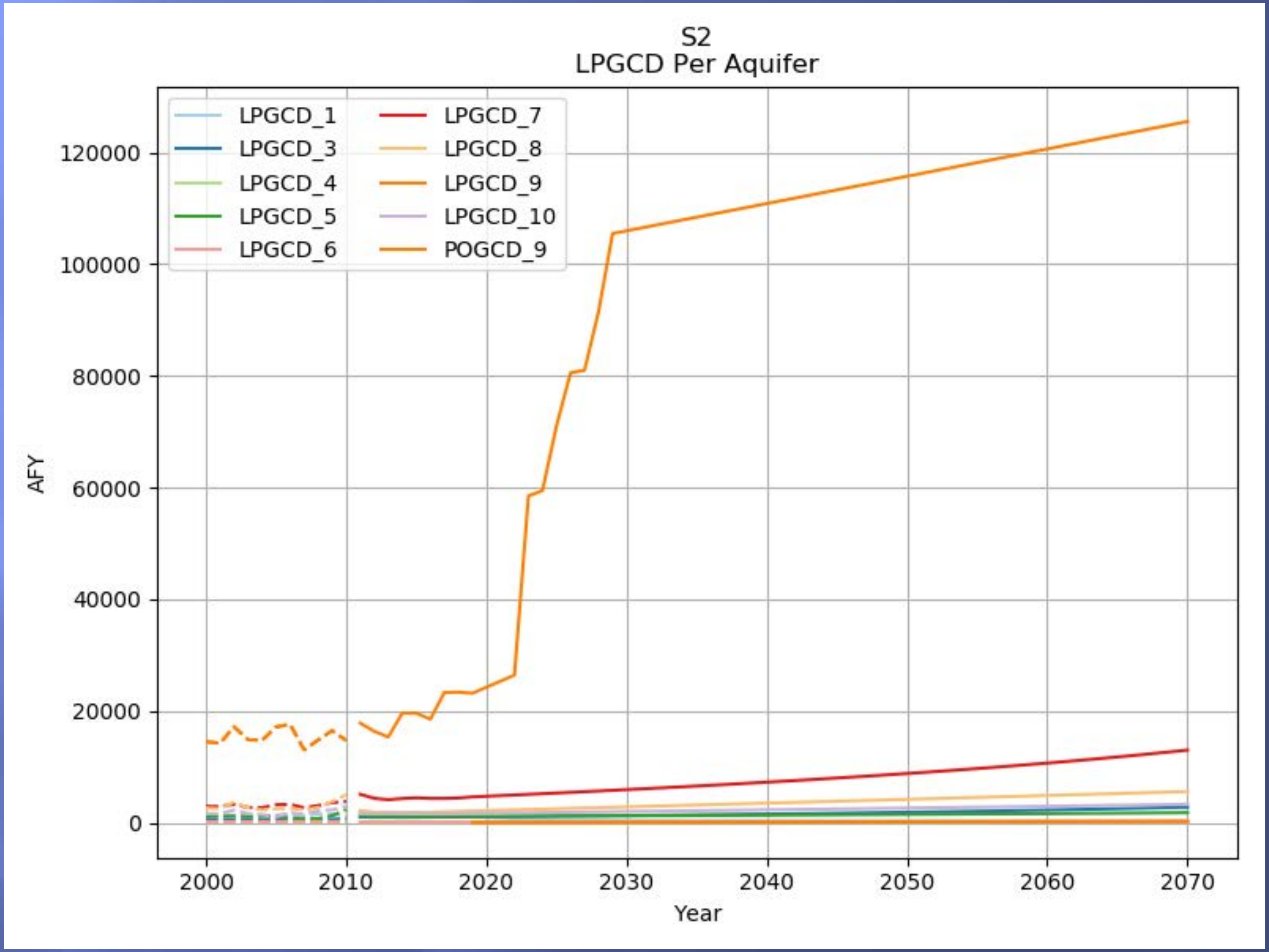
Year
2000
2010
2020
2030
2040
2050
2060
2070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LPGCD_9
LPGCD_10
POGCD_9
AFY
Year
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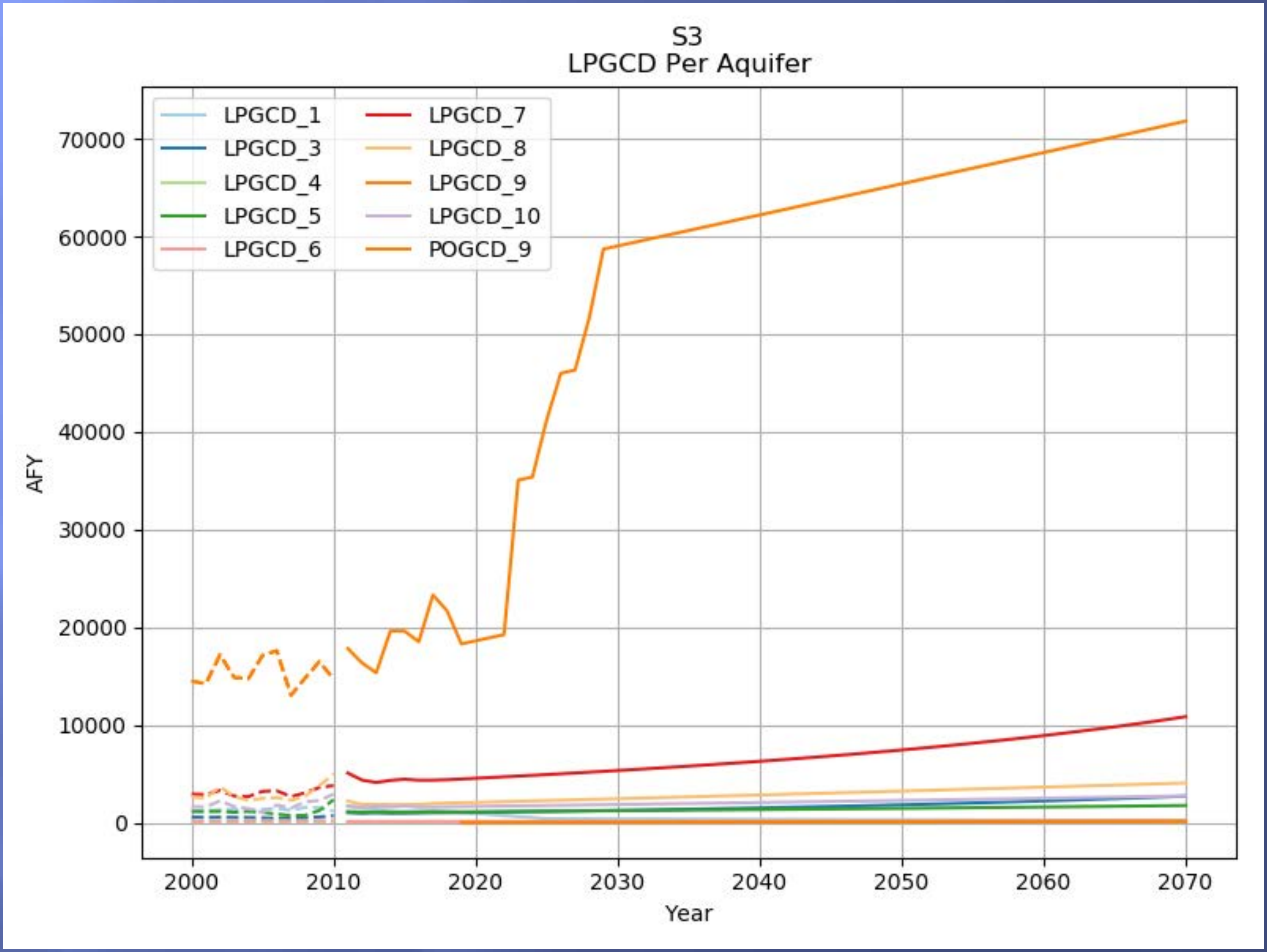
2010
2020
2030
2040
2050
2060
2070



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LPGCD Per Aquifer
LPGCD_1
LPGCD_3
LPGCD_4
LPGCD_5
LPGCD_6
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LPGCD_8
LPGCD_9
LPGCD_10
POGCD_9
AFY
0
10000
20000
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70000
Year
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2020
2030
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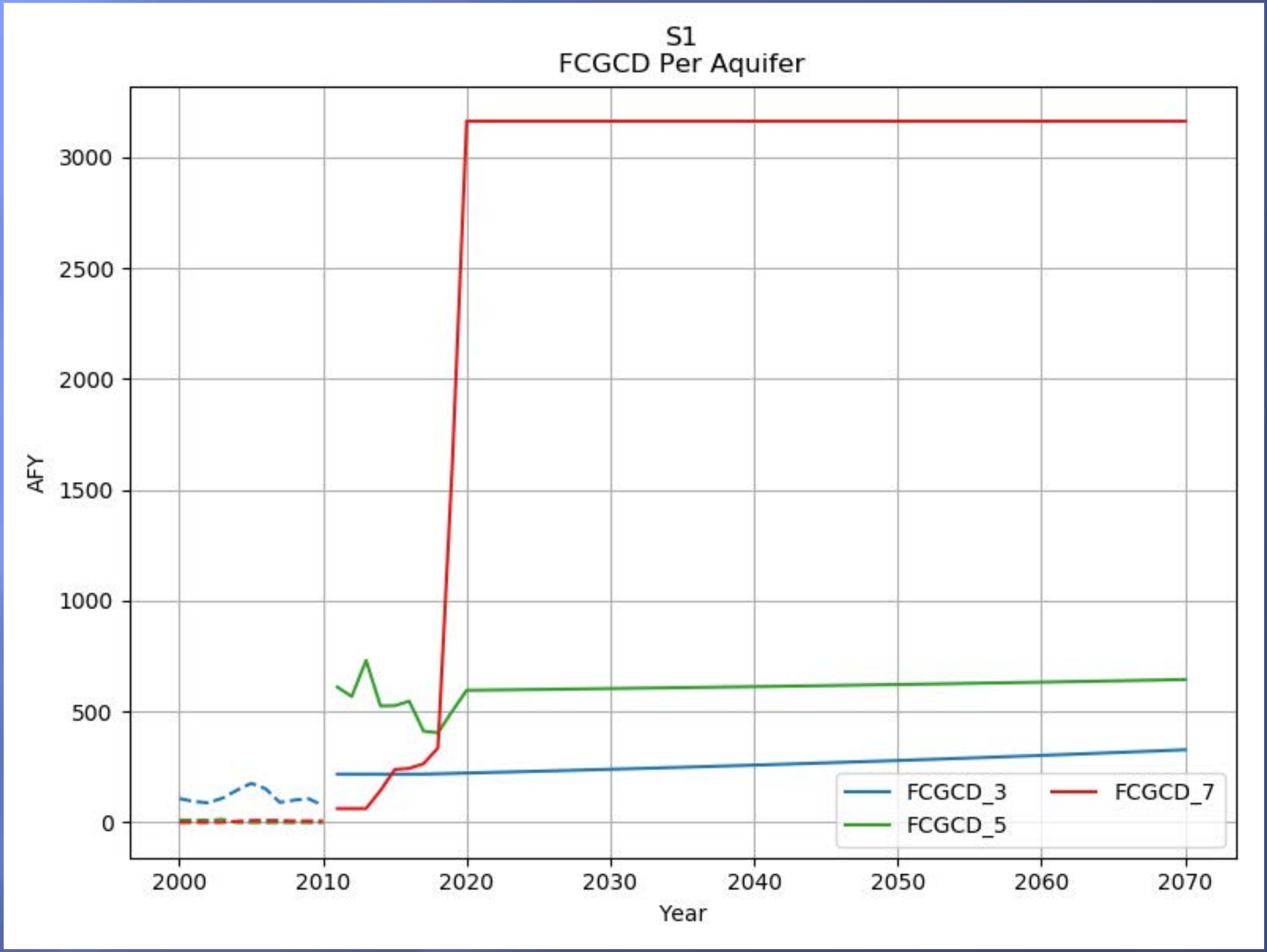
2050
2060
2070

Fayette County GCD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AFY
3000
2500
2000
1500
1000
500
0
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2010
2020
2030
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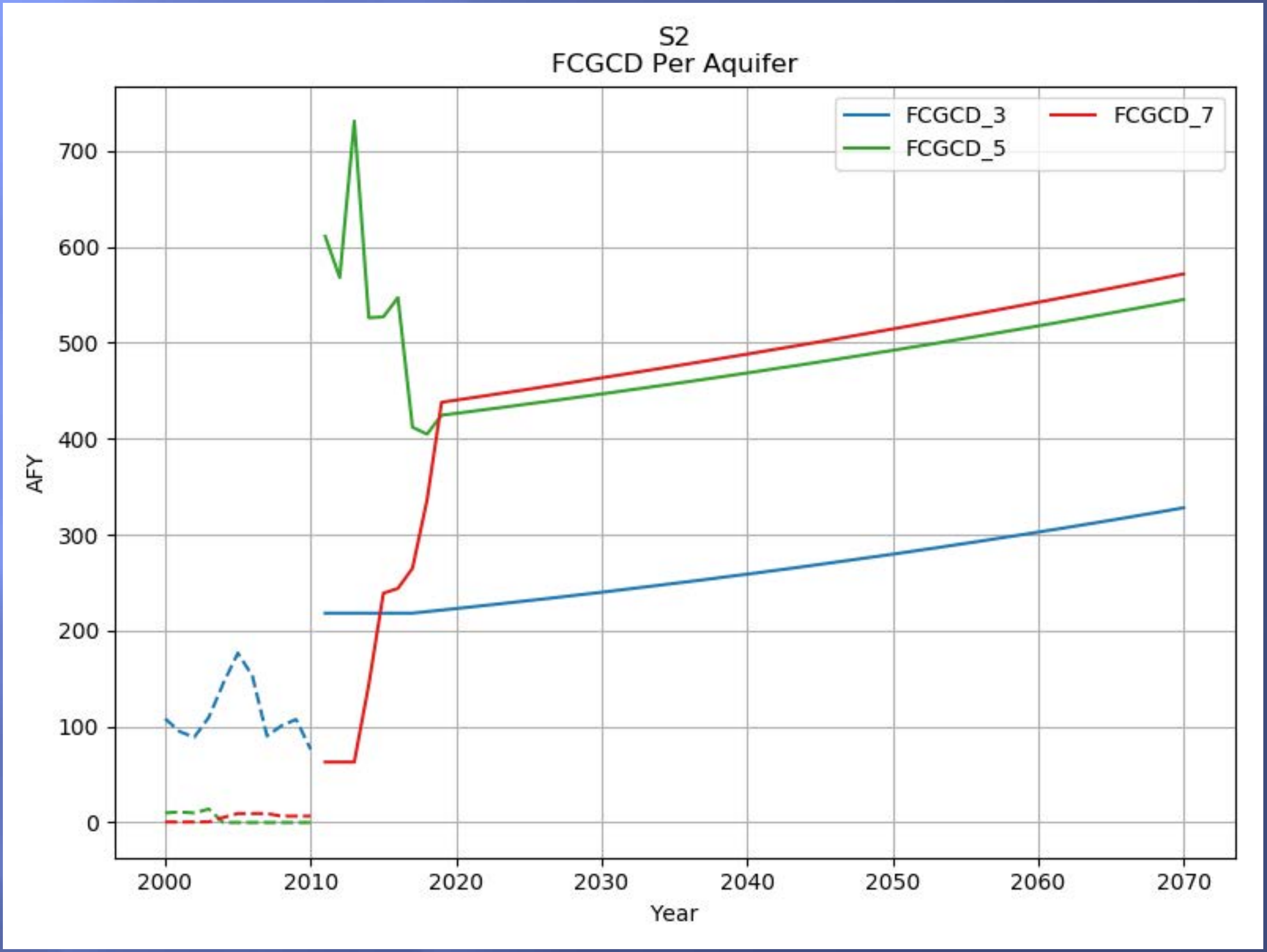
2050
2060
2070
Year
FCGCD_3
FCGCD_5
FCGCD_7


S2
FCGCD Per Aquifer
FCGCD_3
FCGCD_5
FCGCD_7
AFY
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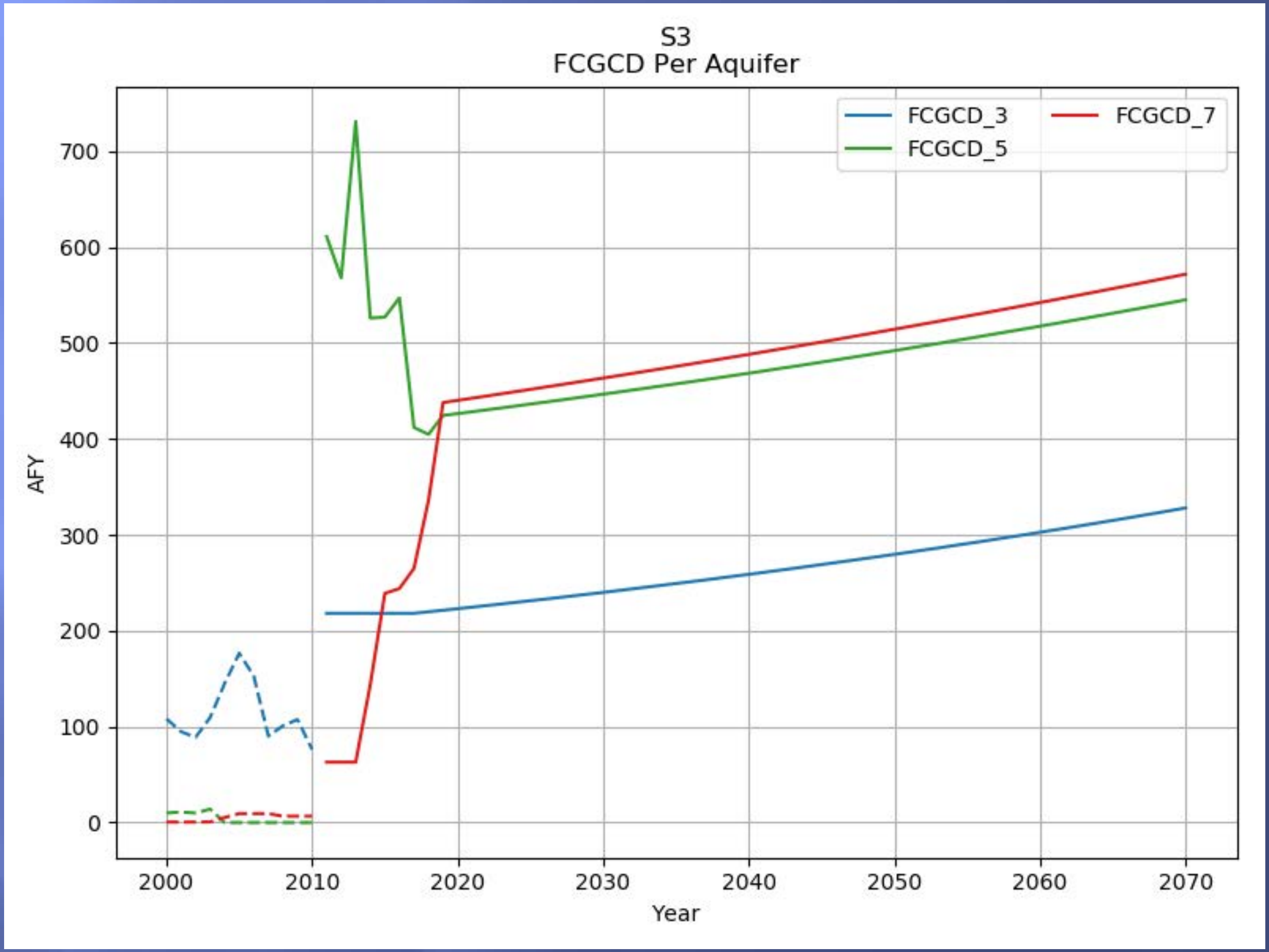
2000
2010
2020
2030
2040
2050
2060
2070
Year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FCGCD Per Aquifer
FCGCD_3
FCGCD_5
FCGCD_7
AFY
Year
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100
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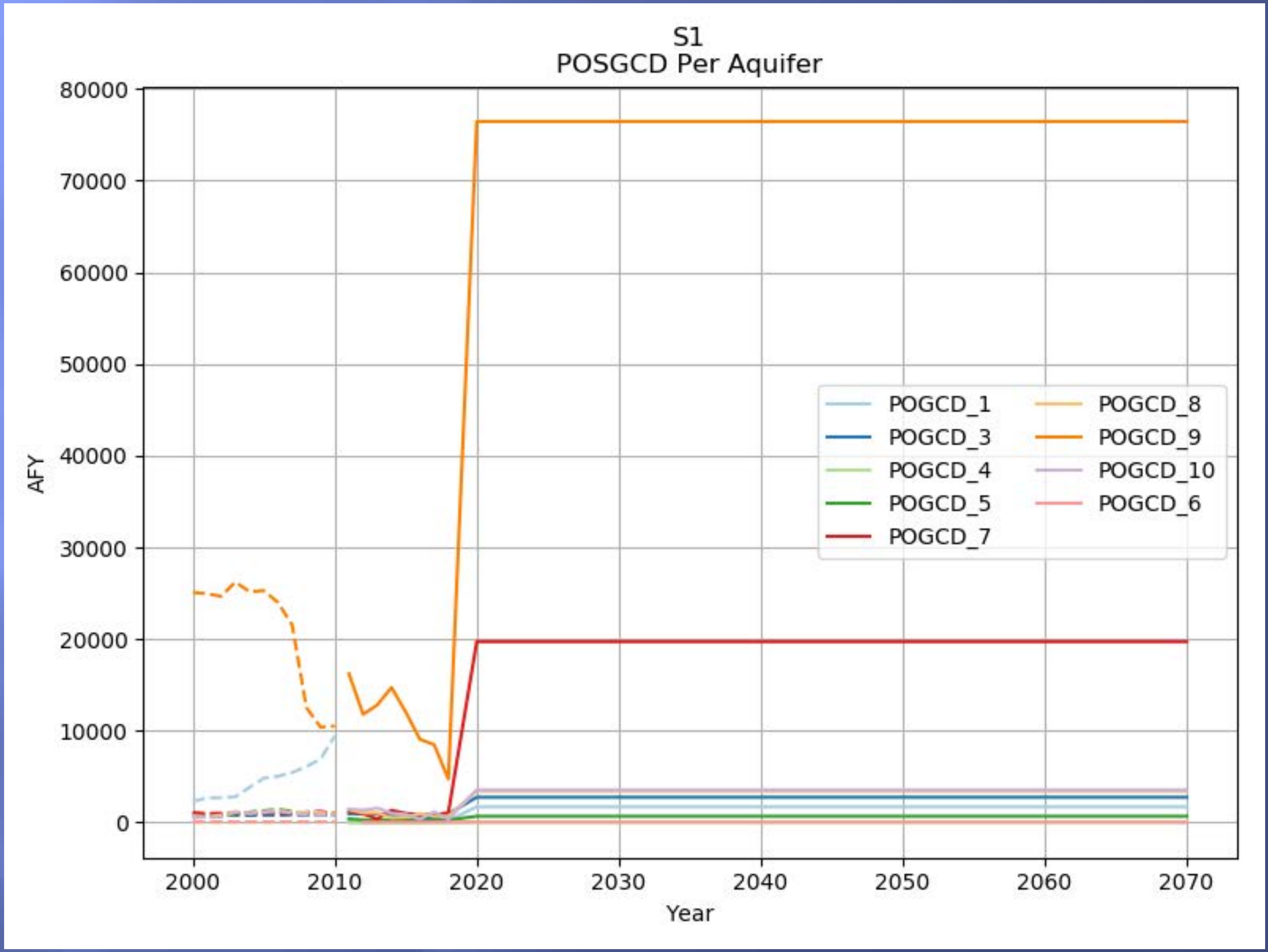
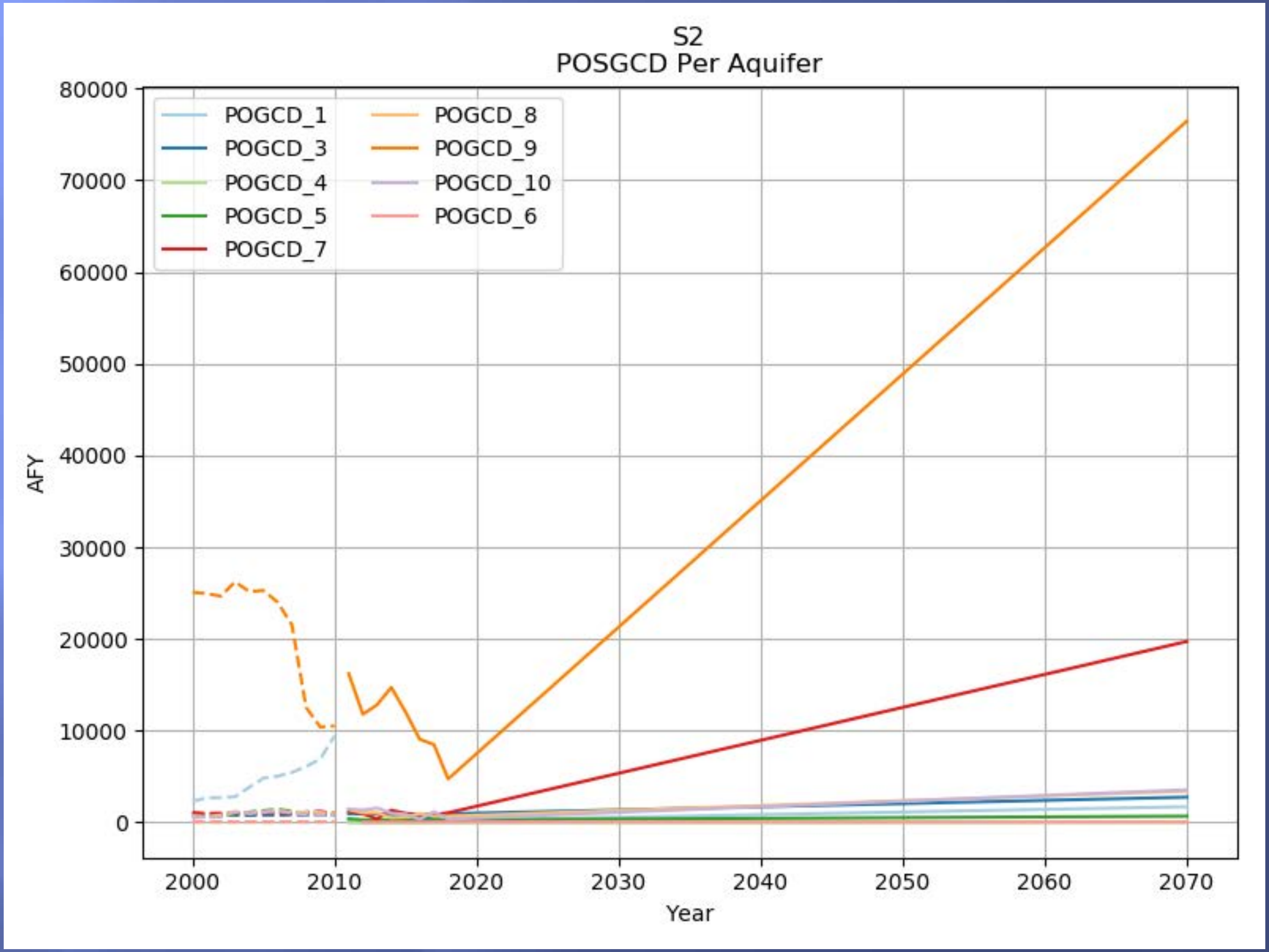
600
700
2000
2010
2020
2030
2040
2050
2060
2070

Post Oak Savannah GCD



S1
POSGCD Per Aquifer
80000
70000
60000
50000
40000
30000
20000
10000
0
AFY
2000
2010
2020
2030
2040
2050
2060
2070
Year
POGCD_1
POGCD_3
POGCD_4
POGCD_5
POGCD_7
POGCD_8
POGCD_9
POGCD_10
POGCD_6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POSGCD Per Aquifer
POGCD_1
POGCD_3
POGCD_4
POGCD_5
POGCD_7
POGCD_8
POGCD_9
POGCD_10
POGCD_6
AFY
Year
80000
70000
60000
50000
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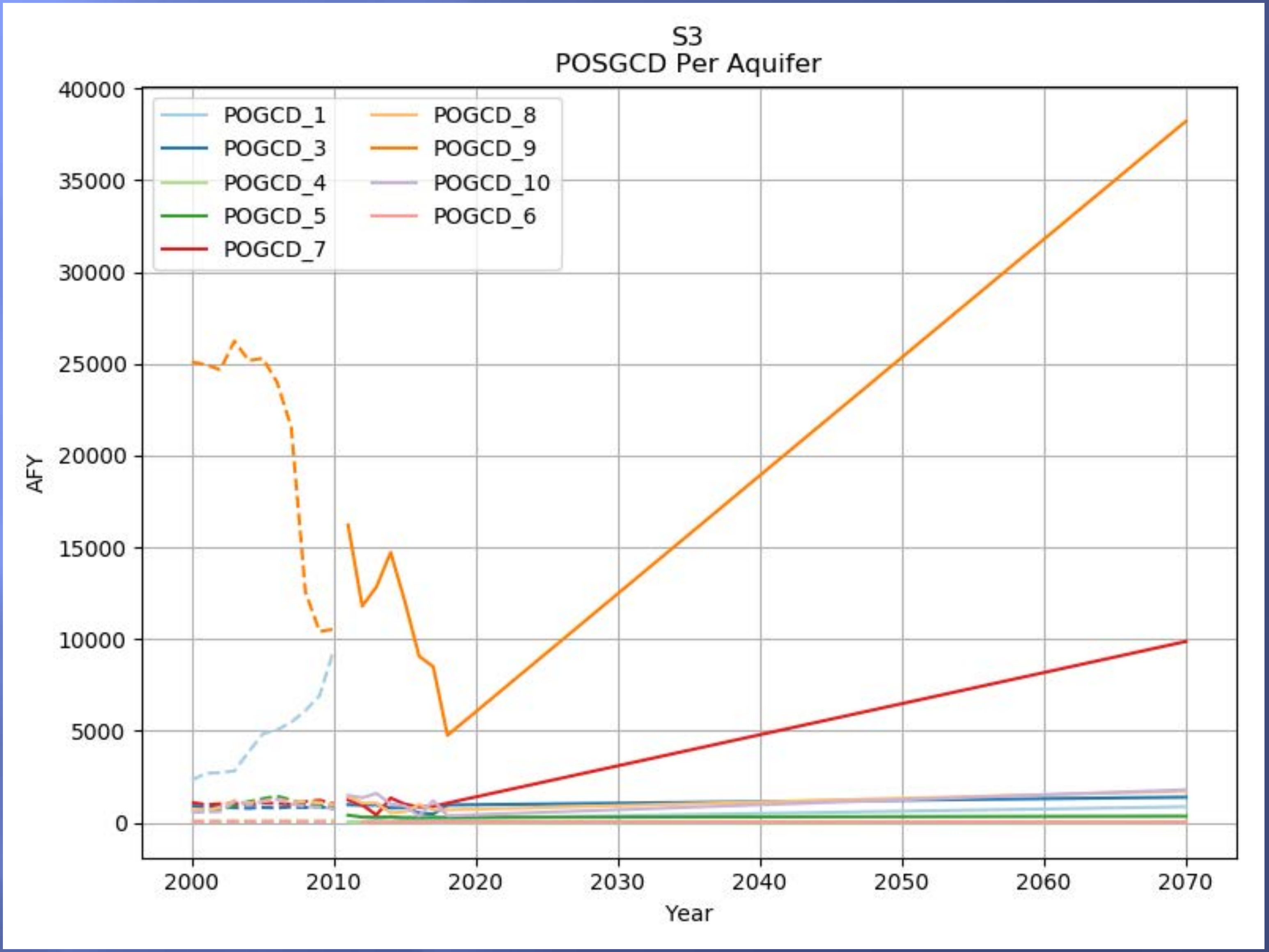
30000
20000
10000
0
2000
2010
2020
2030
2040
2050
2060
2070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POSGCD Per Aquifer
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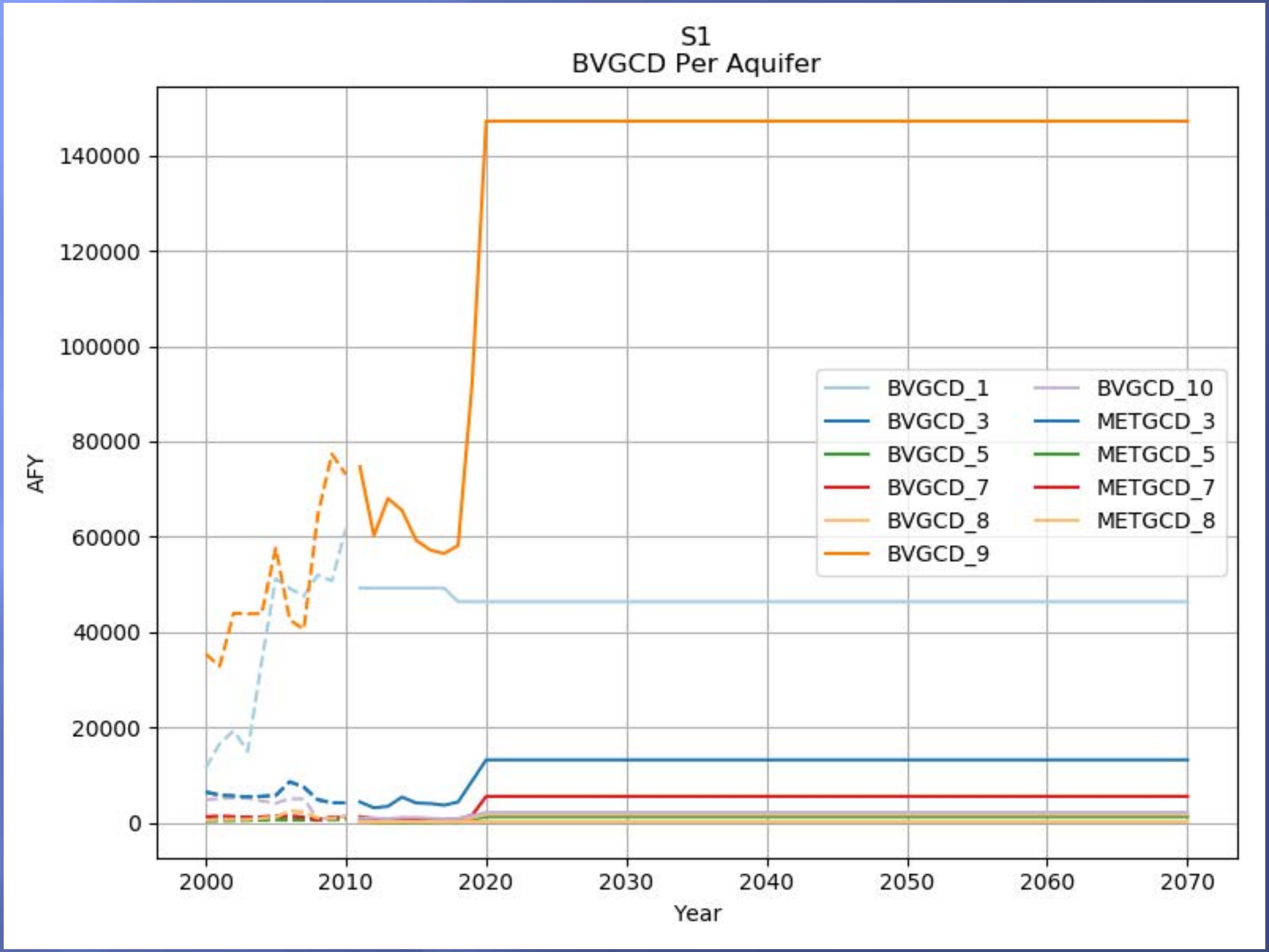
15000
10000
5000
0
AFY
2000
2010
2020
2030
2040
2050
2060
2070
Year
POGCD_1
POGCD_3
POGCD_4
POGCD_5
POGCD_7
POGCD_8
POGCD_9
POGCD_10
POGCD_6

Brazos Valley GCD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BVGCD Per Aquifer
AFY
Year
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20000
40000
60000
80000
100000
120000
140000
2000
2010
2020
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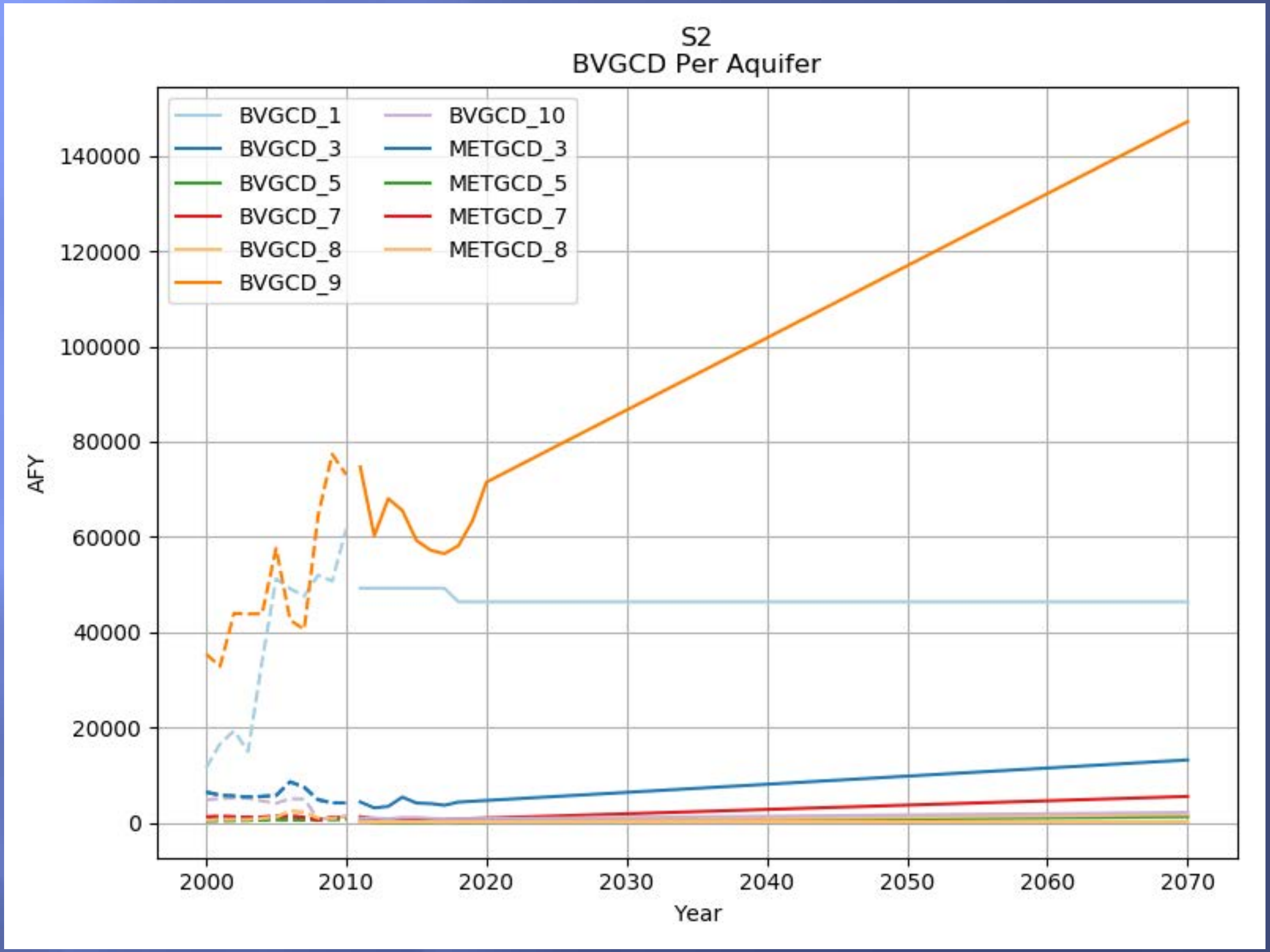
2040
2050
2060
2070
BVGCD_1
BVGCD_3
BVGCD_5
BVGCD_7
BVGCD_8
BVGCD_9
BVGCD_10
METGCD_3
METGCD_5
METGCD_7
METGCD_8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BVGCD Per Aquifer
BVGCD_1
BVGCD_3
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BVGCD_7
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METGCD_3
METGCD_5
METGCD_7
METGCD_8
AFY
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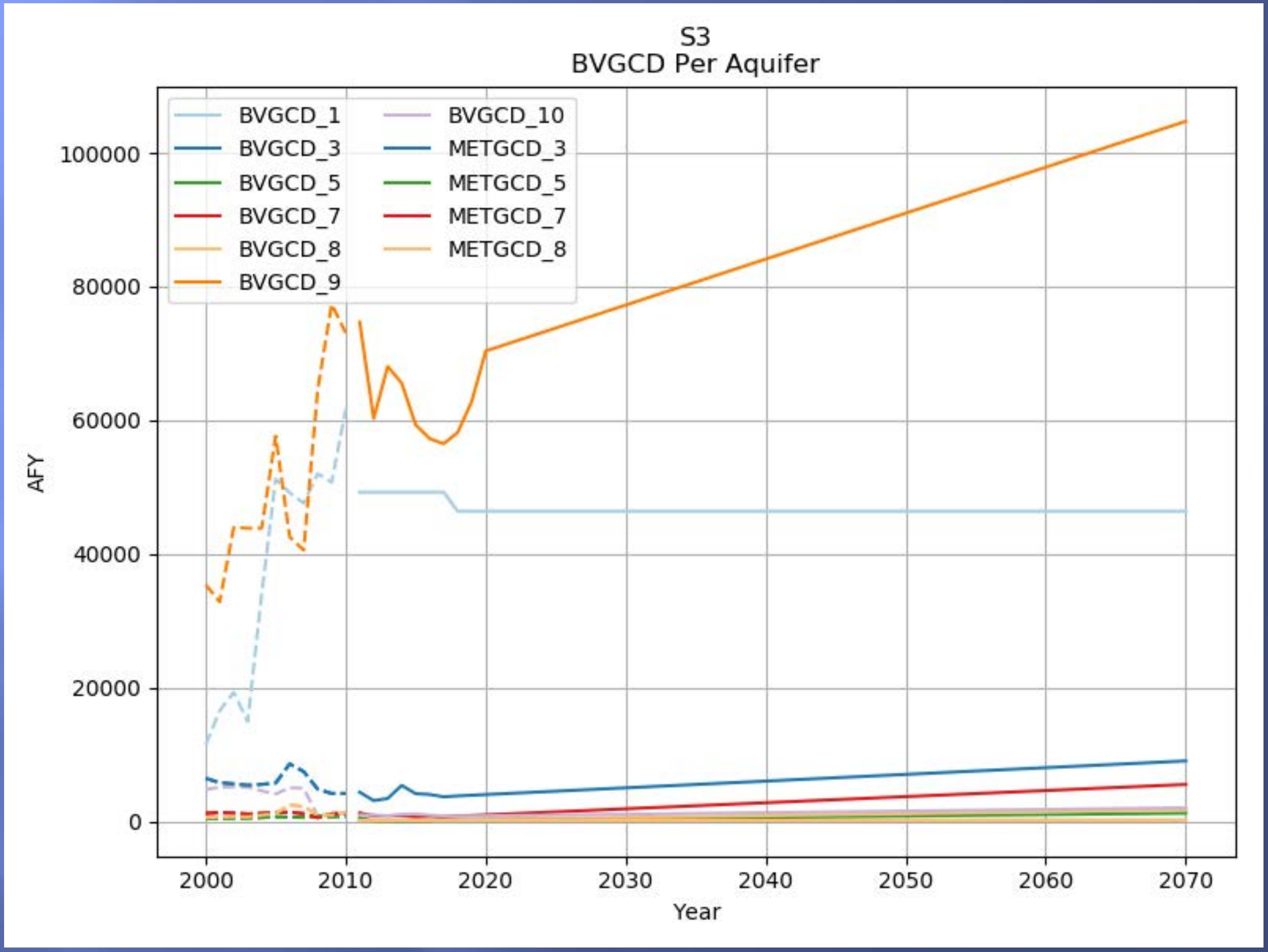
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BVGCD Per Aquifer
BVGCD_1
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BVGCD_10
METGCD_3
METGCD_5
METGCD_7
METGCD_8
AFY
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Year
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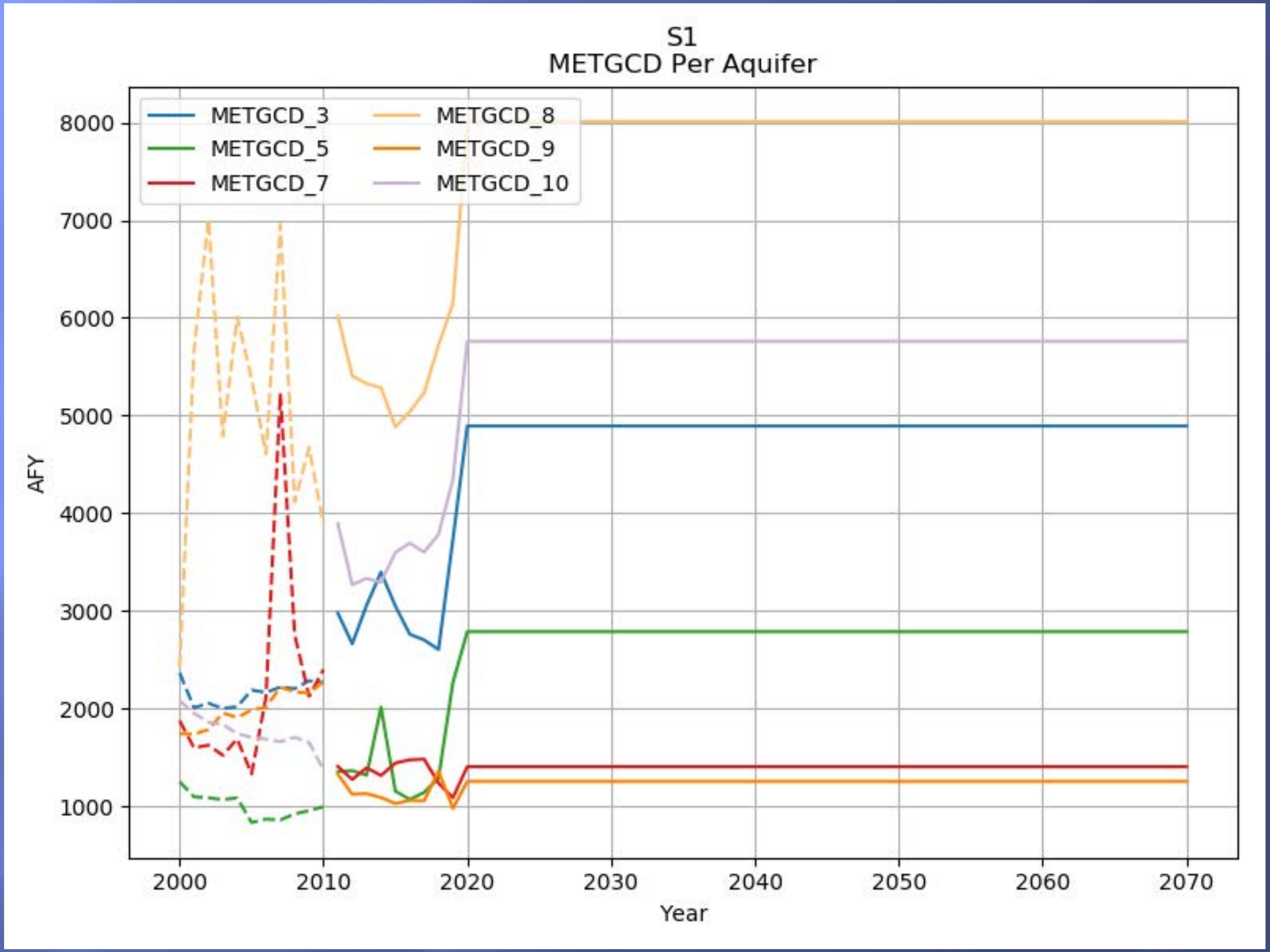
2050
2060
2070

Mid-East Texas GCD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METGCD Per Aquifer
METGCD_3
METGCD_5
METGCD_7
METGCD_8
METGCD_9
METGCD_10
AFY
Year
8000
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6000
5000
4000
3000
2000
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2000
2010
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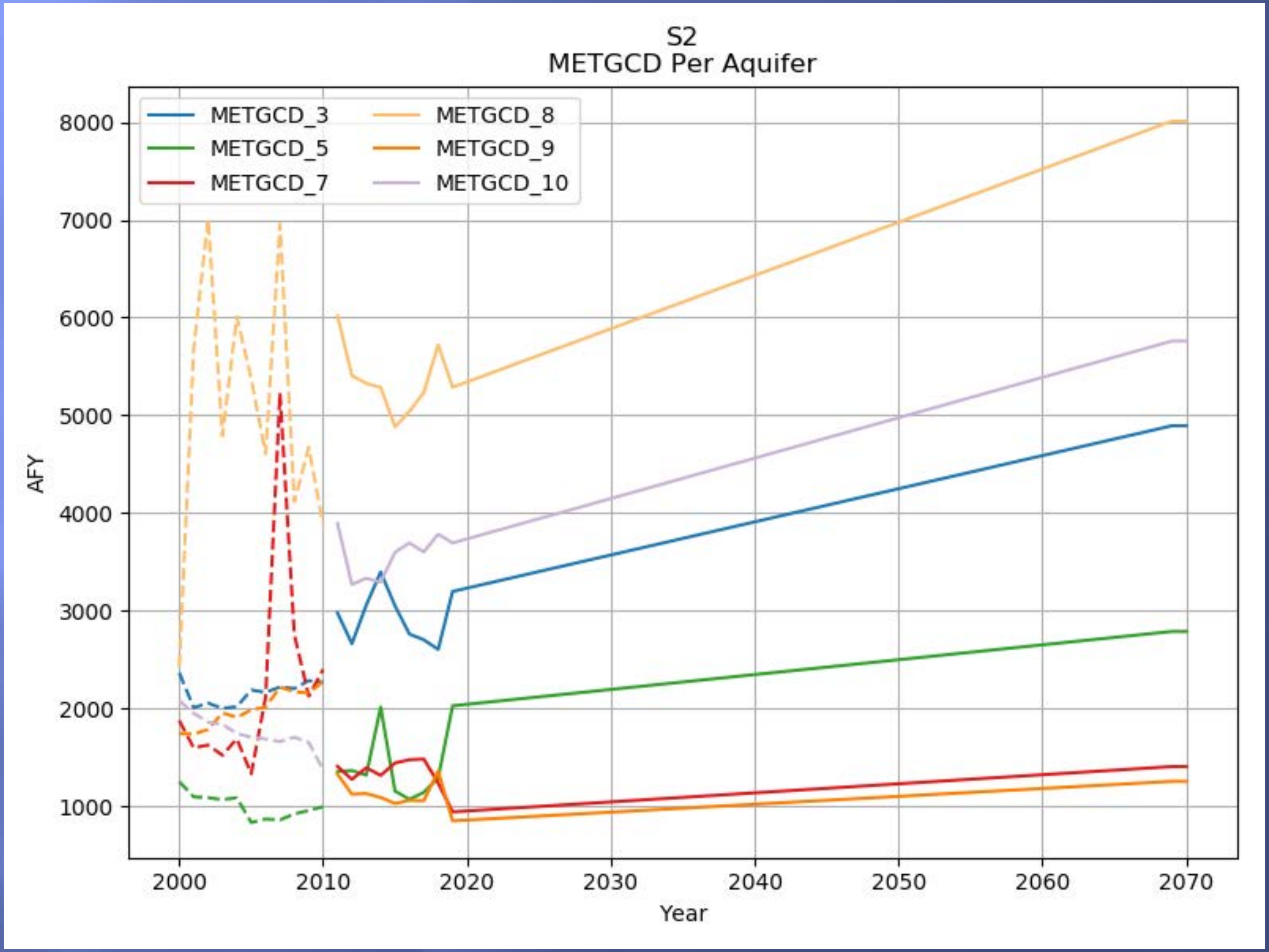
2030
2040
2050
2060
2070


S2
METGCD Per Aquifer
METGCD_3
METGCD_5
METGCD_7
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METGCD_10
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AFY
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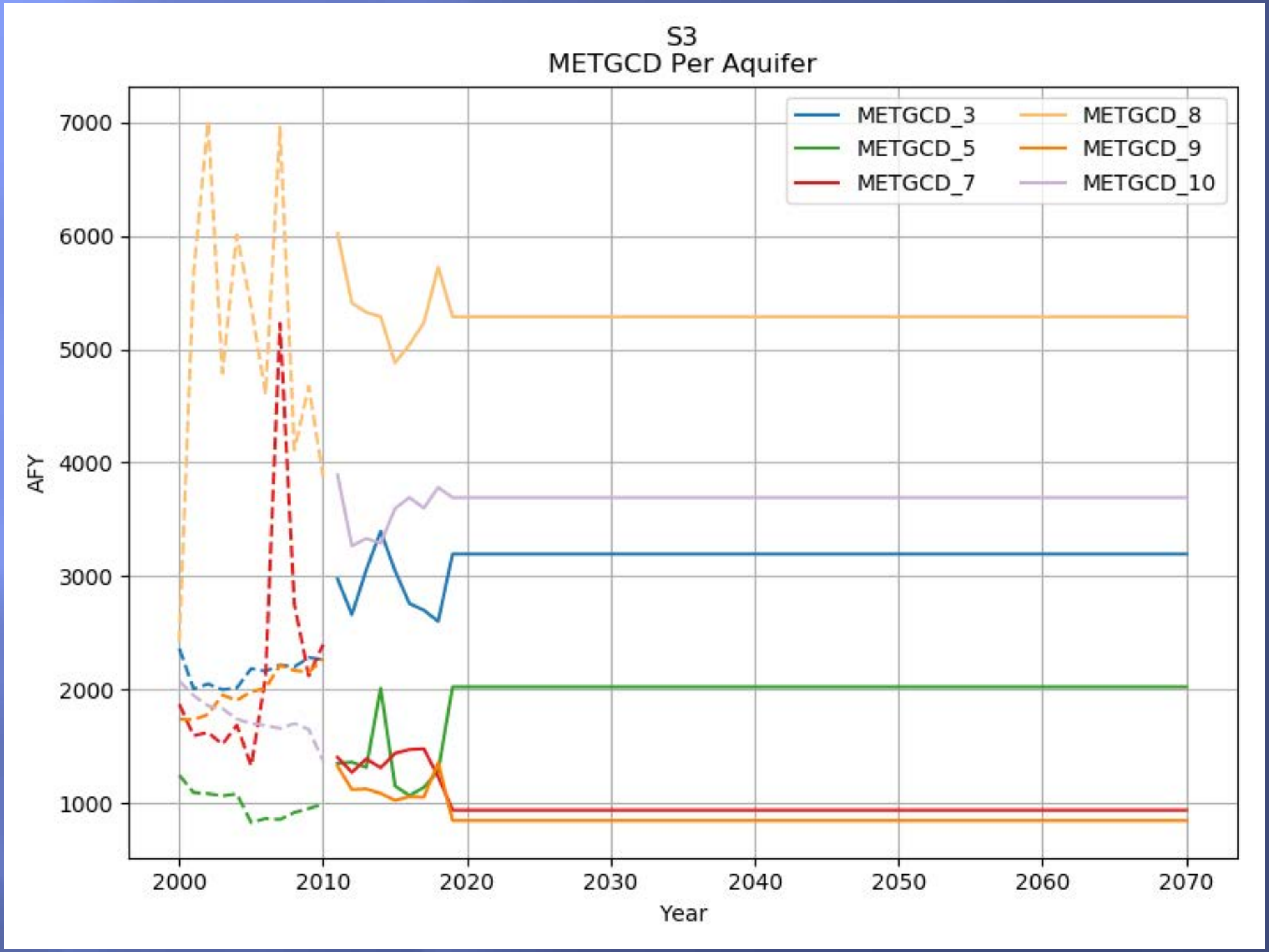
2030
2040
2050
2060
2070
Year


S3
METGCD Per Aquifer
METGCD_3
METGCD_5
METGCD_7
METGCD_8
METGCD_9
METGCD_10
AFY
Year
7000
6000
5000
4000
3000
2000
1000
2000
2010
2020
2030
2040
2050
2060
2070

Results

- Impact of including drought
- Results of each run

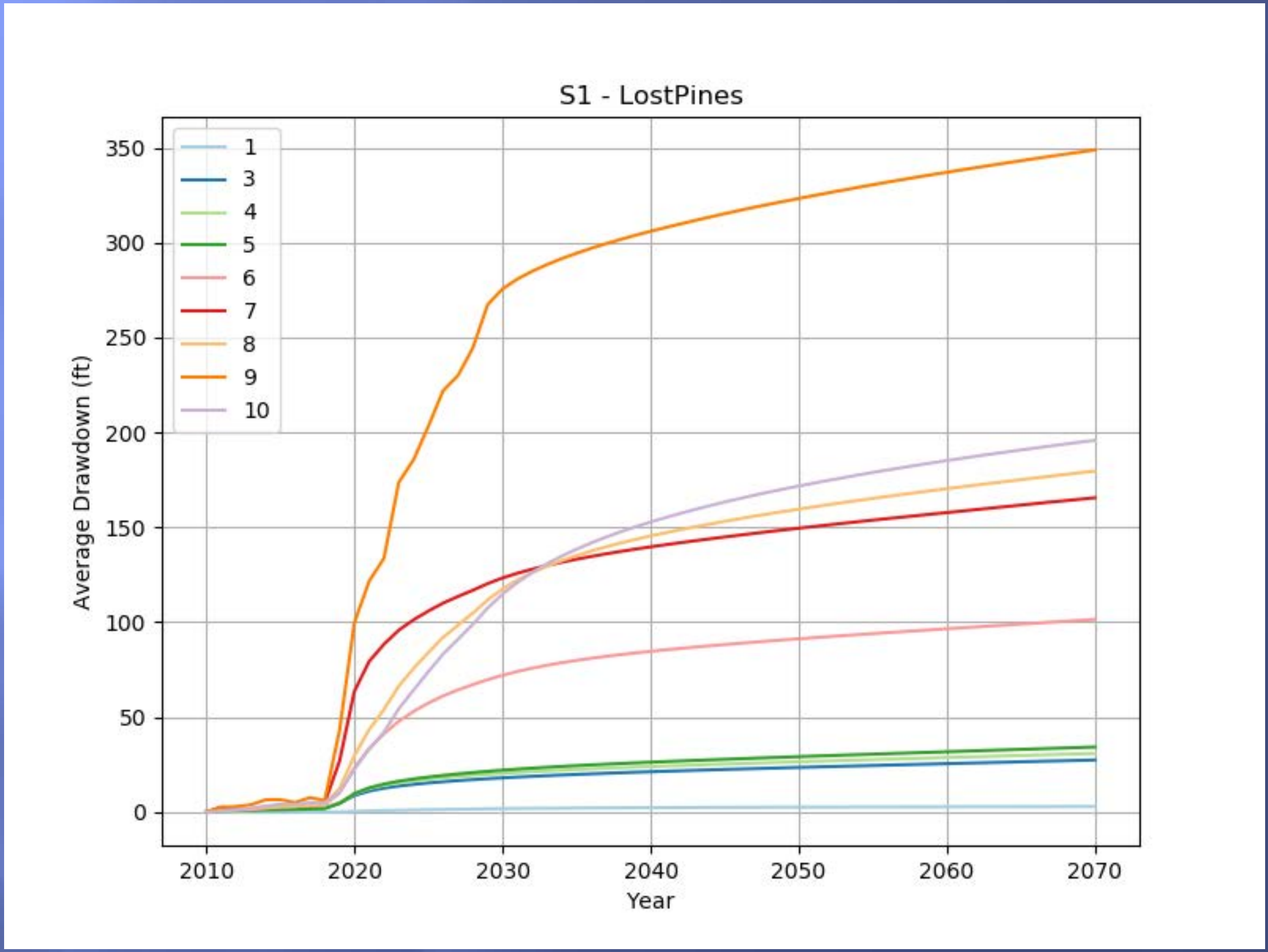
Drought Impact

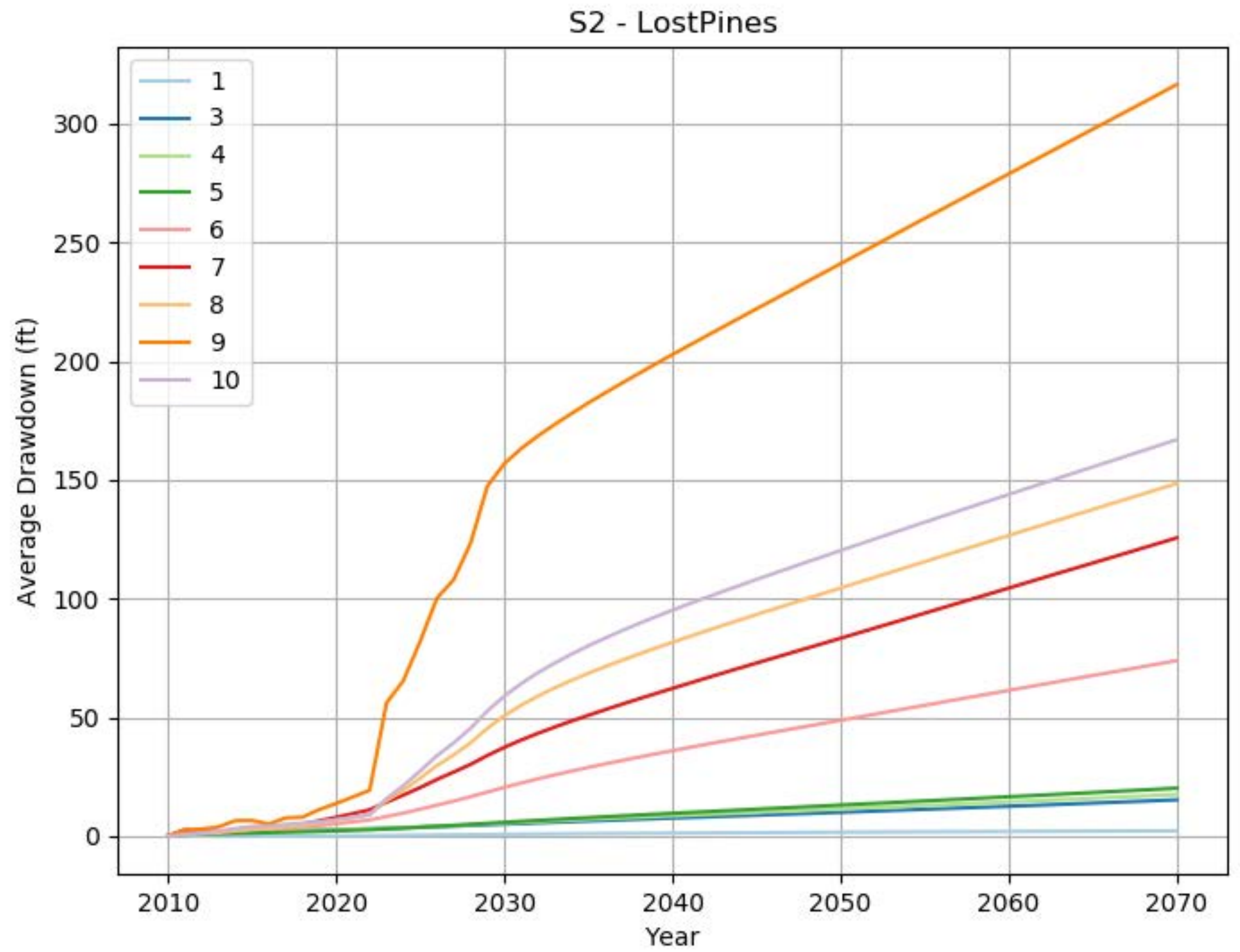
	S-1 Drawdown (feet)		S-2 Drawdown (feet)		S-3 Drawdown (feet)	
	Without Drought	With Drought	Without Drought	With Drought	Without Drought	With Drought
Sparta	27	28	15	16	11	12
Queen City	34	35	20	21	14	16
Carrizo	166	167	126	127	73	74
Calvert Bluff	180	181	148	149	81	82
Simsboro	349	350	317	317	161	162
Hooper	196	197	167	168	88	89

Lost Pines GCD Results

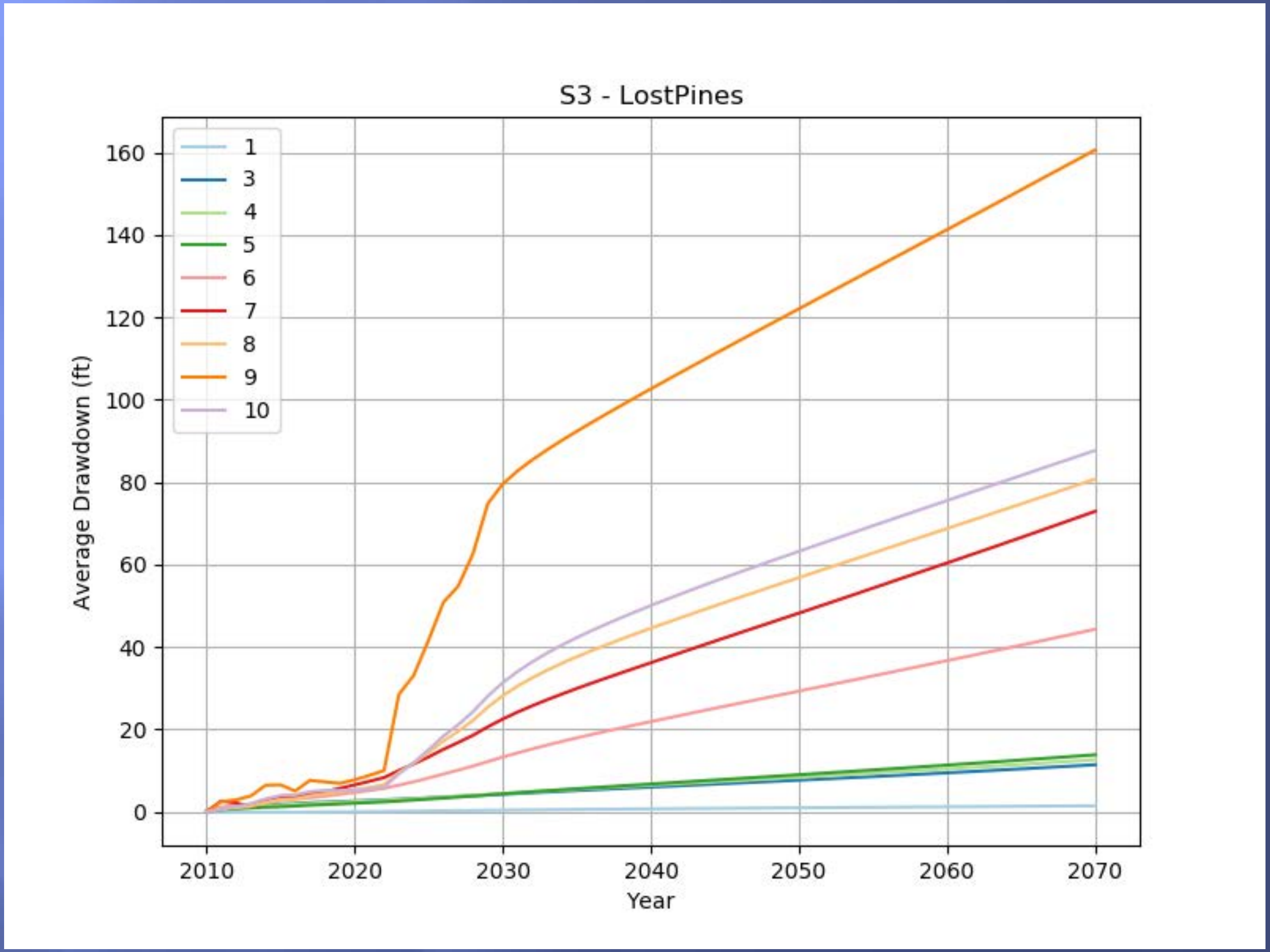
Drawdowns from Runs S-1, S-2, and S-3

Lost Pines GCD


S1 - LostPines
Average Drawdown (ft)
Year
0
50
100
150
200
250
300
350
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10



S2 - LostPines
Average Drawdown (ft)
Year
0
50
100
150
200
250
300
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10



S3 - LostPines
Average Drawdown (ft)
Year
0
20
40
60
80
100
120
140
160
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10

Lost Pines- S-1

	Current DFC (feet)	Current MAG in 2070	S-1 Drawdown in 2070 (feet)	S-1 Pumpage in 2070 (acre-feet)
Sparta	5	2,393	27	3,840
Queen City	15	1,315	34	3,491
Carrizo	62	12,052	166	20,936
Calvert Bluff	100	3,984	180	7,344
Simsboro	240	30,303	349	137,243
Hooper	165	1,255	196	3,273

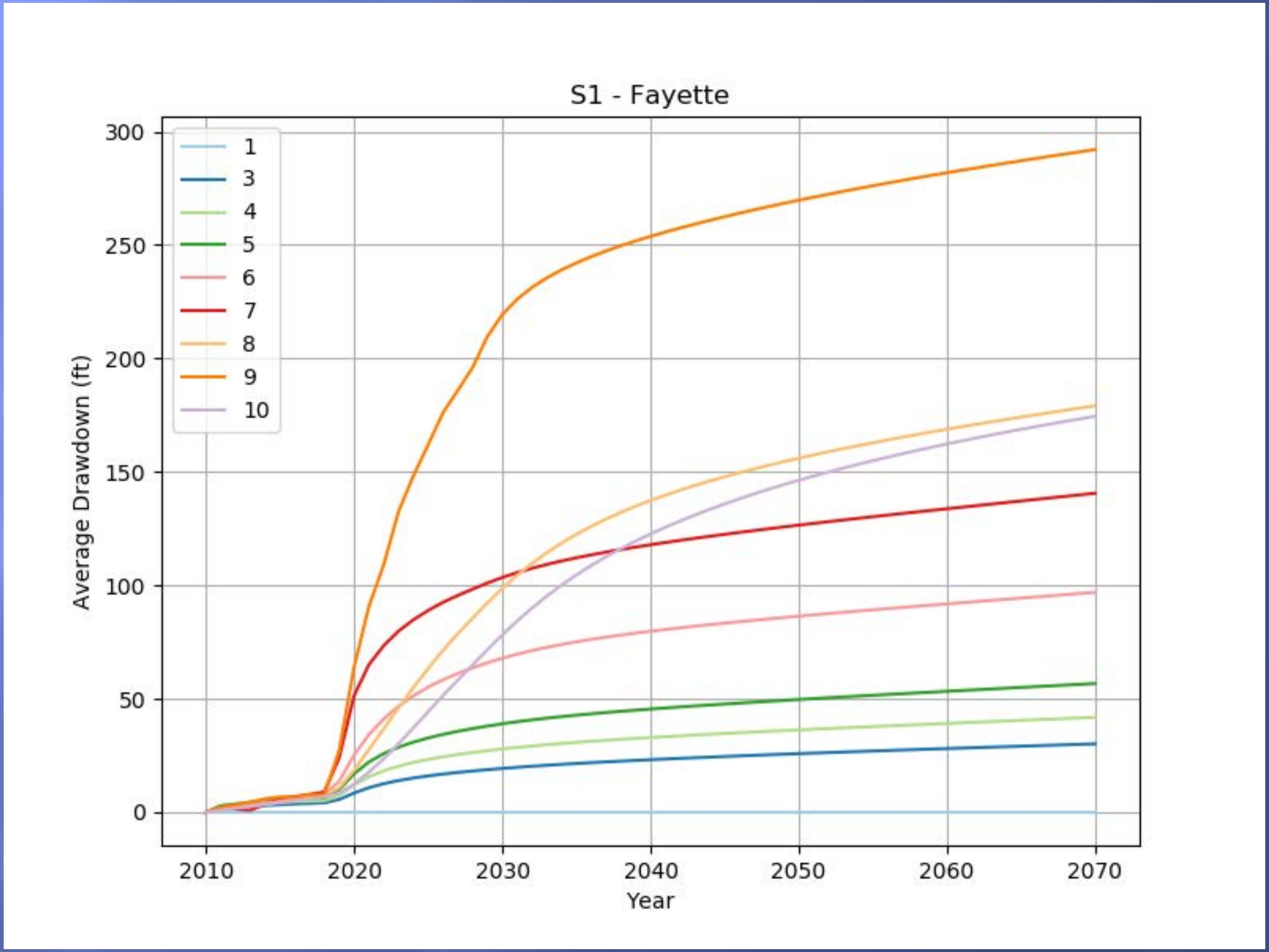
Lost Pines- S-2

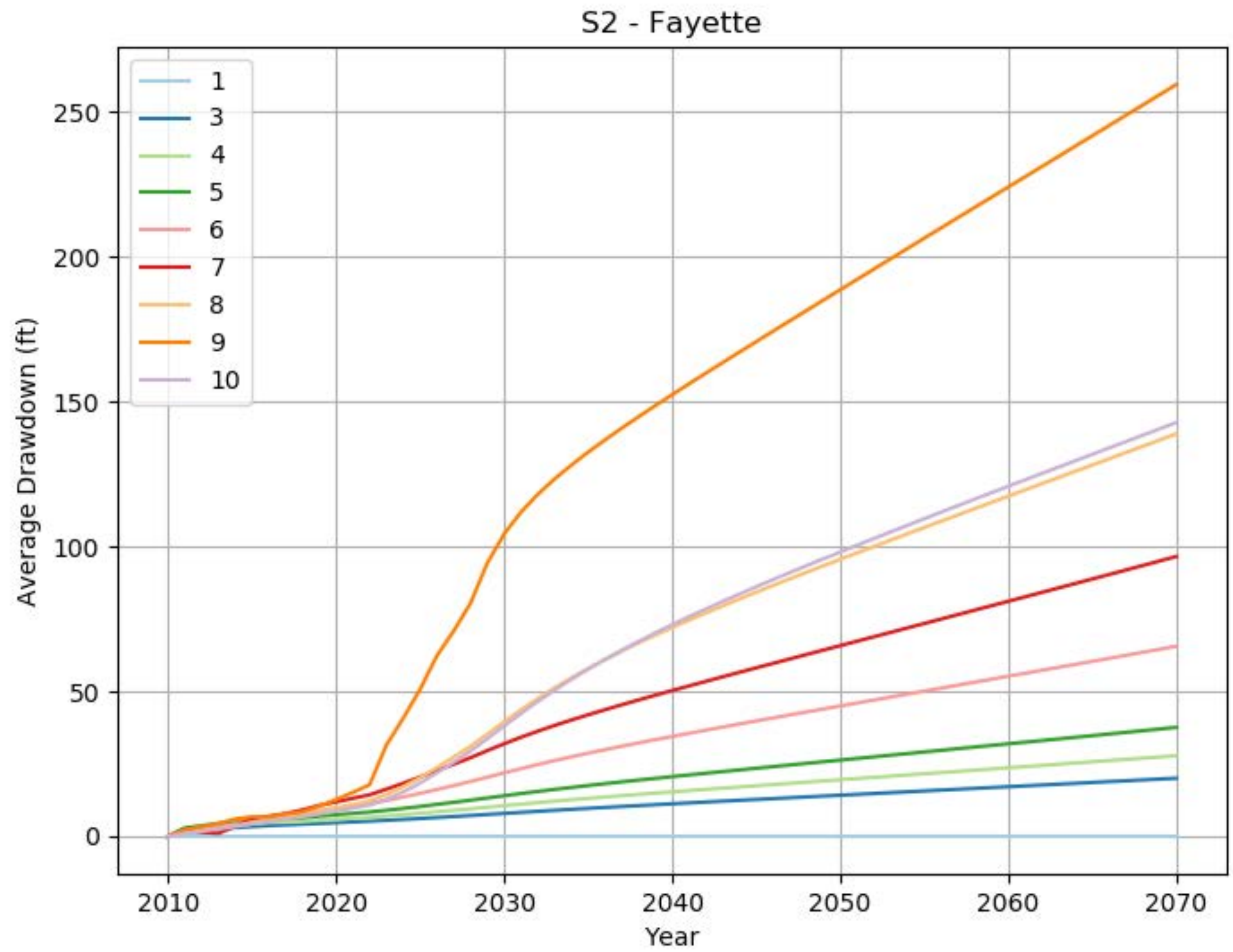
	Current DFC (feet)	Current MAG in 2070	S-2 Drawdown in 2070 (feet)	S-2 Pumpage in 2070 (acre-feet)
Sparta	5	2,393	15	2,766
Queen City	15	1,315	20	1,744
Carrizo	62	12,052	126	12,981
Calvert Bluff	100	3,984	148	5,563
Simsboro	240	30,303	317	125,769
Hooper	165	1,255	167	3,273

Lost Pines- S-3

	Current DFC (feet)	Current MAG in 2070	S-3 Drawdown in 2070 (feet)	S-3 Pumpage in 2070 (acre-feet)
Sparta	5	2,393	11	2,710
Queen City	15	1,315	14	1,744
Carrizo	62	12,052	73	10,837
Calvert Bluff	100	3,984	81	4,047
Simsboro	240	30,303	161	71,295
Hooper	165	1,255	88	2,732

Fayette County GCD


S1 - Fayette
Average Drawdown (ft)
Year
0
50
100
150
200
250
300
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10


S2 - Fayette
Average Drawdown (ft)
Year
0
50
100
150
200
250
2010
2020
2030
2040
2050
2060
2070
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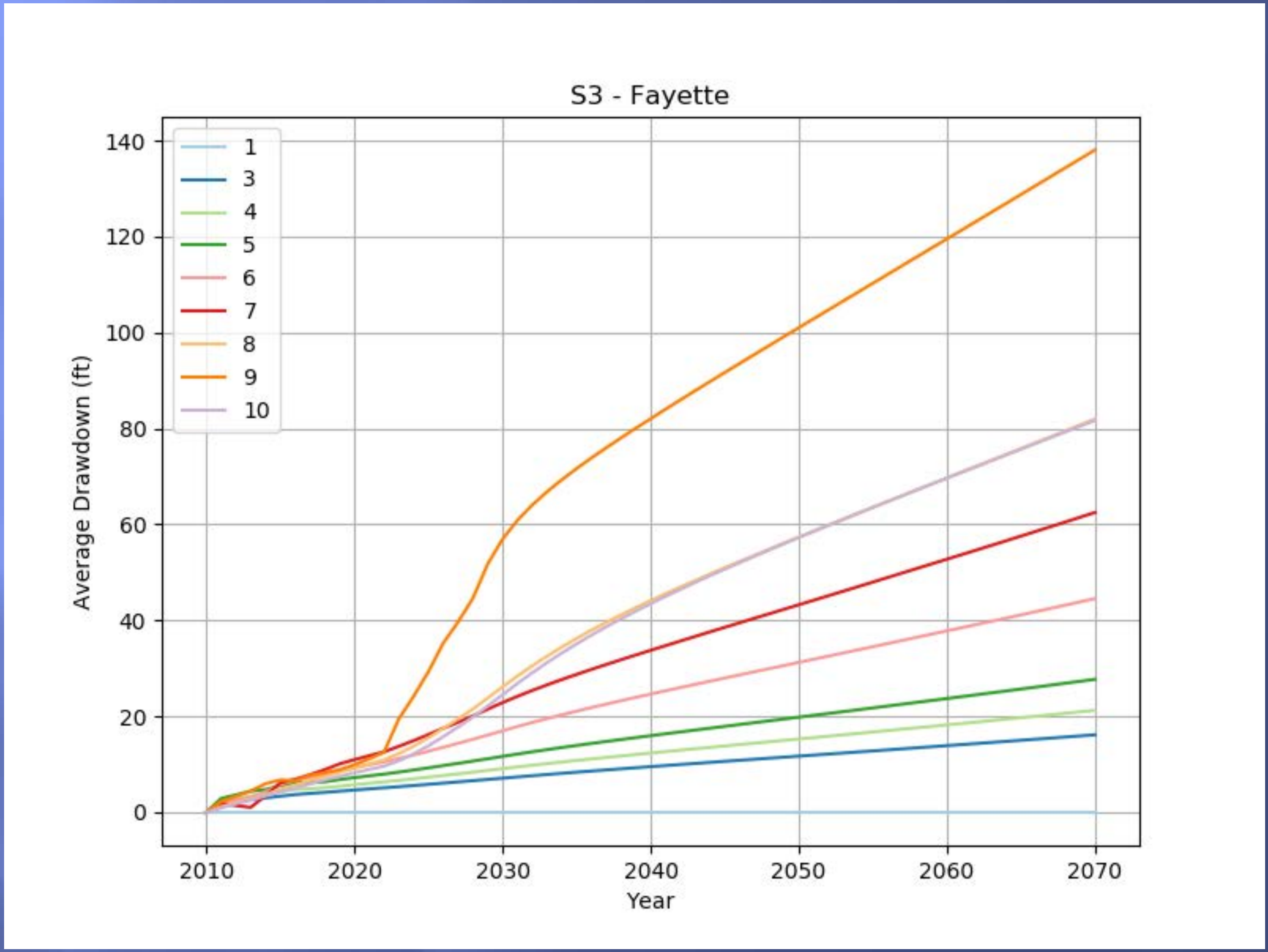
6
7
8
9
10


S3 - Fayette
Average Drawdown (ft)
Year
0
20
40
60
80
100
120
140
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10

Fayette- S-1

	Current DFC (feet)	Current MAG in 2070	S-1 Drawdown in 2070 (feet)	S-1 Pumpage in 2070 (acre-feet)
Sparta	47	2,802	30	328
Queen City	64	2,708	57	545
Carrizo	110	5,474	141	3,163
Calvert Bluff	--	--	--	--
Simsboro	--	--	--	--
Hooper	--	--	--	--

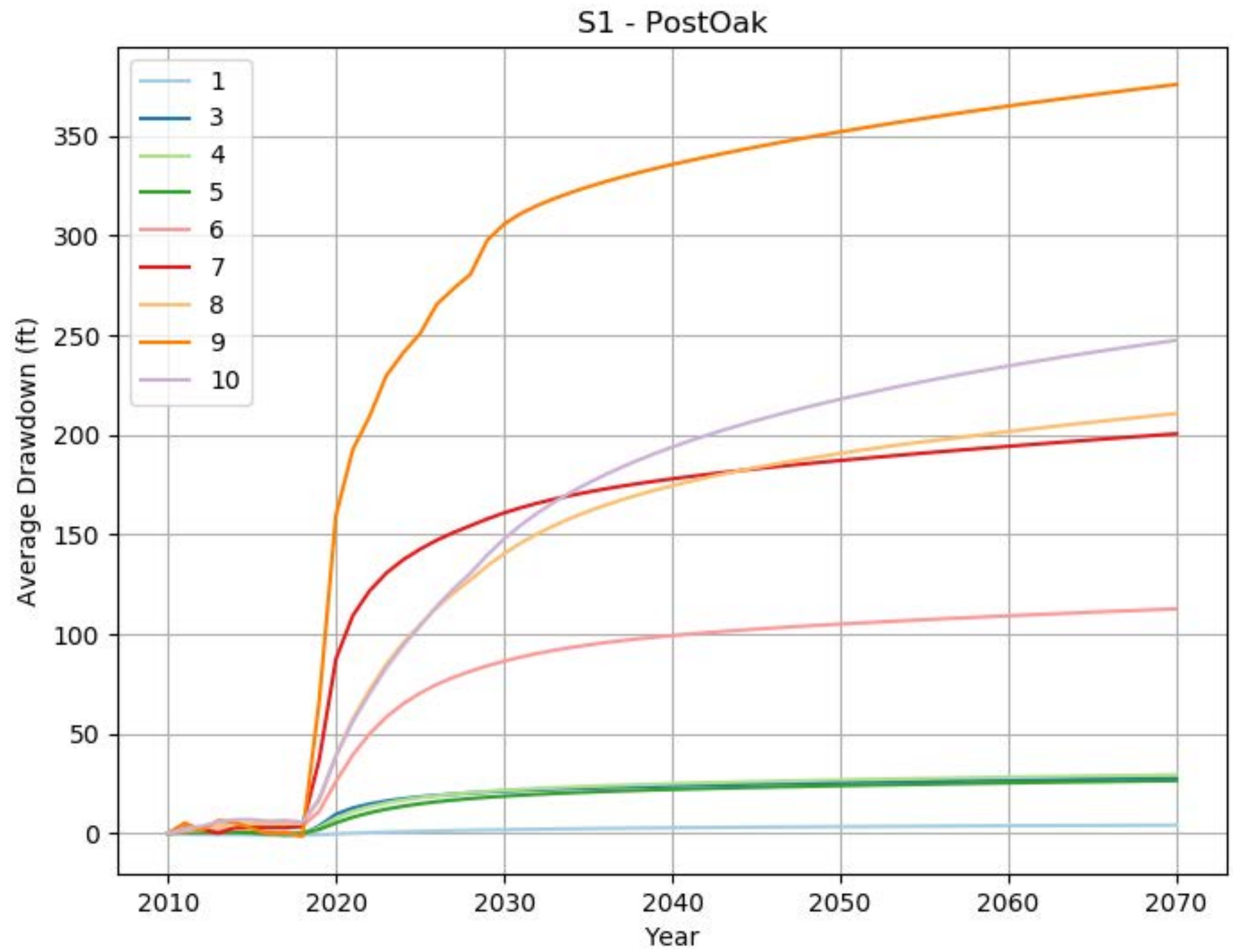
Fayette- S-2

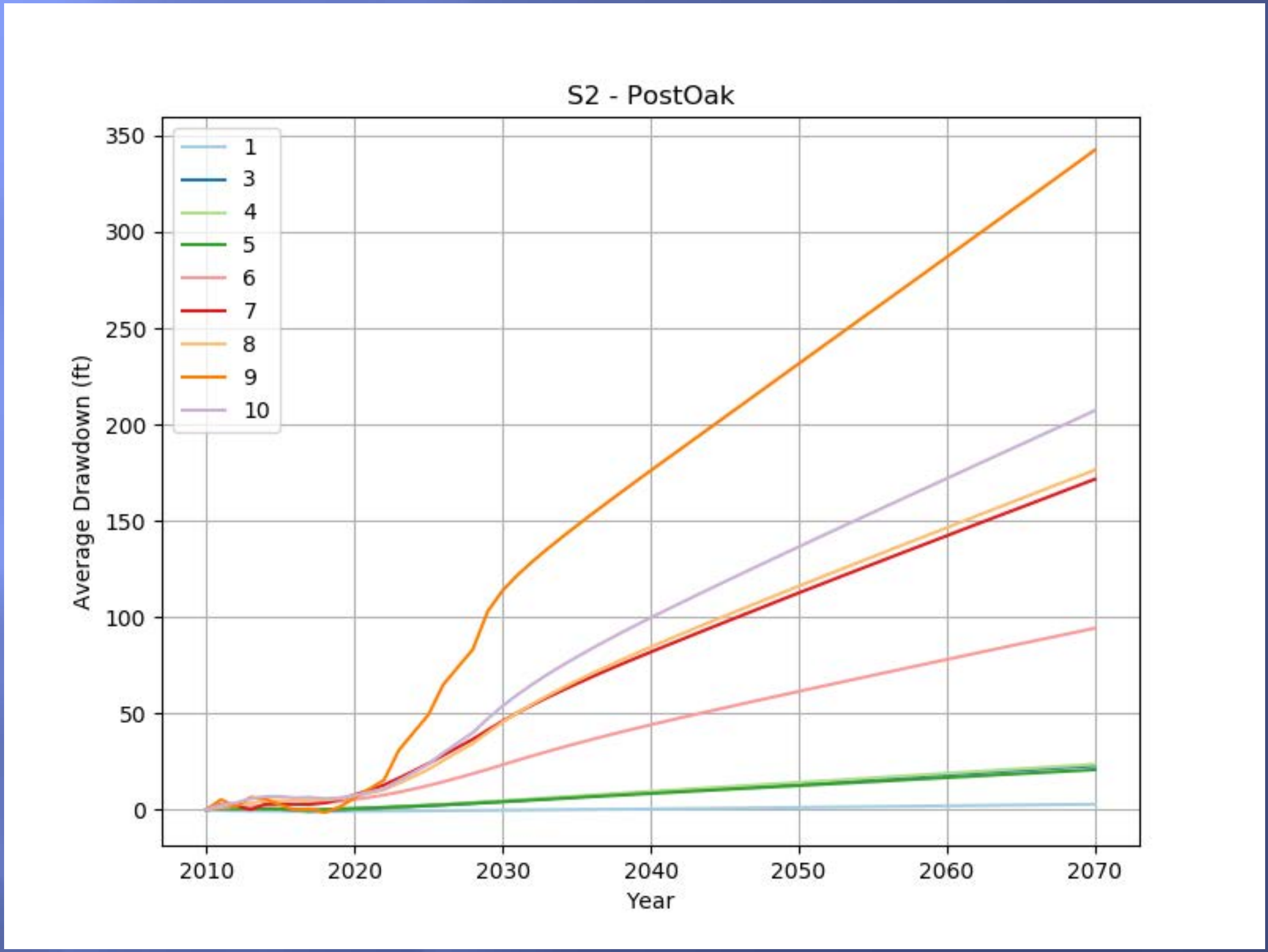
	Current DFC (feet)	Current MAG in 2070	S-2 Drawdown in 2070 (feet)	S-2 Pumpage in 2070 (acre-feet)
Sparta	47	2,802	20	328
Queen City	64	2,708	38	545
Carrizo	110	5,474	96	572
Calvert Bluff	--	--	--	--
Simsboro	--	--	--	--
Hooper	--	--	--	--

Fayette- S-3

	Current DFC (feet)	Current MAG in 2070	S-3 Drawdown in 2070 (feet)	S-3 Pumpage in 2070 (acre-feet)
Sparta	47	2,802	16	328
Queen City	64	2,708	28	545
Carrizo	110	5,474	63	572
Calvert Bluff	--	--	--	--
Simsboro	--	--	--	--
Hooper	--	--	--	--

Post Oak Savannah GCD


S1 - PostOak
1
3
4
5
6
7
8
9
10
350
300
250
200
150
100
50
0
Average Drawdown (ft)
2010
2020
2030
2040
2050
2060
2070
Year


S2 - PostOak
Average Drawdown (ft)
Year
0
50
100
150
200
250
300
350
2010
2020
2030
2040
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7
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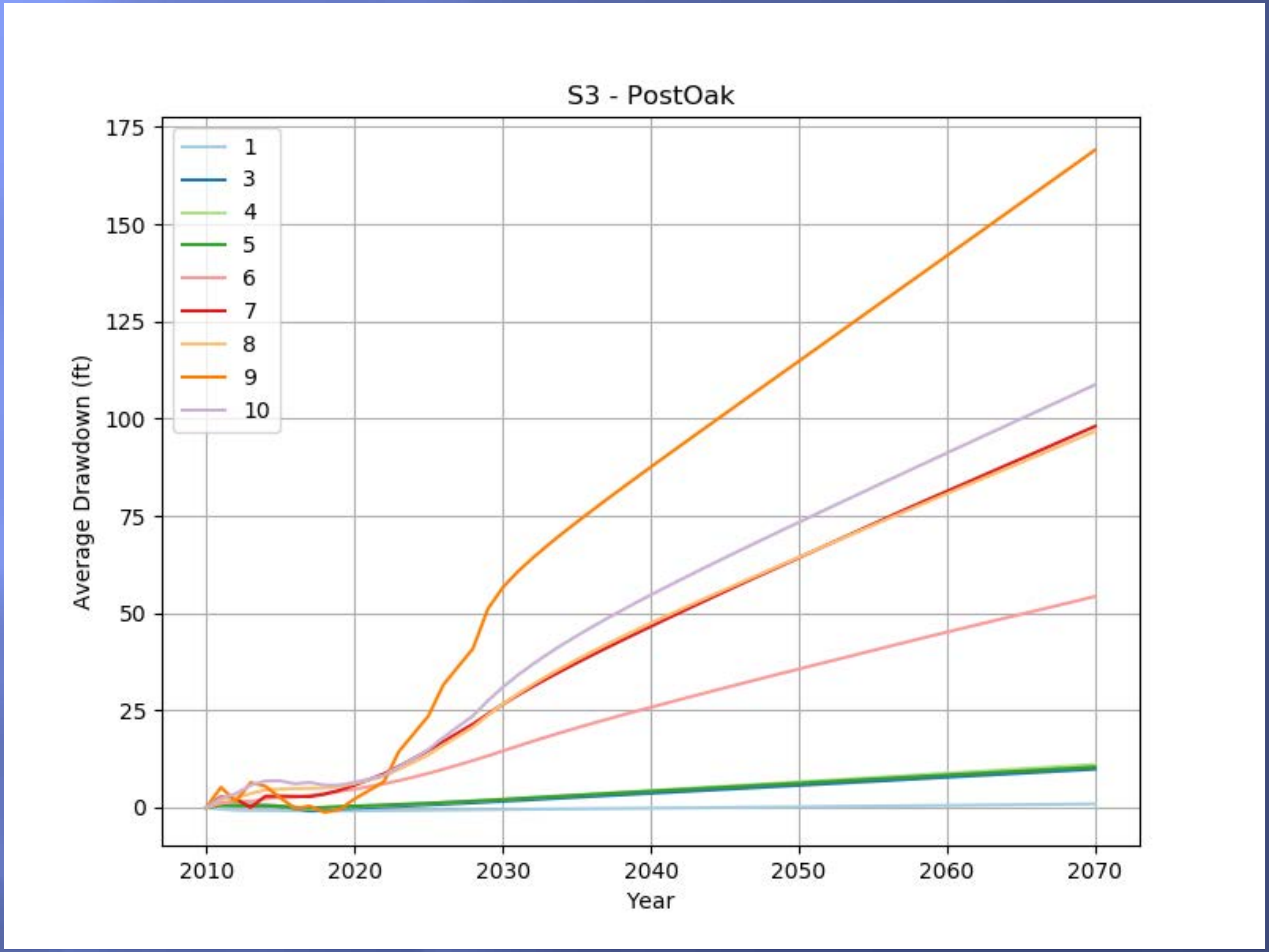

S3 - PostOak
Average Drawdown (ft)
Year
1
3
4
5
6
7
8
9
10
0
25
50
75
100
125
150
175
2010
2020
2030
2040
2050
2060
2070

Post Oak Savannah- S-1

	Current DFC (feet)	Current MAG in 2070	S-1 Drawdown in 2070 (feet)	S-1 Pumpage in 2070 (acre-feet)
Sparta	28	6,735	28	2,764
Queen City	30	504	26	691
Carrizo	67	7,058	201	19,734
Calvert Bluff	149	1,036	211	3,420
Simsboro	318	48,503	376	76,450
Hooper	205	4,422	247	3,563

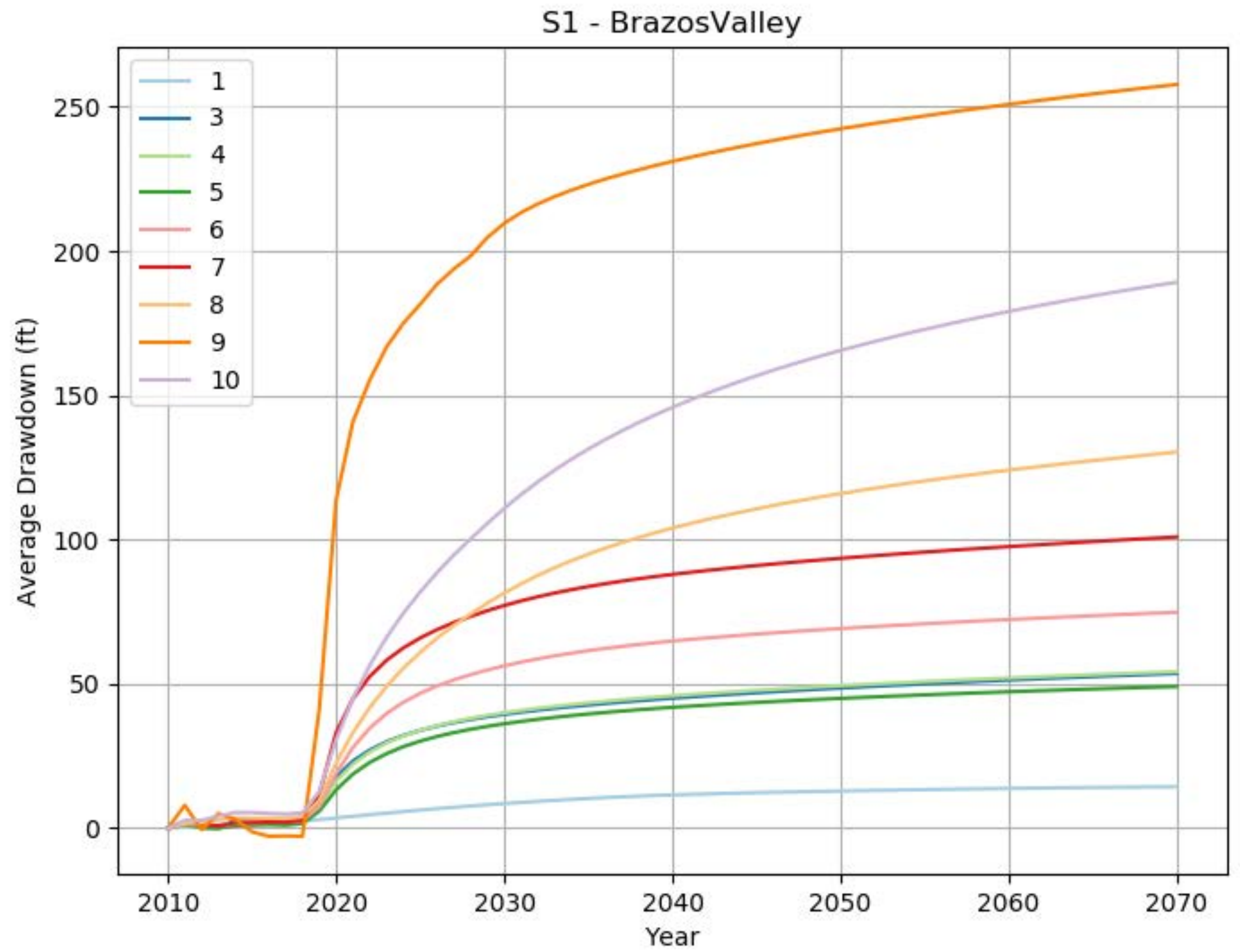
Post Oak Savannah- S-2

	Current DFC (feet)	Current MAG in 2070	S-2 Drawdown in 2070 (feet)	S-2 Pumpage in 2070 (acre-feet)
Sparta	28	6,735	23	2,764
Queen City	30	504	21	691
Carrizo	67	7,058	172	19,734
Calvert Bluff	149	1,036	176	3,420
Simsboro	318	48,503	342	76,450
Hooper	205	4,422	207	3,563

Post Oak Savannah- S-3

	Current DFC (feet)	Current MAG in 2070	S-3 Drawdown in 2070 (feet)	S-3 Pumpage in 2070 (acre-feet)
Sparta	28	6,735	10	1,382
Queen City	30	504	11	345
Carrizo	67	7,058	99	9,867
Calvert Bluff	149	1,036	98	1,710
Simsboro	318	48,503	170	38,225
Hooper	205	4,422	110	1,782

Brazos Valley GCD



S1 - BrazosValley
Average Drawdown (ft)
Year
0
50
100
150
200
250
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
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7
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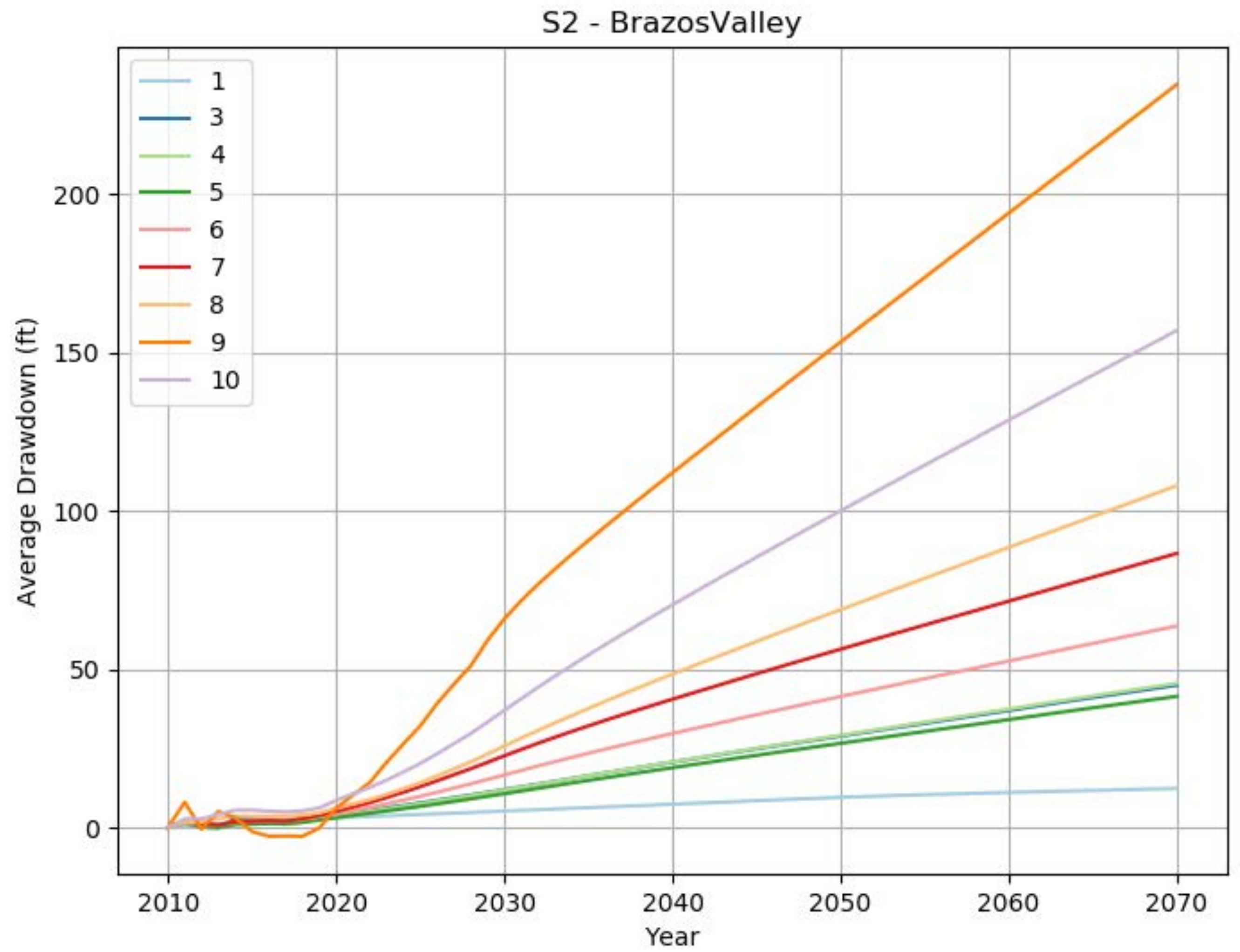

S2 - BrazosValley
Average Drawdown (ft)
Year
0
50
100
150
200
2010
2020
2030
2040
2050
2060
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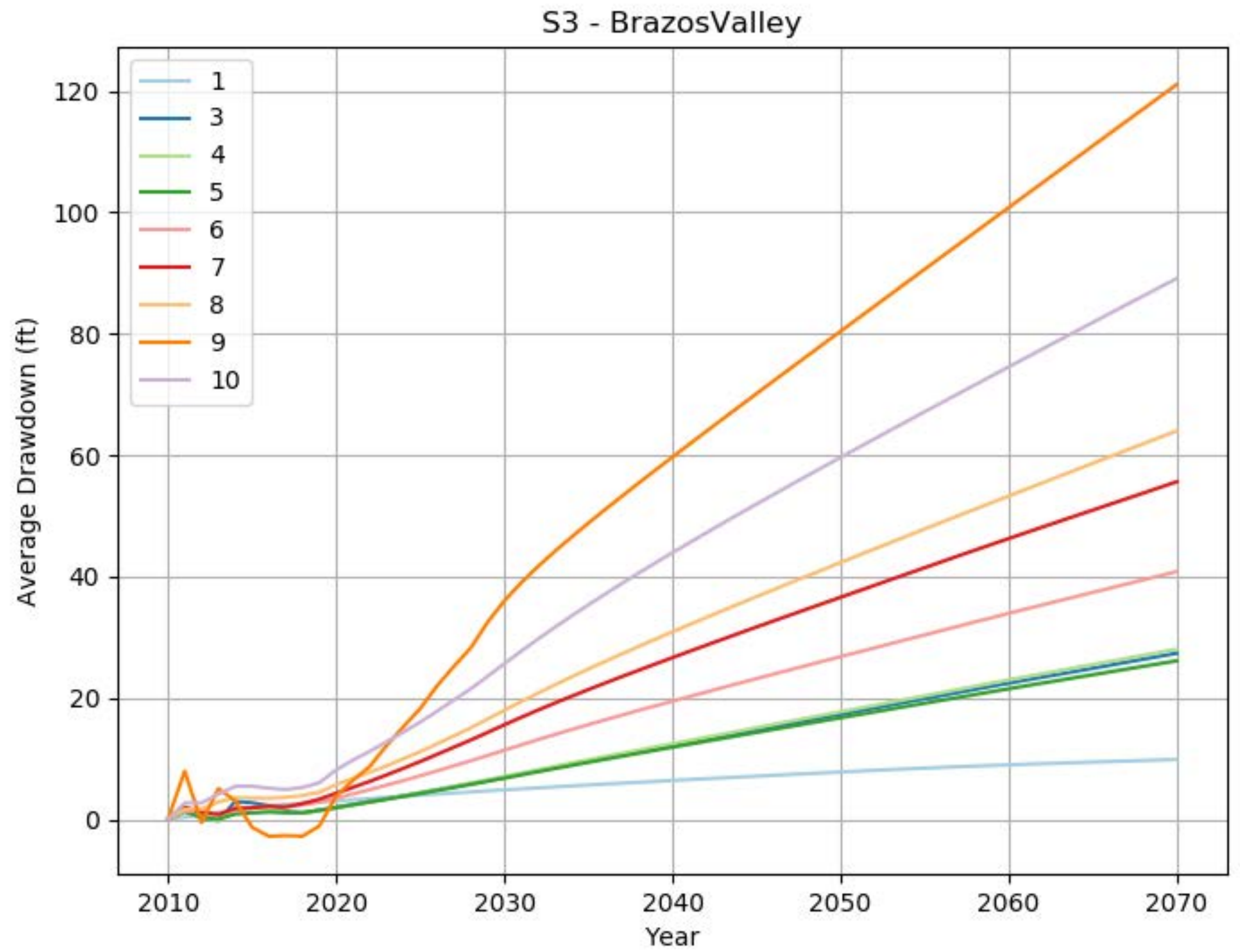
6
7
8
9
10


S3 - BrazosValley
Average Drawdown (ft)
Year
1
3
4
5
6
7
8
9
10
0
20
40
60
80
100
120
2010
2020
2030
2040
2050
2060
2070

Brazos Valley - S-1

	Current DFC (feet)	Current MAG in 2070	S-1 Drawdown in 2070 (feet)	S-1 Pumpage in 2070 (acre-feet)
Sparta	12	9,019	54	13,161
Queen City	12	1,200	49	1,269
Carrizo	61	5,494	101	5,498
Calvert Bluff	125	1,757	130	1,726
Simsboro	295	96,198	258	147,235
Hooper	207	2,000	189	2,139

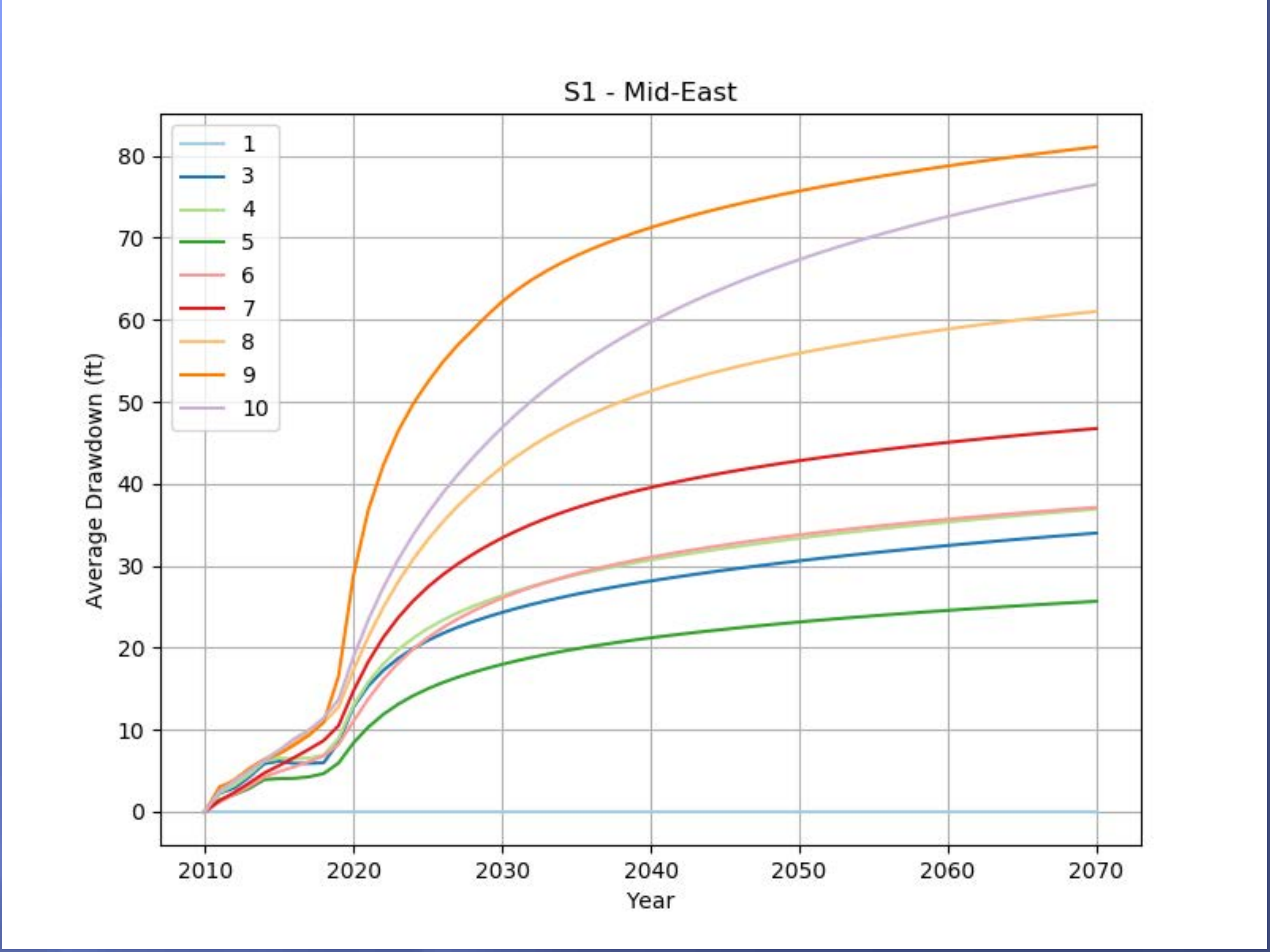
Brazos Valley - S-2

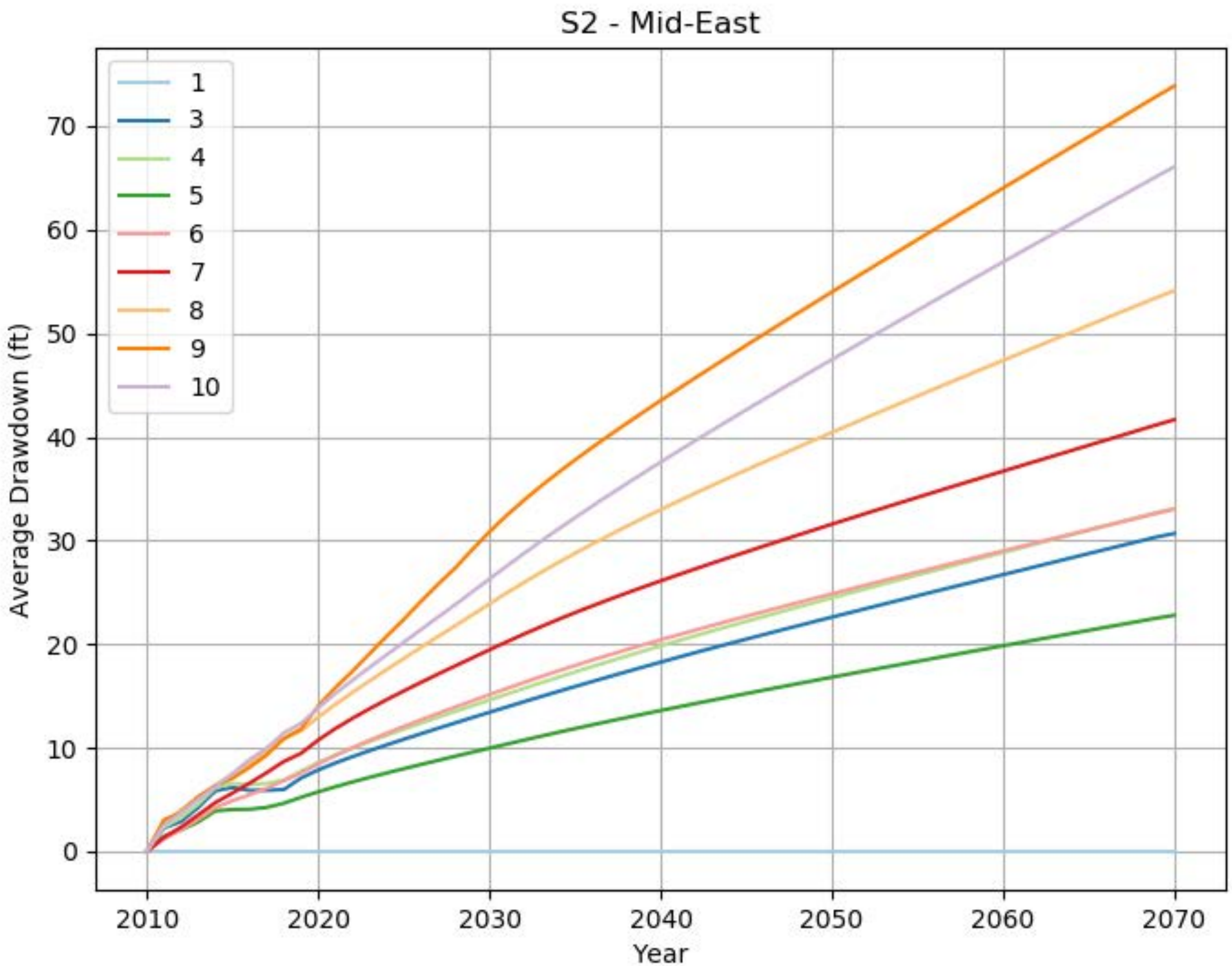
	Current DFC (feet)	Current MAG in 2070	S-2 Drawdown in 2070 (feet)	S-2 Pumpage in 2070 (acre-feet)
Sparta	12	9,019	45	13,161
Queen City	12	1,200	41	1,269
Carrizo	61	5,494	87	5,498
Calvert Bluff	125	1,757	108	1,726
Simsboro	295	96,198	235	147,235
Hooper	207	2,000	157	2,139

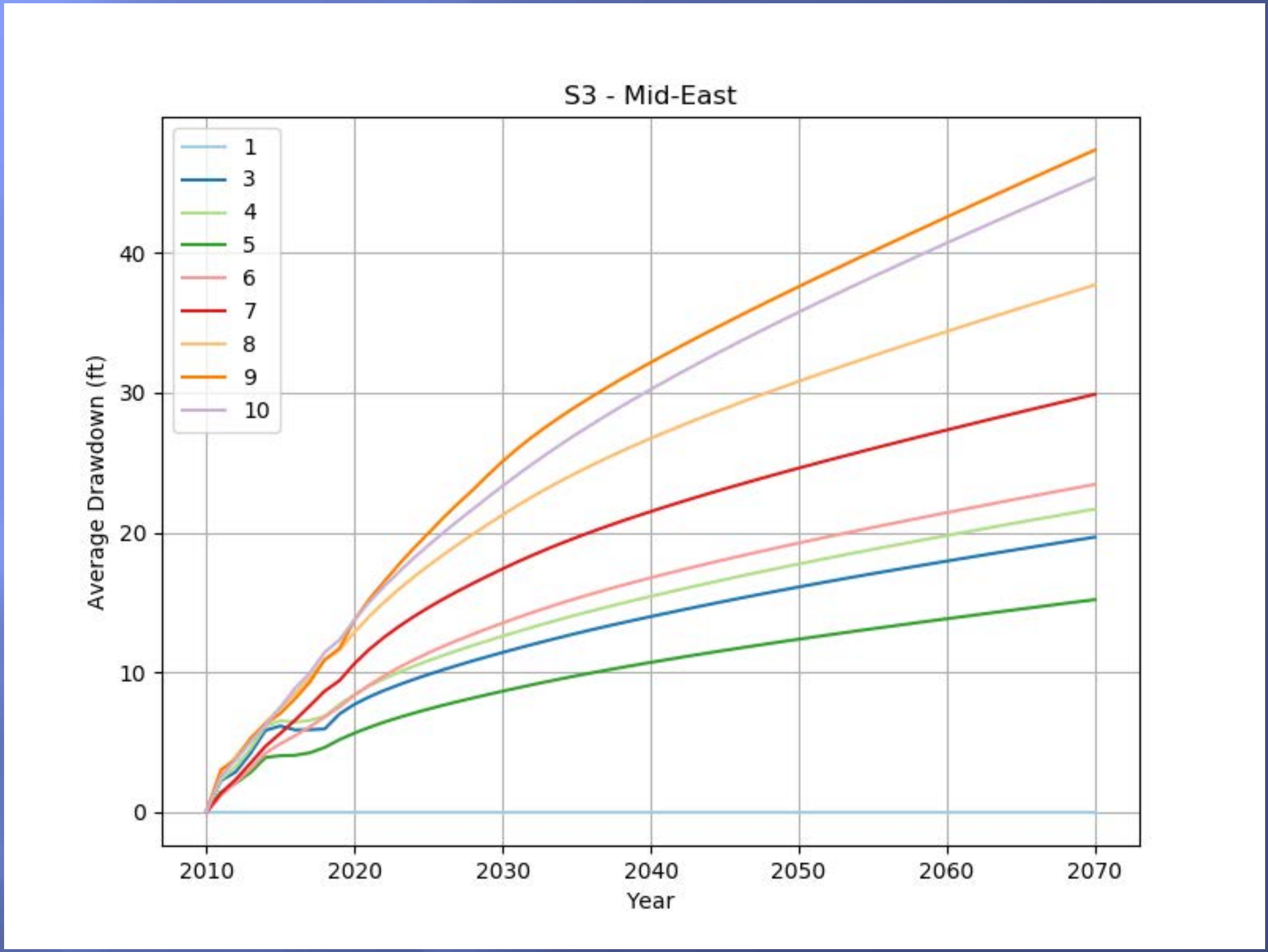
Brazos Valley - S-3

	Current DFC (feet)	Current MAG in 2070	S-3 Drawdown in 2070 (feet)	S-3 Pumpage in 2070 (acre-feet)
Sparta	12	9,019	27	9,019
Queen City	12	1,200	26	1,215
Carrizo	61	5,494	56	5,498
Calvert Bluff	125	1,757	64	1,726
Simsboro	295	96,198	121	104,714
Hooper	207	2,000	89	2,000

Mid-East Texas GCD


S1 - Mid-East
Average Drawdown (ft)
Year
0
10
20
30
40
50
60
70
80
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10


S2 - Mid-East
Average Drawdown (ft)
Year
0
10
20
30
40
50
60
70
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10


S3 - Mid-East
Average Drawdown (ft)
Year
0
10
20
30
40
2010
2020
2030
2040
2050
2060
2070
1
3
4
5
6
7
8
9
10

Mid-East Texas - S-1

	Current DFC (feet)	Current MAG in 2070	S-1 Drawdown in 2070 (feet)	S-1 Pumpage in 2070 (acre-feet)
Sparta	5	3,343	34	4,892
Queen City	2	974	26	2,787
Carrizo	80	11,090	47	1,404
Calvert Bluff	90	3,915	61	8,011
Simsboro	138	7,173	81	1,252
Hooper	125	5,501	77	5,760

Mid-East Texas - S-2

	Current DFC (feet)	Current MAG in 2070	S-2 Drawdown in 2070 (feet)	S-2 Pumpage in 2070 (acre-feet)
Sparta	5	3,343	31	4,892
Queen City	2	974	23	2,787
Carrizo	80	11,090	42	1,404
Calvert Bluff	90	3,915	54	8,011
Simsboro	138	7,173	74	1,252
Hooper	125	5,501	66	5,760

Mid-East Texas - S-3

	Current DFC (feet)	Current MAG in 2070	S-3 Drawdown in 2070 (feet)	S-3 Pumpage in 2070 (acre-feet)
Sparta	5	3,343	20	3,196
Queen City	2	974	16	2,026
Carrizo	80	11,090	31	940
Calvert Bluff	90	3,915	39	5,286
Simsboro	138	7,173	48	848
Hooper	125	5,501	46	3,693

Summary of Average Drawdowns

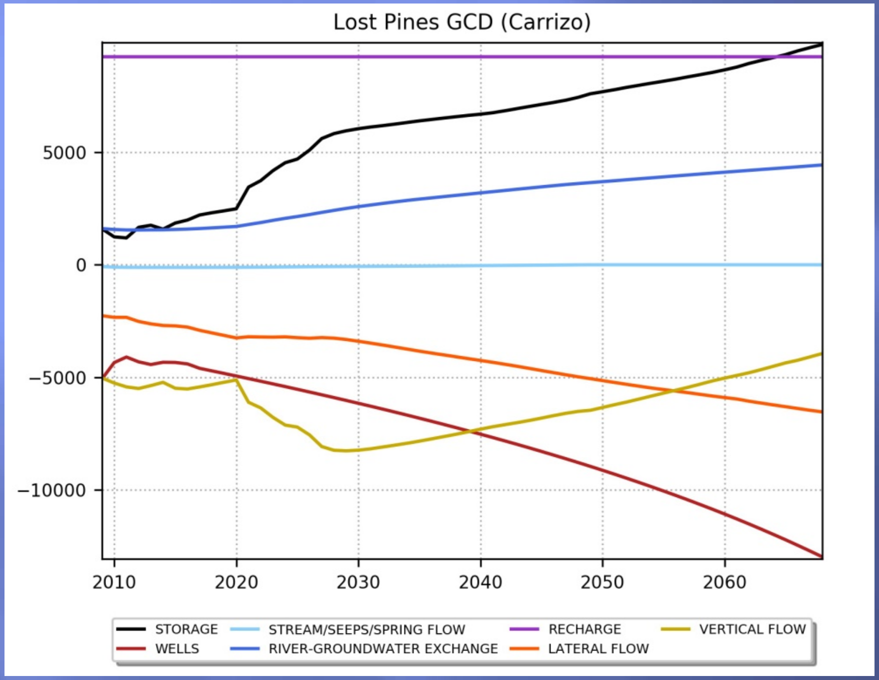
GCD	Sparta				Queen City				Carrizo			
	DFC	S-1	S-2	S-3	DFC	S-1	S-2	S-3	DFC	S-1	S-2	S-3
Brazos Valley	***12***	54	45	27	***12***	49	41	26	***61***	101	87	56
Fayette County	***47***	30	20	16	***64***	57	38	28	***110***	141	96	63
Lost Pines	***5***	27	15	11	***15***	34	20	14	***62***	166	126	73
Mid-East Texas	***5***	34	31	20	***2***	26	23	16	***80***	47	42	31
Post Oak Savannah	***28***	28	23	10	***30***	26	21	11	***67***	201	172	99

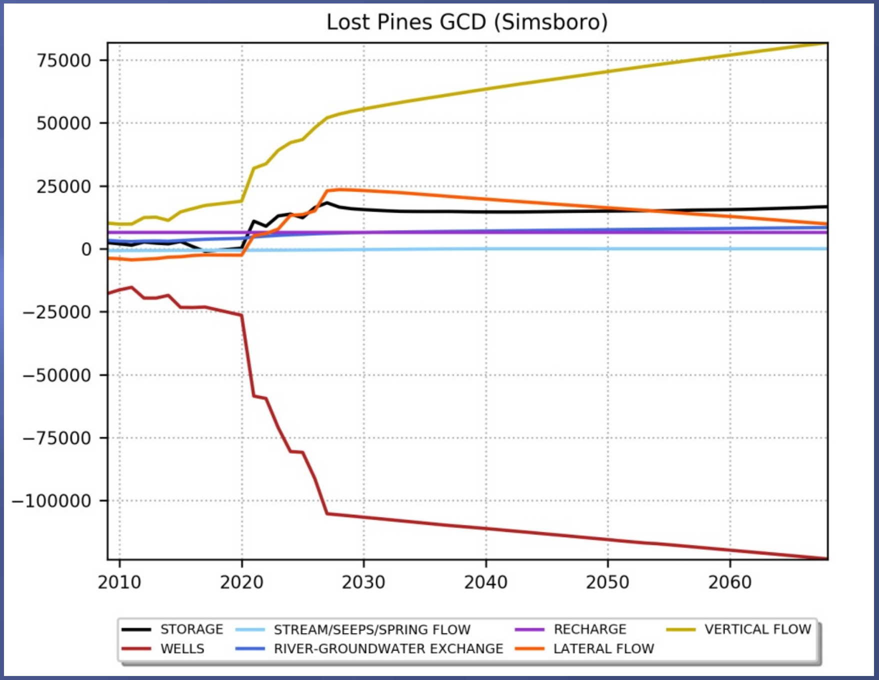
GCD	Calvert Bluff				Simsboro				Hooper			
	DFC	S-1	S-2	S-3	DFC	S-1	S-2	S-3	DFC	S-1	S-2	S-3
Brazos Valley	***125***	130	108	64	***295***	258	235	121	***207***	189	157	89
Fayette County	--	--	--	--	--	--	--	--	--	--	--	--
Lost Pines	***100***	180	148	81	***240***	349	317	161	***165***	196	167	88
Mid-East Texas	***90***	61	54	39	***138***	81	74	48	***125***	77	66	46
Post Oak Savannah	***149***	211	176	98	***318***	376	342	170	***205***	247	207	110

Budget Evaluations

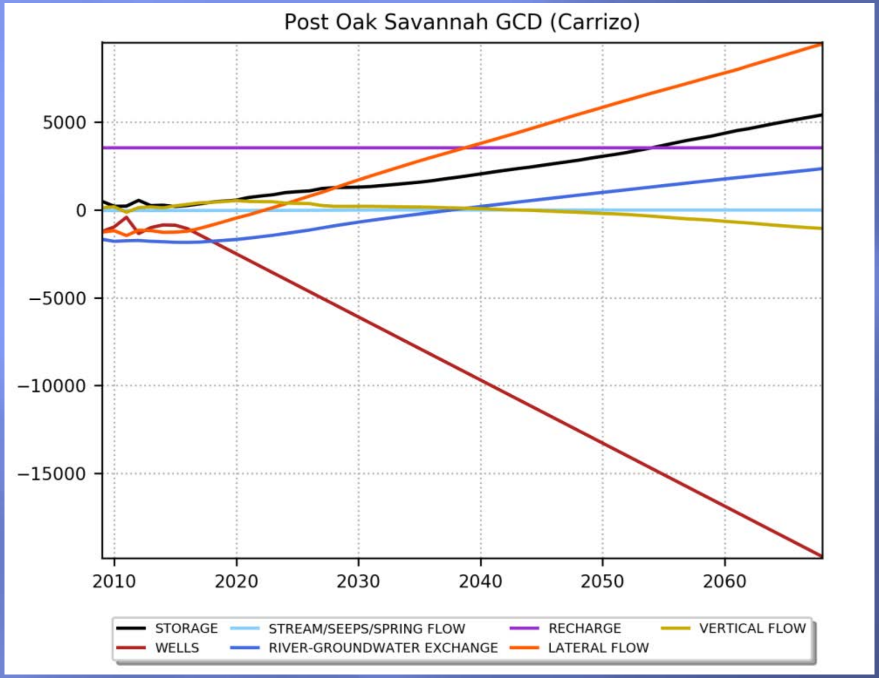
- Examples of budgets presented here for Simulation S-2 for Lost Pines GCD, Brazos Valley GCD, and Post Oak Savannah GCD for the Carrizo and Simsboro Aquifers

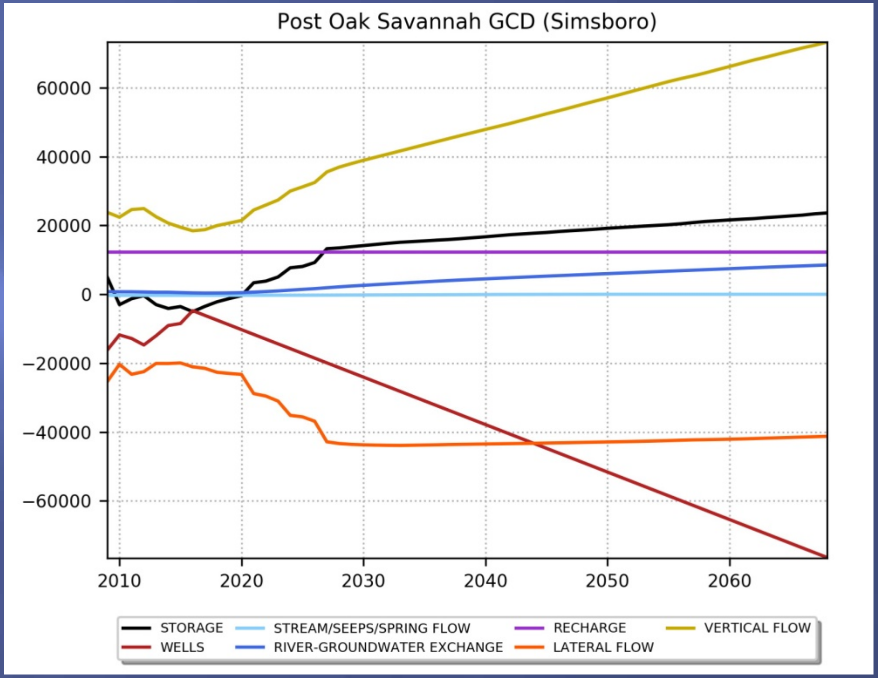
Lost Pines GCD- Run S-2



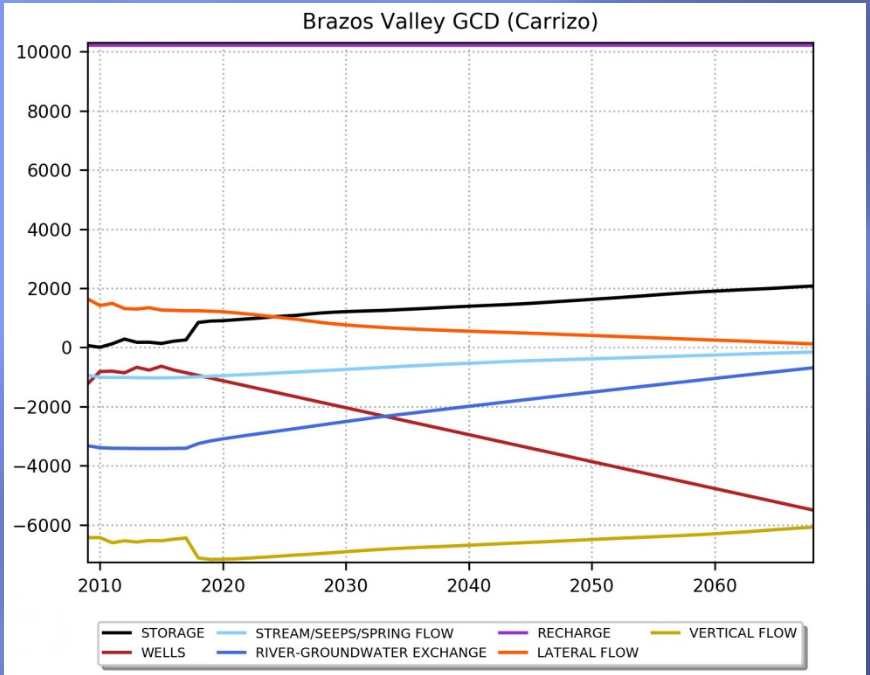


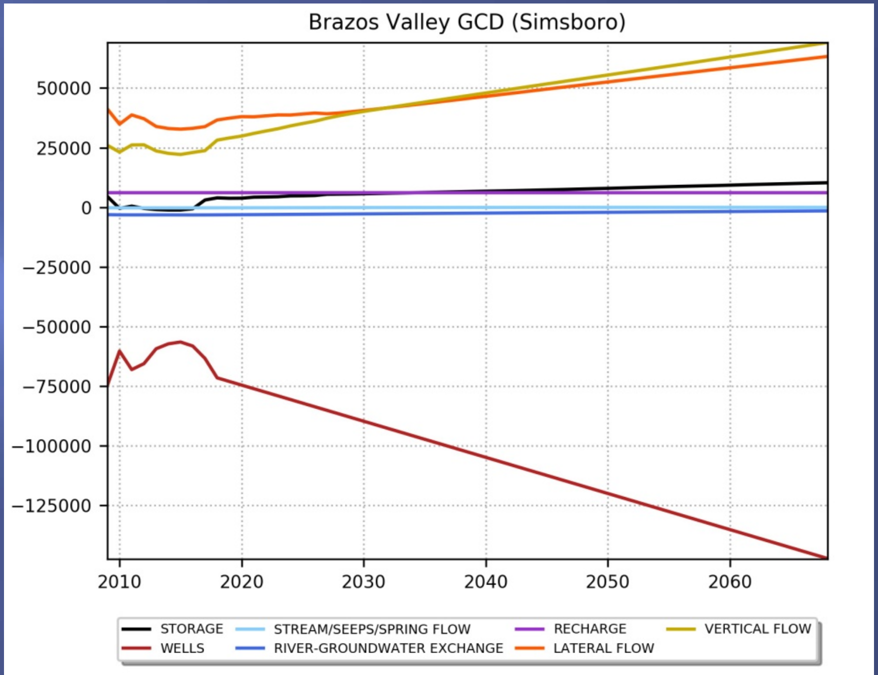
Post Oak Savannah GCD- Run S-2





Brazos Valley GCD- Run S-2





Summary

- Inclusion of drought has minimal impact on results
- As shown in 2018 work by DB Stephens, average drawdowns in the Wilcox are less than with the previous GAM. Average drawdowns in the Sparta, Queen City, and Carrizo are mixed compared to the those developed using the previous GAM, depending on location within the GMA

Next Steps

- Some additional adjustments of pumpage will be needed before moving forward with DFC runs.
  - Fayette County GCD pumpage needs to be increased to current MAG levels
  - Mid-East Texas GCD pumpage needs to be changed to correct MAG levels
  - Minor corrections may be needed in other GCDs
- Once a “baseline” well file (S-4) is developed, need to create a routine to modify pumpage to try and replicate some current DFCs

Next Steps

- Pumpage can be adjusted in the five GMA 12 GCDs to try and achieve current DFCs
- Pumpage can be adjusted by aquifer and by county/GCD
- Pumpage outside of the five GMA 12 GCDs will remain the same for the new predictive simulations

Questions???