

**MEMORANDUM**  
**INTERSTATE STREAM COMMISSION**  
*Pecos Bureau*

**DATE:** April 8, 2010  
**TO:** Greg Lewis  
**FROM:** Kristin Green  
**CC:** ISC Pecos Bureau Staff

**SUBJECT: Pecos Settlement Carlsbad Project Water Supply Projection Procedure**

**Summary**

The Pecos Settlement Agreement, in Paragraph 9.(A), requires that the New Mexico Interstate Stream Commission (ISC), in good-faith consultation with the Carlsbad Irrigation District (CID), the United States, and the Pecos Valley Artesian Conservancy District (PVACD) (collectively, the Settlement Parties), estimate the total Carlsbad CID Project Water Supply that will be available on prescribed Target Dates as summarized in Table 1. If the projected Project Water Supply for a given Target Date is less than the corresponding Target Supply, then ISC shall deliver water to the Pecos River from its augmentation well fields and/or Hagerman Canal as necessary to meet the Target Supply.

<b>Projection Date</b>	<b>Target Date</b>	<b>Target Supply (AF)</b>
November 1	March 1	50,000
March 1	May 1	60,000
May 1	June 1	65,000
June 1	July 15	75,000
July 15	September 1	90,000

Table 1. Settlement Triggers for Augmentation Pumping

The purpose of this memorandum is to provide step-by-step instructions for completing the Project Water Supply projections. The format and description for the projection output data are shown in Table 2, and a sample calculation is provided in Table 3. All tables and recent projections are located in the *Projections* spreadsheet on the Office of the State Engineer’s (OSE) website (<http://www.ose.state.nm.us/>) as *Pecos Settlement Implementation* in ‘Hot Topics’ and on the Pecos Basin page ([http://www.ose.state.nm.us/isc\\_pecos\\_river\\_compact.html](http://www.ose.state.nm.us/isc_pecos_river_compact.html)) under ‘Pecos Basin Links.’ This memorandum breaks down the calculations contained in Table 2 into separate steps as follows:

1. Total and Available Storage at Time of Projection
2. Projected Releases to the State Line
3. CID Delivery
4. Fort Sumner Irrigation District (FSID) Delivery/Allotments
5. Projected Evaporative Losses
6. Average Inflow
7. Total Projected Storage and Settlement Target Determinations

Row	Description	Source of Value	Equation
1	Projection Date	NA	NA
2	Target Date for Projection	ISC	NA
3	Avalon Total Storage on Projection Date	CID	NA
4	Brantley Total Storage on Projection Date	USACE	NA
5	Sumner Total Storage on Projection Date	USACE	NA
6	Santa Rosa Total Storage on Projection Date	USACE	NA
7	Avalon Elevation (rounded to nearest tenth)	CID	NA
8	Brantley Elevation (rounded to nearest tenth)	USACE	NA
9	Sumner Elevation (rounded to nearest tenth)	USACE	NA
10	Santa Rosa Elevation (rounded to nearest tenth)	USACE	NA
11	Total Available Storage (reduced to Brantley) on Projection Date	Calculated	$([3]-\text{min pool-seeds}) + ([4]-\text{min pool-seeds}) + ([5]-\text{min pool-seeds}) * 0.75 + ([6]-\text{min pool-seeds}) * 0.65$
12	Projected releases to state line	ISC	NA
13	CID allotments (prior to projection date)	CID or USGS	NA
14	FSID allotments (through projection time frame)	OSE or USGS	calculated based on 20-yr average data [see FSID tab]
15	Avalon Evaporative Losses	ISC	calculated based on average data & reservoir elevation [see Evaporation tab]
16	Brantley Evaporative Losses	ISC	calculated based on average data & reservoir elevation [see Evaporation tab]
17	Sumner Evaporative Losses	ISC	calculated based on average data & reservoir elevation [see Evaporation tab]
18	Santa Rosa Evaporative Losses	ISC	calculated based on average data & reservoir elevation [see Evaporation tab]
19	Total Evaporative Losses for all 4 Reservoirs	Calculated	$[15] + [16] + [17] + [18]$
20	Santa Rosa Streamflow Forecast (% of average)	NRCS	NA
21	Projected Inflow to Brantley Reservoir	ISC	calculated based on average data [see Inflow tab]
22	Projected Inflow to Sumner Reservoir	ISC	calculated based on average data [see Inflow tab]
23	Projected Inflow to Santa Rosa	ISC	calculated based on average data & streamflow forecast [see Inflow tab]
24	Total Projected Storage (reduced to Brantley) for projection prior to Nov.1 for the following calendar year	Calculated	$[11] - [12] - [13] - [14] - [19] + [22] + [23] * 0.75 + [24] * 0.65$
25	Total Projected Storage (reduced to Brantley) for projection between Nov. 1 and Oct. 31	Calculated	$[11] - [12] + [13] - [14] - [19] + [22] + [23] * 0.75 + [24] * 0.65$
26	Settlement Target	ISC	NA
27	Augmentation Pumping?	Calculated	if $[26] > [27]$ , 'No', if $[27] > [26]$ , 'Yes'
28	How much pumping is required (AF)?	Calculated	$[27] - [26]$

\*Units are acre-feet (AF) unless otherwise noted

USACE United States Army Corps of Engineers

USGS United States Geological Survey

NRCS United States Department of Agriculture National Resource Conservation Service

Table 2. Reservoir Storage Projection Description Table

### Reservoir Storage Projections for Pecos Settlement

Row	Description	Projection
1	Projection Date	3/30/2010
2	Target Date for Projection	May 1
3	Avalon Total Storage on Projection Date	3,106
4	Brantley Total Storage on Projection Date	22,391
5	Sumner Total Storage on Projection Date	30,408
6	Santa Rosa Total Storage on Projection Date	25,322
7	Avalon Elevation (rounded to nearest tenth)	3,175.8
8	Brantley Elevation (rounded to nearest tenth)	3,248.4
9	Sumner Elevation (rounded to nearest tenth)	4,257.8
10	Santa Rosa Elevation (rounded to nearest tenth)	4,715.9
11	Total Available Storage (reduced to Brantley) on Projection Date	55,168
12	Projected releases to state line	0
13	CID delivery (prior to projection date)	0
14	FSID delivery/allotments (through projection time frame)	5,211
15	Avalon Evaporative Losses	665
16	Brantley Evaporative Losses	1,848
17	Sumner Evaporative Losses	1,755
18	Santa Rosa Evaporative Losses	788
19	Total Evaporative Losses for all 4 Reservoirs	5,056
20	Santa Rosa Streamflow Forecast (% of average or NA)	106%
21	Brantley Average Inflow (20-yr average excluding block releases)	4,619
22	Sumner Average Inflow (20-yr average excluding block releases)	6,452
23	Santa Rosa Average Inflow (20-yr average )	9,759
24	Total Projected Storage (reduced to Brantley) for projection prior to Nov.1 for the following calendar year	NA
25	Total Projected Storage (reduced to Brantley) for projection between Nov. 1 and Oct. 31	60,702
26	Settlement Target	60,000
27	Augmentation Pumping?	No
28	How much pumping is required (AF)?	0

\*Units are acre-feet (AF) unless otherwise noted

input cells

Table 3. Reservoir Storage Projection Table

#### Step 1: Total and Available Storage at Time of Projection

To start, open the *Projections* spreadsheet, click on the *Projections* tab and enter information into rows 1 through 10. Cells highlighted in orange are the only cells where data should be manually entered. The total reservoir storage for Santa Rosa Lake, Sumner Lake, and Brantley Reservoir can be found on the US Army Corps of Engineers' (USACE) website at <http://www.spa.usace.army.mil/wc/adbb/pecrt.htm>. Click on the respective reservoir storage links. Once the storage plot loads, click on the *Tabulated Data* link to obtain the elevation and corresponding storage volume for the projection date at midnight or other appropriate time.

If a block release is taking place, use reservoir storage data prior to the start. These data can be found on the USACE website back a short time period or in the Pecos River Operations binder or Excel file on the Pecos server. To obtain the total storage and elevation at Avalon, contact the CID at (575) 236-6390. Enter the total storage values in rows 3 through 6 and elevations in rows 7 through 10. Once entered, Excel will calculate the total available storage (reduced to Brantley) on the projection date (row 11) based on entitlement storage values and historical conveyance losses using the following equations:

**Available storage (AF)** = Current total storage (AF) - minimum pool (AF) – estimated sediment accumulation since last survey (AF)

**Total Available Storage (reduced to Brantley)** = Avalon + Brantley + Sumner\*0.75 + Santa Rosa\*0.65

The minimum pool and the estimated sediment accumulation since last survey values for each reservoir are determined by the Bureau of Reclamation (BOR). Each March, BOR sends a letter to the State Engineer with this information. Table 4 shows the 2010 entitlements storages. This information can also be found in the *Projections* spreadsheet.

Reservoir	Entitlement Storage (AF)	Minimum Pool (AF)	Estimated Sediment Accumulation Since Last Survey (AF)	Total Conservation Storage (AF)	Conservation Elevation (ft)
Santa Rosa	92,604	0	5,060	97,664	4,745.16
Sumner	40,030	2,500	396	42,926	4,262.88 (NAVD 88)
Brantley	40,000	2,000	1,533	43,533	3,256.41 (NAVD 88)
Avalon	3,866	600	0	4,466	3,177.35
<b>Total</b>	<b>176,500</b>				

Table 4. 2010 Entitlement Storages.

**Step 2: Projected Releases to the State Line**

Determine if all the state line deliveries have been made by checking the Pecos Basin website ([http://www.ose.state.nm.us/isc\\_pecos.html](http://www.ose.state.nm.us/isc_pecos.html)). If there are any scheduled state line deliveries, they will be listed in the *News* section. If they are already complete and no other releases will occur within the projected time period then enter zero. Otherwise enter the calculated release into row 12 on the Reservoir Storage Projection Table.

**Step 3: CID Delivery**

During the irrigation season, the CID delivery information will be updated weekly based on USGS stream gage data and cross-checked with values calculated monthly by the CID. The *CID Diversion Calculations* spreadsheet can be found on the Pecos Server under the *CID folder* (Table 5) or by contacting Markus Malessa at (505) 827-4029. Enter the value in row 13 of the Reservoir Storage Projection Table and this value will be added to the Total Projected Storage (reduced to Brantley) in row 25.

CID Diversion Calculations			
Source*	Start Date	End Date	Diversion (AF)
CID	as of	9/8/09	43710
USGS	9/9/09 -	9/15/09	2017.22
USGS	9/16/09 -	9/22/09	2181.85
USGS	9/23/09 -	9/29/09	3036.74
USGS	9/30/09 -	10/6/09	2334.59
<b>Running Total</b>			<b>53,280.40</b>

\*CID data are verbally provided by the CID Manager, USGS data is taken from the USGS website for the Carlsbad Main Canal gage (08403500).

Table 5. Sample CID Diversion Calculations for 2009

*If making the March 1 projection prior to November 1 and when irrigation is still occurring (e.g. October projection for March 1):*

Contact CID to determine the amount remaining in storage that will be delivered. Enter this value in row 13 of the Reservoir Storage Projection Table. As this water will be delivered after the projection date and prior to the target date the formula used for the Total Projected Storage (reduced to Brantley) will be row 26 instead of row 25 as the CID allotment water will be subtracted instead of added to the total. Rows 27 and 28 will need to be altered to reflect the new total.

#### **Step 4: FSID Delivery/Allotments**

Table 6 shows the average monthly values for the FSID diversions from 1989-2008. These values are based on flows recorded at USGS gage number 08385000 (Fort Sumner Main Canal near Fort Sumner, NM). These data, along with conversions to AF can be found in the *Projections* spreadsheet under the *FSID* tab. The FSID delivery/allotment value will be calculated automatically based on the projection date, target date and historical values. The calculated value in row 14 will be multiplied by 0.75 and then subtracted from the total projected storage (reduced to Brantley).

Average FSID Flows (1989-2008)				AF during projection period
Month	Avg Flow (cfs)	AF/Day	AF/month	
Jan	3	5.94	184.14	0
Feb	20	39.6	1108.8	0
Mar	71	140.58	4357.98	281.16
Apr	83	164.34	4930.2	4930.2
May	85	168.3	5217.3	0
Jun	87	172.26	5167.8	0
Jul	79	156.42	4849.02	0
Aug	75	148.5	4603.5	0
Sep	83	164.34	4930.2	0
Oct	81	160.38	4971.78	0
Nov	1	1.98	59.4	0
Dec	0	0	0	0
				5211.36

Table 6. FSID average monthly flows based on 20 years of data and a sample calculation for a projection date of March 30 and target date of May 1.

#### Step 5: Projected Evaporative Losses

This section uses the RiverWare model data to calculate monthly evaporative losses. The data have been copied into the *Projections* spreadsheet under the *Elev\_Area* tab. Area will be determined automatically based on the elevations entered into rows 7 through 10. Calculations for evaporation rates are located in the *Evaporation* tab. The evaporation rates listed in the table are from the *‘Revised Pecos RiverWare Model Report’* p. 87. Total evaporation rates for each reservoir during the projection period are shown in rows 15 through 18 of the Reservoir Storage Projection Table.

#### Step 6: Average Inflow

The average monthly inflow (AF) was calculated based on 20 years of data. A brief summary of methods can be found in *‘Inflow Memokgedits’* dated January 30, 2009 and is located on the Pecos Server. Table 7 has the calculated monthly values for the three reservoirs. During the winter and spring months, it is important to use the streamflow forecast for the Santa Rosa Lake inflow in order to get a more accurate inflow projection. To locate these projections go to <http://www.wcc.nrcs.usda.gov/cgibin/bor.pl>, choose the information from the drop down menu and then click *Retrieve*. If an error occurs, it is most likely because the requested data has not been posted yet. If this is the case, choose the prior month and retrieve the data. Scroll down to the Pecos River Basin Outlook Report and enter the number listed under 50% of average Santa Rosa Lake Inflow into row 20 of the Reservoir Storage Projection Table. The streamflow forecast will be used to refine the average monthly inflow value for Santa Rosa Lake for the forecasted months.

Average Monthly Inflow (AF) based on 20 years of data (1989-2008) *data excludes block releases			
Month	Santa Rosa Reservoir	Sumner Reservoir	Brantley Reservoir
Jan	1,337	5,211	5,781
Feb	1,582	4,992	3,762
Mar	3,919	5,993	6,243
Apr	8,954	6,065	4,216
May	20,559	8,109	4,051
Jun	13,098	9,674	5,439
Jul	7,880	7,399	5,702
Aug	14,987	8,354	4,933
Sep	6,261	7,619	5,543
Oct	2,998	6,171	7,337
Nov	2,489	5,004	5,149
Dec	1,394	5,568	5,806
Total Inflows during projection period	9,759	6,452	4,619

Table 7. Average Monthly Inflows (AF) based on 20 years of data and the Santa Rosa streamflow forecast for a projection date of March 30 and target date of May 1.

**Step 7: Total Projected Storage and Settlement Target Determinations**

Once all the required information has been added to the Reservoir Storage Projection Table the Total Projected Storage (reduced to Brantley) will be calculated. Compare the targeted value with the total projected storage. The target value for the settlement can be found in the *Projections* spreadsheet or in Table 1.

After all the data has been entered into the reservoir storage projection table, make sure the formulas have been copied correctly. Review the values and make any necessary adjustments.