

RECLAMATION

Managing Water in the West

East Valley Water Forum - Drought Scenarios 2 & 3



U.S. Department of the Interior
Bureau of Reclamation

Drought 3 Presentation
Draft to EVWF on 10-20-09

EVWF Basecase & Drought 2 & 3 Scenarios Pumping Recap

Basecase “Business as Usual in the East Valley”

SRP: ~100K AFY avg. pumping 2010 - 2030

Muni: ~239K AFY avg. pumping over 2010 - 2030

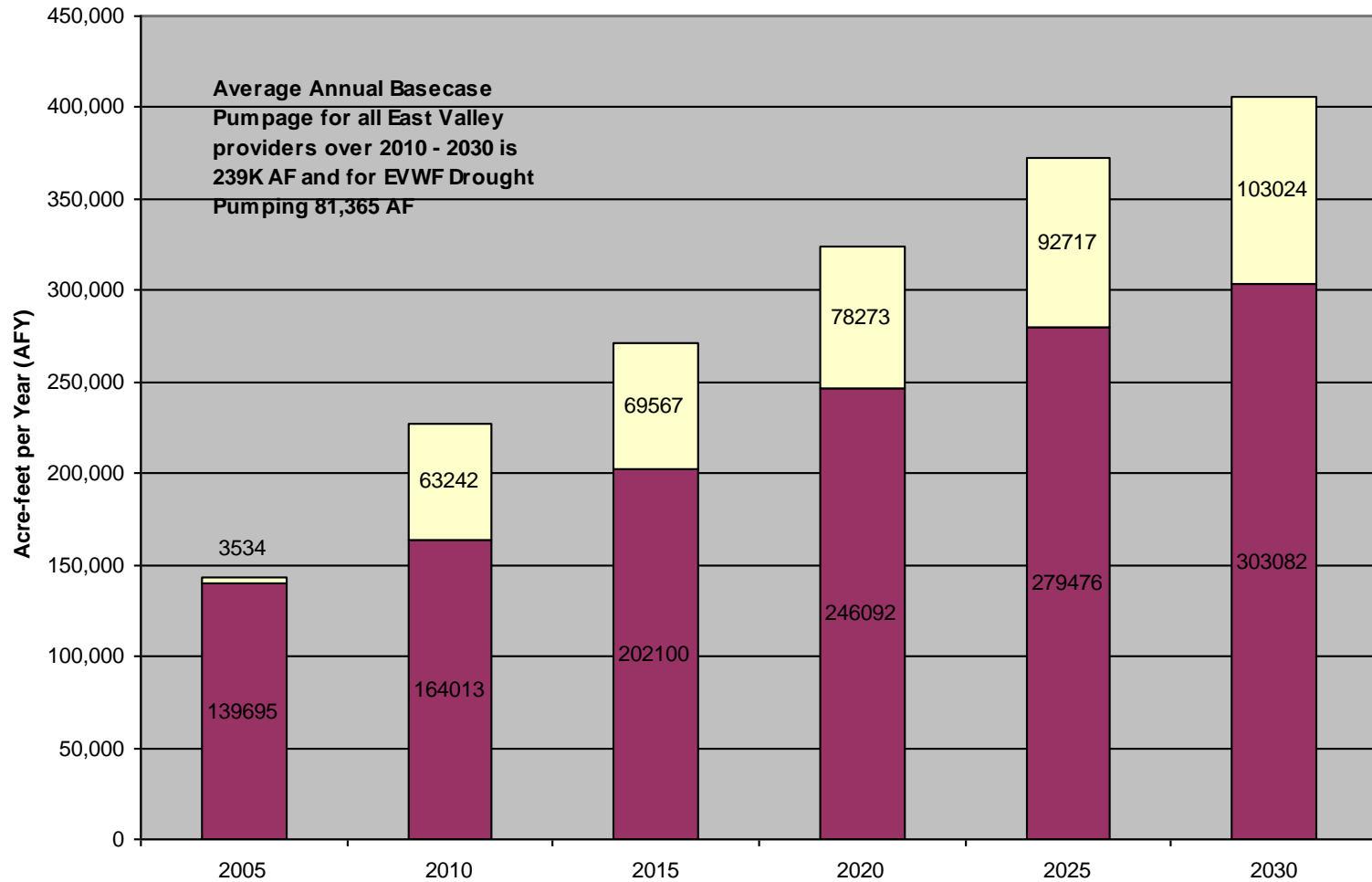
Drought 2 & 3 “Additional Pumping” 2005 - 2030

SRP: ~50K AFY avg. additional pumping 2010 - 2030

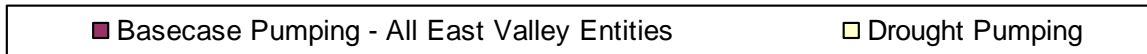
Muni: ~46K AFY avg. additional pumping 2010 - 2030
(includes SRPMIC & GRIC/Sacaton)

Drought Scenarios 2 & 3

Additional SRP and Municipal Pumping to Offset Surface Water Supply Shortages in Relation to Basecase Pumping for all East Valley Water Providers

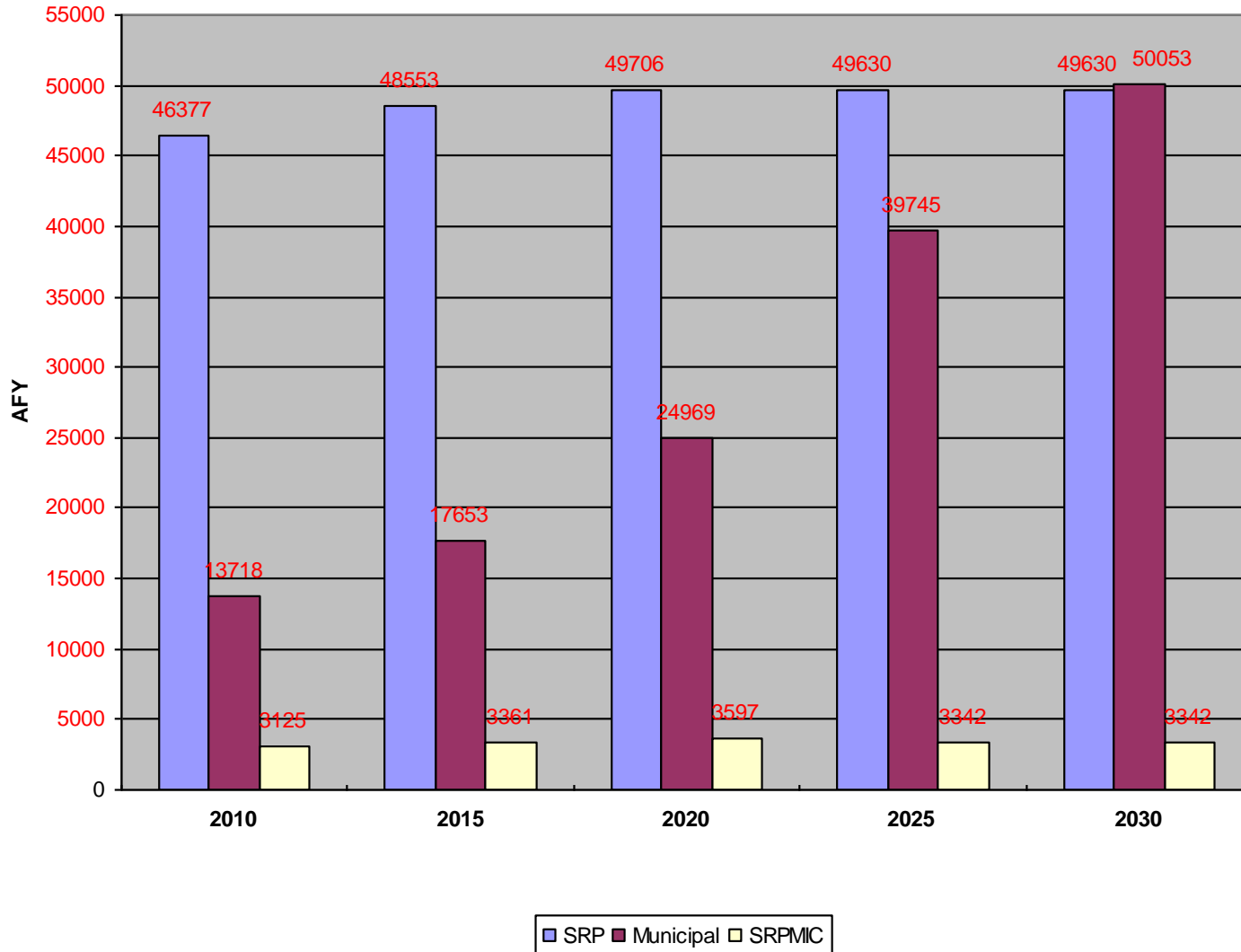


Drought Increases in SRP, SRPMIC, and Municipal Wells in East Valley (AFY)



Additional SRP and Municipal Pumping above Basecase in the ESRV by Entity
Drought Scenarios 2 & 3

Total Pumping by Entity (AFY)



EVWF D2 & D3 Scenarios – USF Recharge Recap

<u>SMRP:</u>	<u>Basecase (AFY)</u>	<u>D2 (AFY)</u>	<u>D3 (AFY)</u>
2005 - 2010	56,500	0	0
2010 - 2015	56,500	30,000	0
2015 - 2020	56,500	30,000	0
2020 - 2025	56,500	0	0
2025 - 2030	56,500	56,500	0
2030 - 2100	56,500	56,500	0

<u>GRUSP:</u>		
2005 - 2010	80,000	80,000
2010 - 2015	80,000	80,000
2015 - 2020	80,000	30,000
2020 - 2025	80,000	30,000
2025 - 2030	80,000	30,000
2030 - 2100	80,000	80,000

<u>SWC:</u>			
2005 - 2010	6,597	6,597	Shortage years
2010 - 2015	20,946	7,888	Shortage years
2015 - 2020	16,042	14,850	(reclaimed + CAP)
2020 - 2025	19,165	16,132	(reclaimed + CAP)
2025 - 2030	23,783	11,631	Shortage years
2030 - 2100	23,783	14,689	

D2 & D3 Scenarios

Pumping Increases from BC

- SRP Wells Pumping
- EVWF Municipal Pumping
- SRPMIC and GRIC Pumping

SRP PUMPING (Drought Scenario 2)		E. Kamienski's Spreadsheet		Re-created by BDP		#s are in Acre-feet/year							
WPA_Numbe	WPA_Name	Basin	RIGHT_TYPE	OTHER_ID	BASEPUMP1 2000 (SP18)	Pump2005 (SP21)	Pump2010 (SP22)	Pump2015 (SP23)	Pump2020 (SP24)	Pump2025 (SP25)	Pump2030 (SP26)	Annual Avg.	Avg. annual incr. 2010-2030
121	CHANDLER	E	57 (Includes SRP)		9,949.5	3,395.2	3,493.1	3,591.0	3,513.3	3,513.3	3,513.3	3,524.8	
121	CHANDLER	E	57+SRP pump incr.	Scen. 2		3,395.0	11,500.0	12,500.0	12,000.0	12,000.0	12,000.0		8,475.2
201	GILBERT	E	57 (Includes SRP)		25,338.6	21,708.3	20,675.9	20,119.9	18,793.5	17,870.2	17,870.2	19,065.9	
201	GILBERT	E	57+SRP pump incr.	Scen. 2		21,708.0	29,500.0	29,000.0	28,000.0	27,000.0	27,000.0	28,100.0	9,034.1
361	MESA	E	57 (Includes SRP)		70,862.0	54,342.0	56,015.8	57,691.6	59,028.4	59,028.4	59,028.4	58,158.5	
361	MESA	E	57+SRP pump incr.	Scen. 2		54,342.0	69,000.0	71,000.0	73,000.0	73,000.0	73,000.0	71,800.0	13,641.5
511	SCOTTSDALE	E	57 (Includes SRP)		14,430.1	10,840.1	11,148.4	11,456.7	11,721.3	11,721.3	11,721.3	11,553.8	
511	SCOTTSDALE	E	57+SRP pump incr.	Scen. 2		10,840.0	19,500.0	20,000.0	20,500.0	20,500.0	20,500.0	20,200.0	8,646.2
611	TEMPE	E	57 (Includes SRP)		11,157.1	7,191.2	7,442.6	7,694.6	7,910.3	7,910.3	7,910.3	7,773.6	
611	TEMPE	E	57+SRP pump incr.	Scen. 2		7,191.0	15,500.0	16,500.0	17,000.0	17,000.0	17,000.0	16,600.0	8,826.4
411	PHOENIX	E	57 (no current 57, SRP)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
411	PHOENIX	E	57+SRP pump incr.	Scen. 2		0.0	0.0	1,500.0	2,000.0	2,500.0	3,000.0	1,800.0	1,800.0
					131,737.3							100,076.7	50,423.3
Hypothetical Examples - for discussion only					total base pump AF							annual avg. 2010-2030 AF	AF additional SRP GW pumping annually in the East Salt River Groundwater Subasin

Additional SRP Pumping for Drought 2 (over existing, beginning 2010) in AF/Y:				Pump2010	Pump2015	Pump2020	Pump2025	Pump2030
121	CHANDLER	E	57 (Includes SRP)	3,493.1	3,591.0	3,513.3	3,513.3	3,513.3
121	CHANDLER	E	57+SRP pump incr.	8,006.9	8,909.0	8,486.7	8,486.7	8,486.7
201	GILBERT	E	57 (Includes SRP)	20,675.9	20,119.9	18,793.5	17,870.2	17,870.2
201	GILBERT	E	57+SRP pump incr.	8,824.1	8,880.1	9,206.5	9,129.8	9,129.8
361	MESA	E	57 (Includes SRP)	56,015.8	57,691.6	59,028.4	59,028.4	59,028.4
361	MESA	E	57+SRP pump incr.	12,984.2	13,308.4	13,971.6	13,971.6	13,971.6
511	SCOTTSDALE	E	57 (Includes SRP)	11,148.4	11,456.7	11,721.3	11,721.3	11,721.3
511	SCOTTSDALE	E	57+SRP pump incr.	8,351.6	8,543.3	8,778.7	8,778.7	8,778.7
611	TEMPE	E	57 (Includes SRP)	7,442.6	7,694.6	7,910.3	7,910.3	7,910.3
611	TEMPE	E	57+SRP pump incr.	8,057.4	8,805.4	9,089.7	9,089.7	9,089.7
411	PHOENIX	E	57 (no current 57, SRP)	0.0	0.0	0.0	0.0	0.0
411	PHOENIX	E	57+SRP pump incr.	0.0	1,500.0	2,000.0	2,500.0	3,000.0

Additional SRP Pumping for Drought 2 (over existing, beginning 2010) in ft ³ /day (rounded) within WPA w/ SRP:				# cells within WPA's SRP area	Average gpm	Pump2010	Pump2015	Pump2020	Pump2025	Pump2030
121	CHANDLER	E	57 (Includes SRP)			416,867	428,550	419,277	419,277	419,277
121	CHANDLER	E	57+SRP pump incr.	41	5,258	955,543	1,063,200	1,012,803	1,012,803	1,012,803
201	GILBERT	E	57 (Includes SRP)			2,467,462	2,401,109	2,242,816	2,132,630	2,132,630
201	GILBERT	E	57+SRP pump incr.	28	5,591	1,053,068	1,059,751	1,098,704	1,089,550	1,089,550
361	MESA	E	57 (Includes SRP)			6,684,926	6,884,916	7,044,449	7,044,449	7,044,449
361	MESA	E	57+SRP pump incr.	51	8,414	1,549,534	1,588,224	1,667,371	1,667,371	1,667,371
511	SCOTTSDALE	E	57 (Includes SRP)			1,330,450	1,367,243	1,398,820	1,398,820	1,398,820
511	SCOTTSDALE	E	57+SRP pump incr.	20	5,345	996,680	1,019,557	1,047,650	1,047,650	1,047,650
611	TEMPE	E	57 (Includes SRP)			888,200	918,274	944,015	944,015	944,015
611	TEMPE	E	57+SRP pump incr.	39	5,437	961,570	1,050,836	1,084,765	1,084,765	1,084,765
411	PHOENIX	E	57 (no current 57, SRP)			0	0	0	0	0
411	PHOENIX	E	57+SRP pump incr.			0	179,010	238,680	298,350	358,020

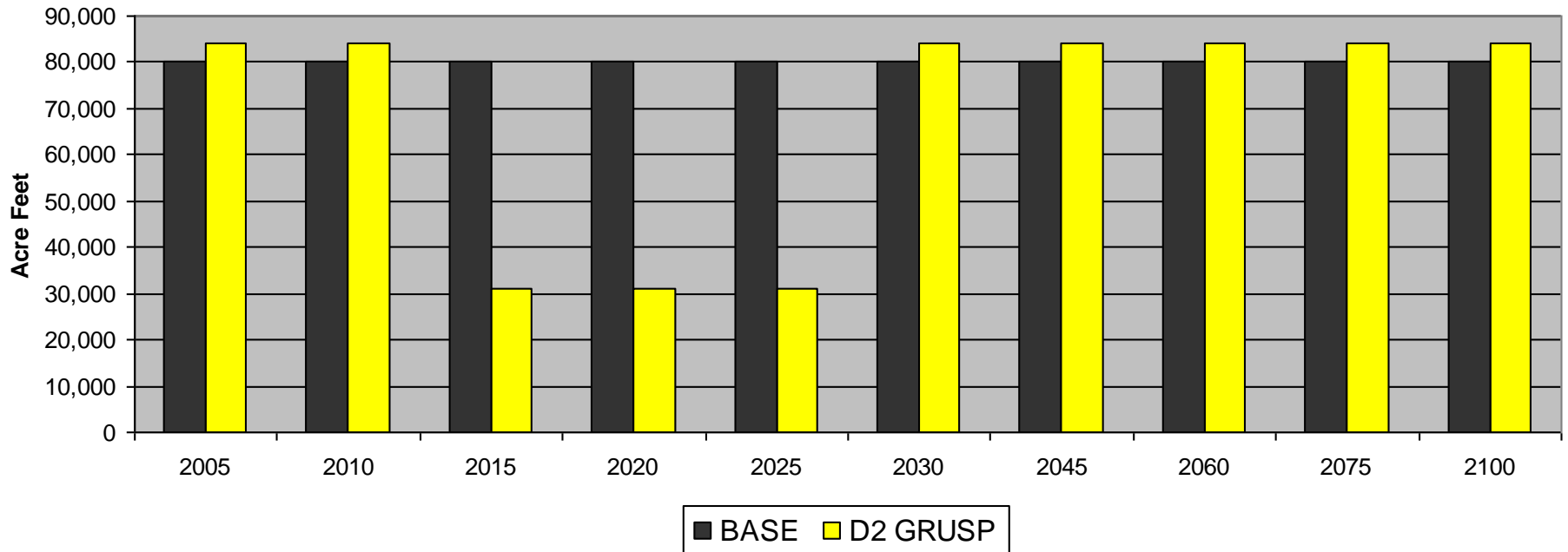
MUNI. PUMPING (Drought Scenario 2)		E. Kamienski's Spreadsheet			Re-created by BDP on 9-3-08		#'s are in Acre-feet/year		
WPA_Number	WPA_Name	WPA_GW_2005	WPA_GW_2010	WPA_GW_2015	WPA_GW_2020	WPA_GW_2025	WPA_GW_2030	Annual Avg.	Avg. annual incr. 2010-30
80	CAREFREE	1924	2274	2527	2781	2785	2834	2640	
80	CAREFREE (Drought Scenario 2)	1924	2274	2527	3000	3100	3200	2820	180
90	CAVE CREEK	520	593	628	662	1077	1399	872	
90	CAVE CREEK (Drought Scenario 2)	520	593	628	900	1400	1800	1064	192
91	CAVE CREEK								
121	CHANDLER	4200	5100	5700	6000	6300	6300	5880	
121	CHANDLER (Drought Scenario 2)	4200	8000	8600	9000	10000	10500	9220	3340
170	FOUNTAIN HILLS	4224	4765	5504	6244	6250	6329	5818	
170	FOUNTAIN HILLS (Drought Scenario 2)	4224	4765	5504	8600	8700	8700	7254	1435
180	FT MCDOWELL	1117	1224	1327	1431	1500	1571	1411	
180	FT MCDOWELL (Drought Scenario 2)	1117	1500	1600	1700	1800	1900	1700	289
190	GILA RIVER	54	58	67	76	84	93	76	
191	GILA RIVER	139	152	180	208	239	270	210	
190, 191	Gila River (Drought Scenario 2)	193	210	300	400	500	600	402	192
201	GILBERT	8300	12336	15800	17500	17500	17500	16127	
201	GILBERT (Drought Scenario 2)	8300	5164	18800	29750	29750	29750	22643	6516
340	MESA								
361	MESA	10217	10217	10217	18019	25137	25137	17745	
361	MESA (Drought Scenario 2)	10217	10217	10921	26283	35200	37093	23943	6197
380	PARADISE VALLEY	2595	2689	2752	2815	2823	2847	2785	
381	PARADISE VALLEY	2565	2668	2701	2733	2744	2761	2721	
380, 381	PARADISE VALLEY (Drought Scenario 2)	5160	5257	5700	5800	5850	5900	5701	2980
410	PHOENIX	182	186	187	187	187	188	187	
411	PHOENIX	22354	22354	22354	22354	22354	22354	22354	
411	PHOENIX (Drought Scenario 2)	22354	25000	26000	26000	28000	29000	26800	4446
491	SACATON	345	358	372	386	412	438	393	
491	Sacaton (Drought Scenario 2)	345	358	450	470	500	550	466	72
510	SCOTTSDALE	2247	2797	3662	4506	4596	4716	4055	
511	SCOTTSDALE	24895	19000	20485	22421	22421	22421	21350	
511	SCOTTSDALE (Drought Scenario 2)	27143	21797	24147	26927	37629	44176	30935	9585
530	SRPMIC								
531	SRPMIC	19560	22820	26080	29340	32600	32600	28688	
531	SRPMIC (Drought Scenario 2)	19560	26000	29500	33000	36000	36000	32100	3412
610	TEMPE								
611	TEMPE	5000	3000	3000	3000	3000	3000	3000	
611	TEMPE (Drought Scenario 2)	6500	8000	10000	11000	12000	14000	11000	8000
								312361	46838
<i>Hypothetical cases - for discussion only</i>								<i>Avg. annual AF pumping 2010 - 2030</i>	<i>AF additional Municipal GW pumping annually in the East Salt River Groundwater Subasin for Drought Scenario 2 discussion and input</i>
Note:									
1. Should Gilbert WPA 201 cell D18 be 15164?									
2. PV WPA 380,381 sum of D22&D23 is 5357 AF; D24 shown as 5257 AF?									

Drought 2 Scenario - Recharge Reductions in Three USF's Change from BC over Years 2005-2030

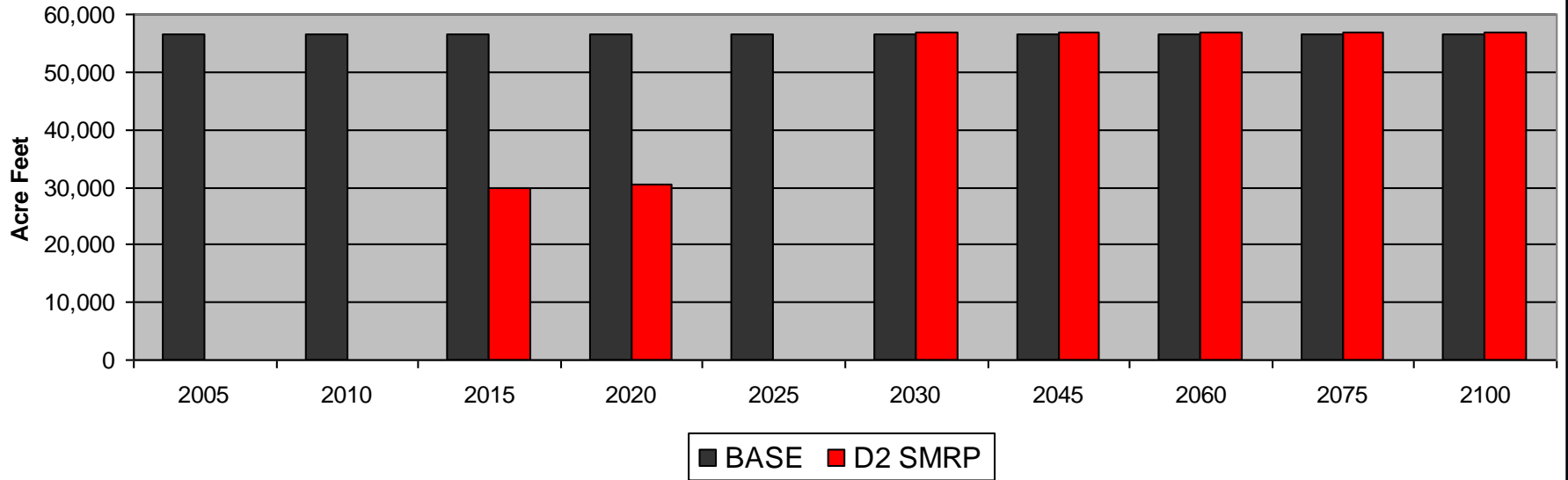
Drought 3 Scenario – No SMRP Recharge

- GRUSP:
BC = 2,000,000 A-F
D2 = 1,305,725 A-F BC-D2 = 694,275 A-F (35 % Reduction)
- SMRP:
BC = 1,412,500 A-F
D2 = 301,885 A-F BC-D2 = 1,110,615 A-F (79 % Reduction)
D3 = 0 (2005-2100)
- SWC:
BC = 432,665 A-F
D2 = 285,490 A-F BC-D2 = 147,175 A-F (34 % Reduction)

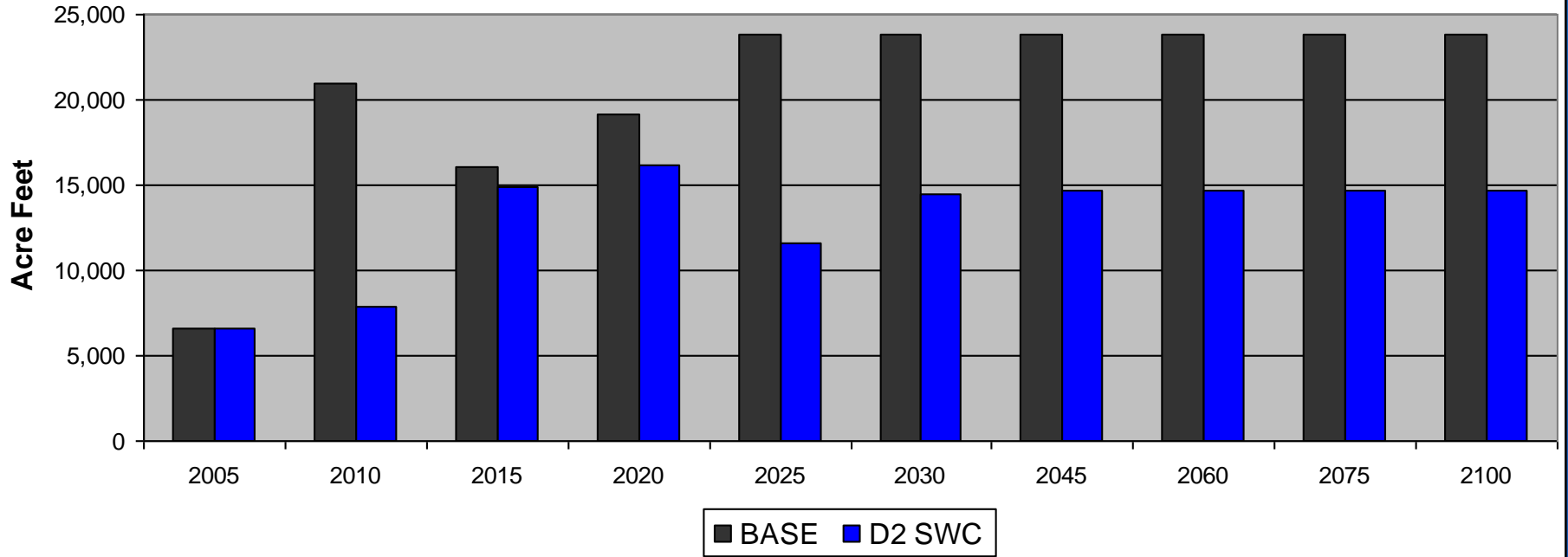
EWWF - Comparison in GRUSP Recharge - Basecase and Drought Scenarios 2 & 3



EWWF - Comparison in Superstition Mountain Recharge Project (SMRP) Recharge - Basecase and Drought 2 Scenarios



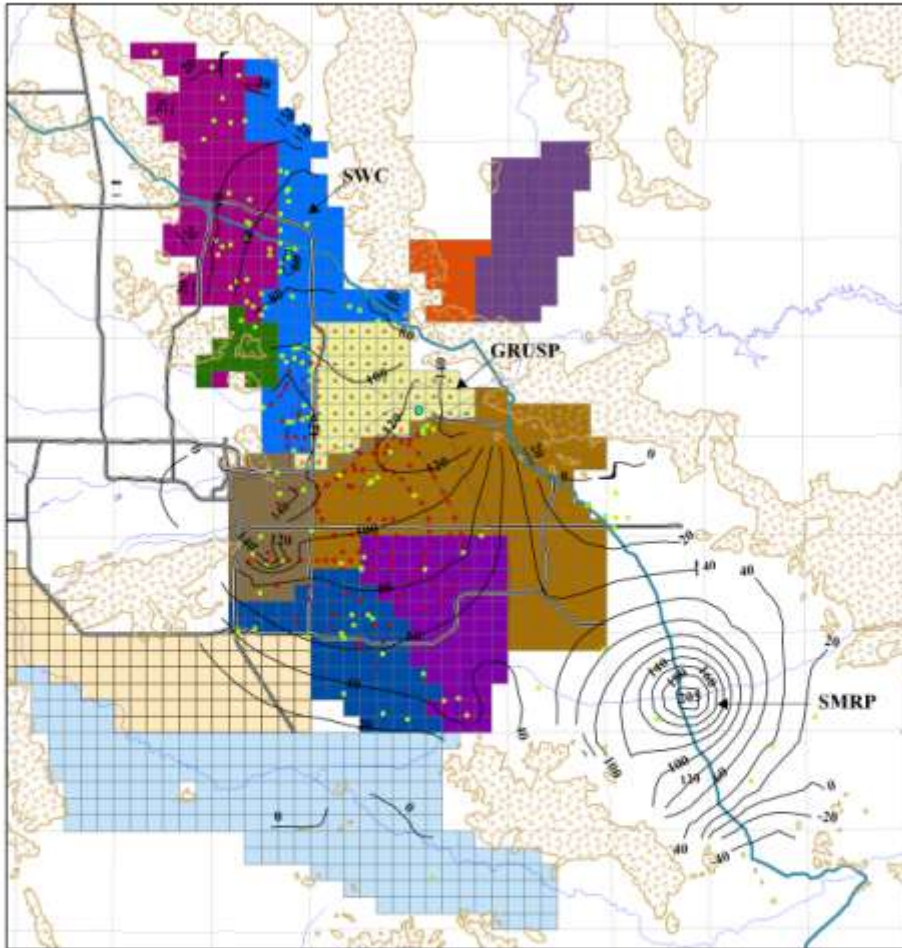
**EVWF - Comparison in Scottsdale Water Campus (SWC) Recharge
Basecase and Drought Scenarios 2 & 3**



D2 Scenario

Simulated Water Level Decline (ft.)
over Basecase (BC)

Year 2030



Preliminary EVWF Drought Modeling - Drought 2 Scenario "D2"

Additional ~90K AFY SRP and Muni. Pumping over Basecase -
Years 2005 to 2030 to Offset Surface Water Supply Shortages
and Reductions in USF Recharge at Grusp, SMRP, & SWC

Simulated Water Level Decline over Basecase at Year 2030



Notes:

1800 AF avg. Phoenix WPA 411

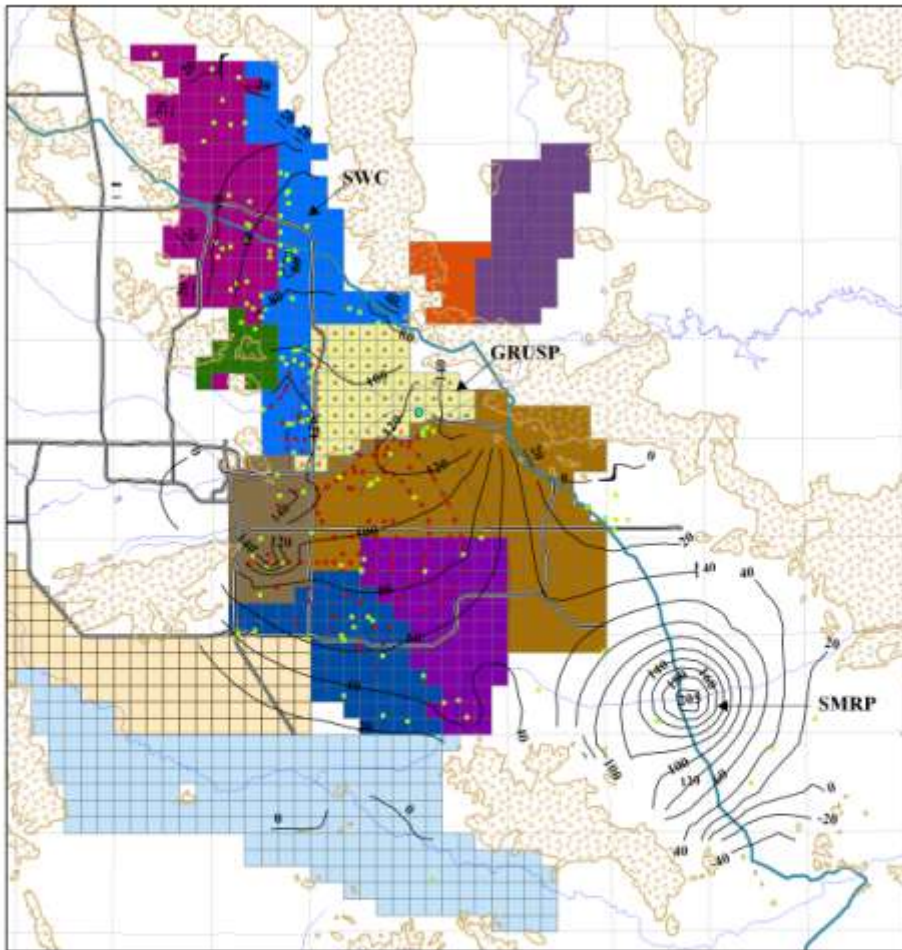
Right 57 (SRP) pumping not included

RECLAMATION

D2 Scenario

Simulated Water Level Decline (ft.)
over Basecase (BC)

Year 2030



Preliminary EVWF Drought Modeling - Drought 2 Scenario "D2"

Additional ~90K AFY SRP and Muni. Pumping over Basecase -
Years 2005 to 2030 to Offset Surface Water Supply Shortages
and Reductions in USF Recharge at Grusp, SMRP, & SWC

Simulated Water Level Decline over Basecase at Year 2030



Notes:

1800 AF avg. Phoenix WPA 411

Right 57 (SRP) pumping not included

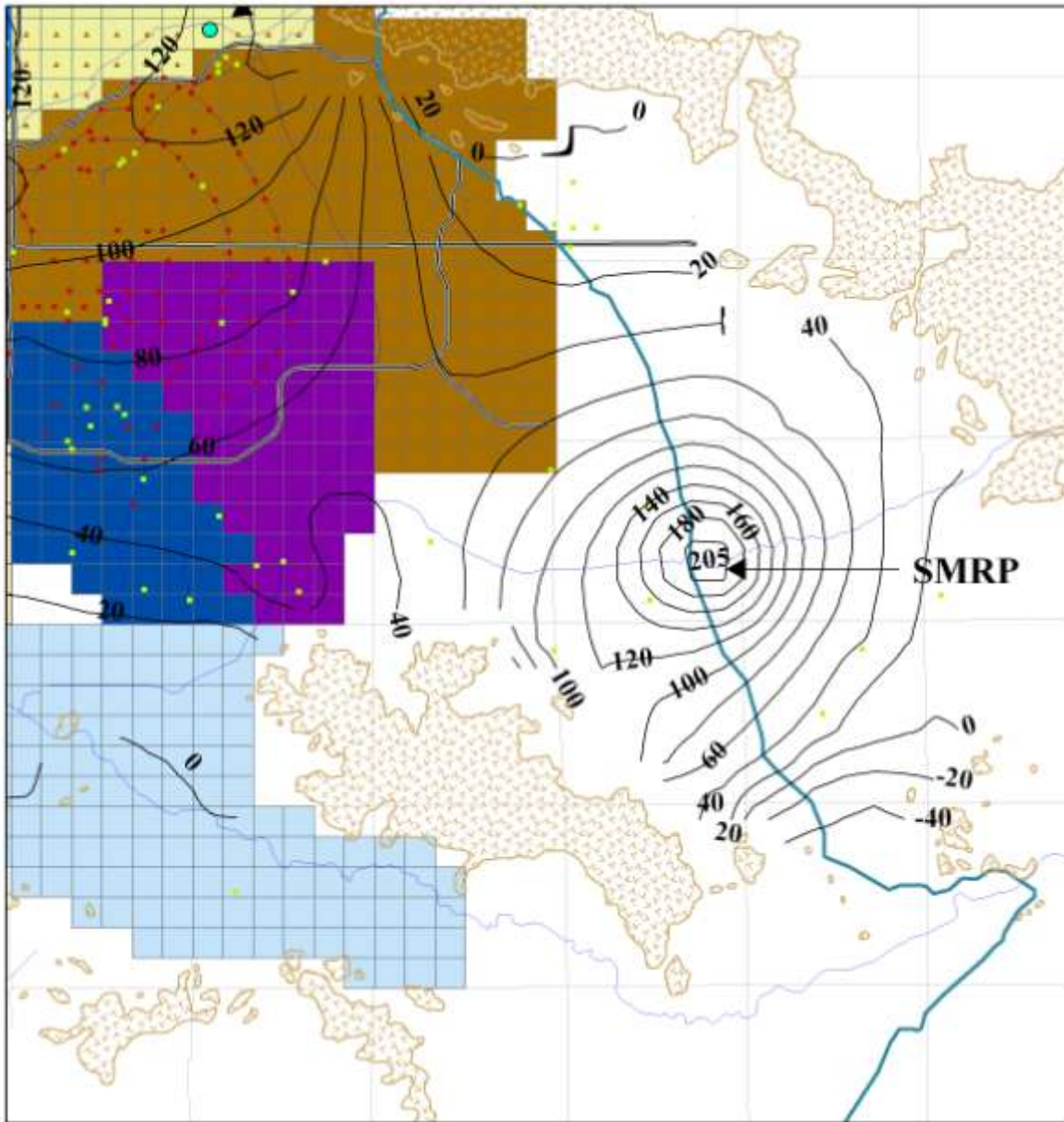
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2030

Close-up of SMRP Area



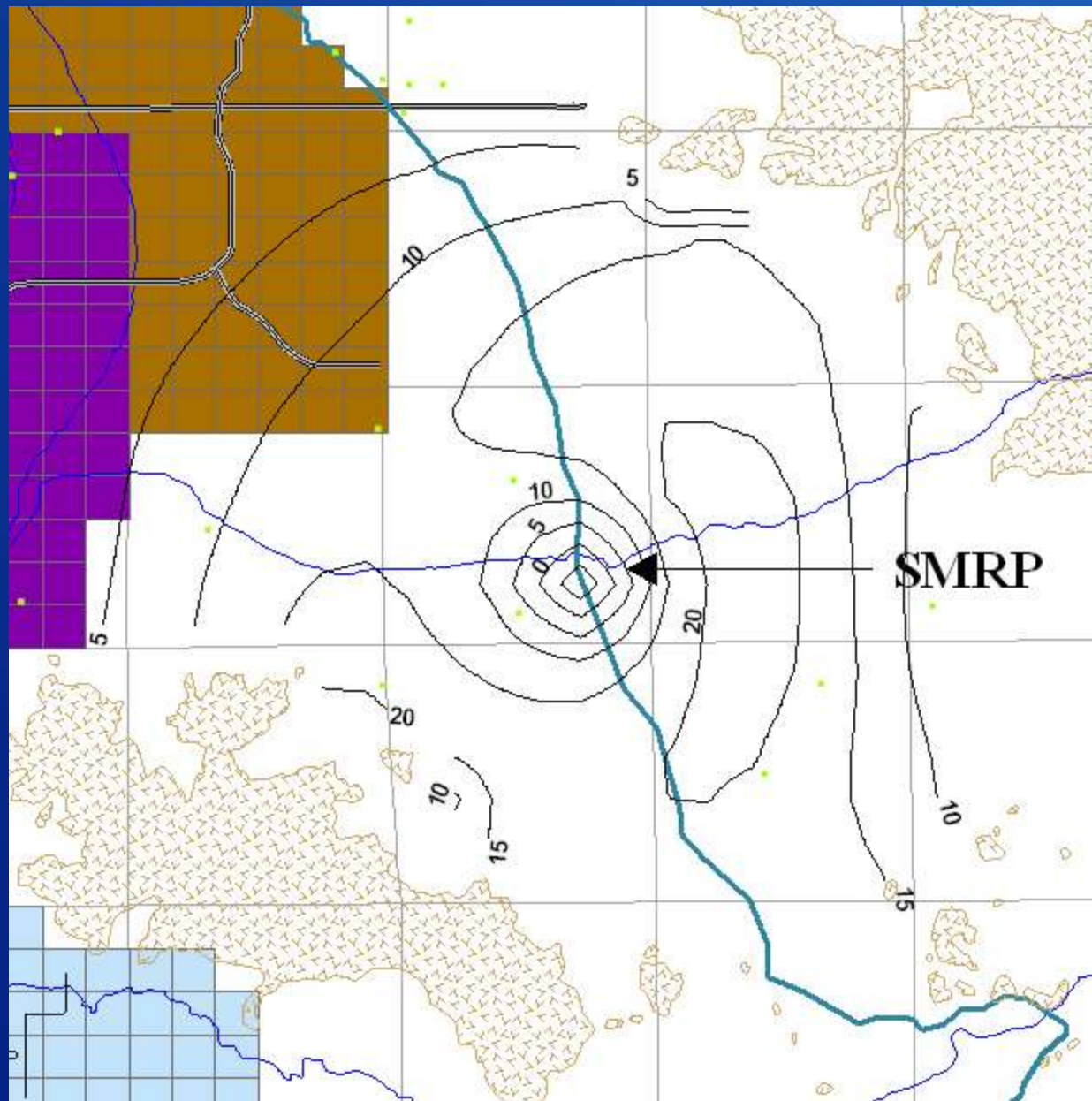
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D3 Scenario

Simulated Additional
Water Level Decline (ft.)
over D2 Scenario

Year 2030

Close-up of SMRP Area



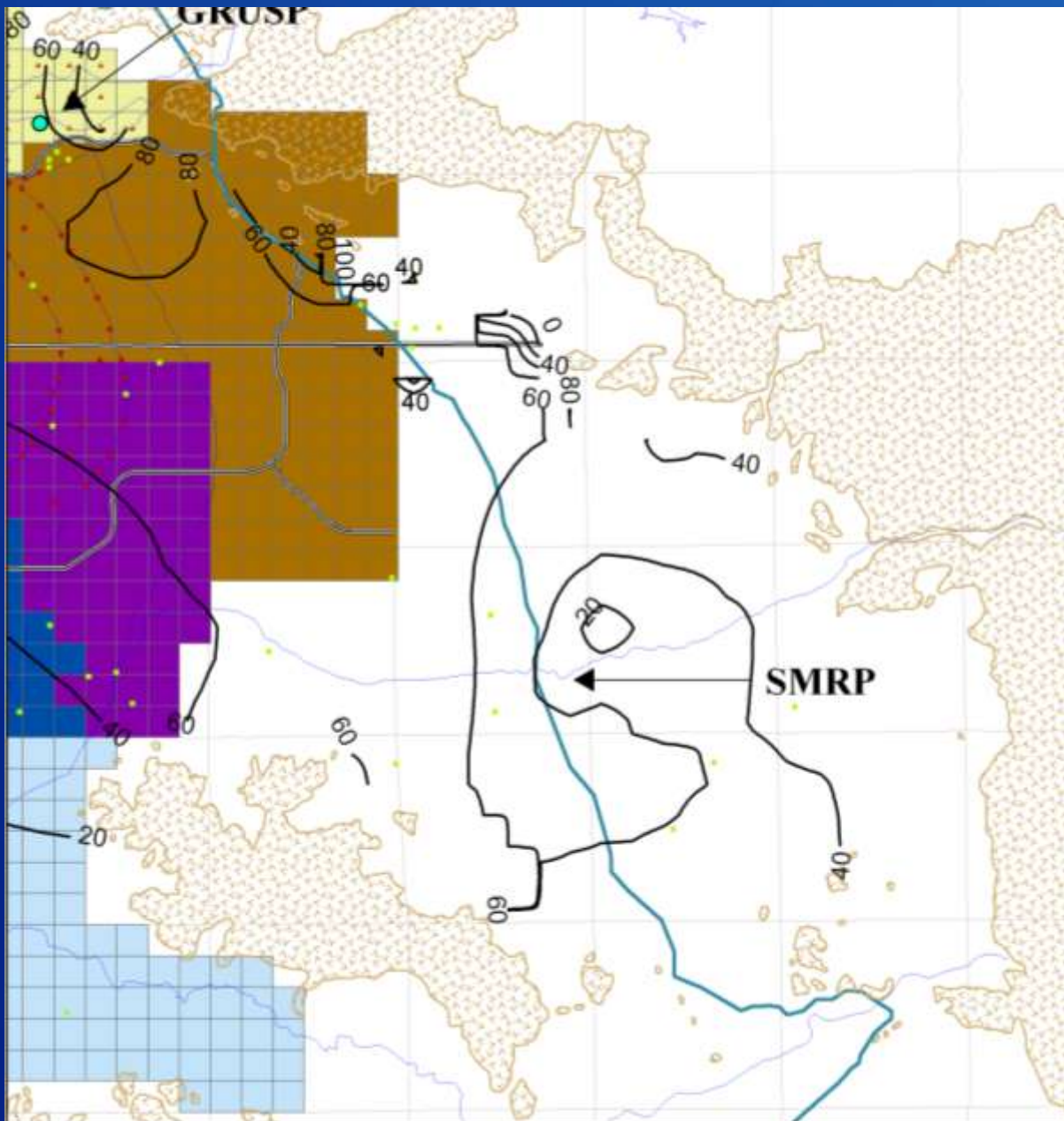
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2100

Close-up of SMRP Area



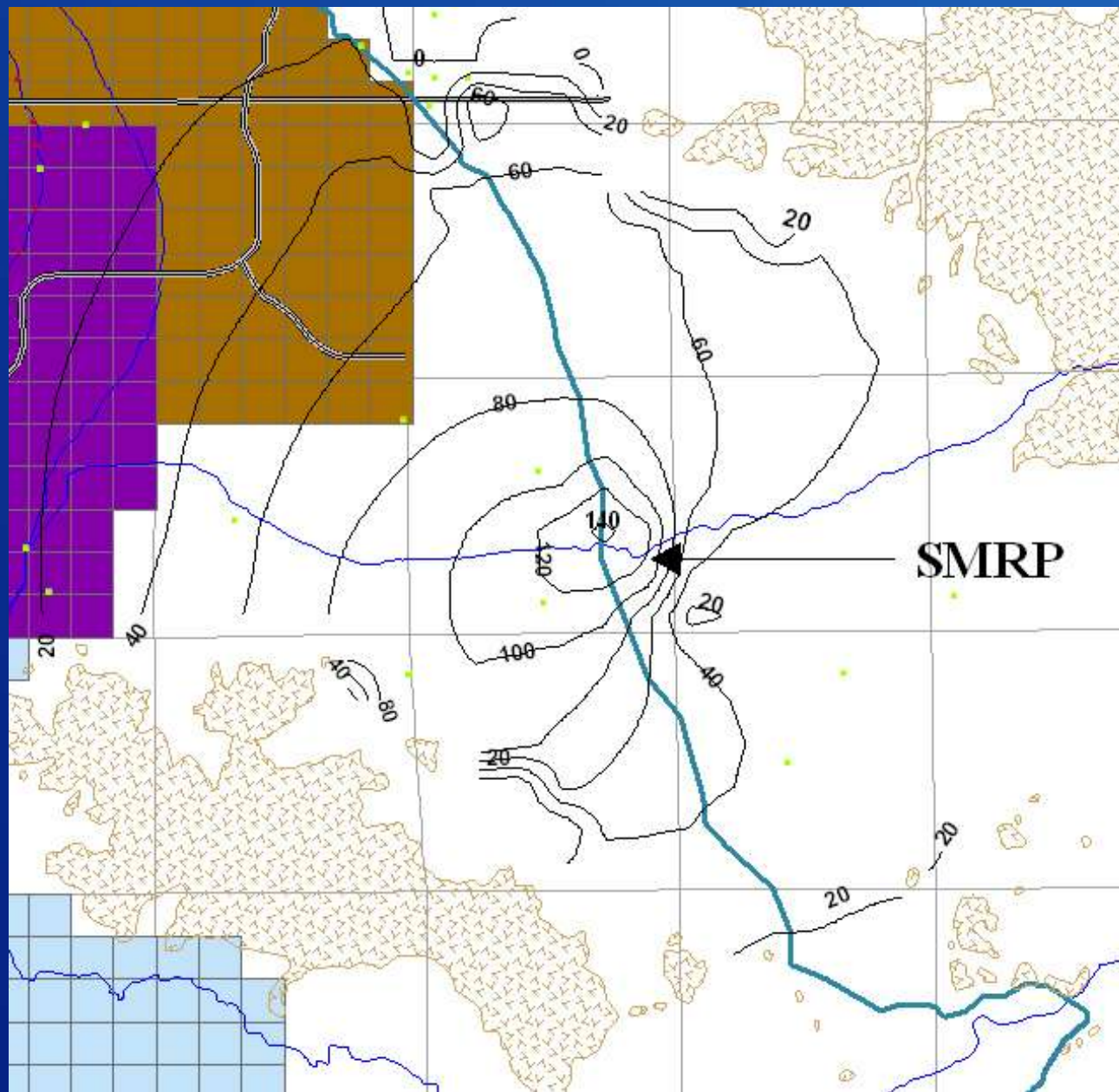
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D3 Scenario

Simulated Additional
Water Level Decline (ft.)
over D2 Scenario

Year 2100

Close-up of SMRP Area



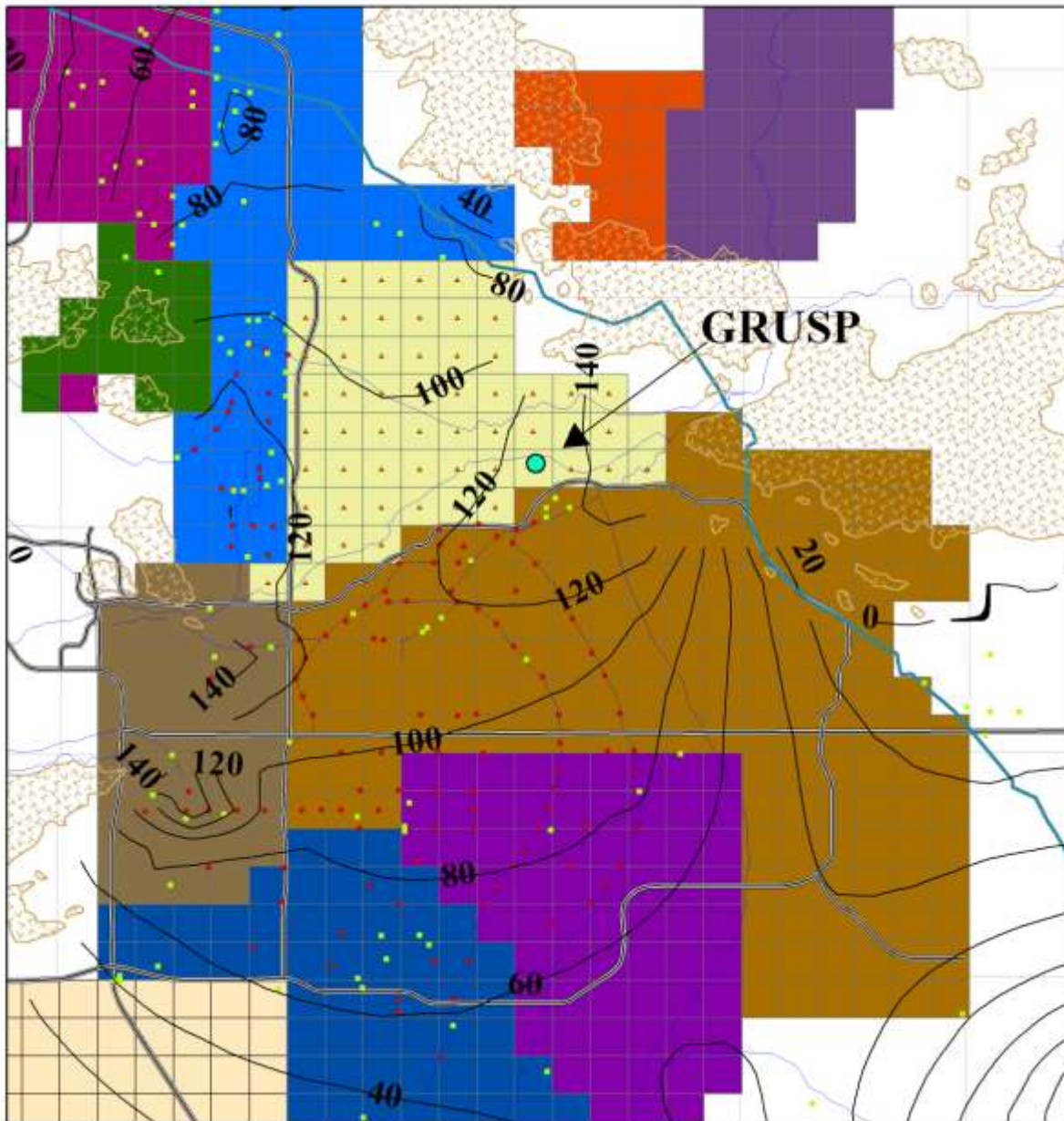
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2030

Close-up of GRUSP
Area



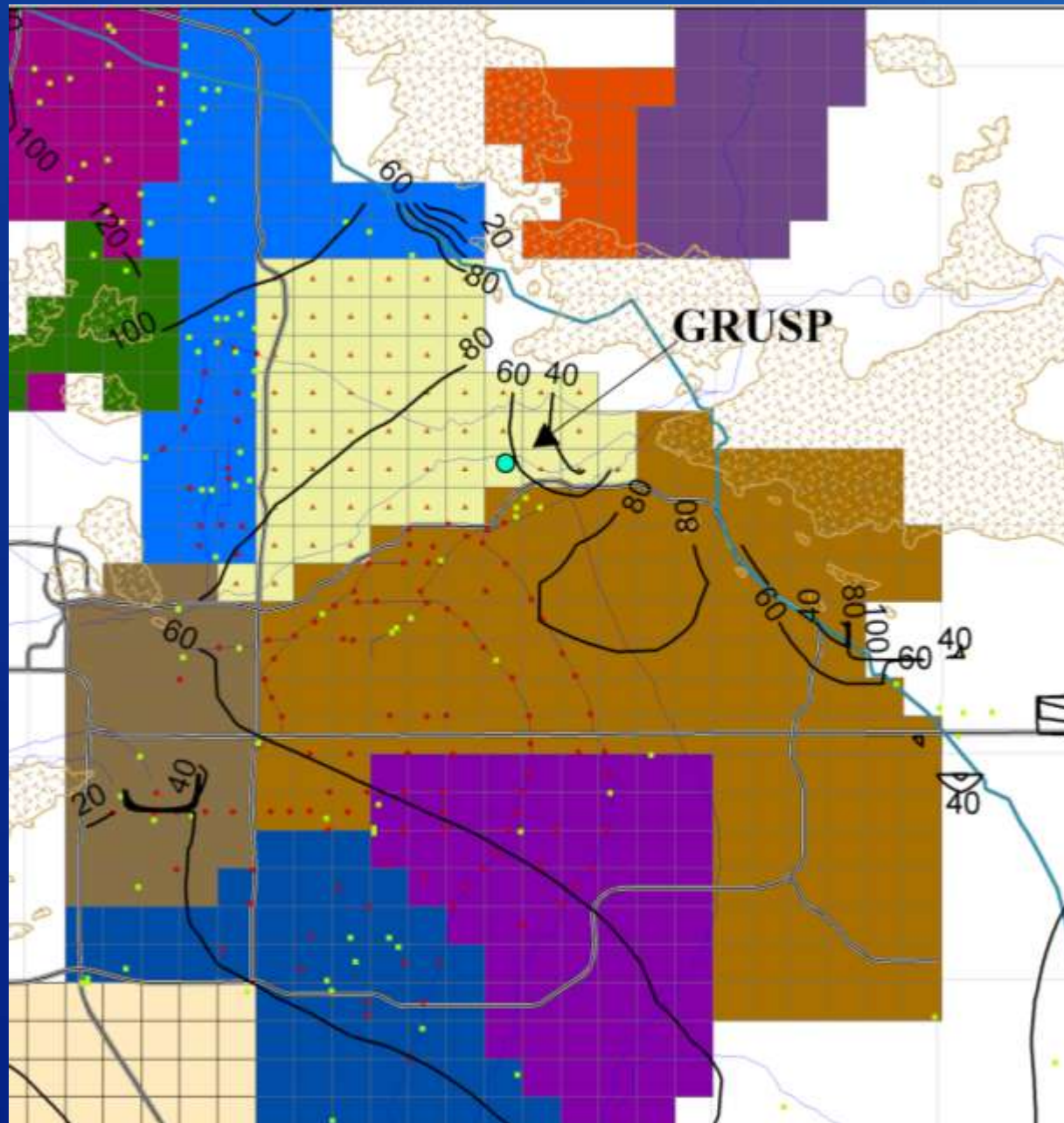
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2100

Close-up of GRUSP
Area



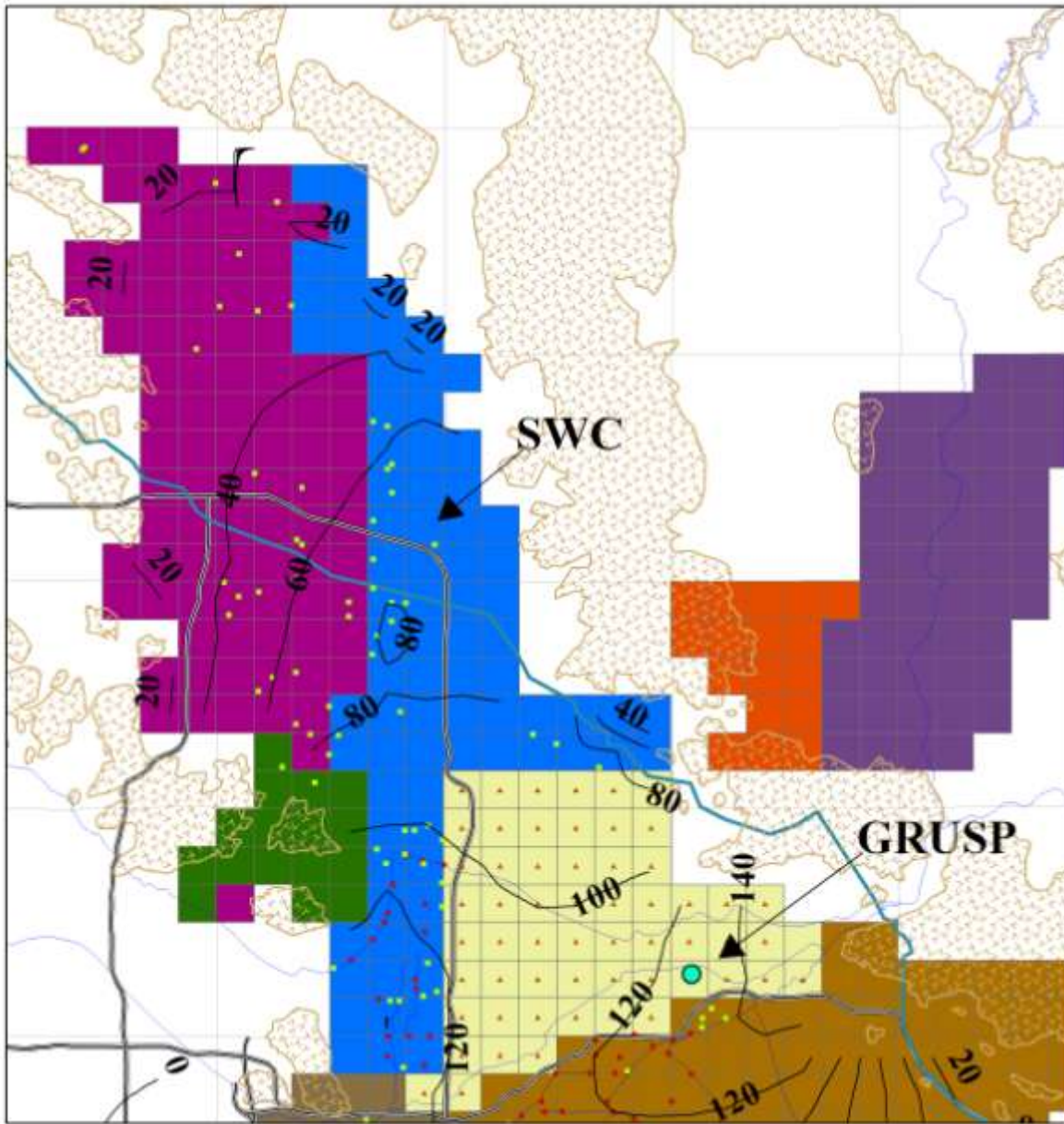
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2030

Close-up of SWC Area



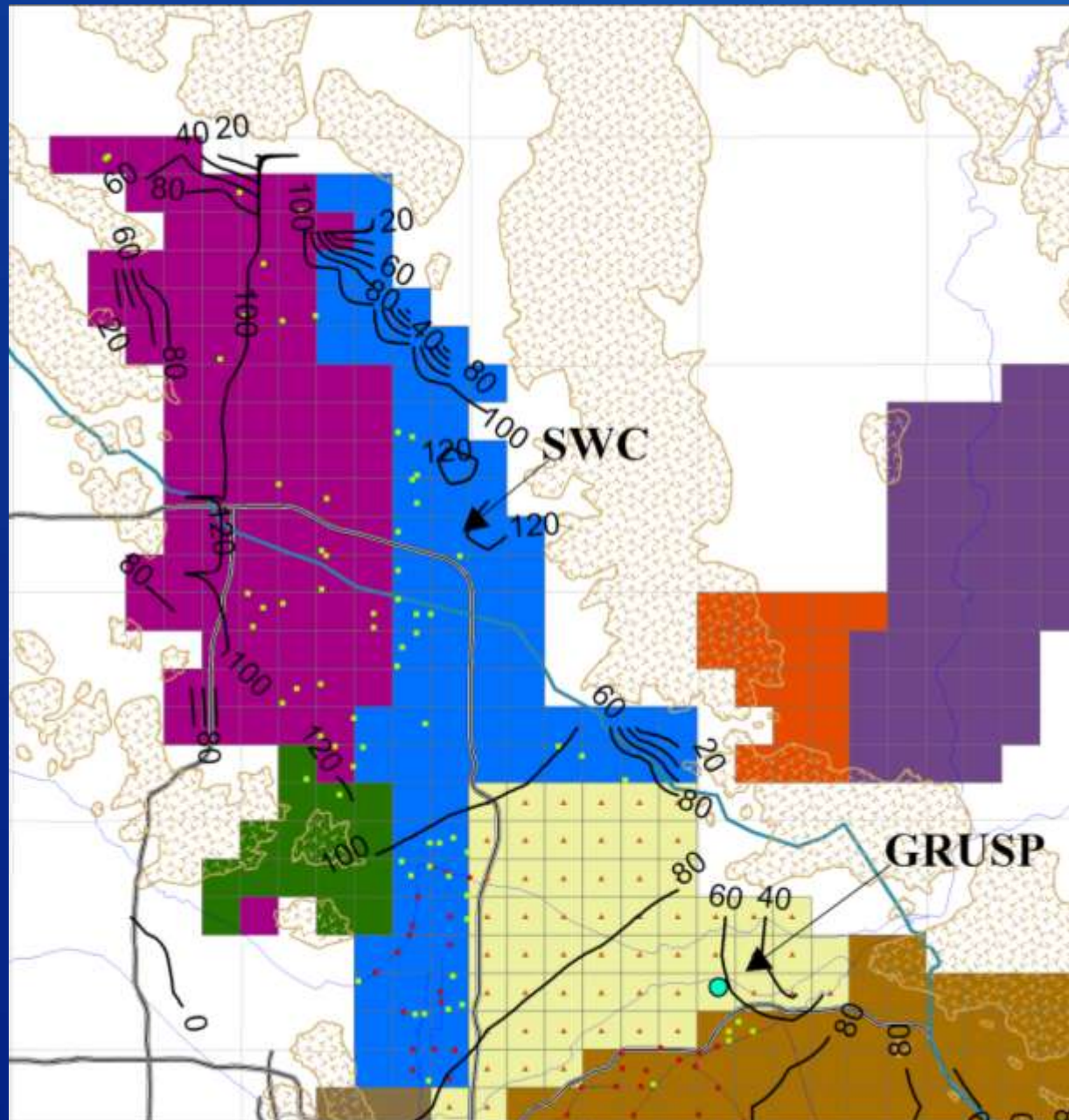
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D2 Scenario

Simulated Water Level
Decline (ft.) over
Basecase (BC)

Year 2100

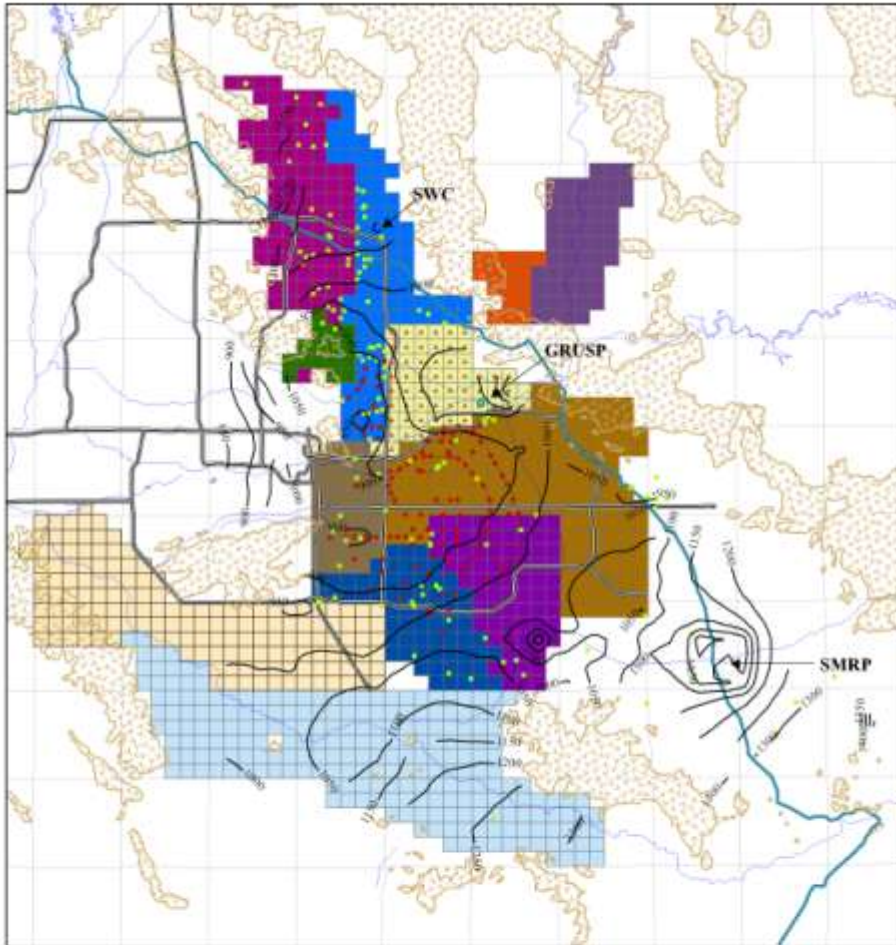
Close-up of SWC Area



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D2 Scenario

Simulated Water Levels - Year 2030



Preliminary EVWF Drought Modeling - Drought 2 Scenario "D2"

Additional ~ 90K AF Annual Average Pumping over Basecase 2010-2030
SRP and Municipal Pumping to Offset Surface Water Supply Shortages
*
~ 50% Reductions in USF Recharge at GRUSP, SMRP, & SWC 2005-2030

Simulated Groundwater Levels at Year 2100

Water Level
Elevation Contours 1100

(ft. amsl)

C.1. = 50'

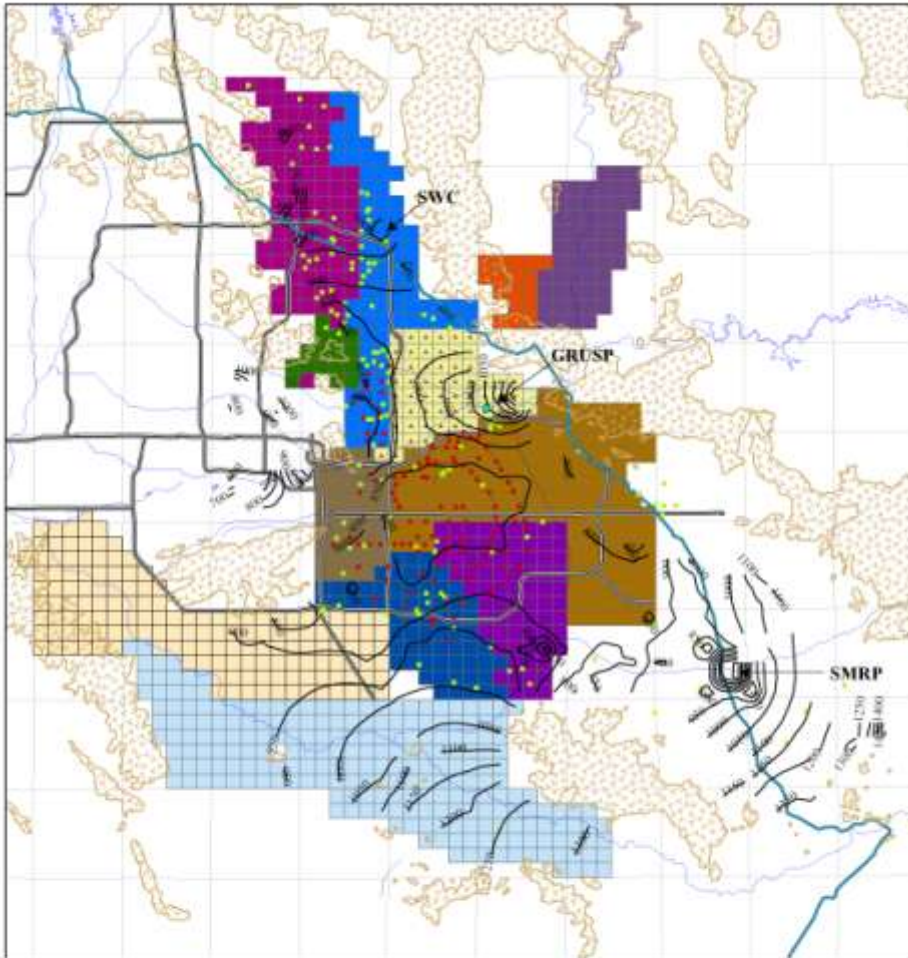
0 3 6 9 12 Miles



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D2 Scenario

Simulated Water Levels - Year 2100

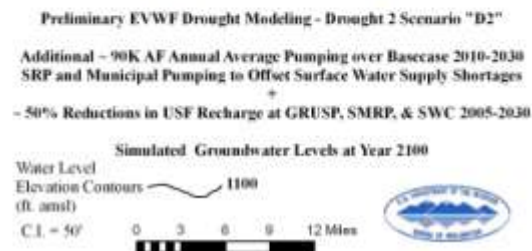


Primary Changes from BC:

- ~90K AFY Additional ESRV Pumping Averaged over Years 2010-2030
- USF Recharge at GRUSP, SMRP, & SWC reduced ~ 50% from BC

•Notes:

1800 AF avg. Phoenix WPA 411
Right 57 (SRP) pumping not included



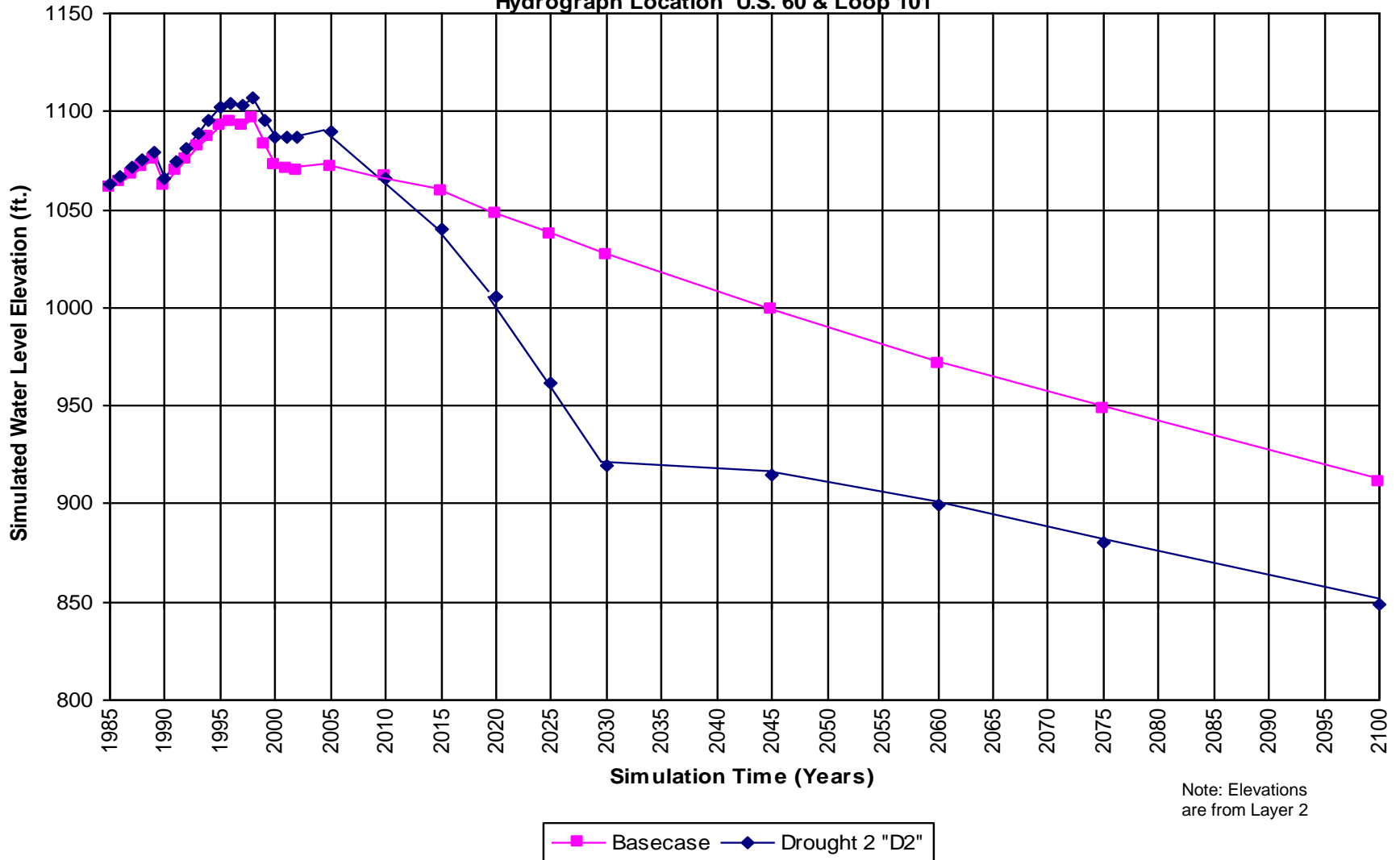
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Water Level Hydrographs

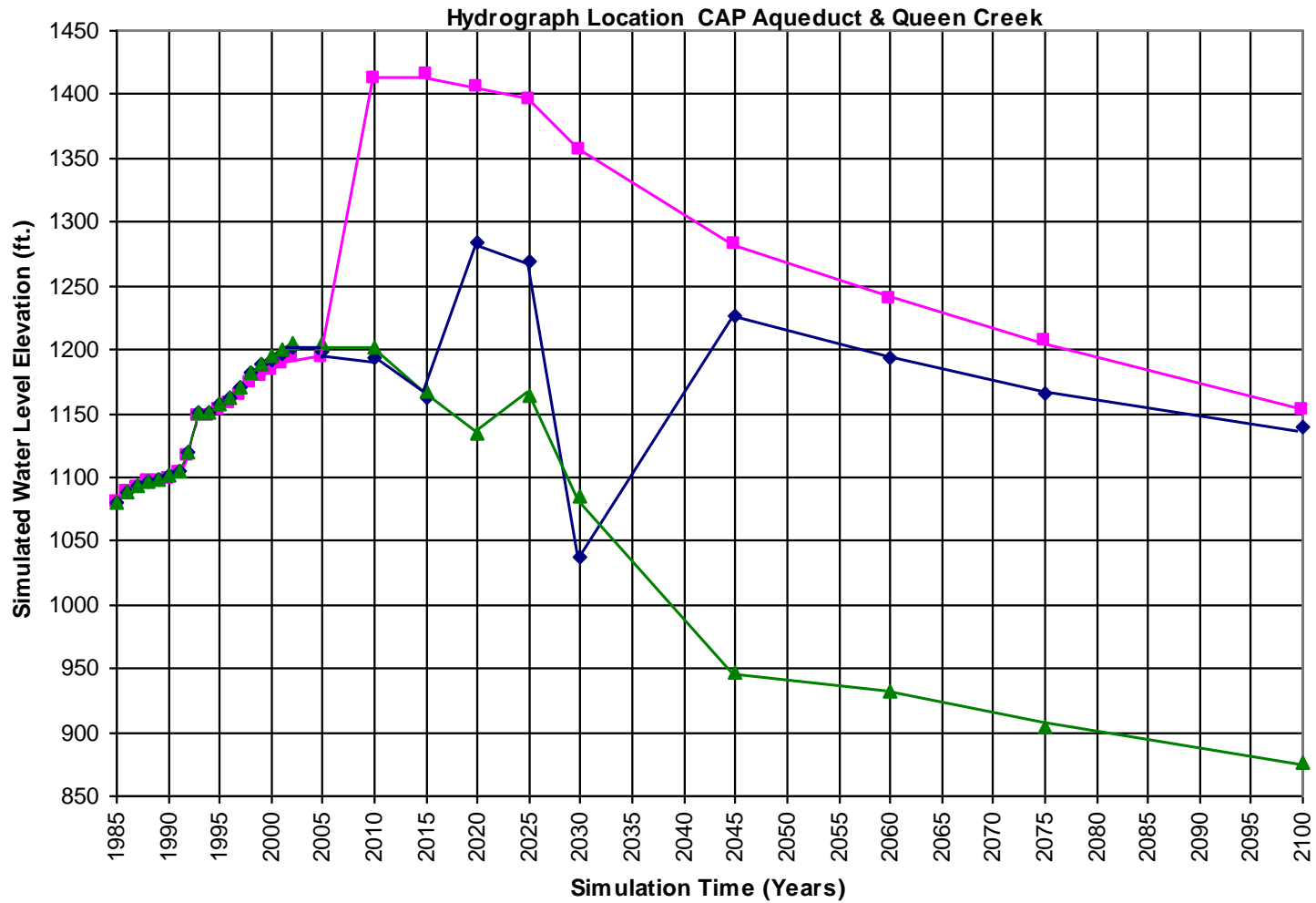
- U.S. 60 & Loop 101
- CAP Aqueduct & Queen Creek
- McDowell Road & Country Club Drive

East Valley Water Forum (EVWF) - Simulated Water Level Elevations 1985 through 2100
Comparison Between Basecase and Drought 2 (1-28-09) Scenarios

Hydrograph Location U.S. 60 & Loop 101



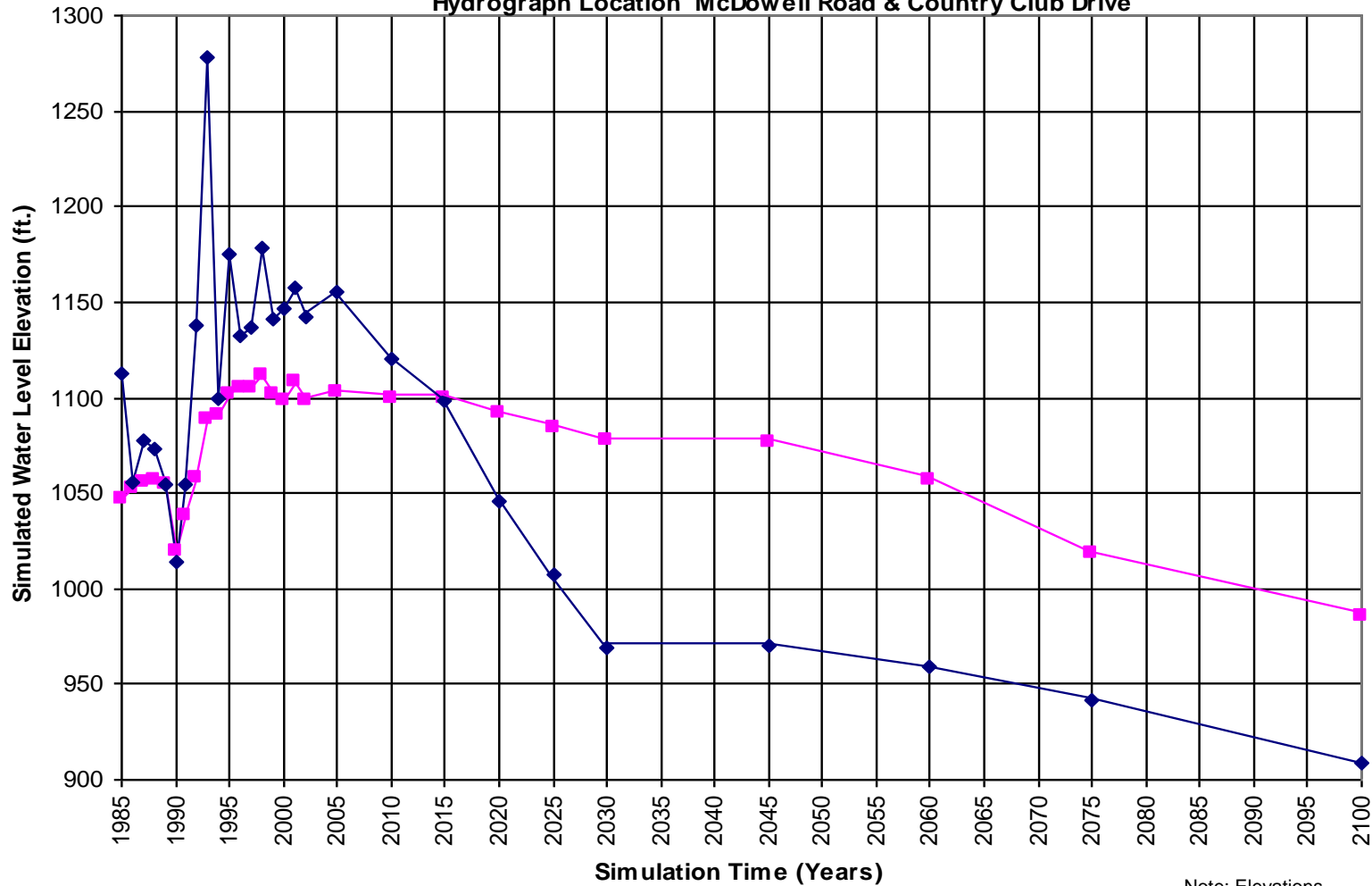
**East Valley Water Forum (EVWF) - Simulated Water Level Elevations 1985 through 2100
Comparison Between Basecase, Drought 2 (1-28-09) & Preliminary Drought 3 (5-26-09) Scenarios**



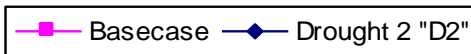
■ Basecase
 ◆ Drought 2 "D2"
 ▲ Drought 3 "D3"

East Valley Water Forum (EVWF) - Simulated Water Level Elevations 1985 through 2100
Comparison Between Basecase and Drought 2 (1-28-09) Scenarios

Hydrograph Location McDowell Road & Country Club Drive



Note: Elevations are from Layer 2



Scenario Results & Visualization

- Determine Times for Presenting Output
- Determine Types & Format of Water Level Maps
- Determine Types of Water Budget Analyses
- Other hydrograph locations?

What are the Drought 2 & 3 Scenario Trends Suggesting?

- Large Volumes of Continuous USF Recharge is Key in the East Valley, Drought 3 (D3) Shows SMRP Recharge is Essential 2030-2100
- The Effects of Early to Mid Century Groundwater Level Declines Dissipate Toward the Latter Years in Areas Influenced by the Large USFs. Aquifer Recoveries are apparent in down-gradient areas receiving recharge in the Lower Half of the East Valley Sub-basin.
- The Sensitivity to Natural Drought effects such as Reduced River Flood Recharge, Mountain-front Recharge, and Continuing Cycles of Drought is not Reflected in the Drought 2/3 Scenarios.
- Overall in the East Valley Sub-basin, more of the Middle and Lower Alluvial Units (Model Layers 2 & 3) go dry around the Periphery of the Basin by Year 2100, compared to Year 2030.

Next Drought Scenarios

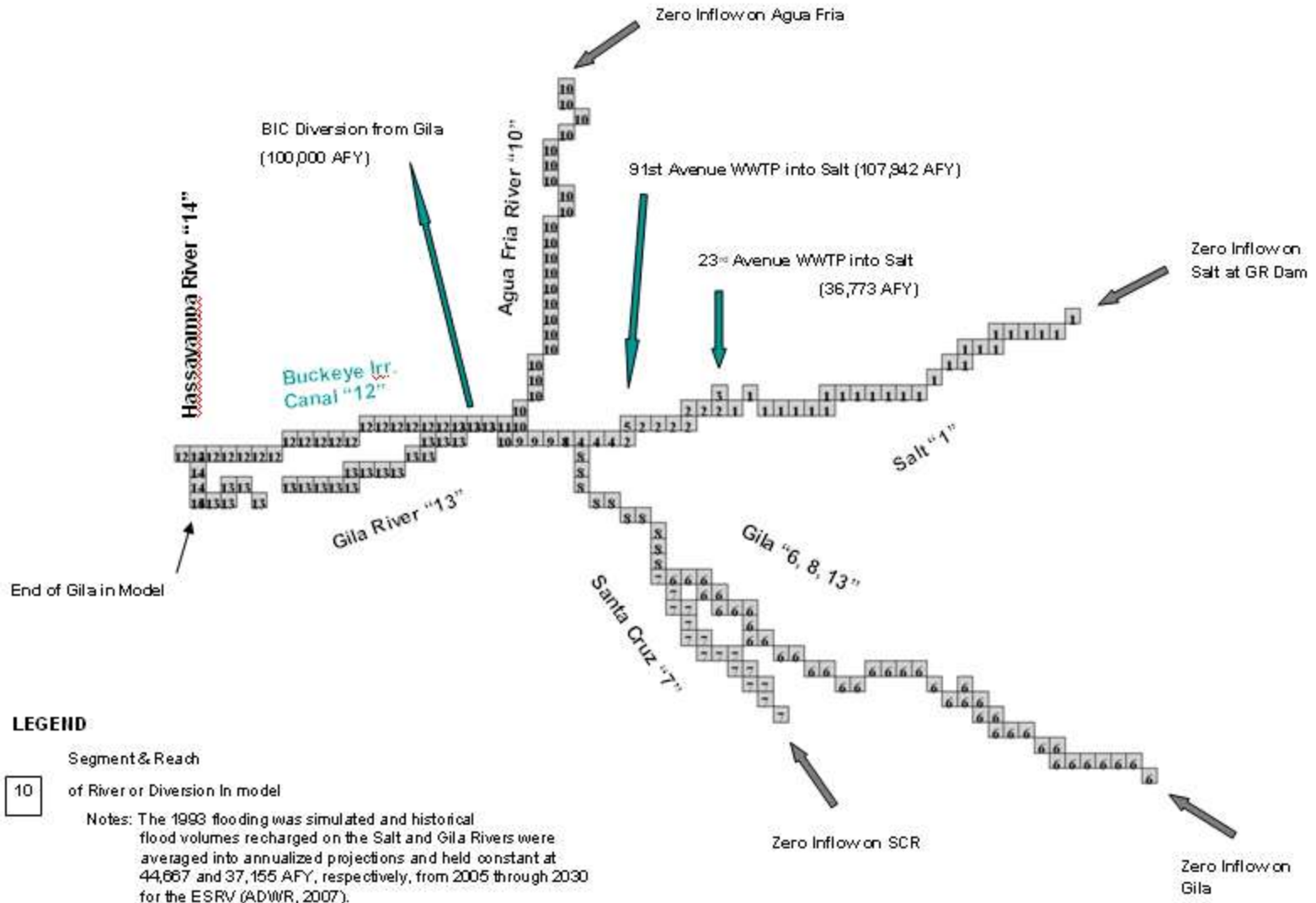
- Include next 20-year drought cycle (e.g., 2060 - 2080) rather than “flat-lined” demand/supply projections between 2030 – 2100?
- Factor in “natural drought effects” such as reduced river flood recharge, mountain-front, urban, etc.

Questions? Thoughts?

- Some enhancements would be to include one or more 20-year drought cycles (e.g., 2060 - 2080) rather than “flat-lined” demand/supply projections between 2030 – 2100.
- Factor in “natural drought effects” such as reduced river flood recharge, mountain-front recharge, less areal precip. etc.

EVWF Basecase Model Schematic – Initial Stream Recharge Input Assumptions (1983)

(for Drought Scenario Discussion)



LEGEND

Segment & Reach

10

of River or Diversion In model

Notes: The 1993 flooding was simulated and historical flood volumes recharged on the Salt and Gila Rivers were averaged into annualized projections and held constant at 44,667 and 37,155 AFY, respectively, from 2005 through 2030 for the ESRV (ADWR, 2007).