

HYDROLOGY OF CHACO CANYON NATIONAL MONUMENT

Chaco Canyon National Monument, located within the Colorado River drainage basin, is characterized by gentle sloping mesas with steep-walled canyons. Chaco River, an intermittent stream, is the principal drainage which is subject to flash flooding. No springs (intermittent or perennial) exist within the Monument.

Groundwater, of limited yield of good chemical water, exists in the alluvial or valley fill with static water level varying from 12 to 69 feet below ground level. Thickness of the aquifer ranges from 0 to 40 feet along the Chaco River.

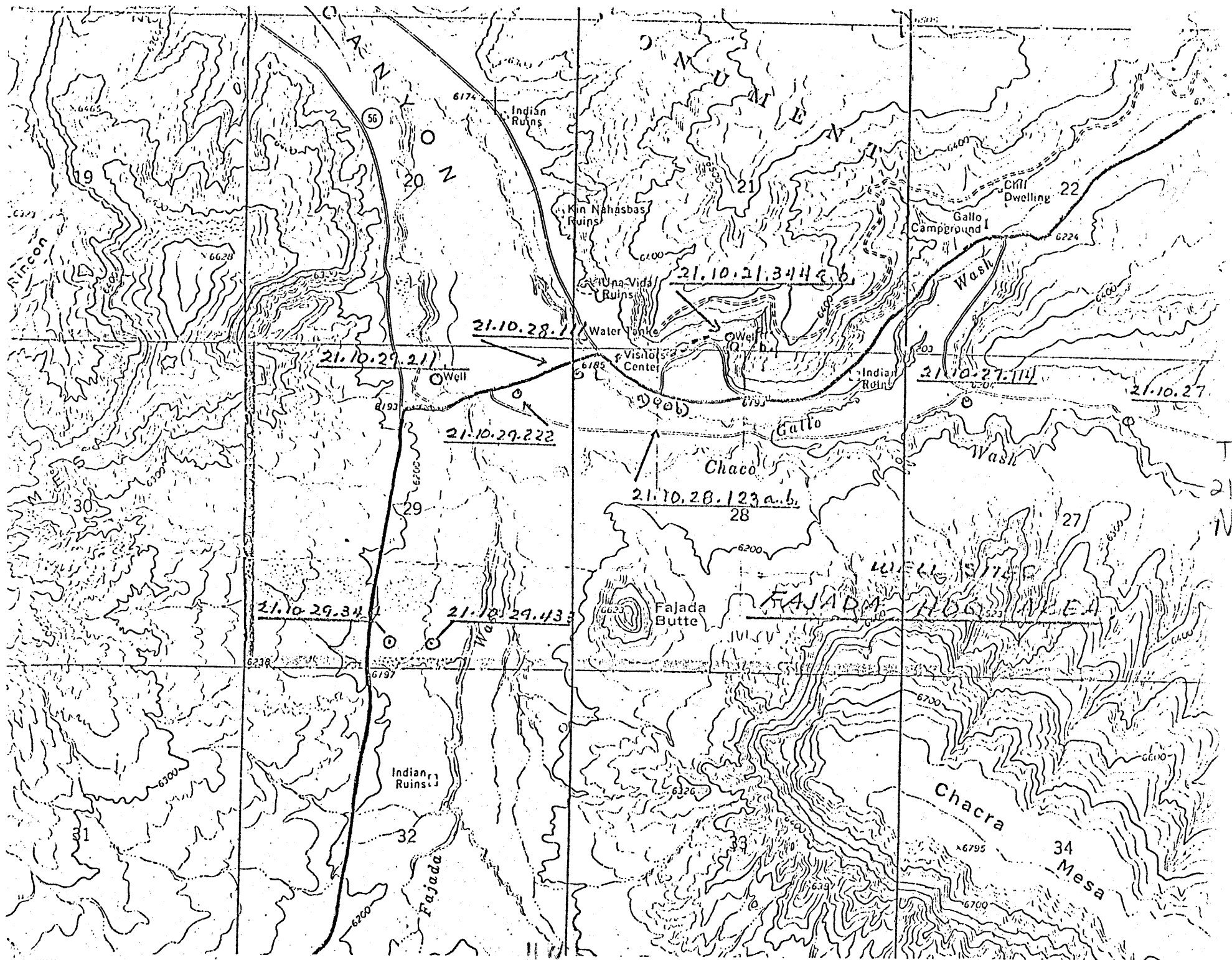
The Mesaverde Group (Upper Cretaceous) underlies the alluvium, containing alternating layers of water bearing sandstone. The beds are separated with aquicludes consisting mostly of shale. Water found in this group are highly mineralized except for the artesian water found in the deepest formation of this group (Gallup Sandstone).

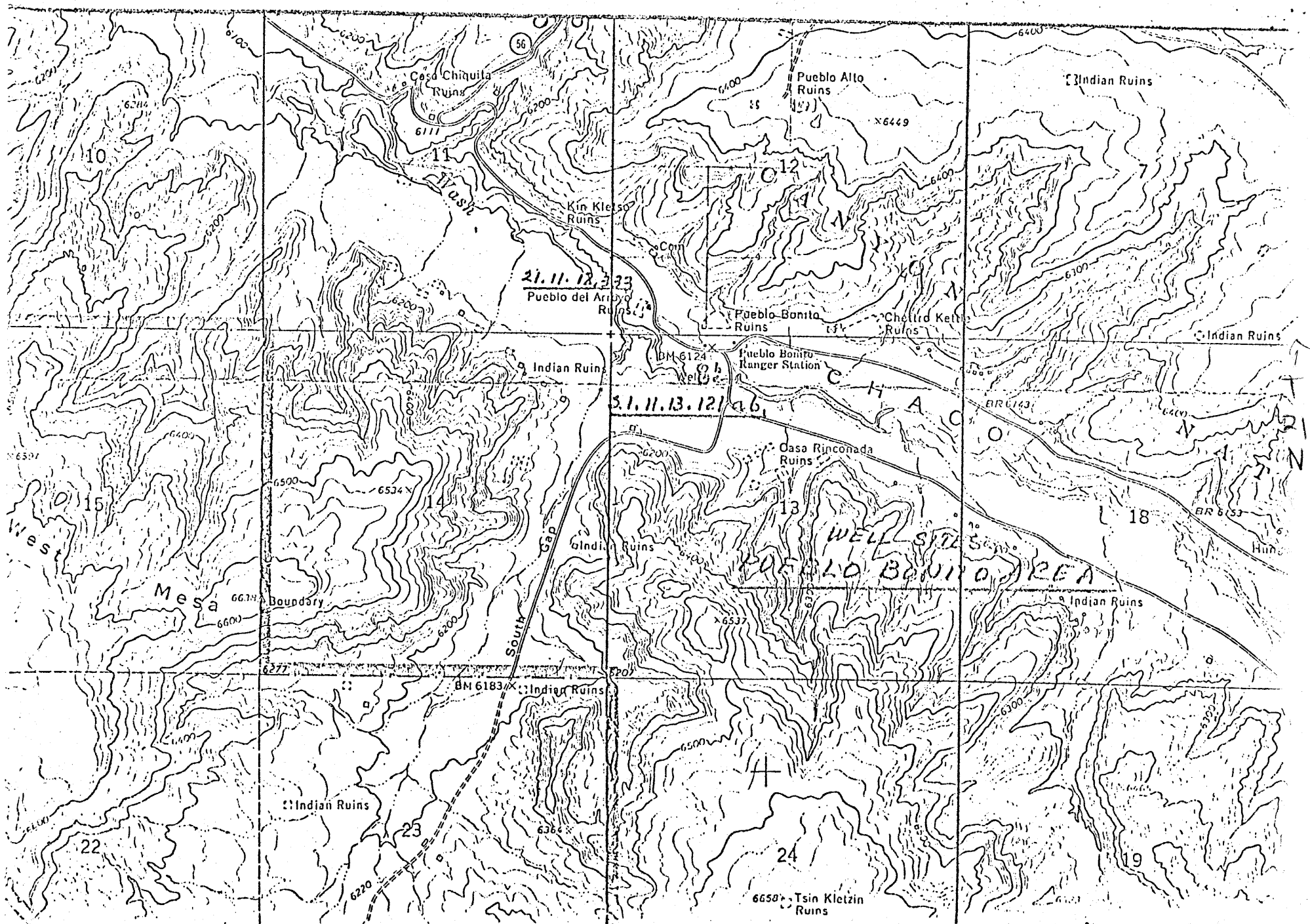
To date 14 test wells have been drilled, 12 in the alluvium, and 2 completed in the Menefee and Gallup sandstone of the Mesaverde Group - see Tabel I and corresponding Figures 1 and 2 for record and location of all wells drilled within Chaco Canyon National Monument.

TABLE I - RECORDS OF WELLS IN CHACO CANYON NATIONAL MONUMENT

<u>LOCATION</u>	<u>DATE COMPLETED</u>	<u>DEPTH</u>	<u>DIAMETER INCHES</u>	<u>WATER LEVEL BGL</u>	<u>DATE</u>	<u>YIELD RATE</u>	<u>DATE</u>	<u>USE</u>	<u>REMARKS</u>
21:10:29:211	1940	16	144	11.96	9/14/56	6	6/56	D.	
21:11:12:333	1937	15	180	18.94	9/14/56	-	-	D.	Abandoned
21:11:13:121a	1940	20	180	-	-	-	-	-	Unused
21:11:13:121b	-	16	48	16.76	9/14/56	2-3	6/27/56	P.S.	
21:10:28:123a	1967	56	4	-	8/ 4/72	-	-	-	
21:10:28:123b	1967	58	4	42	8/ 4/72	-	-	-	
21:10:28:111	1966	96	24	55	1966	-	-	-	Plugged-Salty
21:10:29:222	1966	92	24	45	1966	50	1966	-	Plugged, Yield est. bailing
21:10:29:344	1966	100	10	?	1966	-	1966	-	Plugged
21:10:29:433	1966	200	10	-	1966	-	1966	-	Dry-Plugged
21:10:27:114	1966	100	10	-	1966	-	1966	-	Plugged
21:10:27:214	1966	100	10	-	1966	-	1966	-	Plugged
21:10:21:344a	1966	800	10	69	1966	6	1966	D.	Abandoned
21:10:21:344b	1972	3111	6	+400	1972	170	1972	D.	Artesian flow

D-Domestic Supply
P.S.-Public Supply





GEOHYDROLOGY OF WELL #21:10:21:344b

<u>FORMATION</u>	<u>THICKNESS FEET</u>	<u>LITHOLOGY</u>	<u>WATER BEARING CHARACTERISTICS</u>
Alluvium	20	Unconsolidated deposits of valley fill - chiefly gravel, sand, mudstone clay.	Limited quantity of good to poor quality quantity 6 to an estimated 50 gpm.
Menefee	1730	Sandstone, claystone. Average porosity - 20% Average density - 2.25 g/cc.	Limited quantity of poor water quality. Yield 4-6 gpm.
Point Lookout	190	Sandstone. Average porosity - 17% Average density - 2.35 g/cc.	Unknown - reportedly good quality water elsewhere of limited yield.
Mancos Shale	960	Shale. Average porosity - 4% Average density - 2.60 g/cc.	No water.
Gallup Sandstone	200+	Sandstone. Average porosity - 17% Average density - 2.35 g/cc.	Artesian flow, 175 psi shut in pressure good quality. Yield - 165 gpm.

TABLE III: QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS
CHACO CANYON NATIONAL MONUMENT, NATIONAL PARK SERVICE

CHACO CANYON NM							21-10-21-344	21-10-21-244	21-10-27-114	21-10-27-214
WELL-TEST	21:10:29:222	2:10:28:123a	21:10:29:211	21:10:12:333	21:10:13:121	21:10:29:433	9/18/72	10/22/71		
	4/8/72	8/8/72	5/2/61	9/14/56	9/14/56					
Si (Si O ₂)	< 1.0	8.0	10	10	10		22.1			
Fe (Fe)	2.00	1420	16	19	19		< 0.01			
Manganese (Mn)	0.024	30.1		24	23		12.1			
Calcium (Ca)	92.7	355	38	8.3	10.0		2.21			
Magnesium (Mg)	4.71	176	14				67			
Sodium (Na)	773	3380	210	> 198	> 118		4.4			
Potassium (K)	3.00	15.9	1.3				200			
Carbonate (HCO ₃)	352	0.0	370	372	206		0			
Carbonate (CO ₃)	0.2	0.0	0	0.0	0.0		577			
Sulfate (SO ₄)	1160	7235	274	198	95		44.1			
Chloride (Cl)	57.7	187	9.5	7.0	7.0		1.54			
Fluoride (F)	5.2	0.3	1.4	1.8	1.4		0.7			
Nitrate (NO ₃)	0.8	0.9	3.3	0.2	1.2		-			
PLUGGED										
Dissolved Solids:			745							
Calculated							1275			
Residue on evap- oration at 180°C	2194	14.203	743	653	424					
Hardness as Ca CO ₃	26.7	2222	152	94	98					
Non-carbonate Hardness			0	0	0					
Percent Sodium % Na			75	82	72					
Sodium Adsorption Ratio			7.4	8.0	5.2					
Specific Conductance			1140	986	665		2600			
Phos @ 25°C	8.5	4.3	8.0	7.9			8.1			
Chlorine			0.31	-	-					

GENERAL - BAD SALTY

GENERAL - BAD SALTY
3400 ppm

21:10:28:111 - General - Bad Salty
21:10:29:344 - General - Bad Salty

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS
CHACO CANYON NATIONAL MONUMENT, NATIONAL PARK SERVICE

FEA CHACO CANYON NM							D-3111	D-800		
SOURCE WELL-TEST DATE	21:10:29:222 4/8/72	2:10:28:123a 8/8/72	21:10:29:211 5/2/61	21:10:12:333 9/14/56	21:10:13:121H 9/14/56	21:10:29:433	21:10:21:344b 9/18/72	21:10:21:344a 10/22/71	21:10:27:114	21:10:27:2
Silica (Si O ₂)	< 1.0	8.0	10	10	10		22.1	0.56		
Iron (Fe)	2.00	1420	16	19	19		< 0.01			
Manganese (Mn)	0.024	30.1		24	23		12.1			
Calcium (Ca)	92.7	355	38	8.3	10.0		2.21			
Magnesium (Mg)	4.71	176	14				67			
Sodium (Na)	773	3380	210	> 198	> 118		4.4			
Potassium (K)	3.00	15.9	1.3				200			
Bicarbonate (HCO ₃)	352	0.0	370	372	296		0			
Carbonate (CO ₃)	0.2	0.0	0	0.0	0.0					
Sulfate (SO ₄)	1160	7235	274	198	95.		577			
Chloride (Cl)	57.7	187	9.5	7.0	7.0		44.1			
Fluoride (F)	5.2	0.3	1.4	1.8	1.4		1.54			
Nitrate (NO ₃)	0.8	0.9	3.3	0.2	1.2		0.7			
Dissolved Solids: Calculated			745			PLUGGED			GENERAL - BAD SALTY	GENERAL - BAD SALTY
Residue on evap- oration at 180°C	2194	14,203	743	653	424		1275			
Hardness as Ca Co3	26.7	???	152	94	98					
Non-carbonate Hardness			0	0	0					
Percent Sodium % Na			75	82	72					
Sodium Adsorption Ratio			7.4	8.9	5.2					
Specific Conductance Unhos @ 25°C			1140	986	665		2600			
Unhos	8.5	4.3	8.0	7.9			8.1			
Boron			0.31							

21:10:28:111 - General - Bad Salty
21:10:29:344 - General - Bad Salty

Table 2.3. 1976-1989 water discharge records for three washes in Fajada Gap, Chaco Canyon.a,b,c

Year	Jan	Feb	Mar	Apr	May	Maize Agriculture				Sept	Oct	Nov	Dec	Max. mth	Total	Mean/day
1976d																
Chaco	-	-	-	-	-	-	301.3	141.6	341.2	0.0	0.0	0.0		Sep	784.1+	4.2+
1977																
Chaco	0.0	5.6	1.3	0.0	0.0	0.0	664.5	913.9	4.1	8.3	0.2	0.0		Aug	1597.9	4.4
Gallo	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0			-	-
1978																
Chaco	1.6	118.9	216.2	1.0	287.3	0.0	0.0	28.2	58.0	10.2	7.4	14.8		May	742.3	2.0
Gallo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		none	0	0
1979																
Chaco	1101.1	3627.3	402.8	0.0	41.8	403.1	264.4	120.4	0.0	12.5	27.0	0.0		Feb	6000.4	16.4
Gallo	300.8	36.7	0.3	0.0	0.0	0.0	3.5	5.8	0.0	0.0	0.0	0.0		Jan	347.1	1.0
1980																
Chaco	57.2	144.5	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0		Feb	211.6	0.6
Gallo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		none	0	0
1981																
Chaco	0.0	0.0	10.9	0.8	5.9	87.3	187.3	58.5	122.8	288.0	0.0	0.0		Sept	767.5	2.1
Fajada	-	-	13.9	-	4.1	76.0	73.9	0.0	0.0	45.6	0.0	0.0		Jun	213.1	0.6
Gallo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		none	0	0
1982																
Chaco	0.0	52.3	63.3	1.4	3.7	0.0	8.0	802.7	84.8	0.0	1.0	5.2		Aug	1022.4	2.8
Fajada	0.0	14.6	5.1	0.0	2.3	0.0	4.8	185.4	95.5	0.0	0.2	4.3		Aug	312.0	0.9
1983																
Chaco	19.4	258.8	57.0	16.3	0.5	0.0	3.6	407.7	4.1	64.7	2.3	101.9		Aug	936.4	2.6
Fajada	19.7	23.7	5.4	0.0	0.7	0.0	0.0	6.0	3.2	-	-	-		Feb	58.7	9.0
1984																
Chaco	95.0	209.0	30.5	12.1	0.0	0.0	0.0	43.0	91.6	422.7	1.1	24.0		Oct	929.0	2.5
1985																
Chaco	11.2	429.9	84.2	330.1	35.3	0.0	235.0	307.5	101.7	5.7	0.0	0.0		Feb	1540.5	4.2
1986																
Chaco	0.0	0.0	0.3	8.2	0.0	106.7	461.9	45.4	228.4	263.3	493.0	0.0		Nov	1607.0	4.4
1987																
Chaco	0.0	180.0	482.5	0.0	0.0	0.0	28.3	177.1	0.0	0.0	34.5	0.0		Mar	902.4	2.5
1988																
Chaco	0.0	115.2	0.0	0.0	0.0	26.8	336.6	2358.3	1183.8	0.0	0.0	0.0		Aug	4064.7	11.1
1989d																
Chaco	0.0	0.0	0.0	0.0	0.0	0.0	10.9	4.5	0.0	-	-	-		Jul	15.3	0.06

Mean (1977-1989) for Chaco Wash at the bridge: 4.30 ft³/second; 3,120 acre-ft/yr (13-year record).

^aFrom the United States Geological Survey (1978-1990).

^bChaco Wash discharge measured at the Visitor Center bridge, which includes the Fajada discharge. Descrrepancies of lower discharges at the Chaco Wash station from those at the Fajada station are probably the result of silted recording stations.

^cIn ft³/second

COMPILED BY TOM WINDES