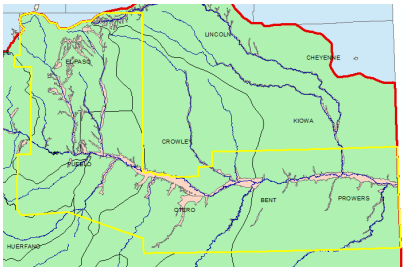
ArkDSS Task 2.8
Appendix B

Alluvial Aquifer Properties: References from the CWCB/CGS Spatial Bibliography and HRS' Notes on Groundwater Zones

See Table A at the end of the document for the Spatial Bibliography publications used; see Spatial Bibliography for additional references

Groundwater Zones: WD16, WD79, WD14 North, WD12, WD17, WD17 North, WD67 Northwest, WD67 Northeast, WD67 South, Southern High Plains DB – WD67, Upper Big Sandy DB, Northern High Plains DB, Adobe, HIM Alluvial Aquifer – WD17, HIM Alluvial Aquifer – WD67, Big Sandy, Rush, Horse, HIM Alluvial Aquifer – WD14, WD14, Chico, Upper Black Squirrel Creek DB, Fountain Creek Reach 1, 2, 3, & 5, Salt Creek-Arkansas River, WD15, Pueblo Res, Florence, Cannon City-Penrose, Purgatoire River-Below Thatcher, and Two Butte Creek
REF NUM: 35



Aquifer name and description	Well characteristics: Depth (ft) Common range	Depth (ft) May exceed	Yield (gal/min) Common range	Yield (gal/min) May exceed	Remarks
Principal Aquifers					
Arkansas alluvial aquifer: Boulders, cobbles, gravel, sand, and clay. Generally grades from fine sand near the surface to coarse sand and gravel at the base. Generally unconfined.	25 – 100	200	100 – 1,200	1,500	Principal source of water for irrigation, public supply, and industrial wells. Transmissivity ranges from 1,000 to 150,000 ft²/d. Dissolved-solids concentration ranges from about 800 to 5,000 mg/L. Water hard to extremely hard.

Useful page(s): 164

Groundwater Zones: WD67 Northeast, WD67 South, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, and Two Butte Creek
REF NUM: 46

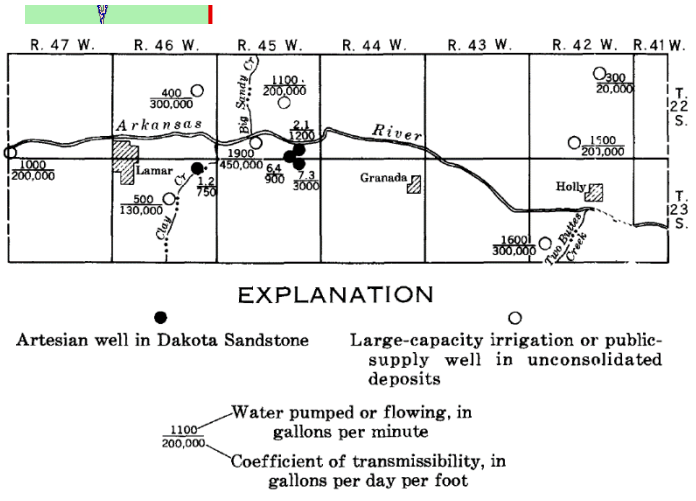


FIGURE 7.—Map of part of the report area showing the location of aquifer tests, the coefficients of transmissibility, and the pumping rates.

Useful pages: 25, 26, 27

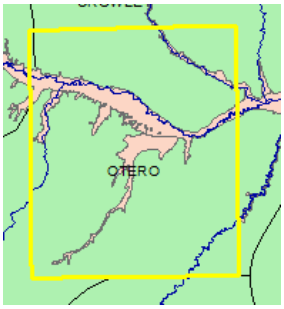
TABLE 2.—*Summary of the results of aquifer tests*

[Principal aquifer: Kd, Dakota Sandstone; To, Ogallala Formation; Qt, terrace deposits, Arkansas River; Qal, alluvium, Arkansas River; Qal, C, alluvium, Clay Creek]

Well	Principal aquifer	Depth of well (feet)	Depth to bedrock (feet)	Depth to water below measuring point (feet)	Total saturated thickness (feet)	Saturated sand and gravel (feet)	Duration of pumping (hours)	Average pumping rate (gpm)	Drawdown (feet)	Specific capacity (gpm per ft of drawdown)	Coefficient of transmissibility (gpd per ft)	Average field coefficient of permeability of entire aquifer (gpd per sq ft)	Average field coefficient of permeability of sand and gravel (gpd per sq ft)	Radius of influence (feet)	Coefficient of storage or specific yield	Water temperature (° F)	Date of test	Remarks
22-42-11bbb	To	144		70	75		8	300	51	6	20,000	300				58	11-11-57	
33abb	Qt	140	138	60.8	77	71	24	1,600	23	68	200,000	3,000	3,000	860	0.2	58	11-12-57	
22-45-15dda	Qt	115		60.1	55		8	1,100	18	58	200,000	4,000				59	10-21-57	
33babl	Qal	63	63	17.1	46	46	20	1,900	16	121	450,000	10,000	10,000	2,500	.1	58	10-24-57	
22-45-35ccd1	Kd			+10.0			2	6.4	10	.6	900				.001	61	10-12-57	Flowing well.
35dba	Kd	220		+22.35			2	2.1	2.6	.8	1,200				.001	59	8-22-57	Do.
22-46-14aaa	Qt	146	146	49.8	98	98	8	400	2.7	146	300,000	3,000	3,000	800	.1	57	11- 6-57	
22-47-31cbc	Qal	36	35	8.1	29		60	1,000	17	61	200,000	7,000		1,240	.2	58	10-15-57	
23-42-30ddd1	Qal	111	109	52.2	57	57	72	1,600	20	77	300,000	5,000	5,000		.2		9- 2-58	
23-45-2aac	Kd	176		+19.5			2	7.3	19.5	.4	3,000					61	10-12-57	Flowing well.
23-46-2dba	Kd	138		+5.1		18	1	1.2	5.1	.2	1,400					59	10-17-57	Do.
23-46-15bca	Qal, C	49	49	36	13	13	46	500	3.5	143	130,000	10,000	10,000	2,000	.1		4- 7-54	Basic data obtained by city of Lamar personnel.

Groundwater Zones: WD14 North, WD 17 North, WD17, HIM Alluvial Aquifer-WD17, Horse, HIM Alluvial Aquifer-WD14, WD14, and Purgatoire River-Below Thatcher

REF NUM: 48



	Field determinations	Laboratory determinations
Number of determinations	18	22
Coefficient of permeability (gpd per sq ft)	520–8, 900	25–7, 800
Average do	4, 300	1, 280
Coefficient of storage	0. 03–0. 17	0. 14–0. 32
Average	. 12	. 25

TABLE 4.—*Summary of the results of aquifer tests*

[Principal aquifer: Kpc, Cheyenne Sandstone Member of the Purgatoire Formation; Kd, Dakota Sandstone; Knf, Fort Hays Limestone Member of the Niobrara Formation; Qtw, Wisconsin terrace]

Location	Owner or user	Principal aquifer	Depth of well (feet)	Total saturated thickness (feet)	Distance to water level below or above (+) land surface (feet)	Average pumping rate (gpm)	Drawdown (feet)	Specific capacity (gpm per ft of drawdown)	Duration of pumping (hours)	Coefficient of transmissibility (gpd per ft)	Coefficient of permeability of entire aquifer (gpd per sq ft)	Apparent coefficient of storage	Apparent radius of influence (feet)	Temperature (°F)	Specific conductance in micromhos at 25°C (field determination)	Kilowatthours per acre-foot of water	Date of test
C21-56- 2bdb	F. Hagan	Qvf	28.7	20	8.5	440	10	44	4	30,000	1,500				6,300	53	9-27-60
C21-58-22aab	L. Kiefer	Qvf	32.2	21	11.3	420	9	47	3	50,000	2,400			60	2,300	47	9-26-60
22daa	W. Bronner	Qvf	28.7	18	10.2	160	6	27	3	30,000	1,700			58	2,100	85	9-27-60
27daa	F. Tanabe	Qvf	41.0	29	11.8	120	17	7	25	15,000	520	0.15	170	58	3,000	167	9-26-60
C22-54-17ddd	O. Bay	Qvf	46.4	20	30.1	300	7	43	96	50,000	2,500	.13	900	57	2,700	90	8-26-60
C22-58-28cac	The Valley Water Co.	Kd, Kpc	1,506	220	85	40	198	.20	48	120	.5			82			2-10-62
C22-59- 7daa	E. Jensen	Qtw	35.3	24	10.8	430	8	54	33	120,000	5,000	.12	800	55	3,700	106	9-25-60
16acb	C. Stauder	Qtw	39.8	29	11.2	940	19	49	28	160,000	5,500			56	2,200	69	9-15-60
16dcc	do	Qtw	30.6	9	21.3	310	8	39	10	80,000	8,900	.16	300	57	2,400	71	9-16-60
C23-54-13bac	J. Dutton	Qtw	32	19	9.8	490	17	29	16	80,000	4,200			58	2,400		8- 3-60
20aac	Bent's Fort Water Co.	Kd, Kpc	[1] 800	227	69.0	75	550	.14	25	110	.5			70			3- 4-61
29daa	J. Dutton	Qtw	32.4	24	8.3	730	12	61	23	90,000	3,800			56	3,300	57	8- 4-60
30cdd	W. Glasco	Qtw	34.5	23	11.0	620	7	89	10	200,000	8,700	.11	600	56	3,600	50	8- 3-60
C23-55-30bcc	Western Alfalfa Co.	Qtw	34.0	28	6.1	670	15	45	94	120,000	4,300	[2] .17	1,700	56	3,500		9- 9-60
33bad	A. Bair	Qtw	36.1	31	7.2	690	16	43	5	100,000	3,200		500	55	1,700	52	8- 6-60
36bbc	Bent'sFort Water Co.	Kd, Kpc	820	202	91	47	488	.10	24	150	.7	.0001		57	2,000	89	8- 8-60
36bda	Wunsch Bros.	Qtw	40.2	16	24.0	760	10	76	12	140,000	8,800			57	2,000	89	8- 8-60
C23-56- 8ddc	D. Reynolds	Qtw	32.2	18	13.7	400	11	36	25	50,000	2,800			57	2,800	59	9- 1-60
C23-57- 2ddc	W. Woodside	Qtw	34.7	12	22.6	200	7.5	27	48	50,000	4,200			56	2,200	100	8-30-60
C24-56- 4cdc	B. Malott	Qvf	41.7	20	21.0	500	13	38	5	80,000	4,000			55	2,200	70	8-10-60
12abb	C. Lusk	Knf	41	30	10.6	125	19	7	69	10,000	330	.009	2,500	54	4,200	63	8-26-60
18acb	W. Caldwell	Qvf	47.4	20	27.4	700	13	54	20	110,000	5,500	.03	1,200	55	3,200	96	9-12-60
C24-58-19abd	Arnold-Harriman Co., Inc.	Kd, Kpc	[3] 1,131	102	+84	9.4	84	.11	3	800	8			77	1,200		9-28-60

[1] Casing perforated 450 to 800 ft.
[2] Coefficient of storage projected for 20 days may exceed 0.25.
[3] Casing perforated 1,110 to 1,130 ft.

- Relevant pages: 33, 37. & 38
- Plate 3 in folder shows the well locations on cross sections; did not copy as Plate is large and would not be intelligible in a word document

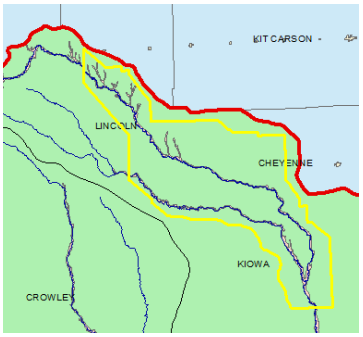
TABLE 5.—*Summary of laboratory-analysis data*

[Analyses by the Hydrol. Lab. of the U.S. Geol. Survey, Denver, Colo.]

Geologic source: Qn, Nebraskan deposits; Qtw, Wisconsin terrace deposits; Qvf, valley-fill deposits.
Specific retention: The ratio of the volume of water retained after a saturated rock has been drained by gravity to the bulk volume of the rock.
Porosity: Ratio of the aggregate volume of the voids in a rock or soil to its bulk volume.
Specific yield: The ratio of the volume of water in a saturated rock that will drain by gravity to the bulk volume of the rock. Porosity minus specific retention equals specific yield.
Coefficient of permeability: Amount of water that will flow through a unit cross section of material in a unit of time under a unit hydraulic gradient at a given temperature. The tabulated values are for a temperature of 60°F.

Location	Depth (feet)	Geologic source	Size of grain (percent by weight)										Specific retention (percent)	Porosity	Specific yield	Coefficient of permeability
			Clay and silt sizes (millimeter less than 0.0625)	Sand sizes (millimeters)				Gravel sizes (millimeters)								
				Very fine (0.0625–0.125)	Fine (0.125 0.25)	Medium (0.25–0.5)	Coarse (0.5–1.0)	Very coarse (1.0–2.0)	Very fine (2.0–4.0)	Fine (4.0 8.0)	Medium (8.0–16.0)	Coarse (16.0–32.0)	Very coarse (32.0–64.0)				
C21–58–36ccc	22– 54.5	Qvf	8.2	1.0	2.7	4.7	14.8	24.0	27.8	11.3	3.0	2.5		7.51	36.2	28.7	150
C21–60–25aaa	27– 54	Qn	.6	.3	.6	1.9	4.6	12.6	25.1	37.6	16.7			5.26	33.8	28.0	1,360
C22–57–26dad	11– 38.5	Qtw	1.2	.1	.5	4.0	10.5	13.7	23.4	37.2	9.4			8.51	33.1	24.6	700
36bbb	11– 42.5	Qtw	.0	.1	.3	3.0	12.3	15.4	19.7	15.7	33.5			2.05	28.2	26.1	1,600
C22–58–23dbb		Qtw	2.0	.8	2.3	5.8	8.5	17.4	40.0	21.6	1.6			7.62	35.4	27.8	300
C22–59–34caa	35– 46	Qvf	5.7	1.5	3.7	5.3	3.3	2.6	6.2	26.0	39.5	6.2		14.42	29.7	15.3	25
C23–54–13add	3– 19	Qtw	.9	.4	1.6	11.6	21.0	22.3	25.1	13.2	3.9			5.09	32.2	27.1	1,300
20add	30– 55	Qtw	.3	.0	.2	1.0	4.8	9.1	14.7	21.5	46.5	1.9		3.29	29.8	26.5	7,800
28cbc	15– 34	Qtw	1.1	.1	.3	1.9	9.8	24.0	20.2	33.7	8.9			4.31	31.6	27.3	1,950
29aaa	13– 44	Qtw	1.8	.3	1.0	5.9	22.9	29.5	33.9	4.5	.2			6.44	33.6	27.2	1,080
C23–56–11bcc	16– 29	Qvf	6.1	1.9	4.1	16.1	31.0	16.5	15.5	7.3	1.5			8.09	31.2	23.1	185
16dda	10½– 28	Qtw	2.9	.6	1.2	9.5	19.9	30.0	24.9	8.0	3.0			7.29	35.2	27.9	980
21daa	10– 43	Qtw	.5	.3	.7	3.2	12.5	24.5	32.0	23.1	3.2			4.89	32.6	27.7	1,920
22dba	6– 42	Qtw	1.2	.3	1.4	6.9	9.3	29.9	24.9	12.3	11.2	2.6		7.79	32.6	24.8	2,120
24cdd	19–425	Qtw	1.0	.4	.9	7.7	22.7	30.9	32.1	4.3				6.37	38.5	32.1	230
26ccc	29– 45	Qtw	4.9	.7	1.4	3.4	10.3	17.5	28.8	22.1	8.7	2.2		10.22	30.7	20.5	700
36acb	31– 53	Qtw	.5	.1	.2	.0	5.6	16.7	30.0	33.6	12.4			3.72	33.5	29.8	2,120
C23–57– 2aaa	0– 34	Qtw	1.4	.5	2.4	11.0	16.9	23.3	29.3	15.0	.2			6.16	31.9	25.7	630
11add	27– 37	Qtw	6.5	.8	2.5	9.0	17.4	20.0	22.0	16.2	5.6			9.10	32.2	23.1	170
C24–55– 2aab	5– 34	Qtw	1.1	.4	1.8	7.2	15.9	32.5	34.1	6.1	.9			4.65	32.7	28.0	2,320
C24–56– 5cdd	15½– 41	Qvf	4.5	1.0	4.0	14.2	11.7	5.9	10.4	21.3	19.5	7.5		10.32	24.4	14.1	50
8aaa	23– 36	Qvf	3.4	.3	.6	1.2	2.0	3.3	11.4	33.2	43.3	1.3		18.19	34.1	15.9	500

Groundwater Zones: WD67 Northwest, HIM Alluvial Aquifer-WD67, Big Sandy, and Rush
REF NUM: 61



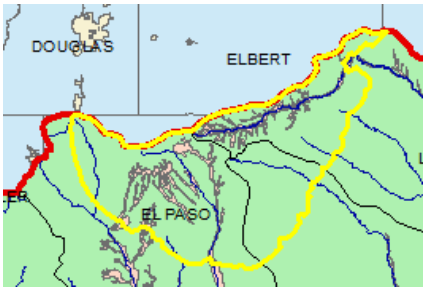
Relevant Pages: 24; see plate 1 for locations of wells

TABLE 2.—*Summary of the results of pumping tests in valley-fill deposits*

Well	Owner	Depth of well (feet)	Depth to bedrock (feet)	Depth to water (feet)	Saturated thickness (feet)	Duration of pumping (minutes)	Average pumping rate (gpm)
C10–55–27cca	B. Hallowell	36	36	6.4	30	2,910	117
C14–51–6ddd	V. George	16	20	6.6	13	1,425	53
C17–45–30cbd	E. Rutledge	23	28	6.6	21	1,440	78
46–18cdd	Town of Eads	46	46	10.9	35	2,880	565

Well	Owner	Drawdown in pumped well at end of pumping (feet)	Specific capacity (gpm per ft of drawdown)	Coefficient of transmissibility (gpd per ft)	Average coefficient of permeability (gpd per sq ft)	Number of observation wells	Date
C10–55–27cca	B. Hallowell	5.3	22	40,000	1,300	3	7–15–60
C14–51–6ddd	V. George	4.2	13	45,000	3,500	1	7–20–60
C17–45–30cbd	E. Rutledge	4.5	17	55,000	2,600	1	7–29–60
46–18cdd	Town of Eads	32.0	18	48,000	1,400	2	7–23–55

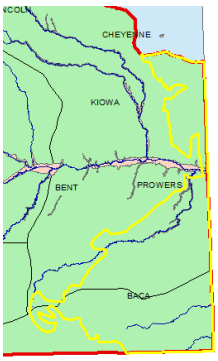
Groundwater Zones: WD14 North, WD17 North, Upper Big Sandy DB, Rush, Horse, Chico WD14, Chico WD10, Fountain Creek Reach 1-4, Upper Black Squirrel Creek DB
REF NUM: 162



Hydraulic Conductivity – 100-2,000 ft/day
Map showing Transmissivity

Useful pages: 28, 29

Groundwater Zones: Cimarron River, WD67 Northeast, WD67 South, Southern High Plains DB-WD66, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, Purgatoire River-Below Thatcher, and Two Butte Creek
REF NUM: 164



No useful information

Groundwater Zones: WD14 North, WD12, WD17 North, Upper Big Sandy DB, Rush, Horse, Chico WD10, Chico WD14, Fountain Creek Reach 1-4, Upper Black Squirrel Creek DB, and Pueblo Res
REF NUM: 128

Relevant pages: 9-11 (show maps of each aquifer and study sites); table taken from page 13; contains information about artificial recharge

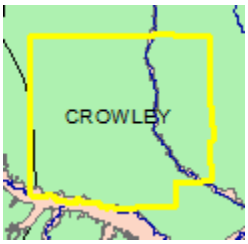
Table 1.--*Summary of alluvial aquifer characteristics*

Aquifer location	Area (square) miles)	Average depth to water below land surface in spring 1974 (feet)	Hydraulic conduc-tivity (feet per day)	Spe-cific yield	Dissolved-solids con-centration (milligrams per liter)
Upper Black Squirrel Creek basin----------	101.3	29	127	0.20	<400
Jimmy Camp Valley-------	13.5	20	135	.1	[1]500-3,000
Fountain Valley (Widefield aquifer)---	3.3	33	757	.25	500

Groundwater Zones: WD79, WD12, Hardscrabble Creek, WD13, WD15, and Coaldale
REF NUM: 143

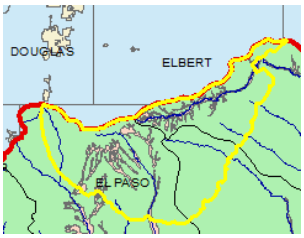
No useful information

Groundwater Zones: WD14 North, WD17 North, Adobe, HIM Alluvial Aquifer-WD17, HIM Alluvial Aquifer-WD14, Horse, WD14
REF NUM: 148



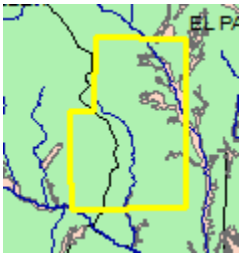
No useful information

Groundwater Zones: WD14 North, WD17 North, Upper Big Sandy DB, Rush, Horse, Chico WD14, Chico WD10, Fountain Creek Reach 1-4, and Upper Black Squirrel Creek DB
REF NUM: 183



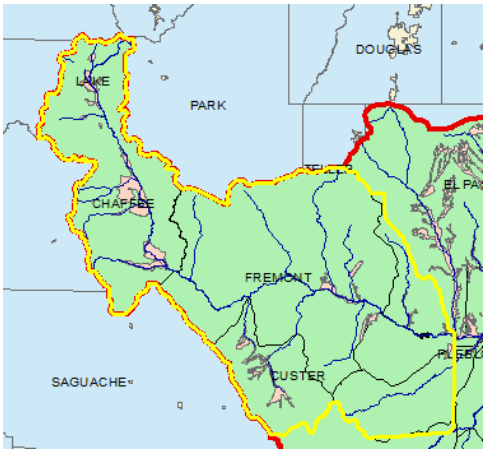
Only contains depth to water information in the alluvial aquifers after pg. 351

Groundwater Zones: WD12, Fountain Creek Reach 1-5, Pueblo Res, Florence, and Canon City-Penrose
REF NUM: 189



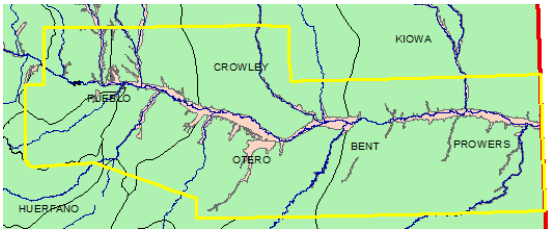
No useful information

Groundwater Zones: WD79, WD12, Leadville, Buena Vista, HIM Alluvial Aquifer-WD14, Fountain Creek Reach 1,3-5, Salt Creek-Arkansas River, Hardscrabble Creek, WD13, WD15, Pueblo Res, Florence, Canon City-Penrose, Coaldale, and Salida
REF NUM: 198



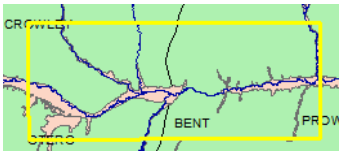
50-500 gal/min, but up to 1,000 gal/min (pg. 13)

Groundwater Zones: Fountain Creek Reach 4-5, WD12, Hardscrabble Creek, Florence, Cannon City-Penrose, WD14 North, HIM Alluvial Aquifer-WD14, WD14, Chico WD14, Salt Creek-Arkansas River, Pueblo Res, WD15, WD16, WD17 North, WD17, Adobe, HIM Alluvial Aquifer-WD17, Horse, Purgatoire River-Below Thatcher, WD67 Northwest, WD67 Northeast, WD67 South, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, Two Butte Creek, WD79
REF NUM: 223



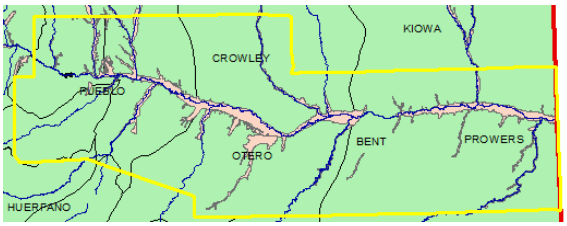
mainly concerned with specific conductance; no information about other aquifer properties

Groundwater Zones: WD17 North, WD17, Adobe, HIM Alluvial Aquifer-WD17, Horse, Purgatoire River-Below Thatcher, WD67 Northwest, WD67 South, HIM Alluvial Aquifer-WD67, and Big Sandy
REF NUM: 266



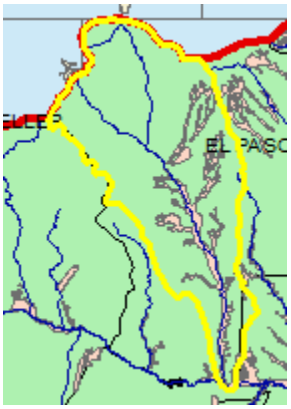
no useful information

Groundwater Zones: Fountain Creek Reach 4-5, WD12, Hardscrabble Creek, Florence, Canon City-Penrose, WD14 North, HIM Alluvial Aquifer-WD14, WD14, Chico WD14, Salt Creek-Arkansas River, Pueblo Res, WD15, WD16, WD17 North, WD17, Adobe, HIM Alluvial Aquifer-WD17, Horse, Purgatoire River-Below Thatcher, WD67 Northwest, WD67 Northeast, WD67 South, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, Two Butte Creek, and WD79
REF NUM: 285



T (aquifer)= 9.3 x 10^{-3} m^2/s (pg.4; Konikow and Person, 1985)
Effective porosity = .2
This paper (Goff) T (stream bed) = 4.7 m^2/s to .02 m^2/s (pg.5)
This paper (Goff) T (canal bed) = 1.9 x 10^{-3} m^2/s to .01 m^2/s (pg. 5)

Groundwater Zones: Fountain Creek Reach 1-5, Upper Black Squirrel Creek DB, WD12, HIM Alluvial Aquifer WD14, Chico WD14, Salt Creek-Arkansas River, Pueblo Res, and WD15
REF NUM: 327



relevant pages: 3, 12

Table 3. Characteristics of subreaches in the Monument Creek study.

Subreach number (fig. 2)	Channel length (miles)	Aquifer length (miles)	Average width of aquifer[1] (feet)	Average transmissivity (feet squared per day)	Average storage coefficient	Cumulative channel length (miles)
MSR1	1.36	1.23	730	7,000	0.20	1.36
MSR2	.48	.42	540	6,000	.20	1.84
MSR3	1.00	.84	180	2,000	.20	2.84
MSR4	1.98	1.59	120	2,000	.20	4.82
MSR5	1.46	1.17	240	3,000	.20	6.28
MSR6	1.53	.89	270	4,000	.20	7.81
MSR7	5.48	3.67	160	3,000	.20	13.29
MSR8	1.77	1.61	170	2,000	.20	15.06
MSR9	3.28	2.44	200	4,000	.20	18.34
MSR10	.80	.57	300	3,000	.20	19.14
MSR11	2.25	2.08	240	3,000	.20	21.39
MSR12	4.23	3.79	230	5,000	.20	25.62
MSR13	.71	.68	1,600	9,000	.20	26.33
MSR14	1.28	1.25	1,250	9,000	.20	27.61
MSR15	.67	.60	3,000	12,000	.20	28.28

[1]One-half of average aquifer width is used for input to stream-aquifer model.

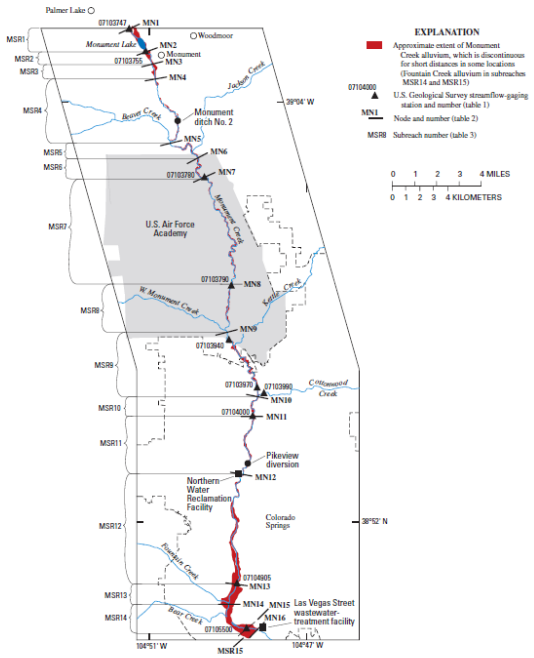


Figure 2. Monument Creek study reach and adjacent area used in application of stream-aquifer model to estimate transit losses for reusable water.

Groundwater Zones: Fountain Creek Reach 1-4, Upper Black Squirrel Creek DB, WD12, Chico WD14, and Pueblo Res
REF NUM: 138

No useful information; only water level data and spring seepage

Groundwater Zones: Fountain Creek Reach 1-5, Chico WD14, Salt Creek-Arkansas River, and Pueblo Res
REF NUM: 211

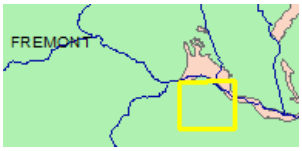
Hydraulic Conductivity: 400 – 1,600 ft/day (pg. 10)
Specific Yield= .2 - .3 (pg. 10)
Groundwater flow averages 20 ft/day and ranges from 10-40 ft/day
Well Yield: 400 – 700 gal/min, but yields of over 3000 gal/min have been reported

Relevant pages: 10, 13

Table 1.--*Summary of gain-loss data for Fountain Creek, 1973-77*

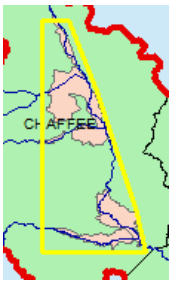
Gain-loss reach	Gain or loss (cubic feet per second) Mean	Standard deviation	Maximum loss (cubic feet per second)	Maximum gain (cubic feet per second)	Number of investigations Loss	Gain
1	-11.0	9.2	-23	3.0	8	2
2	3.2	8.2	-14	15	2	9
3	1.2	11.5	-27	23	5	9
4	6.3	18.1	-24	34	3	10
5	-.5	11.1	-22	27	7	6
6	-3.6	4.6	-12	3.8	10	3
7	-.3	7.9	-18	16	6	7
8	1.3	8.9	-6.5	28	7	6

Groundwater Zones: WD12, Florence, Canon City-Penrose
REF NUM: 220



only water level measurements

Groundwater Zones: Buena Vista, Salida, and WD12
REF NUM: 323



relevant pages:
9, 12

Table 2. Lithologic description and estimated range of porosity, hydraulic conductivity, and specific yield, and reported well yields of the alluvial-outwash, till, basin-fill, and bedrock aquifers.

[<, less than]

Aquifer	Lithologic description	Porosity (percent)	Hydraulic conductivity (feet per day)	Specific yield (percent)	Reported well yield (gallons per minute)
Alluvial outwash	Poorly stratified and poorly to well sorted silty sand and gravel. Locally contains cobbles and boulders.	15 to 40	2.8 to 1,500	12 to 34	0.01 to 1,500
Till	Non-sorted, non-stratified, moderately to firmly compacted sandy boulder tills.	[1]10 to 20	[1]1.6 to 98	[1]5 to 15	0.03 to 60
Basin fill	Unconsolidated to poorly consolidated sand, gravel, and cobbles, with interbedded coherent siltstones and friable sandstones, and volcanic ash beds.	15 to 40	0.0007 to 280	<2 to 34	0.01 to 1,500
Bedrock	Fractured crystalline rocks.	[2]< 1 to 10	[2]<130	[2]<10	[3]< 1 to 10
	Unfractured crystalline rocks.	[2]<1 to 5	[2]<0.0001	[2]<5	[3]<1 to 10
	Tuff.	[1]41	[1]0.2	[1]6 to 16	[3]<1 to 18

[1]Todd (1980, tables 2.1, 2.5, and 3.1).

[2]Freeze and Cherry (1979, tables 2.2 and 2.4).

[3]Crouch and others (1984, table 1).

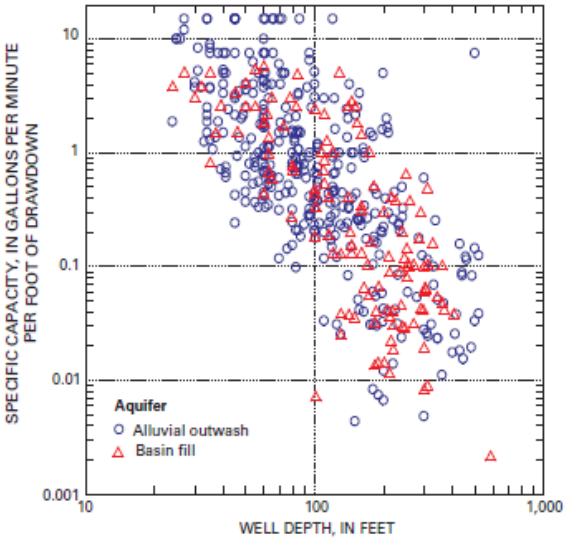
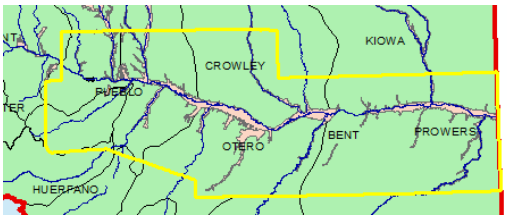


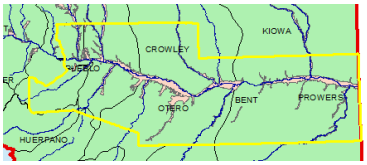
Figure 5. Relation between well depth and estimated specific capacity of wells in the alluvial-outwash and basin-fill aquifers in the study area.

Groundwater Zones: Fountain Creek Reach 4-5, WD12, Hardscrabble Creek, Florence, Canon City-Penrose, WD14 North, HIM Alluvial Aquifer-WD14, WD14, Chico WD14, Salt Creek-Arkansas River, Pueblo Res, WD15, WD16, WD17 North, WD17, Adobe, HIM Alluvial Aquifer-WD17, Horse, Purgatoire River-Below Thatcher, WD67 Northwest, WD67 Northeast, WD67 South, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, Two Butte Creek, and WD79
REF NUM: 86



No useful information

Groundwater Zones: Fountain Creek Reach 4-5, Hardscrabble Creek, WD14 North, HIM Alluvial Aquifer-WD14, WD14, Chico WD17, Salt Creek-Arkansas River, Pueblo Res, WD15, WD16, WD17 North, WD17, Adobe, HIM Alluvial Aquifer-WD17, Horse, Purgatoire River-Below Thatcher, WD67 Northwest, WD67 Northeast, WD67 South, Southern High Plains DB-WD67, Northern High Plains DB, HIM Alluvial Aquifer-WD67, Big Sandy, Two Butte Creek, and WD79
REF NUM: 98



Information is exclusively about soil moisture (specific yield, etc.) not about the alluvial aquifer

Groundwater Zones: Fountain Creek Reach 1-4, Chico-WD14, and Pueblo Res
REF NUM: 40

TABLE 2.—*Summary of the results of aquifer tests in Fountain and Jimmy Camp Valleys*

[Principal aquifer: AF, alluvium of Fountain Valley; AJ, alluvium of Jimmy Camp Valley; AS, alluvium of Sand Creek]

Well location	Owner	Principal aquifer	Depth of well (feet)	Depth to bedrock (feet)	Depth to water below measuring point (feet)	Total saturated thickness (feet)	Duration of pumping (hours)	Average pumping rate (gpm)	Drawdown (feet)	Specific capacity (gpm per ft)	Coefficient of transmissibility (gpd per ft)	Average coefficient of permeability (gpd per sq ft)	Radius of influence at end of pumping period (feet)	Specific yield (percent)	Water temperature (°F)	Date
14-65-27ddb1	Banning-Lewis Ranches.	AJ	80.8	80	27.3	53	7	330	35	9	40,000	750	1,000		55	3-18-55
34aacl	do	AJ	82	82	25.9	57	24	300	38	8	20,000	350	2,000		55	3-17-55
14-66-34cdd	K. J. M. Cormack	AS	97	88	72.9	16	5	78	10	8	10,000	620			55	7-29-55
16-65-3ddd4	Janiell Farms	AJ	61.8	66	23.3	44	96	275	29	9	60,000	1,360	1,200		54	4-11-55
22dbb1	H. W. Houf	AJ	78.8	87	23.8	64	24	690	22	31	100,000	1,560	700		54	5-19-56
15-66-14aacl	Security Village	AF	76.0	74	42.3	34	690	500	15	33	220,000	6,500	3,000	20	55	9-10-54
14abb	T. L. Bender	AF	55.7	55	26.8	29	56	670	10	67	140,000	4,800			53	7-19-54
16-65-16bba2	Rufus Marshall	AF	59.9	60	45.2	17	10	495	13	38	200,000	11,800	500		55	10-20-54
32adal	Clark Hanna	AF	52.3	49	24.4	27	79	525	14	38	150,000	5,500	1,200		55	10-27-54
17-65-3ccb	do	AF	37.3	37	13.5	24	51	460	17	27	120,000	5,000	700		54	11- 1-54
23dda	Dan Holmes	AF	28.8	29	14.3	15	76	280	10	28	50,000	3,300			54	10-6-54
18-65-1bba1	Paige Ranch	AF	[1] 29	[1] 29	[1] 4.0	[1] 25	600	900	19	47	180,000	7,200	2,500	27	63	10-22-54

[1] Average battery of 2 wells.

TABLE 3.—*Summary of laboratory determinations of hydrologic properties of alluvial sediments*

Location	Depth of sample (feet)	Specific retention (percent)	Porosity (percent)	Specific yield (percent)	Coefficient of permeability (gpd per sq ft)
15-66-3acc	35-45	9.4	37.4	28.0	4,200
15-66-10aab	15				3,600
	25				1,700
	35	1.6	31.3	29.7	3,500
	45	2.1	30.5	28.4	1,300
15-66-11bcd	42	1.2	28.7	27.5	3,100
	52	.7	30.2	29.5	5 800
	62	.6	30.5	29.9	5,900
	72	1.2	30.5	29.3	8,600
	79	3.0	29.8	26.8	5,200
15-66-14aac1	38	6.3	32.1	25.8	6,500
	70	2.0	34.0	32.0	1,800
15-66-14aac2	60	4.3	39.6	35.3	10,000
16-65-16bbb2		11.9	35.8	23.9	1,300
16-65-17aaa3	52	11.6	35.5	23.9	860
17-65-3cdb1	16-19	12.0	30.6	18.6	1,300
17-65-4dda	24-26	5.4	35.1	29.7	4,800
18-65-1bba	7				8,000

pg. 24

Comparison of laboratory and field determinations

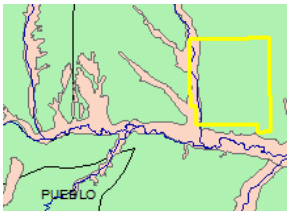
Saturated interval	Thickness (feet)	Coefficient of permeability (gpd per sq ft)	Laboratory determinations: Coefficient of transmissibility (gpd per ft)	Field determination: Coefficient of transmissibility (gpd per ft)
42-49	7	6,500	45,500	
49-65	16	10,000	160,000	
65-76	11	1,800	19,800	
Total section	34		225,300	220,000

pg.25

Groundwater Zones: HIM Alluvial Aquifer-WD14, Chico WD14, Salt Creek-Arkansas River, Pueblo Res, and WD15
REF NUM: 127

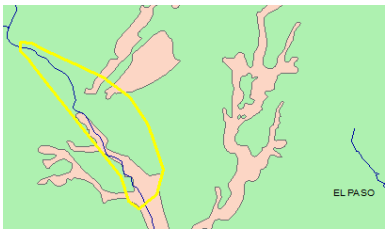
hydraulic conductivity: 8.2 m/d
transmissivity: 25.1 m^2/d
maximum pumping rate: .6 l/s (pg. 5)

Groundwater Zones: WD14 North, HIM Alluvial Aquifer-WD14, and Chico WD14
REF NUM: 239



specific yield ~ .15-.2
hydraulic conductivity: 65 ft/day (pg. 43)

Groundwater Zones: Fountain Creek 1-3
REF NUM: 263



Useful pages: plate 3

Table 2. -- Selected aquifer characteristics and estimated ground-water flow across hydrogeologic sections of the alluvial aquifer, October 1991.

Trace of hydrogeologic section name	Weighted mean hydraulic conductivity[1] (feet per day)	Weighted mean hydraulic gradient[2]	Saturated area of hydrogeologic section (square feet)	Flow rate (cubic feet per second)	Flow rate (acre-feet per day)
		Inflow			
A-A'	250	0.012	25,250	0.9	1.74
A-A"	200	.013	106,250	3.2	6.34
B-B'	70	.025	72,800	1.5	2.92
B'-B"	48	.033	87,750	1.6	3.19
C-C'	52	.027	147,300	2.4	4.75
C'-C"	16	.035	81,900	0.5	1.05
		Outflow			
D-D'	215	.004	96,500	1.0	1.98

[1] Weighted mean hydraulic conductivity is the mean hydraulic conductivity weighted by saturated area of hydrogeologic section

[2] Mean hydraulic gradient is weighted by the saturated area of the hydrogeologic section

Table 1. -- Estimated hydraulic-conductivity values for the alluvial aquifer

Well location[1]	Estimated hydraulic conductivity (feet per day)
SW, NW, SE, 19, 14S, 66W	48
SW, SW, SW, 34, 14S, 66W	9.5
SE, NW, NW, 1, 15S, 66W	330
NW, NW, NW, 2, 15S, 66W	66
SW, SE, NW, 2, 15S, 66W	330
SW, SW, SW, 2, 15S, 66W	320
NE, NW, NE, 3, 15S, 66W	480
SW, NW, NW, 3, 15S, 66W	21
NE, NE, NE, 4, 15S, 66W	91
NE, NW, NE, 4, 15S, 66W	180
NW, SE, NE, 10, 15S, 66W	86
NW, SE, NE, 10, 15S, 66W	18
SE, SE, NE, 13, 15S, 66W	16
NW, NE, SE, 24, 15S, 66W	270
SE, NW, SE, 24, 15S, 66W	110
NW, NE, SE, 29, 14S, 66W	1,300
NE, SE, NE, 32, 14S, 66W	5.3
NE, NE, NE, 32, 14S, 66W	600
SE, NE, SW, 33, 14S, 66W	43
SW, NE, SE, 33, 14S, 66W	68
SW, NE, SE, 33, 14S, 66W	100
SE, SW, SW, 34, 14S, 66W	400
NE, NE, SW, 35, 14S, 66W	330
NW, SW, NW, 19, 15S, 65W	120
SW, NE, NW, 3, 15S, 66W	43
NE, SW, NE, 4, 15S, 66W	510
SW, NW, NE, 11, 15S, 66W	830
SE, SW, NE, 11, 15S, 66W	1.4
SW, SE, SW, 12, 15S, 66W	380
SW, SE, SE, 13, 15S, 66W	140

[1] Well location is an abbreviated description of the 10-acre tract in which the well is located; it is described as follows: 1/4 section of the 1/4 section of the 1/4 section of the section, township, and range. For example, NE, SW, NE, 4,15S, 66W is NE 1/4, SW 1/4, NE 1/4 sec. 4, T.15.S, R.66.W, of the Sixth Principle Meridian.

Groundwater Zones: WD14 North, HIM Alluvial Aquifer-WD14, and Chico WD14
REF NUM: 273

Table 1. Values of hydraulic conductivity of the alluvial aquifers at the Pueblo Depot Activity

[Areas and solitary wells are shown in figure 4]

Well name	Local well number	Depth of screen (feet below land surface)		Hydraulic conductivity, K (feet per day)	Source of data
		Top	Bottom		
Area 1—Terrace alluvial aquifer					
ZNMW–01	SC02006205BCD	30	45	19	(2)
ZNMW–03	SC02006205CCB	20	30	10	(2)
Area 2—Terrace alluvial aquifer					
RFNAMW–01	SC02006212DBC	45.3	60.3	54	(2)
RFNAMW–02	SC02006212DBC	45.0	65.0	54	(2)
RFNAMW–03	SC02006212DBC	45.0	65.0	10	(2)
Area 3—Terrace alluvial aquifer					
TNTMW–01	SC02006220BBD	13	28	130	(1)
TNTMW–02	SC02006220DBC	6	21	26	(1)
TNTMW–03	SC02006220DBC	10	25	57	(1)
TNTMW–04	SC02006220CAD	8	13	2.5	(1)
TNTMW–06	SC02006220DCB	23	38	23	(1)
Area 4—Terrace alluvial aquifer					
LABMW–01	SC02006223BBA	11.9	26.8	6.2	(2)
LABMW–02A	SC02006223BBA	13.3	23.3	14	(2)
LABMW–02B	SC02006223BBA	26.3	41.3	7.9	(2)
LABMW–03A	SC02006223BAC	11.5	26.5	22	(2)
LABMW–03B	SC02006223BAC	26.5	46.5	8.2	(2)
LABMW–04	SC02006214CCD	14.0	23.5	25	(2)
LABMW–05A	SC02006223BAB	13.0	23.0	7.7	(2)
LABMW–06A	SC02006223BBC	14.0	29.0	57	(2)
Area 5—Terrace alluvial aquifer					
GMWMW–01	SC02006224CBC	40.0	50.0	7.9	(2)
GMWMW–02	SC02006224CBC	45.0	55.0	18	(2)
Area 6—Terrace alluvial aquifer					
VMBMW–01	SC02006228AAA	38.0	58.0	27	(2)
VMBMW–02	SC02006228AAD	30.0	40.0	19	(2)
VMBMW–03	SC02006228AAD	29.9	39.9	20	(2)
VMBMW–04	SC02006228AAD	30.0	40.0	34	(2)
Area 7—Terrace alluvial aquifer					
DDMW–01	SC02006228ADD	30.5	45.5	2.8	(1)
DDMW–02	SC02006228DAA	36.7	51.7	15	(1)
DDMW–03	SC02006227CBA	31.0	36.0	36	(1)
DDMW–04	SC02006227CCB	33.0	48.0	7.0	(1)
DDMW–05	SC02006227CBD	38.0	53.0	27	(1)
DDMW–06	SC02006227CAA	32.0	77.0	91	(1)
FCVMW–01A	SC02006228ACC	29.0	39.0	18	(2)
FCVMW–01B	SC02006228ACC	42.0	57.0	12	(2)
FCVMW–02	SC02006228ACC	31.4	51.4	31	(2)
510MW–06	SC02006228DBA	23.7	33.2	128	(2)
510MW–07	SC02006228DAB	24.0	33.5	49	(2)
510MW–08	SC02006228DBA	22.5	32.0	78	(2)
Area 8—Terrace alluvial aquifer					
74MW–01	SC02006228CDA	43.0	52.5	32	(2)
74MW–02	SC02006228CDD	43.0	52.5	41	(2)
74MW–03	SC02006228CDD	43.0	52.5	37	(2)
74MW–04	SC02006228CDD	44.0	53.5	70	(2)

Relevant pages: 14, 15, 16

Well name	Local well number	Depth of screen (feet below land surface)		Hydraulic conductivity, K (feet per day)	Source of data
		Top	Bottom		
Area 9—Terrace alluvial aquifer					
109MW-01	SC02006233ABB	33.2	42.7	21	(2)
109MW-02	SC02006233ABB	32.3	41.8	75	(2)
109MW-03	SC02006233ABB	29.5	39.0	108	(2)
Area 10—Terrace alluvial aquifer					
LFMW-13	SC02006234BCC	8.0	23.0	26	(1)
LFMW-14	SC02006233ADC	34.0	51.0	100	(1)
LFMW-15	SC02006233AAD	27.8	42.8	140	(1)
LFMW-16	SC02006234BCD	14.0	24.0	67	(1)
OLFMW-01	SC02006233DAA	6.0	16.0	220	(1)
OLFMW-02	SC02006233DAB	31.4	36.4	400	(1)
OLFMW-03	SC02006233DDB	19.0	29.0	190	(1)
Area 11—Chico Creek alluvial aquifer					
ODMW-02	SC01906231DAC	8	23	130	(1)
ODMW-03	SC01906231DAB	13	28	290	(1)
ODMW-04	SC01906231DAC	13	18	310	(1)
ODMW-06	SC01906231DAC	10	25	19	(1)
ODMW-07	SC01906231DAB	8	23	240	(1)
ODMW-08	SC01906231DDA	25	40	46	(1)
Area 12—Chico Creek alluvial aquifer					
ODMW-10	SC02006206DCB	9.5	24.5	39	(1)
ODMW-11	SC02006206DBB	14	29	45	(1)
ODMW-12	SC02006206DCC	8	23	23	(1)
ODMW-13	SC02006207ABA	13	33	17	(1)
ODMW-14	SC02006206DCC	13	28	18	(1)
Solitary wells—Terrace alluvial aquifer					
ODMW-01	SC01906232BCC	8.0	18.0	90	(1)
ATMW-01	SC01906234ABA	20.0	39.0	14	(3)
ATMW-02	SC02006208BAC	39.6	48.6	79	(3)
ATMW-03	SC02006209CAA	47.4	67.4	2.1	(3)
ATMW-04	SC02006215DDA	17.5	22.5	22	(3)
ATMW-05	SC02006217DCD	40.0	44.0	1.0	(3)
EBMW-01	SC02006212BCB	55.0	60.0	0.4	(3)
EBMW-02	SC02006224DCD	73.3	93.3	5.6	(3)
599MW-05	SC02006227BAB	39.0	38.5	92	(2)
FTMW-01	SC02006233AAB	22.3	32.3	74	(2)
Solitary wells—Chico Creek alluvial aquifer					
CAMW-01	SC02006219CBD	17.0	21.2	15	(3)
CAMW-02	SC02006231AAC	29.5	34.0	14	(3)
TNTMW-05	SC02006219DDD	22.7	32.7	84	(1)

[1]Daniel Brookshire, Engineering-Science, Inc., written commun., 1990.
[2]Theresa Shock, Black & Veatch Waste Science and Technology Corp., written commun., 1994.
[3]U.S. Geological Survey, data collected for this study, 1993.

Groundwater Zones: Fountain Creek Reach 2-3
REF NUM: 241

powerpoint contains minimal water level information pg. 14

Table A: Spatial Bibliography documents used, ordered by reference number

REF NO	TITLE OF PUBLICATION	AUTHOR(S)
35	The role of ground water in the national water situation	McGuinness, C.L.
40	Ground water in Fountain and Jimmy Camp Valleys, El Paso County, Colorado	Jenkins, E.D.
46	Geology and ground-water resources of Prowers County, Colorado	Voegeli, P.T., Hershey, L.A.
48	Geology and occurrence of ground water in Otero County, and the southern part of Crowley County, Colorado	Weist, W.G., Jr., Jenkins, E.D.; Horr, C.A.
61	Geology and ground-water resources of the Big Sandy creek valley, Lincoln, Cheyenne, and Kiowa counties, Colorado; with a section on chemical quality of the ground water	Coffin, D.L., Horr, C.A.
86	Stream depletion factors, Arkansas River Valley, southeastern Colorado; A basis for evaluating plans for conjunctive use of ground and surface water	Jenkins, C.T., Taylor, O.J.
98	Use of finite-difference arrays of observation wells to estimate evapotranspiration from ground water in the Arkansas River Valley, Colorado	Weeks, E.P., Sorey, M.L.
127	Waterlogging in an alluvial aquifer near Lake Minnequa, Pueblo, Colorado	Emmons, P.J.
128	Artificial-recharge tests in upper Black Squirrel Creek basin, Jimmy Camp Valley, and Fountain Valley, El Paso County, Colorado	Emmons, P.J.
138	Hydrologic data for water-table aquifers in the Colorado Springs-Castle Rock area, Front Range Urban Corridor, Colorado	Hutchinson, E.C., Hillier, D.E.
143	Water-resources appraisal of the Wet Mountain Valley, in parts of Custer and Fremont Counties, Colorado	Londquist, C.J., Livingston, R.K.
148	Ground-water resources of Crowley County	Ryan, B.J., Cain, D.L., Emmons, P.J.
162	Alluvial and bedrock aquifers of the Denver Basin - Eastern Colorado's dual ground-water resource	Robson, S.G.
164	Bedrock geology, altitude of base, and 1980 saturated thickness of the high plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming	Weeks, J. B., Gutentag, E.D.
183	Hydrogeologic data from parts of the Denver Basin, Colorado	Major, T.J., Robson, S.G., Romero, J.C., Zawistowski, S.
189	Assessment of water resources at Fort Carson Military Reservation near Colorado Springs, CO	Leonard, G.J.
198	Water-resources appraisal of the upper Arkansas River Basin from Leadville to Pueblo, Colorado	Crouch, T.M., Cain, D., Abbott, P.O., Penley, R.D., Hurr, T.R.
211	A reconnaissance water-quality appraisal of the Fountain Creek alluvial aquifer between Colorado Springs and Pueblo, Colorado, including trace elements and organic constituents	Cain, D., Edelmann, P.
220	Ground-water flow and quality near Canon City, Colorado	Hearne, G.A., Litke, D.W.

223	Relations of specific conductance to streamflow and selected water-quality characteristics of the Arkansas River basin, Colorado	Cain, D.
239	Geohydrology and ground-water quality at the Pueblo Depot Activity landfill near Pueblo, Colorado	Watts, K.R., Ortiz, R.F.
241	The Widefield Aquifer Management Program	Thompson, G.B.
263	Hydrogeologic characteristics of the alluvial aquifer and adjacent deposits of the Fountain Creek Valley, El Paso	Radell, M.J., Lewis, M.E., Watts, K.R.
266	Irrigation water for the Fort Lyon Canal, southeastern Colorado, 1989-90	Dash, R.G.
273	Hydrogeology of the alluvial aquifers at the Pueblo Depot Activity near Pueblo, Colorado	Chafin, D.T.
285	Simulated effects of irrigation on salinity in the Arkansas River valley in Colorado	Goff, K., Lewis, M.E., Person, M.A., Konikow, L.F.
323	Hydrogeology and quality of ground water in the upper Arkansas River Basin from Buena Vista to Salida, Colorado, 2000-2003	Watts, K. R.
327	Application of a stream-aquifer model to Monument Creek for development of a method to estimate transit losses for reusable water, El Paso County, Colorado	Kuhn, G., Arnold, R. L.