

PECOS RIVER COMPACT

Report of the River Master

Water Year 2020

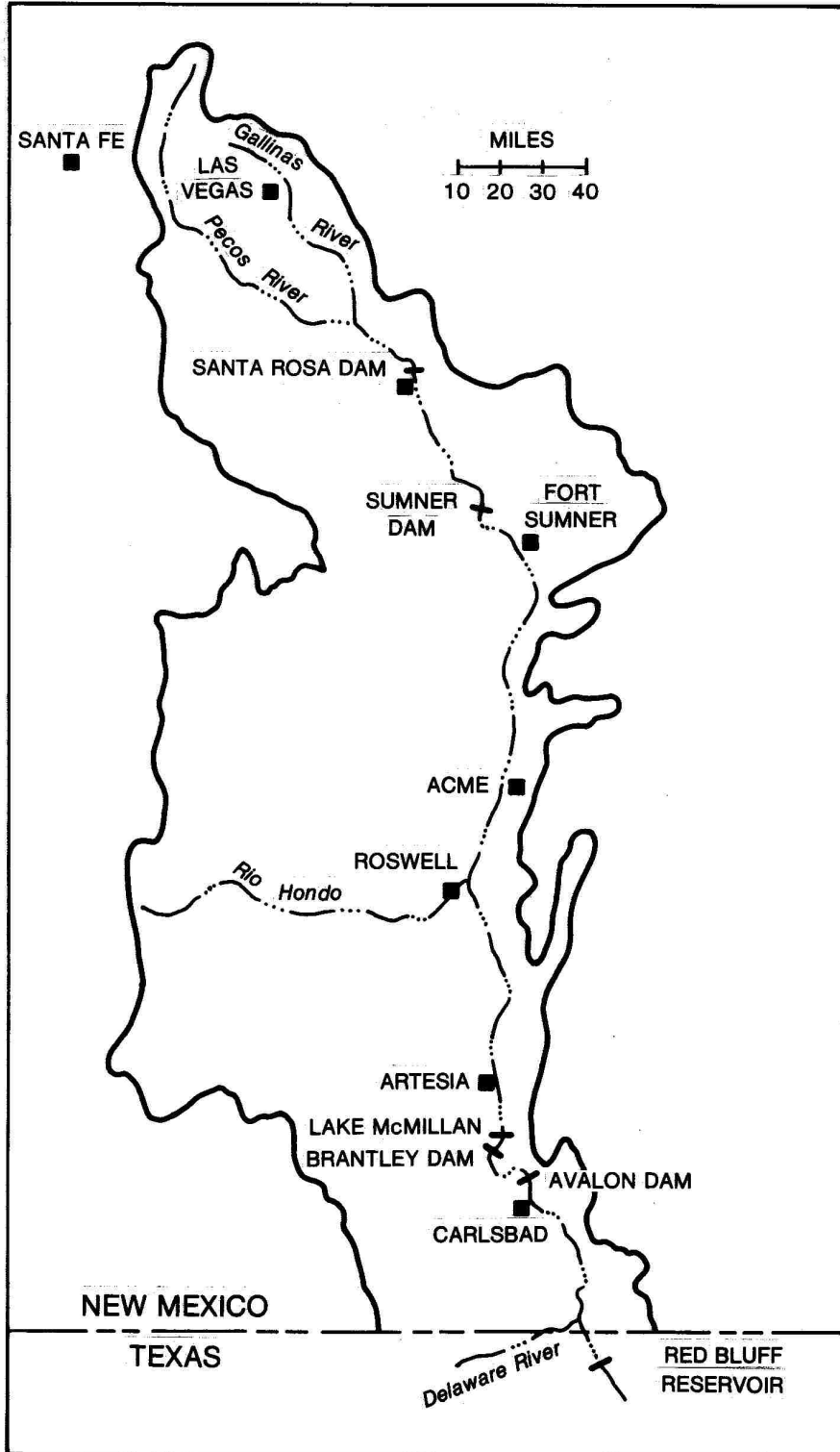
Accounting Year 2021

Final Report

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Map of Pecos River Basin Showing Accounting Reaches

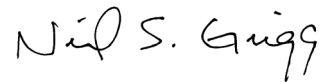
PECOS RIVER COMPACT
Supreme Court of the United States
No. 65, Original
Amended Decree

Final Report of the River Master
Water Year 2020 - Accounting Year 2021
June 26, 2021

Purpose of the Report. In its Amended Decree issued March 28, 1988 the Supreme Court of the United States appointed a River Master of the Pecos River and directed him to "... Deliver to the parties a Preliminary Report setting forth the tentative results of the calculations required by Section III.B.1 of this Decree by May 15 of the accounting year..." and to consider "... any written objections to the Preliminary Report submitted by the parties prior to June 15 of the accounting year..." and to deliver "... to the parties a Final Report setting forth the final results of the calculations required by Section III.B.1 of this Decree by July 1 of the accounting year." This is the required Final Report with the determination of:

- a. The Article III(a) obligation;
- b. Any shortfall or overage, which calculation shall disregard deliveries of water pursuant to an Approved Plan;
- c. The net shortfall, if any, after subtracting any overages accumulated in previous years, beginning with water year 1987.

Result of Calculations and Statement of Shortfall or Overage. The results of the calculations in this Final Report show that New Mexico's delivery in Water Year 2020 was a shortfall of 4,700 acre-feet. The accumulated overage since the beginning of Water Year 1987 is 161,600 acre-feet.



Neil S. Grigg
River Master of the Pecos River

Pecos River Compact		
Accumulated Shortfall or Overage		
	May 7, 2019	
Water Year	Annual Overage or Shortfall, AF	Accumulated Overage or Shortfall, AF
1987	15,400	15,400
1988	23,600	39,000
1989	2,700	41,700
1990	-14,100	27,600
1991	-16,500	11,100
1992	10,900	22,000
1993	6,600	28,600
1994	5,900	34,500
1995	-14,100	20,400
1996	-6,700	13,700
1997	6,100	19,800
1998	1,700	21,500
1999	1,400	22,900
2000	-12,300	10,600
2001	-700	9,900
2002	-3,000	6,900
2003	2,000	8,900
2004	8,300	17,200
2005	24,000	41,200
2006	26,100	67,300
2007	25,200	92,500
2008	6,000	98,500
2009	1,600	100,100
2010	-500	99,600
2011	500	100,100
2012	1,900	102,000
2013	-6,300	95,700
2014	700	96,400
2015	27,300	123,700
2016	27,200	150,900
2017	19,900	170,800
2018	5,300	176,100
2019	-9,800	166,300
2020	-4,700	161,600

Table 1. General Calculation of Annual Departures in TAF (B.1)				
Water Year		2020		
6/23/2021				
		WY 2018	WY 2019	WY 2020
B.1.a. Index Inflows				
(1) Annual flood inflow				
(a) Gaged flow Pecos R bel Alamogordo Dam		97.7	125.8	91.3
(b) Flood Inflow Alamogordo - Artesia (Table 2)		5.3	17.4	-7.8
(c) Flood Inflow Artesia - Carlsbad (Table 3)		9.8	10.0	7.6
(d) Flood Inflow Carlsbad - State Line (Table 4)		5.6	6.7	1.2
Total (annual flood inflow)		118.4	159.9	92.3
(2) Index Inflow (3-year avg)				123.5
B.1.b. 1947 Condition Delivery Obligation (Index Outflow)				
				46.5
B.1.c. Average Historical (Gaged) Outflow				
(1) Annual historical outflow				
(a) Gaged Flow Pecos River at Red Bluff NM		42.6	45.8	36.8
(b) Gaged Flow Delaware River nr Red Bluff NM		1.8	0.9	0.3
(c) Metered diversions Permit 3254 into C-2713		0.4	0.4	0.4
Total Annual Historical Outflow		44.8	47.1	37.4
(2) Average Historical Outflow (3-yr average)				43.1
B.1.d. Annual Departure				
				-3.3
C. Adjustments to Computed Departure				
1. Adjustments for Depletions above Alam Dam				
a. Depletions Due to Irrigation (Table 5)		0.6	0.4	2.6
b. Depl fr Operation of Santa Rosa Reservoir (Table 6)		0.6	4.5	3.7
c. Transfer of Water Use to Upstream of AD		0	0	0
Recomputed Index Inflows				
(1) Annual flood inflow				
(a) Gaged flow Pecos R bel Alamogordo Dam		98.9	130.7	97.6
(b) Flood Inflow Alamogordo - Artesia		5.3	17.4	-7.8
(c) Flood Inflow Artesia - Carlsbad		9.8	10.0	7.6
(d) Flood Inflow Carlsbad - State Line		5.6	6.7	1.2
Total (annual flood inflow)		119.6	164.8	98.6
Recomputed Index Inflow (3-year avg)				127.7
Recomputed 1947 Condition Del Outflow (Index Outflow)				
				48.7
Recomputed Annual Departures				
				-5.6
Credits to New Mexico				
C.2 Depletions Due to McMillan Dike				0.9
C.3 Salvage Water Analysis				0
C.4 Unappropriated Flood Waters				0
C.5 Texas Water Stored in NM Reservoirs				0
C.6 Beneficial C.U. Delaware River Water				0
Final Calculated Departure, TAF				
				-4.7

Table 3. Determination of Flood Inflows, Artesia to Carlsbad (B.4)													
Water Year	2020												
6/24/2021													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
Rio Penasco at Dayton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fourmile Draw nr Lakew	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Seven Rivers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Arroyo at Hwy Br	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flood Inflow, Art-DS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pecos R at Dam Site 3	2.3	3.4	5.4	13.7	12.8	13.6	9.2	6.7	7.0	6.3	0.9	1.1	82.6
CB Sprgs New Water (from Table 7)	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-4.3
Total Inflow, DS3 - CB	2.0	3.1	5.0	13.4	12.5	13.2	8.8	6.4	6.7	6.0	0.6	0.8	78.2
Evap Loss, Lake Avalon (from Table 10)	0.0	0.3	0.2	0.5	0.7	0.8	0.7	0.7	0.4	0.3	0.2	0.2	4.9
Storage Chg, Lake Avalon (from Table 11)	1.4	2.2	-0.3	-1.3	-0.1	0.0	-0.3	-0.4	-0.2	-0.3	0.4	0.5	1.6
Carls ID diversions	0.0	0.0	3.6	13.1	11.3	12.5	9.4	6.2	6.0	5.6	0.0	0.0	67.8
93% CID diver	0.0	0.0	3.4	12.2	10.5	11.6	8.8	5.8	5.6	5.2	0.0	0.0	63.1
Other depletions	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.4
Dark Canyon at Csbad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pecos b Dark Canyon	2.8	1.9	2.0	0.6	1.0	1.0	0.9	0.9	0.8	0.9	0.9	1.0	14.8
Pecos R at Carlsbad	2.8	1.9	2.0	0.6	1.0	1.0	0.9	0.9	0.8	0.9	0.9	1.0	14.8
Total Outflow	4.3	4.5	5.5	12.2	12.1	13.5	10.2	7.2	6.8	6.3	1.6	1.8	85.8
Flood Inflow, DS3-CB	2.3	1.5	0.5	-1.2	-0.3	0.3	1.4	0.8	0.1	0.3	1.0	1.0	7.6
Flood Inflow, Art-CB	2.3	1.5	0.5	-1.2	-0.3	0.3	1.4	0.8	0.1	0.3	1.0	1.0	7.6

Table 4. Summary Table for Computations, Carlsbad to State Line (B.5)						
Water Year	2020					
5/2/2021						
		BCB - RB	Del R	DC		
		RM				
Jan		0.1	0.0	0.0		
Feb		0.1	0.0	0.0		
Mar		0.4	0.0	0.0		
Apr		0.0	0.0	0.0		
May		0.0	0.0	0.0		
Jun		0.1	0.0	0.0		
Jul		0.0	0.0	0.0		
Aug		0.3	0.0	0.0		
Sep		0.1	0.0	0.0		
Oct		0.1	0.0	0.0		
Nov		0.0	0.0	0.0		
Dec		0.0	0.0	0.0		
Total		1.2	0.0	0.0		
Summary of flood inflows, Carlsbad to State Line, TAF						
Red Bluff - Carlsbad + Dark C RM calcs)						1.2
Delaware River						0.0
Total Flood Inflow, Carlsbad to State Line						1.2

Table 5. Depletions Due to Irrigation Above Sumner Dam (C.1.a)								
Water Year	2020							
5/10/2021								
	APR	MAY	JUN	JUL	AUG	SEPT	OCT	TOTAL
Precip Las Vegas FAA AP	0.03	0.19	0.51	4.09	0.75	0.62	0.28	6.47
Eff prec Las Veg FAA AP	0.03	0.19	0.50	3.36	0.73	0.61	0.27	5.69
Precip Pecos Natl Monument	0.74	0.44	0.68	3.57	1.59	3.02	0.39	10.43
Eff Precip Pecos RS	0.72	0.43	0.66	3.00	1.48	2.60	0.38	9.27
Precip Santa Rosa	0.55	0.02	0.50	4.36	0.53	1.02	0.86	7.84
Eff Precip Santa Ro	0.54	0.02	0.49	3.52	0.52	0.99	0.83	6.91
Average eff precip, ft	0.04	0.02	0.05	0.27	0.08	0.12	0.04	0.61
Consumptive use, ft	0.19	0.36	0.36	0.30	0.27	0.18	0.11	1.77
Unit depletion rate (CU less eff precip), ft	0.15	0.34	0.31	0.03	0.19	0.06	0.07	1.16
Acres (most recent inventory)	11529							
Streamflow depletion (actual use), AF	13402							
1947 depletion, AF	10804							
Difference (actual use - 1947 depletion), TAF	2.6							
Adjustment to Gaged Flow, Pecos River below Sumner Dam, TAF =						2.6		

Table 6. Depletions Due to Santa Rosa Reservoir Operations (C.1.b)													
Water Year	2020												
5/10/2021													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
<i>LSR 2013 table (USBR), add 4,200 feet to value shown; LSR 1997 tables used (COE); Add 4,700 feet to value shown</i>													
Lk Sumner ga ht, avg	54.70	56.32	56.84	55.30	52.67	48.59	45.81	43.71	39.13	41.28	43.60	47.00	
LS content, AF, avg	23026	26010	27023	24105	19596	13807	10733	8820	5621	6972	8728	11972	
LS area, acres, avg	1774	1915	1971	1824	1608	1226	993	832	579	689	826	1089	
LS evap, inches	4.10	3.64	8.23	12.01	17.39	18.21	16.26	14.69	10.76	10.00	6.56	5.31	127.16
.77 LS Evap	3.15	2.80	6.34	9.25	13.39	14.02	12.52	11.31	8.29	7.70	5.05	4.09	97.91
LS Precip, inches	0.70	0.29	1.08	0.38	0.08	0.29	2.20	0.64	0.35	0.62	0.10	0.01	6.74
Net LS Evap, inches	2.45	2.51	5.26	8.87	13.31	13.73	10.32	10.67	7.94	7.08	4.95	4.08	91.17
LSum Evaploss, TAF	0.36	0.40	0.86	1.35	1.78	1.40	0.85	0.74	0.38	0.41	0.34	0.37	9.26
							4697.49			4693.55	4693.67	4693.86	
L S Rosa ga ht, avg*	21.50	21.56	21.82	24.31	29.31	5.80	-2.51	2.62	2.08	-6.45	-6.33	-6.14	
LSR content, AF, avg	25812	26132	26537	30677	40456	9583	5110	7621	7324	3610	3651	3716	
LSR area, acres, avg	1522	1542	1566	1759	2148	675	425	558	541	340	342	345	
LSR evap, inches	3.72	5.16	8.58	9.52	13.63	14.85	12.77	11.81	8.87	9.14	4.88	3.76	106.69
.77 LSR Evap	2.86	3.97	6.61	7.33	10.50	11.43	9.83	9.09	6.83	7.04	3.76	2.90	82.15
LSR precip, inches	0.79	0.78	0.79	0.55	0.02	0.50	4.36	0.53	1.02	0.86	0.17	0.21	10.58
Net LSR Evap, inches	2.07	3.19	5.82	6.78	10.48	10.93	5.47	8.56	5.81	6.18	3.59	2.69	71.57
LSR Evaploss, TAF	0.26	0.41	0.76	0.99	1.88	0.62	0.19	0.40	0.26	0.18	0.10	0.08	6.12
Total evaploss, TAF	0.63	0.81	1.62	2.34	3.66	2.02	1.05	1.14	0.64	0.58	0.44	0.45	15.38
* Indicates below 4700 ft													
Sum contents, AF	48838	52142	53560	54782	60052	23390	15843	16441	12945	10582	12379	15688	
1947 area, acres	2195	2352	2438	2513	2748	1221	967	997	818	774	800	959	
1947 evaploss, TAF	0.45	0.49	1.07	1.86	3.05	1.40	0.83	0.89	0.54	0.46	0.33	0.33	11.68
current-1947evaploss	0.18	0.32	0.55	0.48	0.61	0.62	0.22	0.25	0.10	0.12	0.11	0.12	3.70
							Annual adjustment for excess evaporation =						3.7
ADJUSTMENT FOR EXCESSIVE STORAGE IN SANTA ROSA RESERVOIR													
			2019	2019	2020	2020							
			Gage	Storage	Gage	Storage							
EndYear Sumner Sto			4253.79	21446	48.30	13456							
EndYear S R Sto			4721.49	26026	94.00	3765							
Sum				47472		17221							
Sto Adjustment, TAF						0.0							
Adjustm Ex Evap, TAF						3.7							
Total Adjustment, TAF						3.7							
			Storage adjustment										
			Both equal or less than 129.3 TAF, adjustment is zero										
			Both greater than 129.3 TAF, subtract previous from current year										
			Current year less than 129.3 TAF, previous greater than 129.3 TAF, subtract previous year from 129.3 TAF										
			Current year greater than 129.3 TAF, previous year less than 129.3 TAF, subtract 129.3 TAF from current year										

Table 7. Carlsbad Springs New Water [B.4.c.(2)]					
Water Year	2020				
6/24/2021					
		TAF	AF/day	cfs	Totals
Pecos R bel DC		14.8	40.5	20.4	20.4
Dark Canyon		0.0	0.0	0.0	0.0
Pecos R bel Lake Avalon		0.1	0.2	0.1	0.1
Depletion, cfs					2.0
CID lag seep, cfs (from Table 8)					6.8
Return flow, cfs					1.0
Lake Av lagged seep, cfs (from Table 9)					17.5
PR seepage, cfs					3.0
Carls new water, cfs					-5.98
Carls new wat, TAF					-4.3
Carls new wat monthly, TAF					-0.4

Table 8. Carlsbad Main Canal Seepage Lagged [B.4.c.(2)(e)]													
Water Year	2020												
5/10/2021													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
WY 2020													
CID, TAF	0.0	0.0	3.6	13.1	11.3	12.5	9.4	6.2	6.0	5.6	0.0	0.0	67.8
days/mo	31	29	31	30	31	30	31	31	30	31	30	31	366
cfs	0	0	58.7	220.9	183.3	210.2	153.5	100.9	101.3	91.2	0.0	0.0	93.3
cfs, qtr avg			20.0			204.6			118.7			30.7	
WY 2019		1Q	2Q	3Q	4Q								
FLOWS, cfs				169.3	40.3								
SEVEN %				11.9	2.8								
WY 2020 lagged		1Q	2Q	3Q	4Q								
FLOWS, cfs		20.0	204.6	118.7	30.7								
SEVEN %		1.4	14.3	8.3	2.2								
LAG		3.6	8.1	9.2	6.2	Avg =	6.8	cfs					

Table 9. Lake Avalon Leakage Lagged [B.4.c.(2)(g)]													
Water Year	2020												
	6/24/2021												
WY 2020	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
Elev NM rept	61.2	75.6	76.9	74.2	74.3	74.0	74.2	74.4	73.1	72.8	72.8	73.6	
ga ht, avg*	4.2	18.6	19.9	17.2	17.3	17.0	17.2	17.4	16.1	15.8	15.8	16.6	
cfs	0.0	27.1	33.0	20.3	20.6	19.4	20.1	21.0	15.1	13.6	13.5	17.1	
days	31	29	31	30	31	30	31	31	30	31	30	31	366
cfs avg	20.1			20.1			18.8			14.7			18.4
WY 2019		1Q	2Q	3Q	4Q								
cfs				19.3	7.0								
WY 2020 lagged		1Q	2Q	3Q	4Q								
cfs		20.1	20.1	18.8	14.7								
lag cfs		15.6	17.9	19.4	17.0	Avg =	17.5	cfs					

* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)

Table 10. Evaporation Loss at Lake Avalon [B.4.d.(1)]													
Water Year	2020												
6/24/2021													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
Av WS NM Rept	61.24	75.63	76.87	74.21	74.27	74.03	74.17	74.37	73.12	72.81	72.79	73.55	
Avalon ga ht, avg, ft*	4.24	18.63	19.87	17.21	17.27	17.03	17.17	17.37	16.12	15.81	15.79	16.55	
Avg area Avalon, ac**	0	821	898	711	717	691	707	728	585	556	555	634	
Panevap Brantley, in.	4.65	5.80	6.78	11.09	16.15	17.38	16.05	14.69	10.89	9.32	4.80	4.34	121.94
Lakeevap Brantley, in.	3.58	4.47	5.22	8.54	12.44	13.38	12.36	11.31	8.39	7.18	3.70	3.34	93.89
Precip Brantley, in.	0.25	0.63	2.20	0.05	0.04	0.12	0.82	0.30	0.02	0.05	0.17	0.02	4.67
Netevap, inches	3.33	3.84	3.02	8.49	12.40	13.26	11.54	11.01	8.37	7.13	3.53	3.32	89.22
Evaploss Av, TAF	0.00	0.26	0.23	0.50	0.74	0.76	0.68	0.67	0.41	0.33	0.16	0.18	4.92
* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)													
** Based on 2006 USBR Area and Capacity Table													

Table 11. Change in Storage, Lake Avalon [B.4.d.(2)]														
(Gage heights are end of month)														
Water Year	2020													
	5/8/2021													
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
	2019	2020												
WS NM Rept	60.0	73.5	76.4	76.1	74.5	74.3	74.3	73.8	73.2	72.9	72.4	73.1	73.9	
Gage EOM, ft*	3.0	16.5	19.4	19.1	17.5	17.3	17.3	16.8	16.2	15.9	15.4	16.1	16.9	
Storage, AF**	0	1385	3613	3357	2073	1926	1926	1580	1202	1029	757	1143	1647	
Change sto, TAF		1.4	2.2	-0.3	-1.3	-0.1	0.0	-0.3	-0.4	-0.2	-0.3	0.4	0.5	1.6
* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)														
** Based on 2006 USBR Area and Capacity Table														

APPENDIX

RESPONSE TO STATES'
OBJECTIONS

RESPONSE TO STATES' OBJECTIONS

Final Report, Accounting Year 2021

NEW MEXICO'S OBJECTIONS

I. Table 1. General Calculation of Annual Departures in TAF

New Mexico reported an error in Table 1, which contained some values that were not corrected from Accounting Year 2020. This objection is accepted. Table 1 has been corrected.

II. Table 7. Carlsbad Springs New Water for WY 2020

New Mexico reported that the calculation of Carlsbad Springs New Water did not include a small spill from Avalon Reservoir. The objection is accepted, and Table 7, Table 3, and Table 12 have been modified.

III. Table 9. Avalon Lagged Leakage for WY 2020

New Mexico reported that no leakage was shown for November and December. The objection is accepted, and Table 9, Table 7, and Table 3 have been corrected.

IV. Table 10. Evaporation Loss at Lake Avalon for WY 2020

New Mexico reported that Avalon Reservoir area for December was missing. The objection is accepted, and Tables 10 and Table 3 have been corrected.

TEXAS' OBJECTIONS

1. Table 1. General Calculation of Annual Departures (B.1), TAF for WY 2020:

Texas noted the same error in Table 9 that is described in New Mexico's objection III above. The objection is accepted. Texas and the River Master both calculated 17.0 for 4th Quarter lagged leakage, but Texas computed an annual average of 17.4 cfs and the River Master computed 17.5 cfs (see Table 9 in this Final Report). The difference appears to be due to rounding. After correcting Tables 9, 7, and 3, Flood Inflow Artesia to Carlsbad was 7.6 TAF.

2. Table 1. General Calculation of Annual Departures in TAF for WY 2020:

Texas noted the same error in Table 1 that is described in New Mexico's objection I. The objection is accepted, and the table has been corrected.

FINAL CALCULATED DEPARTURE

The Preliminary Report had a Final Calculated Departure as a shortfall of 17.2 TAF. After considering the states' objections, the Final Determination is a shortfall of 4.7 TAF.