

Restrictive Geography

*Prepared for the Town of Bluff Planning and Zoning Commission by
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Physical Geology Features: Geology, Soils, and Hydrology

Geology and Soils: Current Conditions

[Note: The following is extracted from Davis and Westfall 2009]

The geology of the middle San Juan is dominated by the exposed sedimentary beds of the Jurassic Morrison Formation and Quaternary silts, sands and gravels (Stokes 1977). At Bluff, in order of decreasing age, the exposed bedrock units are the Carmel Formation, the Entrada Sandstone, the Wanakah Formation, and the Bluff sandstone, all Jurassic in age. North of Bluff, these geologic units form the broad expanses of the Bluff Bench and Tank Mesa, dissected from east to west by Cow Canyon, Calf Canyon, Cottonwood Wash, and Butler Wash. To the south, the broad Casa del Eco mesa forms a long, unbroken cliff face bordering the south side of the river.

Quaternary-era deposits in the Bluff area include Pleistocene and Holocene sediments. The oldest Quaternary deposits consist of the isolated dissected mounds of cobbles, gravel, and sand on the Bluff Bench and Tank Mes, 130-150 meters above the San Juan River (Oviatt 1982:27). Younger Pleistocene deposits of similar composition and texture form a series of at least two recognizable terraces within the river valley. The upper terrace is partially obscured by sand dunes and forms the gravel surface of Cemetery Hill in the center of town. The lower terrace averages about three meters thick and rests upon the Entrada Sandstone (Oviatt 1982:28).

Holocene deposits consist of alluvium, colluvium, and eolian sand. The alluvial deposits occur along wash bottoms and the San Juan River floodplain. Eolian sediments are represented by three distinct sand dune formations in the Bluff area: longitudinal, climbing, and parabolic. Longitudinal dunes occur on the higher Bluff Bench, Tank Mesa, and Casa del Eco, and support a diverse vegetation community. Within the river valley, climbing dunes are common on the Pleistocene cobble terraces and colluvial slopes west and east of Bluff. Parabolic dunes and sheet sands have accumulated along the lower elevation terraces and floodplain along the river; these are generally less than one meter in depth, but in some places may be thicker (Oviatt 1982:50-51).

West of Bluff, rock layers exposed on the east face of the Comb Ridge monocline includes the Permian Organ Rock Shale, the Triassic Moenkopi and Chinle Formations, and the Jurassic Wingate, Kayenta, and Navajo Sandstone Formations.

Hydrology: Current Conditions

1. San Juan River and associated tributaries, including Cow Canyon, Calf Canyon, Cottonwood Wash, Butler Wash, Comb Wash, and numerous unnamed washes.

Historically, the San Juan River flooded almost yearly, contributing to an extensive riparian habitat along the floodplain. Subsequent historic settlement in Bluff during the 1880s-1890s stripped the floodplain of trees for rip-rap barriers, which were unsuccessful (Aton and McPherson 2000). The construction of Navajo Dam above Farmington, NM in 1962, and Red Dike at Bluff in 1947-1952, introduced flood control measures which partially contributed to the formation of the present narrow channelization of the San Juan River at Bluff. Water releases from Navajo Dam are currently maintained at a minimum flow to fulfill agricultural-related water usage rights and to maintain viable habitat for the endangered Colorado pikeminnow and razorback sucker. Table A-1 shows the extensive system of tributaries below Navajo Dam that channel surface waters to the San Juan River.

2. Bluff Sandstone Aquifer

This is an unconfined aquifer, and the source for seeps and springs located between the base of the upper Bluff Sandstone and the top of the Wanakah Formations. Gregory (1938:74) describes this as a “zone of seeps” (also termed a “spring line”). At Bluff, it is marked by a band of green vegetation that includes columbine, primrose, goldenrod, scarlet monkeyflower, evening primrose, buffaloberry and stream orchid. This habitat is recognized as a relict boreal oasis, perhaps dating from the Ice Age (Eastwood 1896).

3. Navajo Sandstone Aquifer

The 2019 Bluff Water Study will provide descriptive and historical information on the aquifer.

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Year East Bluff Storm Water Control Project. Data on file?

Bluff Special Service District

Year West Bluff Storm Water Control Project. Data on file?

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Portion of TABLE 3 [modified for Bluff Report by Debbie Westfall]

LIST OF MAJOR TRIBUTARIES TO SAN JUAN RIVER

Below Navajo Dam down to Comb Wash

Edited Compilation by Gene M. Stevenson May 8, 2019

Name	Side of River RL vs RR	Length (miles)	Elevation @ Mouth (feet)	Gradient feet per mile (fpm)	Drainage Area square miles (mi ²)
Major Tributaries from Navajo Dam to Four Corners					
Gobernador Canyon	RL	28.6	5,650	52.45	
Pump Canyon	RR	23.4	5,640	67.09	
Manzanares Canyon	RL	8.3	5,565	112.65	
Largo Cañón	RL	71.6	5,530	26.12	<u>1,548 mi²</u>
Kutz Canyon	RL	16.3	5,380	74.85	
Gallegos Canyon	RL	36.4	5,310	44.51	
Animas River	RR	122.4	5,250	55.15	
Animas River + Florida River Drainage Area					<u>1,420 mi²</u>
La Plata River	RR	67.7	5,210	91.43	
Chaco Wash	RL	149.4	4,910	13.15	<u>4,465 mi²</u>
Shiprock Wash	RL	40.5	4,750	101.73	<u>227.0 mi²</u>
Redrock Creek	RL	43.2	4,715	93.87	
Beclabito Wash	RL	12.4	4,710	152.42	
Shoe-Game Wash	RL	16.5	4,690	252.12	
Salt Wash	RL	9.25	4,670	143.78	
Total Drainage Area for Redrock Creek to Salt Wash					<u>512.0 mi²</u>
Mancos River	RR	92.8	4,635	79.36 (15)	<u>803.0 mi²</u>
Four Corners to Comb Ridge					
Tohache Wash	RL	8.64	4,620	87.96	
Toh Dahstini Wash	RL	21.3	4,610	209.86	<u>94.0 mi²</u>
(Includes Teec Nos Pos Wash)					
Cowboy Wash	RR	25.3	4,590	142.69	
Marble Wash	RR	18.5	4,515	95.41	
Cowboy to Marble Wash including Coyote & Mariano washes: Combined Drainage Area					<u>200.0 mi²</u>
Tsitah Wash	RL	33.6	4,510	127.68	
McElmo Creek	RR	69.8	4,465	37.75	<u>700.0 mi²</u>
Lone Mountain Creek	RL	13.9	4,455	89.57	
Montezuma Creek	RR	87.7	4,397	68.44	<u>1,165.0 mi²</u>
Desert Creek	RL	15.7	4,386	70.96	
Bucket Canyon	RR	5.4	4,385	95.37	
McCracken Canyon	RR	15.25	4,380	63.28	
Recapture Creek	RR	47.2	4,355	124.26	<u>214.0 mi²</u>
St Christopher Wash	RR	4.5	4,325	127.78	
Cow Canyon	RR	4.45	4,315	131.46	
Cottonwood Wash	RR	62.1	4,310	68.41	<u>350.0 mi²</u>
Buck Creek	RR	2.2	4,280	281.82	
Butler Wash	RR	28.0	4,255	59.82	
Gothic Wash	RL	30.6	4,254	45.94 (18)	
Comb Wash	RR	38.3	4,230	78.36	<u>285.0 mi²</u>

Esri Arc/GIS computer software program was used to calculate square mileage, GPS coordinates, elevations and river lengths from maps at 1:24000 scales!

Compiled by Gene M. Stevenson Summer, 2016