REVISE RAFT

San Juan Basin Depletions - Modified Blaney-Criddle w/SCS Effective Rainfall (new program)

Comp. Framework Study acres

Area	Acres (ac)	Average CIR (in)	Average Crop CU (af)	Average Incidental Depletions (af)	Average Total Depletions (af)	Average Shortages (%)	Average Shortages (af)	Average Shorted Depletions (af)	1.9 w/ OPS	
Pine River	600	2.02	1215	234	1448	0	0	1448	1595	2740
Dulce-Jicarilla	300	1.26	378	68	447	50 0	0	447	892	
Animas River	15000	2.18	32667	6358	39025	0	0	39025		
Above Archuleta	27	2.53	68	13	81	0	0	81		
Citizens Ditch	3233	2.43	7862	1644	9507	0	0	9507		
Archuleta Ditch	40	2.53	101	19	120	0	0	120		
Turley	200	2.4	480	89	569	0	0	569		
Hammond	3900	2.52	9821	2314	12135	0	0	12135		
Echo Ditch	500	2.33	1163	235	1398	0	0	1398		
Upper La Plata	200	2.25	449	100	549	50	247	302	274	0.3
La Plata	4300	2.2	9481	1800	11281	50	5076	6205	5640	5.6
Chaco River (Indian)	3300	2.24	7406	1347	8754	50	4377	4377	x.7	3064
Chaco River (non-Indian)	900	1.91	1716	309	2025	50	1013	1013	x.7	709
Farmington Glade	100	2.3	230	45	275	0	0	275		
Farmers Mutual Ditch	3800	2.5	9500	1749	11249	0	0	11249		
Jewett Valley	1200	2.6	3125	588	3713	0	0	3713		
Fruitland	3235	2.36	7637	1378	9015	0	0	9015		
Hogback East	2000	2.44	4872	878	5750	0	0	5750		
Cambridge	100	2.36	236	42	278	0	0	278		
Hogback West	6430	2.46	15813	2848	18660	0	0	18660		
Cudei	400	2.47	989	178	1167	0	0	1167		
Crystal (Whiskey Ck.)	300	2.15	644	116	760	50	380	380	x.7	266
Total Basin	50065	2.31	115853	22352	138206		11093	127113		

Notes: No alfalfa yield function, 1929-2003 weather data,2000, 2003-2005(avg) crop mix, baseline acres, 2000,2003-2005 avg irrigation method distribution, incidental depletion =18% flood, 24% sprinkler, 5% drip ,water right acres HB/FP

1533 WR Diversion

1200 w/ 20% fallow

use 1.9 = 1533 Dic. WR ac. x 1,240 af

Exc. shorts on ephemeral tribs & fallow ⇒ offsets little acreage left on Pine R or factor % shorts & river impact on use 5.9 JAM uses

Decree limits JAM depletion by irrigation to 1,731 AF. Most Pine R acres fed by Navajo Res. w/ rights being transferred

Ron Bliesner – 4.6% sprinkler evap loss based on his experiences elsewhere (ie-NIIP)

*1962 BR feasibility report, App. B, on the ALP uses 54.6% shortage for La Plata R. irrigation in NM

newbasin.xls

4/26/2006

OSE-0617

San Juan Basin Depletions - Modified Blaney-Criddle w/SCS Effective Rainfall (new program)													
Area	Acres (ac)		Average CIR (in)		Average Crop CU (af)	Average Incidental Depletions (af)		Average Total Depletions (af)		Average Shortages (%)	Average Shortages (af)	Average Shorted Depletions (af)	
Combined Areas													
Above Navajo Dam	900		1.77		1593	302		1895		0	0	1895	1.9
Upper San Juan	3500		2.43		8511	1765		10277		0	0	10277	10.3
includes													
Above Archuleta													
Citizens Ditch													
Archuleta Ditch													
Turley													
Hammond	3900		2.52		9821	2314		12135		0	0	12135	12.1
Animas River	15600		2.18		34060	6638		40698		0	0	40698	40.7
includes													
Echo Ditch													
Farmington Glade													
La Plata River	4500	↑Shortage on this acreage	2.21		9930	1900		11830		~~50~~ 45	~~5324~~	~~6507~~	~~6.6~~ 5.9
Farmers Mutual Ditch	3800		2.50		9500	1749		11249		0	0	11249	11.2
Jewett Valley Ditch	1200		2.60		3125	588		3713		0	0	3713	3.7
Fruitland-Cambridge	3335 = WR		2.36		7873	1420		9293		0	0	9293	WR= 8.0
Hogback-Cudei	8830 = WR		2.45		21674	3904		25577		0	0	25577	WR= 21.3 } Δ=16%
Chaco River	4200		2.17		9122	1656		10779		50	5390	5390	3.1 Nav.
													0.7 Non-Nav.
Crystal	300		2.15		644	116		760		50	380	380	0.3
Total Basin	50065		2.31		115853	22352		138206			11093	127113	
Notes: No alfalfa yield function, 1929-2003 weather data,2000, 2003-2005(avg) crop mix, baseline acres, 2000,2003-2005 avg irrigation method distribution, incidental depletion =18% flood, 24% sprinkler, 5% drip ,water right acres HB/FP													

Stock 4.3 4.0

1/3 × .7
2/3 × 1.0

not sent

DRAFT

Memorandum
March 28, 2006

To: Scott Balcomb, Larry Anderson, Pat Tyrrell
From: John D'Antonio

Subject: Impacts on Lee Ferry Flows of Uses on Ephemeral Tributaries in the Upper Basin

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Under New Mexico's Proposed Hydrologic Determination, water use on the ephemeral tributaries within the San Juan River drainage is to be included in determining Upper Basin consumptive use, but only to the extent that such use affects the flow of the San Juan River. Article III(d) of the Colorado River Compact requires that the Upper Basin not deplete the flow at Lee Ferry below 75 maf in any period of ten consecutive years. Thus, the depletion in the Upper Basin must be measured at the point of delivery (that is, Lee Ferry). Second, Article III(a) of the Upper Colorado River Basin Compact apportions the flow available to the Upper Basin at Lee Ferry, and Article VI of this compact provides for the use of the inflow-outflow method to account historic consumptive uses in the Upper Basin. Article VI of the Upper Colorado River Basin Compact states:

> "The [Upper Colorado River] commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the upper basin and for each state of the upper basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the commission, by unanimous action, shall adopt a different method of determination."

The inflow-outflow method would account for the net of all impacts on stream flow of man's activities, including salvage of river channel losses, by measuring the net effect of depletions at the downstream point (that is, the delivery point at Lee Ferry). The Upper Colorado River Commission by unanimous consent may adopt a method other than the inflow-outflow method, but has not done so.[1] Third, the yield studies of the 1988 Hydrologic Determination and the current hydrologic determination update determine the yield available for development in the Upper Basin as measured at Lee Ferry. Thus, depletions that are compared against the yield should reflect the depletions of natural flow at Lee Ferry after salvage, not the depletions at the sites of use.

Salvage of channel losses in the mainstream Upper Colorado, Green and San Juan rivers by use was identified for each state by the 1948 Engineering Advisory Committee report to the Upper Colorado River Basin Compact Commission. Later, Tipton and Kalmbach in

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[1] Agreement on the Proposed Hydrologic Determination, including the proposed methodology for determining irrigation consumptive uses and the consideration of impacts of ephemeral tributary uses and ground water uses on mainstream river flows, could provide a mechanism for the Upper Colorado River Commission to account consumptive uses in the Upper Basin.

1965 prepared a report for the Upper Colorado River Commission on water supplies available for use by the Upper Division States that included the Department of the Interior's July 1965 projections of depletions at Lee Ferry that were reduced for salvage of mainstream channel losses. In support of the 1968 Colorado River Basin Projects Act, the Secretary of the Interior and the Bureau of Reclamation provided Congress tabulations of Upper Basin depletions used as the basis for forecasting the water supply available at Lee Ferry for the Lower Basin generally and the Central Arizona Project in particular, which tabulations included reductions in Upper Basin on-site depletions for salvage by use estimated at 4 percent of on-site depletions.[2] In the preparation of the Long-Range Operating Criteria pursuant to the Colorado River Basin Projects Act, including in development of the 602(a) storage algorithm, Reclamation in 1969 included salvage by uses in the Upper Basin to project the flow at Lee Ferry, with salvage amounting to about 4 percent of on-site depletions for the Upper Basin in the aggregate and about 3.5 percent of on-site depletions in New Mexico.[3]

During the Bureau of Reclamation's preparation of Colorado River System Consumptive Uses and Losses (CU&L) reports for the periods 1971-1975 and 1976-1980, the Upper Colorado River Commission notified Reclamation that: (1) the reports should account for salvage of channel losses by uses in the Upper Basin; (2) consumptive uses in the Upper Basin for compact purposes must be determined in terms of man-made depletions of the virgin flow at Lee Ferry; and (3) future reports need to address salvage by use as a compact consideration that becomes more important as the use of water in the Upper Basin approaches the limit of apportionment. Reclamation agreed that the value of the CU&L reports would be enhanced by inclusion of channel loss salvage, but did not have a procedure in place for estimating it. Despite stated intentions by Reclamation and the Commission to develop an acceptable procedure for estimating salvage for future CU&L reports, no such procedure has been developed.[4] The CU&L reports do, however, incorporate in the computation of reservoir evaporation from Colorado River Storage Project units the salvage of river channel losses within the reservoir basins that results from inundation due to filling of the reservoirs, thus reflecting the net impact of storage on natural flows.

Due to disagreement resulting from technical uncertainties in channel loss computations, salvage by use was not included in schedules of Upper Basin depletions for the Upper Division States prepared for the 1988 Hydrologic Determination. Regardless, the Upper

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[2] See hearing testimony on H.R. 4671 and similar bills, Lower Colorado River Basin Project, August-September 1965.

[3] See Meeting of Federal and State Representatives for Review of Basic Data Pertinent to the Preparation of Operating Criteria for the Colorado River Pursuant to Section 602 of Public Law 90-537, July 1969.

[4] See: Ival Goslin's January 28, 1977, letter to Commissioner Gilbert Stamm; Commissioner Keith Higginson's April 11, 1977, letter to Ival Goslin; Paul Billhymer's December 7, 1981, letter to Clifford Barrett; Clifford Barrett's February 2, 1982, letter to Paul Billhymer; Paul Billhymer's May 23, 1983, letter to Clifford Barrett; John Buyok's May 31, 1983, letter to Clifford Barrett; Philip Mutz' June 6, 1983, letter to Clifford Barrett.

Colorado River Commission by resolution of June 2, 1987, stated that it did not endorse the projections of Upper Basin depletions, study assumptions or analytical methodologies used in the 1988 Hydrologic Determination. The depletions schedules adopted for planning purposes by the Commission in 1994 and 1999 include a statement that the schedules do not attempt to interpret the compacts or any other element of the "Law of the River," and should not be construed as an acceptance of any assumption that limits the Upper Basin's depletions.

Because of technical uncertainties and disagreements in channel loss computations on mainstream rivers, New Mexico at this time is not proposing to include salvage of river channel losses on the Upper Colorado, Green or San Juan rivers. New Mexico proposes only that the Upper Colorado River Commission agree in principle that small amounts of use of ephemeral tributary waters and ground waters in the San Juan River drainage be accounted just to the extent that they impact the flows of the San Juan River. Such accounting would be consistent with Article VI of the Upper Colorado River Basin Compact, with the allocations of water available for use by the Upper Division States made at Lee Ferry under the yield studies, and with the accounting of incidental channel losses on ephemeral tributaries resulting from return flows from the Navajo Indian Irrigation Project and Four Corners Power Plant.[5] On the other hand, if the full amount of on-site uses in the ephemeral tributary drainages are accounted regardless of impact on Lee Ferry flows, then New Mexico should not be charged with channel losses on the same ephemeral tributaries resulting from return flows from water development (that is, only the on-site consumptive use should be accounted, regardless of whether returns reach the San Juan River undiminished by losses). The latter approach appears contradictory to accounting impacts of water development on the natural flow at Lee Ferry.

Under New Mexico's proposal, New Mexico would include in its schedule of anticipated depletions what it believes are reasonable estimates of the net impacts on San Juan River flows resulting from uses in ephemeral tributary drainages in New Mexico. But, the Upper Colorado River Commission would not be agreeing to the specific quantification of these impacts at this time.[6]

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[5] Four Corners Power Plant discharges from Morgan Lake made steadily over weeks at a time travel about 3 miles in an arroyo to its confluence with the Chaco River and an additional 14 miles in the Chaco River before reaching the San Juan River, and historically constituted the base flow of the Chaco River in that reach. Analysis of discharge data for Morgan Lake and flow data for the Chaco River near Waterflow gaging station, and river channel evaporation estimates, indicate that about 30 percent of the discharges are lost in transit prior to reaching the San Juan River. Return flows from the Navajo Indian Irrigation Project enter several arroyos outside the Chaco River drainage, and also will enter arroyos within the drainage when the project is fully developed.

[6] The Commission also at this time is not agreeing to the specific quantities of anticipated future depletions for other uses in New Mexico that New Mexico has estimated and included in its depletions schedule.

Project or Supply	Channel miles to SJ River or no surface connection (NC)	ISC delineated *small project and misc. acres* [a]		USDA *original project acres* [b]	1994 Irrigated Acres	2000 Irrigated Acres	Estimated 2000 Total irrigated acres		2003 Irrigated Acres
Chaco River									
Captain Tom Wash	52	1503	e	3700	265	198	301	c	225
Sanostee	51	813		1000			81	d	50
Toh Al Sissy	36	245	39%	300	88%		24	d	1
Tocito	48	162		250			16	d	6
Stinking Water	45	26		50			3	d	0
Whiskey Lake	NC	179					36	c	10
Grey Mesa	NC	487		500	120	109	49	d	132
Toadlena	NC	202		300			20	d	2
Choiska	NC	565		500			113	c	0
Misc. Surface	NC	1564					0	d	26
Misc. Ground	NC	1256					0	d	5
Total Chaco		7004		6600			643		456
Chinle Wash									
Crystal	177	411		480			41		0
Misc. Surface	NC	416					42		0
Total Chinle		827		480			83		0

282 = 62%

175

a Parcels delineated from USGS DOQQs

b Inventory of Navajo Indian Irrigation Projects, August 1986, USDA Soil Conservation Service

c Irrigated acres with storage assumed 20% of small project and misc. acres

d Irrigated acres with no storage assumed 10% of small project and misc. acres

e Includes drainage above and below Captain Tom Reservoir

2005

	Animas	La Plata	San Juan
Current Seep/brush Acres Total	1,277	249	1,685
1938 HS breakdown:	wtd. CIR = 2.49	wtd. CIR = 1.80	2.49
Seeped (56%)	Dep = 3,180 AF	Dep = 448 AF	Dep = 4,196 AF
Swamp (40%)		Σ = 7,824 AF	
Brush (4%)			
1948 EAC breakdown:	wtd. CIR = 2.44	wtd. CIR = 1.67	2.44
Seeped (20%, 48%)	Dep = 3,116 AF	Dep = 416 AF	Dep = 4,111 AF
Swamp (13%, 9%)		Σ = 7,643 AF	
Brush (66%, 39%)			
Ponds (1%, 4%)			
(A&SJ, LP)			

CIR's → (1948 EAC region)

	A&SJ:	LP:
Seep	2.14	1.52
Swamp	2.98	2.19
Trees/Brush	2.42	1.74
ponds	2.28	1.63

(~71-73% of A&SJ due to 30% avg. shortage)

— Use 7,700 AF for incidental vegetative non-crop losses

Canal water surface acres — 692 Ac SJ&A
× 2.28 AF/Ac → 1,578 AF evap.
— 12 A LP
× 1.63 AF/Ac → 20 AF evap
1,598 AF total

— Use 1,600 AF for incidental canal evap...

Total non-crop & canal loss = 9,300 AF
(SJ, AR, LP).

9,500 AF if LP not shorted

(excludes on-farm losses which OSE ~~estimates~~ at 5% of CIR)

Current acres crop CU ≈ 46,500 AF

Inc. depletions (exc. on-farm losses)
≈ 20% today's conditions

If acreage irrigated increases, Incid. dep's will increase in Hogback area but not so much in non-Indian areas (all wasteways currently in use in non-Indian areas)

Considering baseline/dep. sched. acreage conditions & also on-farm losses, incidental dep's of 20% total of crop CU for flood irrig. not unreasonable.

(lower % if crop CU based on MBC)

TABLE 2. 2003 CROP ACREAGE DATA FOR THE SAN JUAN RIVER BASIN IN NEW MEXICO BY AREA																
					CROP CATEGORY									INCIDENTAL AREAS		
HYDROLOGIC UNIT	IRRIGATION AREA	ITEM	ALFALFA	CORN/ SORGHUM	MISC. VEGET.	ORCHARD	PASTURE	SMALL GRAINS	SOD	TOTAL ACREAGE IRRIGATED	ACREAGE NOT IRRIGATED	TOTAL ACREAGE	SEEPED/BRUSH ACRES	DITCH WATER SURFACE ACRES	% OF TOTAL ACRES	% OF IRRIGATED ACRES
	ARCHULETA DITCH, CITIZENS DITCH TURLEY DITCH, HAMMOND FARMERS MUTUAL DITCH JEWETT VALLEY AND WESTWATER COMBINED	**TOTAL ACRES**	5,316	81	297	61	2,833	120	331	9,039	696	9,735				
		% DISTRIB.	59	1	3	1	31	1	4							
		Flood-irrigated	2,461	53	82	26	1,736	82	29	4,468						
		Sprinkler-irrigated	2,856	28	210	34	1,097	38	302	4,565						
		Drip-irrigated	0	0	5	1	0	0	0	5						
	TOTAL ANIMAS RIVER (ANIMAS RIVER, ECHO, AND FARMINGTON GLADE COMBINED)	**TOTAL ACRES**	2,084	6	109	112	2,733	65	502	5,610	584	6,195	1,277	217	24%	27%
		% DISTRIB.	37	0	2	2	49	1	9							
		Flood-irrigated	1,501	6	78	101	2,204	65	11	3,967						
		Sprinkler-irrigated	583	0	31	7	529	0	491	1,641						
		Drip-irrigated	0	0	0	3	0	0	0	3						
	TOTAL LA PLATA RIVER (UPPER LA PLATA AND LA PLATA RIVER COMBINED)	**TOTAL ACRES**	1,231	0	0	0	576	24	3	1,835	1,127	2,962	249	12	9%	14%
		% DISTRIB.	67	0	0	0	31	1	0							
		Flood-irrigated	983	0	0	0	474	16	3	1,476						
		Sprinkler-irrigated	249	0	0	0	102	8	0	359						
		Drip-irrigated	0	0	0	0	0	0	0	0						
	FRUITLAND, CAMBRIDGE AND HOGBACK-EAST COMBINED	**TOTAL ACRES**	1,924	630	64	8	309	37	8	2,979	1,269	4,247				
		% DISTRIB.	65	21	2	0	10	1	0							
		Flood-irrigated	1,897	630	64	8	309	37	5	2,950						
		Sprinkler-irrigated	26	0	0	0	0	0	3	29						
		Drip-irrigated	0	0	0	0	0	0	0	0						
	HOGBACK-WEST AND CUDEI COMBINED	**TOTAL ACRES**	1,293	534	39	11	318	0	11	2,206	751	2,957				
		% DISTRIB.	59	24	2	1	14	0	0							
		Flood-irrigated	1,290	534	39	11	312	0	3	2,189						
		Sprinkler-irrigated	3	0	0	0	6	0	8	17						
		Drip-irrigated	0	0	0	0	0	0	0	0						
	TOTAL SAN JUAN RIVER (ARCHULETA DITCH, CITIZENS DITCH TURLEY DITCH, HAMMOND FARMERS MUTUAL DITCH JEWETT VALLEY AND WESTWATER COMBINED; FRUITLAND, CAMBRIDGE AND HOGBACK-EAST COMBINED; and HOGBACK-WEST AND CUDEI COMBINED)									14,223	2,715	16,939	1,685	475	13%	15%
	AVERAGE ANIMAS LA PLATA & SAN JUAN RIVERS BELOW NAVAJO DAM									21668	4427	26095	3211	704	15%	18%

Linked to acres03b.xls
Linked to nliphist2.xls

Ditch	HWM width	Existing flume width	Ditch Length	Ditch Area	Reach
	feet	feet	miles	acres	
Wright-Leggett	2		3.7	0.9	AN
Willett	26		0.9	2.8	AN
Sargent	10		2.7	3.3	AN
Twin Rocks	10		2.8	3.4	AN
Ranchmans Terrell	10.5		3	3.8	AN
Cedar	10		3.9	4.7	AN
Kello-Blancett	10		5.2	6.3	AN
Ralston	10.2		6.9	8.5	AN
Stacey	12		6	8.7	AN
Farmington Allen*	25		3.1	9.4	AN
North Farmington	13		6	9.5	AN
Eledge	17		8	16.5	AN
Graves-Atterberry (Old Inca)	14		10	17.0	AN
Echo	25		6.5	19.7	AN
Farmers	13		15	23.6	AN
Lower Animas	15		16.6	30.2	AN
Halford Independent	14		19.8	33.6	AN
Star*	12		3		AN
Aztec		8.75	13.8	14.6	~~LP~~ AN
TOTAL ANIMAS				216.6	
Pioneer		1	1.3	0.2	LP
Enterprise		2	1.1	0.3	LP
Left Hand		1.5	1.6	0.3	LP
Larkin-Reynolds		2	1.6	0.4	LP
Pickering	2.9		1.9	0.7	LP
McDermott		2	3.1	0.8	LP
Greenhorn		1.5	4.3	0.8	LP
La Plata Indian		3	2.3	0.8	LP
Jackson		1.5	6.4	1.2	LP
Helton		2	5	1.2	LP
Cunningham		3	3.6	1.3	LP
Hillside		3	5	1.8	LP
Highland Park		3	5.8	2.1	LP
Crame*	2		0.4		LP
TOTAL LA PLATA				11.8	
Martin Valencia*	10		1.9	2.3	SJ
Archuleta	11.2		2.3	3.1	SJ
Turley	13		2.3	3.6	SJ
Jewett Valley	16.4		7.4	14.7	SJ
Farmers Mutual	23		35.3	98.4	SJ
Citizens (Bloomfield Porter, Jacquez, La Pumpa, Citizens)	23		42.1	117.4	SJ
Lawson*	3		0.3		SJ
Fruitland Canal*	20		21	50.9	SJ
Hogback Canal*	20		34.6	83.9	SJ
Cudei Ditch*	10		4.6	5.6	SJ
Hammond	20		39.2	95.0	SJ
TOTAL SAN JUAN				474.9	
TOTAL ALL DITCHES				703.2	
*Assumed ditch width					
1938 hydrosurvey seeped acres					
Seeped (Probably cultivated at one time, but involuntarily abandoned)				1550.9	
Swamp, or badly seeped (Probably cultivated at one time, but involuntarily abandoned)				8.7	
Swamp, or badly seeped (Probably never cultivated)				1129.5	
Trees or brush - seeped (Probably cultivated at one time, but involuntarily abandoned)				29.1	
Trees or brush - swamp				81.7	
Vega or Pasture - Seeped (Probably cultivated at one time, but involuntarily abandoned)				53.5	
Total				2853.4	

F = Full water sup
S = Short water
a = Natural over. aas
b = Domestic use
c = Reservoir evaporation losses
d = Transmountain diversions
e = Trees and brush

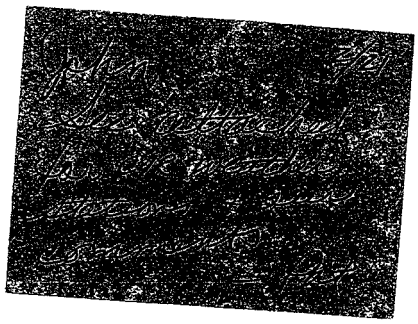
f = Seeped lands
g = Pon
h = S
i =
j = R
k = Import

AVERAGE YEARLY STREAM DEP. AT SITES OF USE

PERIOD 1914-45

Location		Alfalfa			Grass, Hay & Pasture			Grains and Beans			Corn and Other Annuals			Orchard			Incidental Areas			Other b, c, & d	Total Acre-feet
		Acres	Rate Feet	Depletion Acre-feet	Acres	Rate Feet	Depletion Acre-feet	Acres	Rate Feet	Depletion Acre-feet	Acres	Rate Feet	Depletion Acre-feet	Acres	Rate Feet	Depletion Acre-feet	Acres	Rate Feet	Depletion Acre-feet		
24. Montezuma and McElmo below Cortez	F	4330	1.57	6798	640	1.33	851	2470	.97	2398				160	.97	155	1000	1.71	1710	2700	14610
25. Upper San Juan	F	2000	.92	1840	7362	.73	5374										500	.83	415	735	
Piedra	F	2000	1.29	2580	2186	1.06	2317										200	1.33	266		13527
26. Los Pinos (Pine) River	F	13014	1.29	16788	9647	1.06	10226	8838	.77	6805	421	.77	324	453	.69	313	5000	1.33	6650	660	41766
27. Animas River	F	4461	1.24	5532	2984	1.01	3014	2711	.73	1979	122	.85	104				1000	1.32	1320	3420	15369
28. Florida River	S	5500	.82	4510	4400	.65	2860	4053	.73	2959	200	.85	170	347	.66	229	3000	1.32	3960		14688
29. LaPlata River	S	8279	.93	7699	2590	.73	1891	10240	.82	8397				50	.77	38	1600	1.36	2176	160	20361
30. Mancos River	S	4790	1.00	4790	2164	.81	1753	3300	.97	3201				100	.97	97	1000	1.76	1760	100	11701
Total Colorado		309522		396180	244054		175686	178047		170393	33333		45371	25650		33748	106812		178662	62713	1062753
NEW MEXICO																					
1. Navajo River	S	216	1.09	235	42	.86	36	32	.66	21							e 45	1.44	65		
																	f 15	.95	14		371
2. Los Pinos (Pine River)	F	397	1.29	512	151	1.06	160	304	.78	237	100	.85	85	6	.66	4	e 150	1.33	200		
																	f 5	1.14	6		
																	g 2	2.07	4		1208
3. LaPlata River	S	2198	.98	2154	503	.78	392	1392	.88	1225	767	1.37	1051	83	1.36	113	e 290	1.74	505		
																	f 355	1.52	540		
																	g 35	1.63	57		
																	g 65	2.19	142		6179
4. Animas and San Juan Rivers	F	8229	2.25	18515	2513	1.93	4850	5048	1.12	5654	8654	1.43	12375	2543	1.43	3636	e 3645	2.42	8821	1000	
																	f 1095	2.14	2343		
																	g 40	2.28	91		
																	h 740	2.98	2205		59490
5. Chaco	S	1641	.98	1608	3680	.78	2870	501	.88	441											4919
Total New Mexico		12681		23024	6889		8308	7277		7578	9521		13511	2632		3753	6482		14993	1000	72167
UTAH																					
1. Henrys Fork	S	5650	1.16	6554	1550	.94	1457	1750	.94	1645							800	1.02	816		
		i 320															f 450	1.18	531		
																	j 250	1.34	335		11338
2. Ashley Valley and Brush Creek	F	12250	1.56	19110	5620	1.24	7531	9260	1.09	10093							3490	1.30	4537		
		i 720															f 1290	1.49	1922		
																	j 620	1.30	806	2000	45999
3. Ouray	S	3260	1.26	4108	350	1.02	357	3840	1.10	4224							560	1.64	918		
		i 180															j 300	1.64	492		10099
4. Unita Basin Bench Lands	S	15730	1.61	25325	51930	1.31	68028	7600	.97	7372	1665	1.18	1965				8900	1.68	14952		
																	f 1750	1.48	2590		
																	j 1540	1.28	1971	79000	201203
5. Unita Basin Valley Lands	S	22165	1.82	40340	25800	1.50	38700	7570	1.10	8327	2430	1.38	3353				8800	2.00	17600		
																	f 2500	1.78	4450		
																	g 1100	1.89	2079		
																	j 910	1.73	1574	9800	126223
6. Price River	F	6550	1.81	11855	1560	1.54	2402	5760	1.06	6106	1590	1.32	2099	60	1.17	70	900	1.91	1719		
		i 450															f 950	2.15	2042		
																	j 360	2.40	864	4300	31457
7. Green River	F	1260	2.40	3024	290	2.08	603	1794	1.22	2189	1070	1.61	1723	6	1.64	10	200	2.08	416		
		i 200															f 180	2.38	428		
																	j 140	2.67	374		8767
8. Moab	S	620	2.07	1283	650	1.70	1105	540	1.09	589	300	1.48	444	30	1.69	51	160	2.17	347		
																	f 80	2.49	199		
																	j 20	2.17	43		4061
9. LaSal	S	1620	1.08	1750	940	.86	808	2750	.92	2530							580	1.22	708		
		i 620															f 80	1.43	114		5910

f = Seeped lands
g = Ponds
h = Swamp



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Documentation
Natural Flow Development
San Juan River Basin

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Western Colorado Area Office
Southern Division

October 30, 2000

OSE-0628

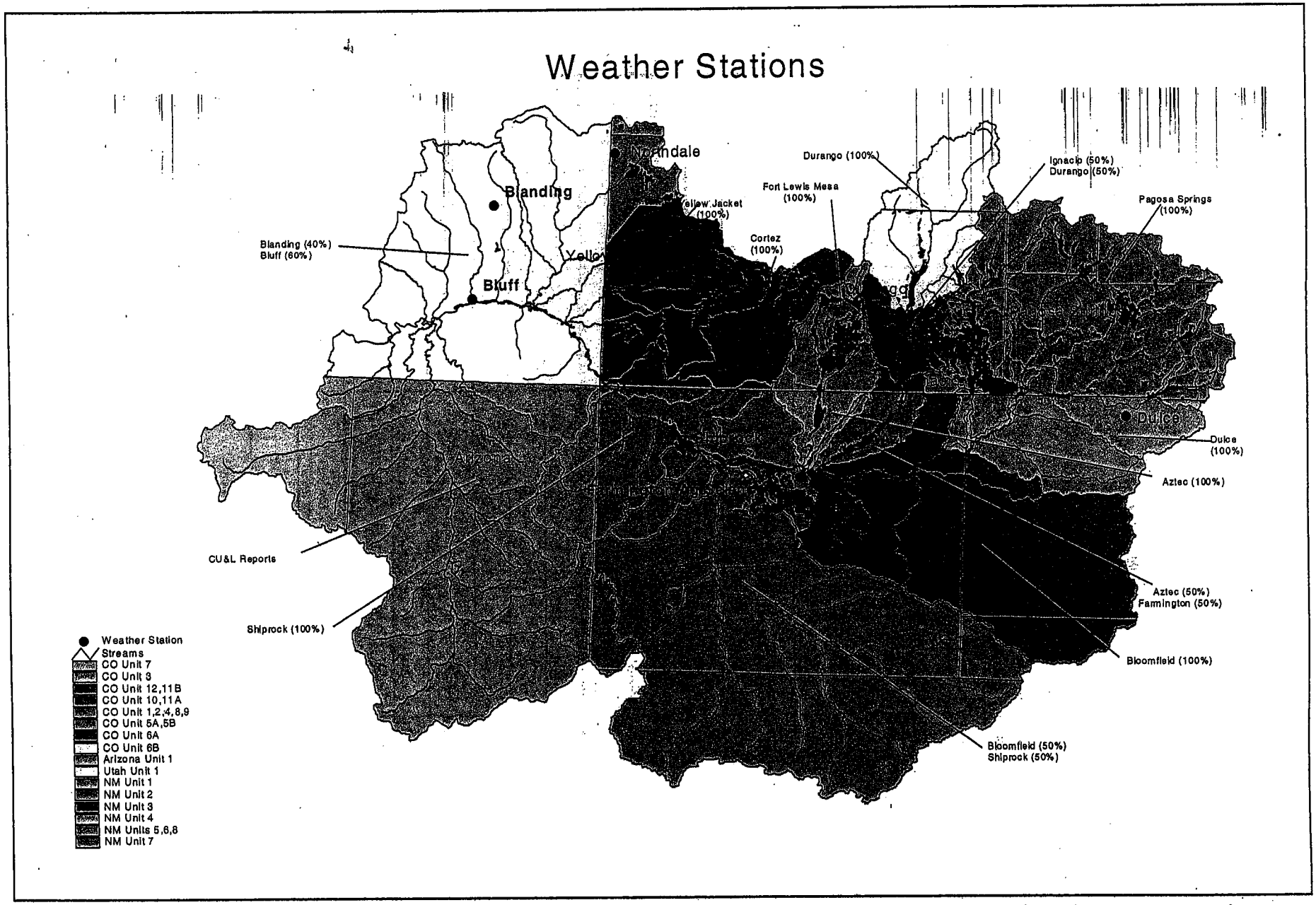

Figure 2.6. Temperature and precipitation data from these NOAA weather stations were used in calculation of crop consumptive use. Colored areas represent each weather stations area of influence and weighting factor.

ISC comments on USBR 2/22/99 document

Page 3-9, first paragraph, first sentence. Factors such as station elevation should be considered, as well as location, in determining which meteorologic data should be used for estimating crop consumptive use in an irrigated area. Comparing this sentence to the information given in table 3.3, it does not appear that averaging data for the Aztec and Farmington weather stations would be appropriate for the entire Animas River Valley, or that averaging the Bloomfield and Shiprock weather station data would be appropriate for irrigated areas in the Chaco River drainage far south of the San Juan River. It also is not clear why the Fruitland weather station data were not used for irrigated lands near Fruitland.

Page 3-9, second paragraph, second through fourth sentences. It is not clear why correlations between weather stations of daily minimum and maximum temperatures were not prepared for use in filling in days of missing temperature data.

Page 3-9, third paragraph, second to last sentence. It is not clear why a constant average freeze date was used for each year to calculate historic irrigation depletions rather than using the actual freeze date which occurred each year. An important feature of the RiverWare model in its potential use in evaluating operations of water projects as against the flow recommendations is hydrologic variability.

Page 3-10, table 3.3. If the Theissen Polygon method was used to determine which stations would represent irrigated lands within a unit, it is not clear how the weather station at Farmington could be selected for use in determining crop water demands in the Animas River Valley above Farmington but not used to calculate crop consumptive use in areas along the San Juan River such as near Fruitland, for which table 3.3 indicates weather stations at Shiprock and Bloomfield were used. Nor is it clear why the weather station at Fruitland is not used. Also, New Mexico does not agree with the terminology for "developed acres" as will be explained below in comments on the appendices to the draft report. Further, New Mexico does not agree that 10% is the proper percentage for estimating incidental depletions in all irrigated areas in the San Juan River Basin in New Mexico.

Page 3-11, first complete paragraph. The draft report does not make clear whether the determination of cut-off date or last

DRAFT - Chaco River Area Split

San Juan Basin Depletions - Modified Blaney-Criddle SCS Effective Rainfall (AP=3 inches)

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)	SJR Irrigated Ac
Pine River	600	1.99	1191	226	1417	0	0	1417	100%
Dulce-Jicarilla	300	1.21	363	65	428	0	0	428	
Animas River	15000	2.17	32527	6506	39033	0	0	39033	
Above Archuleta	27	2.48	67	12	79	0	0	79	
Citizens Ditch	3233	2.19	7079	1512	8591	0	0	8591	
Archuleta Ditch	40	2.48	99	25	124	0	0	124	
Turley	200	2.41	482	90	572	0	0	572	
Hammond	3900	2.5	9751	2402	12153	0	0	12153	
Echo Ditch	500	2.34	1169	245	1414	0	0	1414	
Upper La Plata	200	2.28	456	104	560	45	252	308	
La Plata	4300	2.23	9607	1827	11433	45	5145	6288	100%
~~Chaco River (Farmington)~~ Chaco R Indian (Navajo)	~~4200~~ 3300	~~2.09~~ 2.20	~~8785~~ 7253	~~1600~~ 1321	~~10386~~ 8574	~~50~~ 50	~~5193~~ 4287	~~5193~~ 4287	70%
Chaco R non-Ind (Chaco Canyon)	900	1.90	1706	307	2013	50	1007	1007	70%
Farmington Glade	100	2.46	246	50	296	0	0	296	100%
Farmers Mutual Ditch	3800	2.45	9324	1719	11043	0	0	11043	
Jewett Valley	1200	2.56	3072	584	3655	0	0	3655	
Fruitland	3235	2.32	7505	1351	8856	0	0	8856	
Hogback East	2000	2.41	4814	868	5683	0	0	5683	
Cambridge	100	2.3	230	41	271	0	0	271	
Hogback West	6430	2.42	15552	2797	18349	0	0	18349	
Cudei	400	2.49	997	179	1176	0	0	1176	100%
~~Crystal (Whiskey Ck.)~~	~~300~~	~~2.69~~	~~778~~	~~140~~	~~918~~	~~50~~	~~459~~	~~459~~	
Crystal Tohatchi	300	2.33	699	126	824		412	412	70%
Total Basin	50065	2.28	~~114094~~	22343	~~136437~~		~~11049~~	~~125388~~	
		2.28	114189	22357	136544		11103	125442	

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

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San Juan Basin Depletions - Modified Blaney-Criddle SCS Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Combined Areas								
Above Navajo Dam	900	1.73	1554	292	1845	0	0	1845
Upper San Juan	3500	2.21	7727	1639	9366	0	0	9366
includes								
Above Archuleta								
Citizens Ditch								
Archuleta Ditch								
Turley								
Hammond	3900	2.5	9751	2402	12153	0	0	12153
Animas River	15600	2.18	33942	6801	40743	0	0	40743
includes								
Echo Ditch								
Farmington Glade								
La Plata River	4500	2.23	10063	1931	11993	45	5397	6596
Farmers Mutual Ditc	3800	2.45	9324	1719	11043	0	0	11043
Jewett Valley Ditch	1200	2.56	3072	584	3655	0	0	3655
Fruitland-Cambridge	3335	2.32	7735	1392	9127	0	0	9127
Hogback-Cudei	8830	2.42	21363	3844	25208	0	0	25208
Chaco R, Locale	4200	2.13	8957	1628	10587	50	5294	5294
Chaco River	4200	~~2.09~~	~~8785~~	~~1600~~	10386	50	~~5193~~	~~5193~~
Crystal	300	~~2.59~~	~~778~~	~~140~~	~~918~~	50	~~459~~	~~459~~
Crystal	300	2.33	699	126	824		412	412
Total Basin	50065	2.28	~~114094~~	~~22344~~	~~136437~~		~~11049~~	~~126388~~
		2.28	114189	22358	136547		11103	125492

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

DRAFT - Chaco River Area Split

San Juan Basin Depletions - Modified Blaney-Criddle USBR Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Pine River	600	1.88	1128	214	1342	0	0	1342
Dulce-Jicarilla	300	1.08	324	58	382	0	0	382
Animas River	15000	2.08	31184	6238	37422	0	0	37422
Above Archuleta	27	2.4	65	12	77	0	0	77
Citizens Ditch	3233	2.12	6839	1461	8300	0	0	8300
Archuleta Ditch	40	2.4	96	24	120	0	0	120
Turley	200	2.32	465	87	552	0	0	552
Hammond	3900	2.43	9471	2333	11804	0	0	11804
Echo Ditch	500	2.26	1131	237	1369	0	0	1369
Upper La Plata	200	2.2	439	100	540	45	243	297
La Plata	4300	2.16	9267	1762	11029	45	4963	6066
Chaco River-Trillian (Navajo)	~~330~~	~~2.15~~	710~~2~~	1294	~~8395~~	50	~~4198~~	~~4198~~
Chaco River (Farmington US)	4200	2.04	8553	1558	10111	50	~~5056~~	~~5056~~
Chaco River non-Trill (Navajo)	900	1.80	1617	291	1908	50	954	954
Farmington Glade	100	2.37	237	48	293	0	0	293
Farmers Mutual Ditch	3800	2.39	9064	1671	10735	0	0	10735
Jewett Valley	1200	2.49	2993	569	3562	0	0	3562
Fruitland	3235	2.26	7321	1318	8639	0	0	8639
Hogback East	2000	2.35	4708	849	5558	0	0	5558
Cambridge	100	2.24	224	40	264	0	0	264
Hogback West	6430	2.37	15214	2736	17950	0	0	17950
Cudei	400	2.43	973	175	1148	0	0	1148
Crystal (Whiskey Ck.)	300	~~2.53~~	~~780~~	~~187~~	~~896~~	50	~~448~~	~~448~~
Crystal (Tohatchi)	300	~~2.25~~	~~675~~	121	796	50	398	398
Total Basin	50065	2.21	~~110456~~	~~21627~~	~~132093~~		~~10710~~	~~121363~~
		~~2.21~~	110537	21638	132185		10756	121429

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

San Juan Basin Depletions - Modified Blaney-Criddle USBR Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Combined Areas								
Above Navajo Dam	900	1.61	1452	272	1724	0	0	1724
Upper San Juan	3500	2.14	7465	1584	9049	0	0	9049
Includes								
Above Archuleta								
Citizens Ditch								
Archuleta Ditch								
Turley								
Hammond	3900	2.43	9471	2333	11804	0	0	11804
Animas River	15600	2.09	32552	6523	39084	0	0	39084
includes								
Echo Ditch								
Farmington Glade								
La Plata River	4500	2.16	9706	1862	11569	45	5206	6363
Farmers Mutual Ditc	3800	2.39	9084	1671	10735	0	0	10735
Jewett Valley Ditch	1200	2.49	2993	569	3562	0	0	3562
Fruitland-Cambridge	3335	2.26	7545	1358	8903	0	0	8903
Hogback-Cudei	8830	2.37	20895	3760	24656	0	0	24656
Chaco R Locale	4200	~~2.68~~	~~8719~~	~~1585~~	~~10304~~		5152	5152
Chaco River	4200	~~2.84~~	~~8553~~	~~1558~~	~~10111~~	50	~~5056~~	~~5056~~
Crystal	300	2.53	~~700~~	~~137~~	~~836~~	50	~~418~~	~~418~~
Crystal	300	2.25	675	121	796		398	398
Total Basin	50065	2.21	~~110456~~	~~21627~~	~~132083~~		~~10710~~	~~121383~~
		~~2.21~~	110537	21638	132186		10756	121429

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

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San Juan Basin Depletions - Modified Blaney-Criddle SCS Effective Rainfall (3 inch application depth)

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Pine River	600	1.99	1191	226	1417	0	0	1417
Dulce-Jicarilla	300	1.21	363	65	428	0	0	428
Animas River	15000	2.17	32527	6506	39033	0	0	39033
Above Archuleta	27	2.48	67	12	79	0	0	79
Citizens Ditch	3233	2.19	7079	1512	8591	0	0	8591
Archuleta Ditch	40	2.48	99	25	124	0	0	124
Turley	200	2.41	482	90	572	0	0	572
Hammond	3900	2.5	9751	2402	12153	0	0	12153
Echo Ditch	500	2.34	1169	245	1414	0	0	1414
Upper La Plata	200	2.28	456	104	560	45	252	308
La Plata	4300	2.23	9607	1827	11433	45	5145	6288
Chaco River	4200	2.09	8785	1600	10386	50	5193	5193
Farmington Glade	100	2.46	246	50	296	0	0	296
Farmers Mutual Ditch	3800	2.45	9324	1719	11043	0	0	11043
Jewett Valley	1200	2.56	3072	584	3655	0	0	3655
Fruitland	3235	2.32	7505	1351	8856	0	0	8856
Hogback East	2000	2.41	4814	868	5683	0	0	5683
Cambridge	100	2.3	230	41	271	0	0	271
Hogback West	6430	2.42	15552	2797	18349	0	0	18349
Cudei	400	2.49	997	179	1176	0	0	1176
Crystal (Whiskey Ck.)	300	2.59	778	140	918	50	459	459
Total Basin	50065	2.28	114094	22343	136437		11049	125388

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

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San Juan Basin Depletions - Modified Blaney-Criddle SCS Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Combined Areas								
Above Navajo Dam	900	1.73	1554	292	1845	0	0	1845
Upper San Juan	3500	2.21	7727	1639	9366	0	0	9366
Includes								
Archuleta								
zens Ditch								
uleta Ditch								
Turley								
Hammond	3900	2.5	9751	2402	12153	0	0	12153
Animas River	15600	2.18	33942	6801	40743	0	0	40743
Includes								
Echo Ditch								
gton Glade								
La Plata River	4500	2.23	10063	1931	11993	45	5397	6596
Farmers Mutual Ditc	3800	2.45	9324	1719	11043	0	0	11043
Jewett Valley Ditch	1200	2.56	3072	584	3655	0	0	3655
Fruitland-Cambridge	3335	2.32	7735	1392	9127	0	0	9127
Hogback-Cudei	8830	2.42	21363	3844	25208	0	0	25208
Chaco River	4200	2.09	8785	1600	10386	50	5193	5193
Crystal	300	2.59	778	140	918	50	459	459
Total Basin	50065	2.28	114094	22344	136437		11049	125388

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

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San Juan Basin Depletions - Modified Blaney-Criddle USBR Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Pine River	600	1.88	1128	214	1342	0	0	1342
Dulce-Jicarilla	300	1.08	324	58	382	0	0	382
Animas River	15000	2.08	31184	6238	37422	0	0	37422
Above Archuleta	27	2.4	65	12	77	0	0	77
Citizens Ditch	3233	2.12	6839	1461	8300	0	0	8300
Archuleta Ditch	40	2.4	96	24	120	0	0	120
Turley	200	2.32	465	87	552	0	0	552
Hammond	3900	2.43	9471	2333	11804	0	0	11804
Echo Ditch	500	2.26	1131	237	1369	0	0	1369
Upper La Plata	200	2.2	439	100	540	45	243	297
La Plata	4300	2.16	9267	1762	11029	45	4963	6066
Chaco River	4200	2.04	8553	1558	10111	50	5056	5056
Farmington Glade	100	2.37	237	48	293	0	0	293
Farmers Mutual Ditch	3800	2.39	9064	1671	10735	0	0	10735
Jewett Valley	1200	2.49	2993	569	3562	0	0	3562
Fruitland	3235	2.26	7321	1318	8639	0	0	8639
Hogback East	2000	2.35	4708	849	5558	0	0	5558
Cambridge	100	2.24	224	40	264	0	0	264
Hogback West	6430	2.37	15214	2736	17950	0	0	17950
Cudei	400	2.43	973	175	1148	0	0	1148
Crystal (Whiskey Ck.)	300	2.53	760	137	896	50	448	448
Total Basin	50065	2.21	110456	21627	132093		10710	121383

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

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San Juan Basin Depletions - Modified Blaney-Criddle USBR Effective Rainfall

Area	Acres (ac)	Average CIR (in)	Crop CU (af)	Incidental Depletions (af)	Total Depletions (af)	Shortages (%)	Shortages (af)	Shorted Depletions (af)
Combined Areas								
Above Navajo Dam	900	1.61	1452	272	1724	0	0	1724
Upper San Juan	3500	2.14	7465	1584	9049	0	0	9049
Includes								
Archuleta								
zens Ditch								
uleta Ditch								
Turley								
Hammond	3900	2.43	9471	2333	11804	0	0	11804
Animas River	15600	2.09	32552	6523	39084	0	0	39084
Includes								
Echo Ditch								
gton Glade								
La Plata River	4500	2.16	9706	1862	11569	45	5206	6363
Farmers Mutual Ditc	3800	2.39	9064	1671	10735	0	0	10735
Jewett Valley Ditch	1200	2.49	2993	569	3562	0	0	3562
Fruitland-Cambridge	3335	2.26	7545	1358	8903	0	0	8903
Hogback-Cudel	8830	2.37	20895	3760	24656	0	0	24656
Chaco River	4200 (3300 Ind. 900 Non-Ind.)	2.04	8553	1558	10111	50	5056	5056
Crystal	300	2.53	760	137	896	50	448	448
Total Basin	50065	2.21	110456	21627	132093		10710	121383

Notes: No alfalfa yield function, 1929-2003 weather data, 2003-2004(avg) crop mix, baseline acres, 2004 irrigation method distribution, incidental depletion =18% flood, 25% sprinkler, 5% drip

Notes: Water right acres HB/FP

Rights	Δ	
7970	-933	10.5%
21280	-3374	

} x 50% for salvage.

117.1

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Upper Colorado River System – Consumptive Uses and Losses Comparisons 1976-1980

The NM Interstate Stream Commission did a study to duplicate the consumptive use obtained in the "Colorado River System Consumptive Uses and Losses Report 1976-1980", (CU+L), which used the Modified Blaney-Criddle method, and compare those numbers to consumptive use values obtained with the Original Blaney-Criddle computation method. This report explains the assumptions and calculations made in duplicating the CU+L report, and the assumptions and calculations made with the Original Blaney-Criddle method.

Back-up data exists for the 1976-1980 CU+L report for the Upper Colorado River. This data consists of a Technical Appendix, which contains sections detailing calculations for the water use categories, and the Irrigation Consumptive Use report, which contains copies of the printouts from the consumptive use calculations.

The Upper Colorado River Basin was divided into 64 smaller subareas, which followed state and hydrologic boundaries. For the purpose of this ISC study, we used the same subareas and did separate studies for each of the four upper basin states, New Mexico, Wyoming, Utah, and Colorado. The ISC has a Fortran computer program that can calculate consumptive use and CIR's for up to 20 geographic regions, using up to 20 weather stations and up to 30 crops. The state of Colorado had 32 subareas and so for computation purposes, Colorado was split into three areas by river basin (Green, Upper Colorado mainstem, and San Juan), and then summed for a state total. The Fortran program will compute consumptive use with either the Original Blaney-Criddle or the Modified Blaney-Criddle methods.

In the 1976-1980 CU+L report, a representative climate station was selected for each subarea. The printout copies show the weather data (temperature, precipitation, and frost dates) that were used in the CU+L computations. Since the objective was to duplicate the CU+L report, these values were input as weather data into the Fortran model. CU+L frost dates were the last spring 28 degree day, the first fall 32 degree day, and the first fall 28 degree day.

The method used to compute consumptive use in the 1976-1980 CU+L report was the Modified Blaney-Criddle method, as described in the Soil Conservation Service Technical Release No. 21, "Irrigation Water Requirements", revised September 1970. This same method was used in the ISC Fortran program to compute consumptive use. Irrigated acres and crop types were taken from the CU+L printout copies and input as crop acreage and crop type data into the Fortran model. A substantial number of crop acres in the upper basin are alfalfa and pasture which is subject to a shortage nearly every year. These acres were shorted based upon the CU+L printout growing seasons. The CU+L report had growing season stop dates based on streamflow hydrographs and an assumed irrigation cutoff date. A start date and end date with corresponding length of growing season and appropriate crop type was input into the ISC program.

CIR's in the CU+L report were obtained by subtracting the effective precipitation from the consumptive use. Effective precipitation in the CU+L report was obtained by using the method in the U.S. Department of Agriculture, Agricultural Research Service, Technical Bulletin No. 1275. This method is also known as the USBR method. This same method of determining effective precipitation was used in the ISC study to duplicate the CU+L results.

Comparing the ISC Fortran program results and the CU+L results showed a very close reproduction of the CU+L results. Differences between the two outputs were 0.6% or less, as shown in Table 1., Upper Colorado Basin CU+L Comparisons (Average 1976-1980).

Once the duplication of the CU+L results was completed, the ISC wanted to compare those numbers to results using the Original Blaney-Criddle method. The Original Blaney-Criddle method used is as described in NMSU Agricultural Experiment Station Bulletin 531, "Consumptive Irrigation Requirements of Selected Irrigated Areas in New Mexico". The appropriate crop coefficients listed in the bulletin were used in the ISC study with the Orignal Blaney-Criddle method.

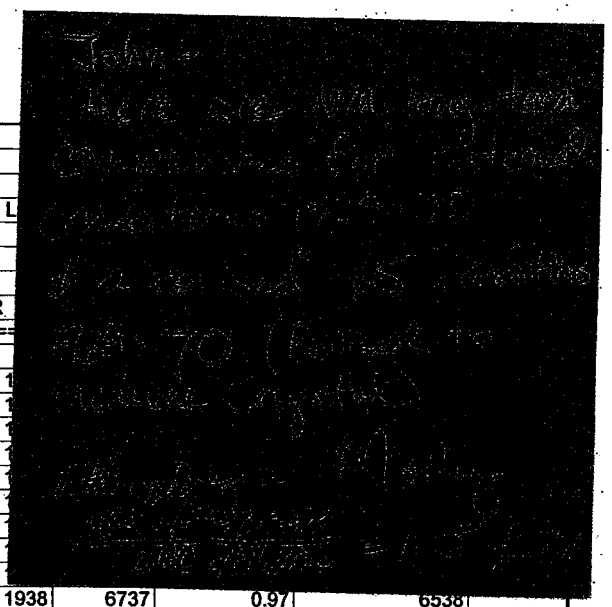
The Original Blaney-Criddle method, published in 1950, did not include a method for calculating effective precipitation, but Blaney in 1962 adopted the USBR method. This method was used in the ISC study.

The crop types, irrigated acres, and weather data were kept the same as was used in the CU+L report so the only difference was the consumptive use calculation method. The results are shown in Table 1.

Table 1.
Upper Colorado Basin CU+L Comparisons (Average 1976-1980)

State	CU + L (acre-feet)	Modified Blaney-Criddle (af) USBR rainfall	Original Blaney-Criddle (af) USBR rainfall	Modified USBR/ Original USBR
New Mexico	92207	92674	85557	1.06
Wyoming	196712	197073	223787	0.92
Utah	367978	369571	386963	0.99
Colorado				
Green River	88398	88920	97353	0.94
Upper Mainstem	710948	716953	743641	0.93
San Juan	138566	139131	149963	0.92
Total Colorado	937912	945004	990957	0.95

DRAFT



San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix
Modified Blaney-Criddle, SCS Effective Precipitation
Basin Total (no La Plata,Chaco,Crystal)

YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU FULL SUPPLY (AF)
1929	25668	1.75	44942
1930	25748	1.87	48250
1931	25829	1.93	49784
1932	25912	1.83	47403
1933	25992	1.93	50249
1934	26073	1.98	51632
1935	26155	1.83	47774
1936	26235	1.98	51890
1937	25918	1.98	51210
1938	26408	1.91	50454
1939	27034	2.15	58178
1940	27832	2.05	57018
1941	28630	1.64	46972
1942	27961	2.10	58854
1943	28855	2.11	60918
1944	29323	2.00	58527
1945	29602	2.06	60844
1946	30131	2.05	61901
1947	30692	1.85	56764
1948	30770	1.96	60264
1949	30681	1.94	59433
1950	31597	2.27	71835
1951	31532	2.20	69234
1952	31792	2.27	72064
1953	32087	2.23	71688
1954	31864	2.21	70529
1955	31639	2.14	67736
1956	32520	2.38	77315
1957	33447	1.84	61633
1958	30001	2.32	69576
1959	31051	2.29	71057
1960	31823	2.48	79047
1961	31459	2.28	71758
1962	33120	2.39	79210
1963	33954	2.48	84084
1964	35266	2.26	79586
1965	35900	1.95	69980
1966	34490	2.57	88629
1967	33137	2.26	74998
1968	31781	2.12	67390
1969	30569	2.12	64675
1970	29155	2.13	62173
AVERAGE	29991	2.11	63273

YEAR			
1938	6737	0.97	6538
1939	6795	1.10	7447
1940	7301	1.03	7501
1941	7804	0.81	6322
1942	8310	1.06	8812
1943	8814	1.07	9468
1944	9318	1.02	9506
1945	9824	1.05	10284
1946	9777	1.04	10149
1947	9734	0.96	9329
1948	9694	0.98	9465
1949	9654	0.96	9253
1950	9613	1.11	10669
1951	9572	1.11	10661
1952	9531	1.13	10767
1953	9490	1.15	10927
1954	9449	1.13	10687
1955	9408	1.09	10251
1956	9368	1.20	11244
1957	9327	0.93	8634
1958	9285	1.17	10821
1959	9245	1.16	10741
1960	9204	1.25	11473
1961	9163	1.10	10052
1962	9123	1.20	10929
1963	9082	1.25	11321
1964	9040	1.13	10171
1965	9000	0.89	8027
1966	8806	1.30	11409
1967	8613	1.15	9946
1968	8418	1.07	9034
1969	8224	1.10	9063
1970	8031	1.08	8636
AVERAGE	7978	1.07	8522

San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix
Modified Blaney-Criddle, SCS Effective Precipitation
Basin Total including shorted La Plata,Chaco,Crystal

YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU (AF)
1929	29372	1.64	48113
1930	29452	1.75	51674
1931	29685	1.80	53368
1932	29921	1.71	51197
1933	30153	1.80	54257
1934	30387	1.84	56007
1935	31074	1.68	52321
1936	31760	1.81	57477
1937	32050	1.78	57114
1938	33145	1.72	56992
1939	33829	1.94	65625
1940	35133	1.84	64519
1941	36434	1.46	53294
1942	36271	1.87	67666
1943	37669	1.87	70386
1944	38641	1.76	68033
1945	39426	1.80	71128
1946	39908	1.81	72050
1947	40426	1.63	66093
1948	40464	1.72	69729
1949	40335	1.70	68686
1950	41210	2.00	82504
1951	41104	1.94	79895
1952	41323	2.00	82831
1953	41577	1.99	82615
1954	41313	1.97	81216
1955	41047	1.90	77987
1956	41888	2.11	88559
1957	42774	1.64	70267
1958	39286	2.05	80397
1959	40296	2.03	81798
1960	41027	2.21	90520
1961	40622	2.01	81810
1962	42243	2.13	90139
1963	43036	2.22	95405
1964	44306	2.03	89757
1965	44900	1.74	78007
1966	43296	2.31	100038
1967	41750	2.03	84944
1968	40199	1.90	76424
1969	38793	1.90	73738
1970	37186	1.90	70809
AVERAGE	37969	1.89	71795

San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix

Modified Blaney-Criddle, USBR Effective Precipitation

Basin Total (no La Plata,Chaco,Crystal)				La Plata (45% shortage)+Chaco, Crystal (50% shortage)			
YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU FULL SUPPLY (AF)	YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU SHORTED SUPPLY (AF)
1929	25651	1.69	43235	1929	3706	0.83	3059
1930	25731	1.82	46905	1930	3706	0.91	3356
1931	25812	1.85	47780	1931	3858	0.88	3392
1932	25895	1.77	45709	1932	4011	0.91	3631
1933	25975	1.86	48326	1933	4163	0.92	3829
1934	26056	1.91	49840	1934	4316	0.97	4179
1935	26138	1.73	45184	1935	4921	0.86	4224
1936	26218	1.89	49678	1936	5527	0.95	5250
1937	25901	1.89	49075	1937	6134	0.90	5537
1938	26408	1.81	47712	1938	6737	0.90	6039
1939	27034	2.07	56044	1939	6795	1.03	7000
1940	27832	1.95	54388	1940	7301	0.96	6977
1941	28630	1.50	42815	1941	7804	0.71	5532
1942	27961	2.02	56511	1942	8310	0.99	8237
1943	28855	2.02	58153	1943	8814	1.00	8840
1944	29323	1.90	55833	1944	9318	0.95	8857
1945	29602	1.98	58550	1945	9824	0.98	9673
1946	30131	1.97	59252	1946	9777	0.97	9457
1947	30692	1.72	52739	1947	9734	0.87	8470
1948	30770	1.84	56733	1948	9694	0.89	8671
1949	30681	1.82	55752	1949	9654	0.87	8404
1950	31597	2.20	69381	1950	9613	1.04	9984
1951	31532	2.12	66698	1951	9572	1.05	10032
1952	31792	2.18	69168	1952	9531	1.05	10050
1953	32087	2.15	69009	1953	9490	1.08	10283
1954	31864	2.12	67659	1954	9449	1.06	9986
1955	31639	2.06	65333	1955	9408	1.02	9633
1956	32520	2.31	75122	1956	9368	1.14	10671
1957	33447	1.71	57265	1957	9327	0.84	7790
1958	30001	2.22	66475	1958	9285	1.08	10057
1959	31051	2.18	67542	1959	9245	1.07	9909
1960	31823	2.37	75533	1960	9204	1.16	10667
1961	31459	2.19	68837	1961	9163	1.02	9343
1962	33120	2.30	76024	1962	9123	1.11	10138
1963	33954	2.39	81277	1963	9082	1.17	10633
1964	35266	2.17	76623	1964	9040	1.05	9515
1965	35900	1.81	65124	1965	8700	0.83	7210
1966	34490	2.49	85958	1966	8514	1.26	10764
1967	33137	2.18	72333	1967	8331	1.12	9328
1968	31781	2.03	64410	1968	8144	1.03	8375
1969	30569	2.01	61594	1969	7958	1.06	8443
1970	29155	2.04	59380	1970	7773	1.02	7967
AVERAGE	29988	2.02	60499	AVERAGE	7939	1.00	7938

San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix
Modified Blaney-Criddle, USBR Effective Precipitation
Basin Total including shorted La Plata,Chaco,Crystal

YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU (AF)
1929	29357	1.58	46294
1930	29437	1.71	50261
1931	29670	1.72	51172
1932	29906	1.65	49340
1933	30138	1.73	52155
1934	30372	1.78	54019
1935	31059	1.59	49408
1936	31745	1.73	54928
1937	32035	1.70	54612
1938	33145	1.62	53751
1939	33829	1.86	63044
1940	35133	1.75	61365
1941	36434	1.33	48347
1942	36271	1.79	64748
1943	37669	1.78	66993
1944	38641	1.67	64690
1945	39426	1.73	68223
1946	39908	1.72	68709
1947	40426	1.51	61209
1948	40464	1.62	65404
1949	40335	1.59	64156
1950	41210	1.93	79365
1951	41104	1.87	76730
1952	41323	1.92	79218
1953	41577	1.91	79292
1954	41313	1.88	77645
1955	41047	1.83	74966
1956	41888	2.05	85793
1957	42774	1.52	65055
1958	39286	1.95	76532
1959	40296	1.92	77451
1960	41027	2.10	86200
1961	40622	1.92	78180
1962	42243	2.04	86162
1963	43036	2.14	91910
1964	44306	1.94	86138
1965	44600	1.62	72334
1966	43004	2.25	96722
1967	41468	1.97	81661
1968	39925	1.82	72785
1969	38527	1.82	70037
1970	36928	1.82	67347
AVERAGE	37926	1.80	68437

San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix									
Original Blaney-Criddle, USBR Effective Precipitation									
Basin Total (no La Plata,Chaco,Crystal)						La Plata (45% shortage)+Chaco,Crystal (50% shortage)			
		CROP	CROP					CROP	CROP
		WEIGHTED	CU FULL					WEIGHTED	CU SHORTED
YEAR	ACRES	CIR (FT)	SUPPLY (AF)			YEAR	ACRES	CIR (FT)	SUPPLY (AF)
1929	25651	1.41	36215			1929	3706	0.69	2545
1930	25731	1.64	42103			1930	3706	0.88	3269
1931	25812	1.59	41168			1931	3894	0.77	3002
1932	25895	1.50	38744			1932	4081	0.79	3242
1933	25975	1.65	42957			1933	4268	0.87	3693
1934	26056	1.61	41883			1934	4456	0.81	3617
1935	26138	1.53	40006			1935	5096	0.78	3984
1936	26218	1.65	43300			1936	5737	0.84	4803
1937	25901	1.63	42264			1937	6379	0.79	5012
1938	26408	1.64	43317			1938	7018	0.84	5866
1939	27034	1.83	49467			1939	7110	0.93	6608
1940	27832	1.74	48291			1940	7651	0.86	6577
1941	28630	1.32	37696			1941	8189	0.64	5240
1942	27961	1.83	51201			1942	8729	0.91	7929
1943	28855	1.80	51926			1943	9269	0.92	8497
1944	29323	1.79	52565			1944	9808	0.92	8980
1945	29602	1.75	51840			1945	10349	0.85	8817
1946	30131	1.75	52852			1946	10286	0.87	8941
1947	30692	1.59	48675			1947	10237	0.84	8620
1948	30770	1.72	52858			1948	10122	0.86	8695
1949	30681	1.75	53810			1949	10144	0.87	8866
1950	31597	2.03	64095			1950	10254	0.98	10069
1951	31532	1.89	59544			1951	10007	0.96	9653
1952	31792	1.97	62631			1952	9996	0.93	9267
1953	32087	1.95	62424			1953	9953	1.00	9958
1954	31864	1.87	59691			1954	9925	0.92	9119
1955	31639	1.86	58994			1955	9819	0.92	9014
1956	32520	2.08	67744			1956	9842	1.04	10200
1957	33447	1.65	55132			1957	9673	0.84	8100
1958	30001	2.06	61677			1958	9794	1.00	9833
1959	31051	1.92	59487			1959	9675	0.95	9203
1960	31823	2.11	67024			1960	9648	1.02	9869
1961	31459	1.96	61559			1961	9583	0.89	8520
1962	33120	2.11	69772			1962	9584	1.02	9740
1963	33954	2.17	73795			1963	9492	1.06	10080
1964	35266	2.04	71978			1964	9387	1.00	9343
1965	35900	1.67	59777			1965	8700	0.76	6647
1966	34490	2.31	79510			1966	8517	1.17	9938
1967	33137	2.05	67849			1967	8338	1.05	8741
1968	31781	1.86	59117			1968	8153	0.93	7592
1969	30569	1.87	57198			1969	7969	0.97	7763
1970	29155	1.86	54100			1970	7785	0.93	7254
AVERAGE	29988	1.82	54672			AVERAGE	8246	0.91	7541

San Juan River Basin 1929-1970 Weather, ISC Trend acres, crop mix
Original Blaney-Criddle, USBR Effective Precipitation
Basin Total including shorted La Plata,Chaco,Crystal

YEAR	ACRES	CROP WEIGHTED CIR (FT)	CROP CU (AF)
1929	29357	1.32	38760
1930	29437	1.54	45372
1931	29706	1.49	44170
1932	29976	1.40	41986
1933	30243	1.54	46650
1934	30512	1.49	45500
1935	31234	1.41	43990
1936	31955	1.51	48103
1937	32280	1.46	47276
1938	33426	1.47	49183
1939	34144	1.64	56075
1940	35483	1.55	54868
1941	36819	1.17	42936
1942	36690	1.61	59130
1943	38124	1.58	60423
1944	39131	1.57	61545
1945	39951	1.52	60657
1946	40417	1.53	61793
1947	40929	1.40	57295
1948	40892	1.51	61553
1949	40825	1.54	62676
1950	41851	1.77	74164
1951	41539	1.67	69197
1952	41788	1.72	71898
1953	42040	1.72	72382
1954	41789	1.65	68810
1955	41458	1.64	68008
1956	42362	1.84	77944
1957	43120	1.47	63232
1958	39795	1.80	71510
1959	40726	1.69	68690
1960	41471	1.85	76893
1961	41042	1.71	70079
1962	42704	1.86	79512
1963	43446	1.93	83875
1964	44653	1.82	81321
1965	44600	1.49	66424
1966	43007	2.08	89448
1967	41475	1.85	76590
1968	39934	1.67	66709
1969	38538	1.69	64961
1970	36940	1.66	61354
AVERAGE	38234	1.63	62213

Modified Blaney-Criddle-USBR effective precipitation

San Juan Basin 1965 crop mix, 1965 acres, 1929-1970 weather data SUMMARY

Basin Wide, Full Supply (no La Plata, Chaco,Crystal)				Short Supply (La Plata, Chaco, Crystal) Modified Blaney-Criddle La Plata=45%shortage, Chaco+Crystal=50%shortage				
year	acres	CU	Basin CIR	year	acres	Full CU	Short CU	Short Basin CIR
1929	35900	68751	1.92	1929	9000	16892	8830	0.98
1930	35900	73138	2.04	1930	9000	17707	9281	1.03
1931	35900	73823	2.06	1931	9000	17609	9225	1.03
1932	35900	71893	2.00	1932	9000	17688	9272	1.03
1933	35900	74671	2.08	1933	9000	17859	9362	1.04
1934	35900	76647	2.14	1934	9000	18608	9762	1.08
1935	35900	69682	1.94	1935	9000	17106	8944	0.99
1936	35900	76027	2.12	1936	9000	18023	9454	1.05
1937	35900	77208	2.15	1937	9000	17368	9092	1.01
1938	35900	72572	2.02	1938	9000	17349	9060	1.01
1939	35900	79875	2.22	1939	9000	18975	9968	1.11
1940	35900	76631	2.13	1940	9000	17929	9392	1.04
1941	35900	56753	1.58	1941	9000	13442	7018	0.78
1942	35900	78725	2.19	1942	9000	18659	9801	1.09
1943	35900	79054	2.20	1943	9000	18857	9898	1.10
1944	35900	75211	2.10	1944	9000	17776	9315	1.03
1945	35900	78654	2.19	1945	9000	18435	9668	1.07
1946	35900	78427	2.18	1946	9000	18233	9581	1.06
1947	35900	68272	1.90	1947	9000	16317	8555	0.95
1948	35900	70959	1.98	1948	9000	16484	8650	0.96
1949	35900	69690	1.94	1949	9000	15989	8365	0.93
1950	35900	85206	2.37	1950	9000	19231	10099	1.12
1951	35900	81163	2.26	1951	9000	19248	10101	1.12
1952	35900	82546	2.30	1952	9000	19377	10160	1.13
1953	35900	81596	2.27	1953	9000	19869	10425	1.16
1954	35900	81796	2.28	1954	9000	19480	10239	1.14
1955	35900	79051	2.20	1955	9000	18811	9873	1.10
1956	35900	88011	2.45	1956	9000	20868	10962	1.22
1957	35900	63289	1.76	1957	9000	15191	7970	0.89
1958	35900	82548	2.30	1958	9000	19709	10348	1.15
1959	35900	81195	2.26	1959	9000	19501	10240	1.14
1960	35900	88552	2.47	1960	9000	21045	11058	1.23
1961	35900	80767	2.25	1961	9000	18526	9723	1.08
1962	35900	84445	2.35	1962	9000	20154	10565	1.17
1963	35900	87930	2.45	1963	9000	21214	11130	1.24
1964	35900	79438	2.21	1964	9000	19049	10001	1.11
1965	35900	65124	1.81	1965	9000	14328	7516	0.84
1966	35900	88956	2.48	1966	9000	21244	11141	1.24
1967	35900	77658	2.16	1967	9000	18868	9890	1.10
1968	35900	72262	2.01	1968	9000	17306	9083	1.01
1969	35900	72412	2.02	1969	9000	17772	9347	1.04
1970	35900	72403	2.02	1970	9000	17229	9047	1.01
AVERAGE	35900	76738	2.14	AVERAGE	9000	18222	9557	1.06

San Juan Basin 1965 crop mix, 1965 acres, 1929-1970 weather data SUMMARY																	
Basin Wide, Full Supply (no La Plata, Chaco,Crystal)					Modified Blaney-Criddle SCS eff. Precip				Short Supply (La Plata, Chaco,Crystal)				Modified Blaney-Criddle				
													La Plata=45%shortage,Chaco,Crystal=50%shortage				
year		acres		CU		Basin CIR			year		acres		CU		Short CU		Short Basin CIR
1929		35900		71234		1.98			1929		9000		17517		9158		1.02
1930		35900		75054		2.09			1930		9000		18183		9528		1.06
1931		35900		76770		2.14			1931		9000		18328		9605		1.07
1932		35900		74119		2.06			1932		9000		18251		9566		1.06
1933		35900		76979		2.14			1933		9000		18410		9650		1.07
1934		35900		78780		2.19			1934		9000		19057		9997		1.11
1935		35900		72731		2.03			1935		9000		17815		9318		1.04
1936		35900		78480		2.19			1936		9000		18661		9788		1.09
1937		35900		79504		2.21			1937		9000		17952		9399		1.04
1938		35900		75637		2.11			1938		9000		18119		9468		1.05
1939		35900		81989		2.28			1939		9000		19547		10265		1.14
1940		35900		79235		2.21			1940		9000		18583		9736		1.08
1941		35900		61396		1.71			1941		9000		14610		7631		0.85
1942		35900		80962		2.26			1942		9000		19229		10102		1.12
1943		35900		81460		2.27			1943		9000		19451		10211		1.13
1944		35900		77460		2.16			1944		9000		18328		9606		1.07
1945		35900		80289		2.24			1945		9000		18832		9874		1.10
1946		35900		80486		2.24			1946		9000		18800		9878		1.10
1947		35900		72129		2.01			1947		9000		17229		9036		1.00
1948		35900		74098		2.06			1948		9000		17280		9068		1.01
1949		35900		72884		2.03			1949		9000		16844		8817		0.98
1950		35900		86760		2.42			1950		9000		19684		10336		1.15
1951		35900		82980		2.31			1951		9000		19674		10325		1.15
1952		35900		84819		2.36			1952		9000		19976		10476		1.16
1953		35900		83873		2.34			1953		9000		20366		10687		1.19
1954		35900		83959		2.34			1954		9000		20042		10534		1.17
1955		35900		80806		2.25			1955		9000		19301		10132		1.13
1956		35900		89524		2.49			1956		9000		21234		11156		1.24
1957		35900		67384		1.88			1957		9000		16189		8495		0.94
1958		35900		85043		2.37			1958		9000		20368		10694		1.19
1959		35900		84221		2.35			1959		9000		20296		10660		1.18
1960		35900		91579		2.55			1960		9000		21813		11462		1.27
1961		35900		83182		2.32			1961		9000		19146		10049		1.12
1962		35900		87065		2.43			1962		9000		20922		10969		1.22
1963		35900		90046		2.51			1963		9000		21767		11419		1.27
1964		35900		81756		2.28			1964		9000		19638		10310		1.15
1965		35900		69338		1.93			1965		9000		15303		8027		0.89
1966		35900		90842		2.53			1966		9000		21710		11388		1.27
1967		35900		79682		2.22			1967		9000		19369		10152		1.13
1968		35900		74767		2.08			1968		9000		17924		9408		1.05
1969		35900		75096		2.09			1969		9000		18354		9651		1.07
1970		35900		75068		2.09			1970		9000		17963		9431		1.05
AVERAGE		35900		79273		2.21			AVERAGE		9000		18859		9893		1.10

	San Juan Basin 1965 crop mix, 1965 acres, 1929-1970 weather data SUMMARY																	
	Basin Wide, Full Supply (no La Plata, Chaco,Crystal)				Original Blaney-Criddle USBR effective precip					Short Supply (La Plata, Chaco,Crystal)					Original Blaney-Criddle La Plata=45%shortage,Chaco,Crystal=50%shortage			
year		acres		CU		Basin CIR				year		acres		CU		Short CU		Shorted Basin CIR
1929		35900		57954		1.61				1929		9000		14378		7491		0.83
1930		35900		65919		1.84				1930		9000		16279		8541		0.95
1931		35900		63809		1.78				1931		9000		15385		8049		0.89
1932		35900		61547		1.71				1932		9000		14916		7819		0.87
1933		35900		66639		1.86				1933		9000		16261		8526		0.95
1934		35900		64455		1.80				1934		9000		15764		8252		0.92
1935		35900		62028		1.73				1935		9000		15091		7892		0.88
1936		35900		66876		1.86				1936		9000		15734		8247		0.92
1937		35900		66641		1.86				1937		9000		15047		7876		0.88
1938		35900		66139		1.84				1938		9000		16115		8421		0.94
1939		35900		66997		1.87				1939		9000		16115		8412		0.93
1940		35900		67924		1.89				1940		9000		16074		8410		0.93
1941		35900		50007		1.39				1941		9000		11972		6246		0.69
1942		35900		70799		1.97				1942		9000		17058		8948		0.99
1943		35900		70887		1.97				1943		9000		17332		9093		1.01
1944		35900		70260		1.96				1944		9000		17140		8980		1.00
1945		35900		69044		1.92				1945		9000		16061		8428		0.94
1946		35900		69766		1.94				1946		9000		16437		8637		0.96
1947		35900		62679		1.75				1947		9000		15575		8143		0.90
1948		35900		65572		1.83				1948		9000		15801		8290		0.92
1949		35900		67083		1.87				1949		9000		15997		8361		0.93
1950		35900		78302		2.18				1950		9000		18468		9693		1.08
1951		35900		72098		2.01				1951		9000		17665		9262		1.03
1952		35900		74632		2.08				1952		9000		17144		8995		1.00
1953		35900		74021		2.06				1953		9000		18446		9678		1.08
1954		35900		72683		2.02				1954		9000		17133		9024		1.00
1955		35900		71345		1.99				1955		9000		16890		8873		0.99
1956		35900		79574		2.22				1956		9000		19167		10066		1.12
1957		35900		61100		1.70				1957		9000		15129		7934		0.88
1958		35900		76707		2.14				1958		9000		18445		9675		1.07
1959		35900		71414		1.99				1959		9000		17306		9086		1.01
1960		35900		78424		2.18				1960		9000		18702		9833		1.09
1961		35900		72365		2.02				1961		9000		16169		8504		0.94
1962		35900		77854		2.16				1962		9000		18571		9745		1.08
1963		35900		80002		2.23				1963		9000		19315		10143		1.13
1964		35900		74717		2.08				1964		9000		17970		9439		1.05
1965		35900		59776		1.67				1965		9000		13202		6938		0.77
1966		35900		81362		2.27				1966		9000		19693		10340		1.15
1967		35900		72054		2.01				1967		9000		17825		9344		1.04
1968		35900		65630		1.83				1968		9000		15871		8325		0.93
1969		35900		66609		1.86				1969		9000		16416		8640		0.96
1970		35900		65278		1.82				1970		9000		15830		8305		0.92
average		35900		69018		1.92				average		9000		16569		8688		0.97

1965 Type I – SCS Upper CO Region, Type I Survey – NM. Water Resources – Present Water Use. CIR in AF by evaluation areas and crops. 8/20/68.

SJ – Navajo Dam to 4-Corners – avg. Bloomfield & Shiprock weather data 1949-66.

AR & LP – Aztec Ruins weather data 1921-50.
(LP 54.6% shortage from 1962 USBR ALP feasibility report, Appendix B).

Navajo, Largo & Pine – Ignacio, CO, weather data 1931-60
(growing seasons on Nav/Pine extended 10 days)

Chaco – Newcomb & Tohatchi avg. 1948-66.
(inc. good land irrig. once in spring).
(~50% overall shortage)

CU & L

Note – carried forward 1965 Inc. Users %. –
~~5.1%~~ above Navajo Dam, ~~20.5%~~ SJR ab. Shiprock +
Animas & LP & Chaco.
~~15.2%~~ SJR b/l Shiprock & Coyote (See USBR CU&L Report 1976-1980 Technical Appendix UC Region).

Chaco – Tohatchi
LP & AR – Aztec
SJR b/l Shiprock – Shiprock
SJR ab. Shiprock – Shiprock + Bloomfield Average
ab. Nav. Dam – Navajo Dam

OSE-0651

Notes in file circa 1949 - (probably John Erickson)
NM #15

SJR Water consuming channel areas in NM:

SJR-Rosa to 4 Corners = 17,630 ac
Pine River = 1,370 ac
AR = 2,384 ac
LPR = 2,256 ac

Stream Depletion Subcommittee, EAC to UCRBCC, Water Consuming Areas pertinent to Stream depletion SJRB in NM, circa 1949

Natural riparian veg. areas converted to irrig. ag. lands:

SJ = 290 ac LPR = 15 ac
Navajo = 20 ac
Pine = 0 ac
AR = 630 ac

11/12/47 memo from USBR Hydrology Div. to EAC of the UCRBCC:

evap losses

1. Pine River 2,400 ac (1,370 ac in NM)
   AR 2,580 ac (2,384 ac in NM)
   LPR 2,256 ac (all in NM)
   SJR 18,172 ac in NM
2. evap. rates from rate-elev. curves times turbulence factor of 1.3

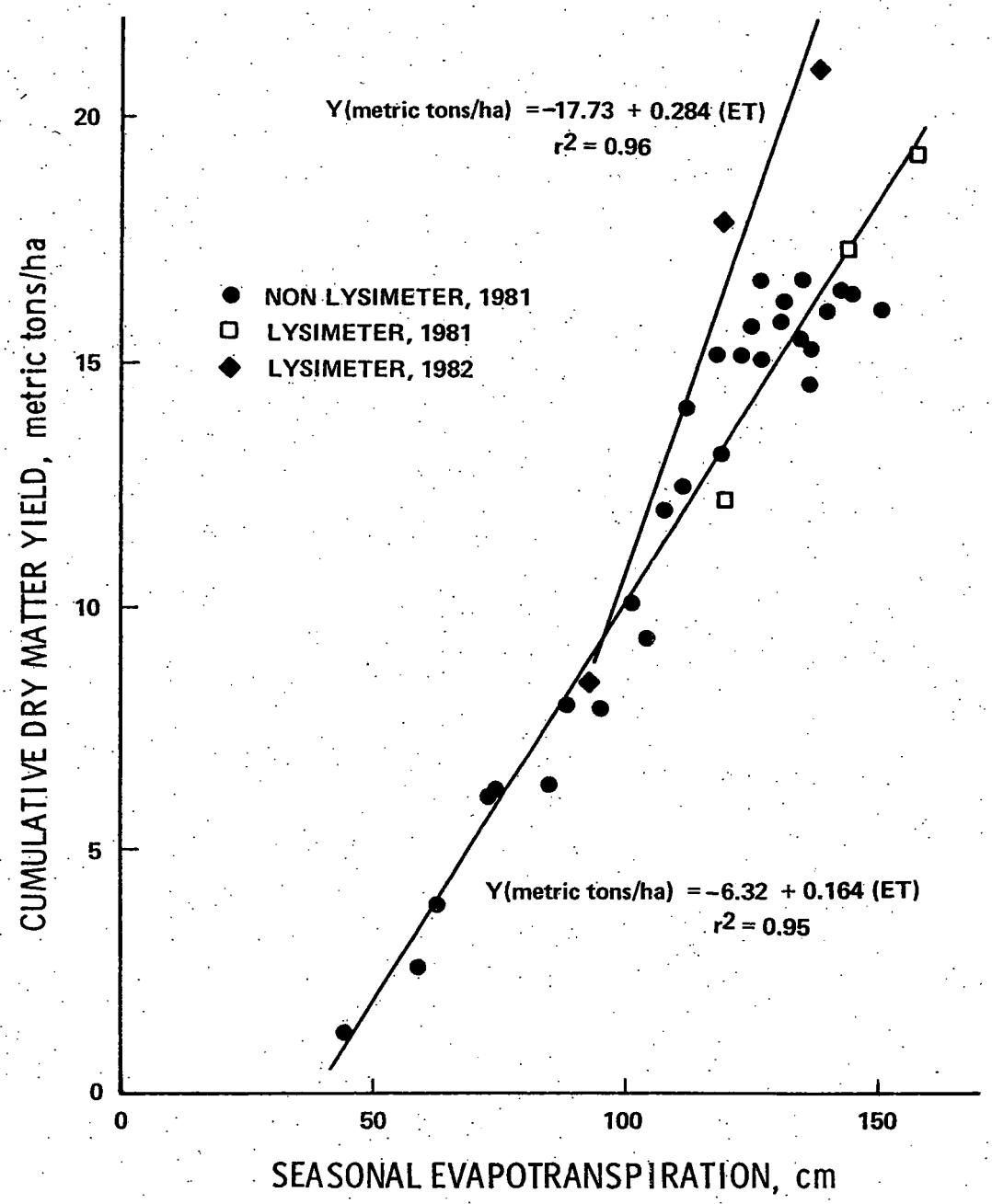


Figure 10. The seasonal cumulative water-production functions of alfalfa, 1981 and 1982.

DRAFT

Alfalfa Crop-production Functions (Farmington)