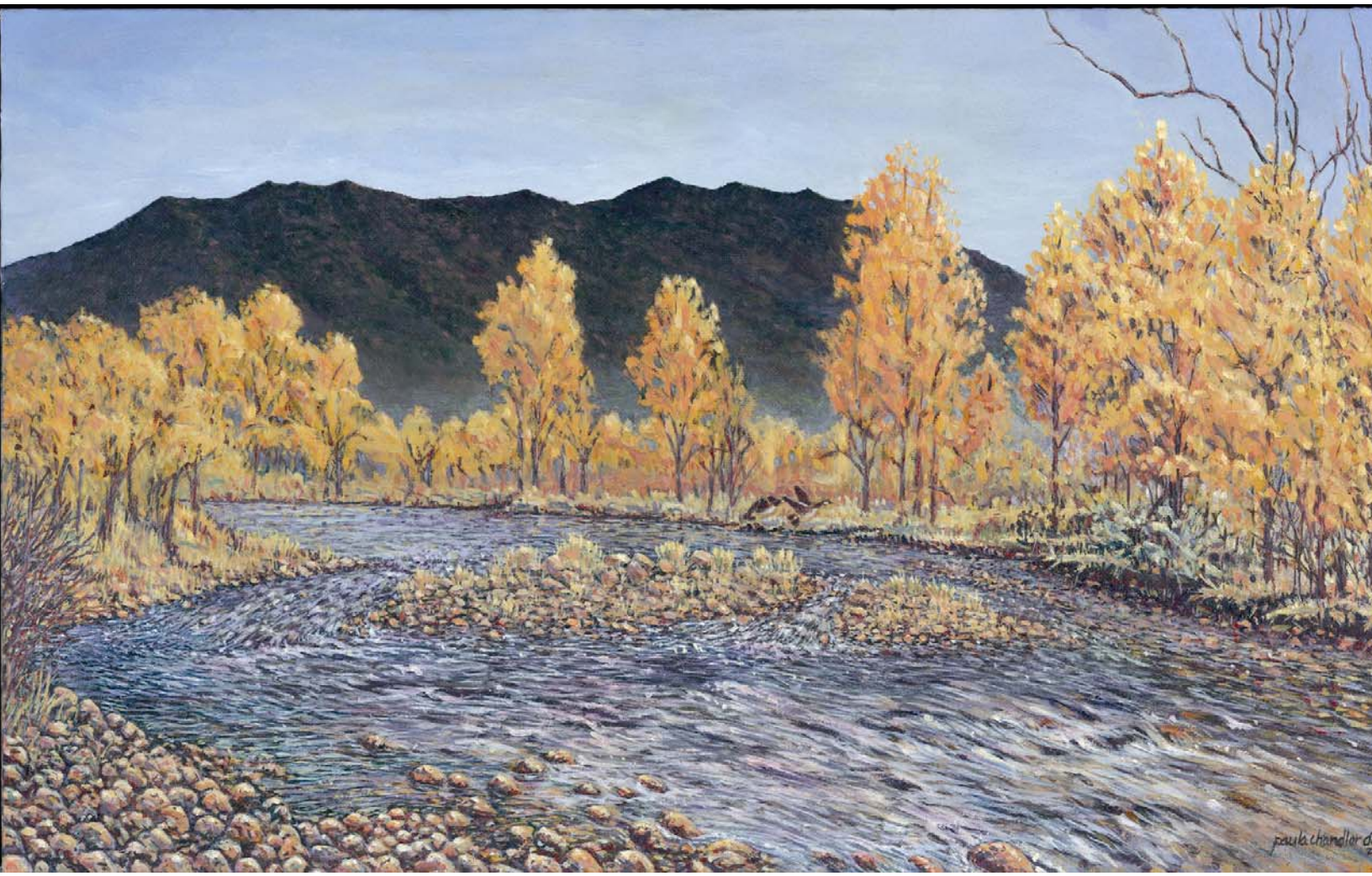

Roaring Fork Watershed Inventory

September 2007

Watershed Inventory Prepared by:
Tim O'Keefe & Lindsay Hoffmann

ROARING FORK CONSERVANCY
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Roaring Fork Conservancy

Roaring Fork Conservancy is the watershed conservation organization in the Roaring Fork Valley that brings people together to protect our rivers. We are an independent, non-profit 501(c)3 organization whose mission is to inspire people to explore, value, and protect the Roaring Fork Watershed. From Aspen to Glenwood Springs, Meredith to Marble, Roaring Fork Conservancy is focused on:

water quantity -- keeping water in our rivers,
water quality -- keeping our rivers healthy, and
habitat preservation -- keeping our riparian habitat intact.

Founded in November 1996 through a unique public-private partnership, Roaring Fork Conservancy has become one of the most respected watershed conservation organizations in Colorado. Jeanne Beaudry served as first Executive Director from 1997 to 2005 and long-time staffer Rick Lofaro became the second Executive Director in May of 2005. Roaring Fork Conservancy's offices have been located in Basalt, the geographic center of the watershed, from the time of its inception. We are currently funded through individual donations, grants, special events, and program fees. In 2000, Roaring Fork Conservancy formed the Rivers Council to help raise funds for the organization's four program areas: watershed education, land conservation, water resources research, and water quality monitoring.

Introduction

Through our work at Roaring Fork Conservancy, we hope that residents of and visitors to the Roaring Fork Valley will begin to see beyond political boundaries and understand that the Valley is a unified and complex entity defined by our rivers. This entity, the area of land that drains to a single point, we call a watershed.

This watershed inventory was prepared by Roaring Fork Conservancy to provide vital statistics and information on the Roaring Fork Watershed. John Wesley Powell's expedition of the Colorado River in the 1860s led him to recommend that management of the west be based on watershed units, not typical township and range survey system. Today, Roaring Fork Conservancy seeks to help people with the six municipalities and four counties in our watershed to see our watershed as a whole.

Originally published in September 2003, the information presented in this inventory was collected from numerous sources (see footnotes). Reasonable attempts were made to ensure that information and figures are as accurate as possible, but no representation or guarantee is made as to either the correctness or suitability of information for particular purposes. All critical information should be independently verified. Please address suggestions, additions or changes to this inventory to Roaring Fork Conservancy, P.O. Box 3349, Basalt, Colorado 81621.

Acknowledgements

Roaring Fork Conservancy would like to acknowledge and thank the following individuals for contributing to or reviewing sections of this inventory: Cindy Cochran and staff at Frontier Historical Museum; Dennis Davidson, Natural Resources Conservation Service; Stephen Ellsperman, City of Aspen; Janis Huggins; Randy Mandel, Rocky Mountain Native Plants Company; Mike Schlegel, Colorado Watershed Network; and Garry Zabel, Colorado Mountain College. Thanks to the following individuals from the Roaring Fork Conservancy for reviewing the document: Jeanne Beaudry, Kristine Crandall, Devon Hutton, Rick Lofaro, and Nicki Nabb. We also would like to give thanks to Justine Campbell, who compiled the first list of facts on the Roaring Fork Watershed for Roaring Fork Conservancy in 1998.

I. GENERAL INFORMATION

Watershed Name: Roaring Fork Watershed
USGS Cataloging Unit: 14010004

Begins: Headwaters at Continental Divide (Independence Lake)
Ends: At confluence with Colorado River at Glenwood Springs

Area Drained: 1,451 square miles
Percent of Colorado: 1.4% (104,100 square miles)

Approximate Length: 51.3 miles (Independence Pass to Glenwood Springs) [1]
39.5 miles (longest east-west distance)
Approximate Width: 51.7 miles (longest north-south distance)

Number of Stream Miles: 1,962 miles[2]

Average annual discharge at Glenwood Springs: 943,000 acre feet[3]

Contributions to flow[4]

Roaring Fork River	54%
Crystal River	32%
Fryingpan River	14%

Regional Watershed: Colorado River Basin[5]

Area Drained: 271,000 square miles
(Includes parts of seven U.S. states: Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, and two Mexican states: Baja and Sonora)

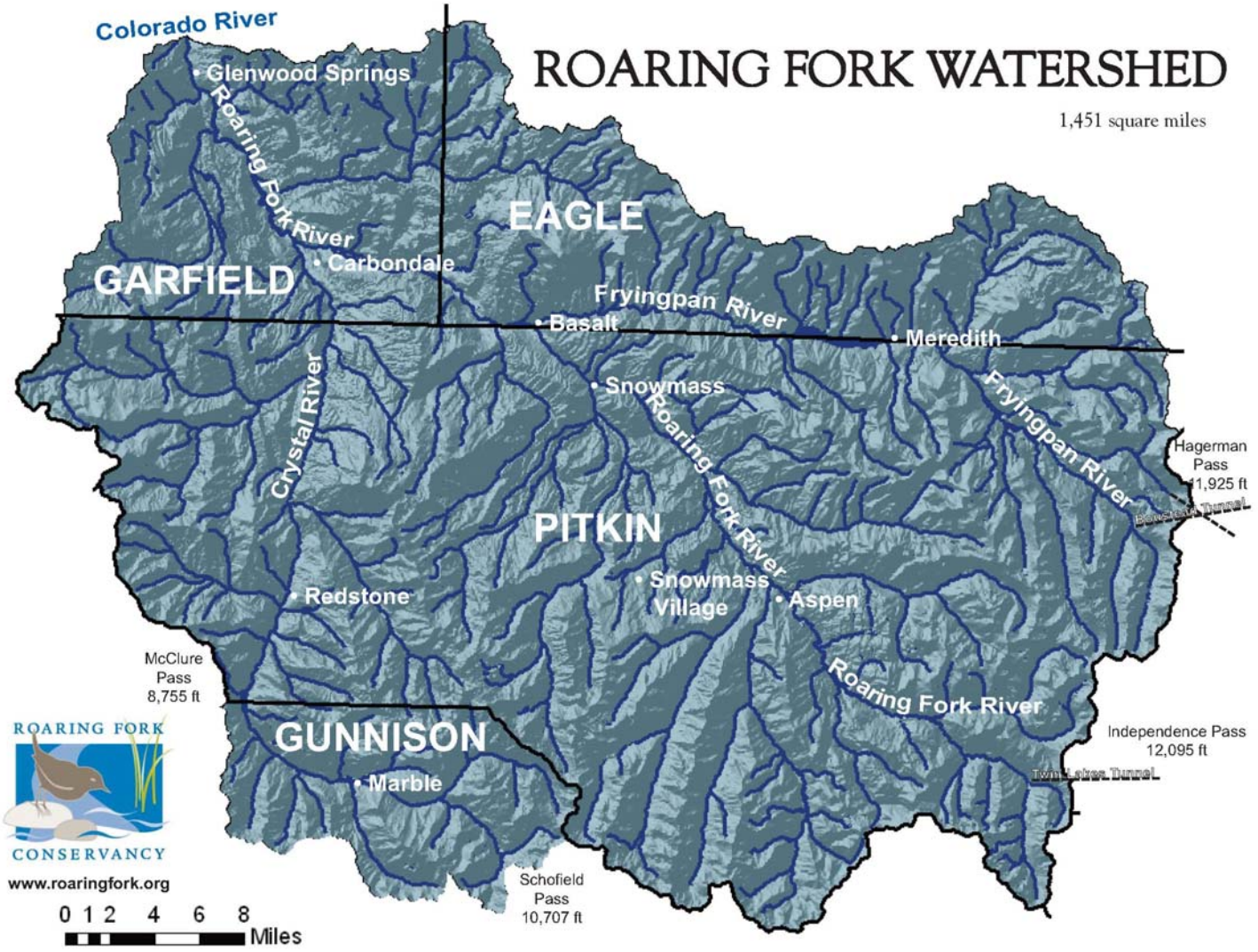
Approximate Length: 1,450 miles

People Served: 27,000,000

Farmland Acres Irrigated: 3,500,000

1 Colorado Watershed Partnership, GIS Mapping Project (Version 2.0), Measure Tool.
2 U.S. Environmental Protection Agency, Assessed Waters of Colorado by Watershed, Watershed Assessment Tracking and Environmental Results System, *http://oaspub.epa.gov/waters/w305b_report.state?p_state=CO.*
3 Southeast Colorado Water Conservancy District, Fryingpan Arkansas Project: *http://www.secwcd.org/collection.htm.*
4 Northwest Colorado Council of Governments, Roaring Fork Watershed Management Plan, 2002 *http://www.nwc.cog.co.us/Water/PDF/RFR02REV.final.pdf*
5 Water Education Foundation, *www.water-ed.org.*

Roaring Fork Watershed[6]



6 Roaring Fork Conservancy map.

II. CLIMATE

Overview

Colorado's climate is relatively dry and extremely variable. Annual precipitation averages only 17 inches statewide. It varies from a high of 55 inches in a few isolated high-mountain locations to a low of six inches in some valleys. Compared to most other parts of the United States, the level of precipitation in Colorado is meager.[7]

The Roaring Fork Valley is considered part of the Colorado Western Slope, which receives on average more precipitation than the drier Front Range that includes Denver, Colorado Springs, and Pueblo. Summers are generally mild to warm in temperature and see frequent thunderstorms in the afternoons, especially in the mountains. From November through April, the Roaring Fork Valley receives the majority of its precipitation in the form of snow. This snow melts throughout the spring and summer to recharge groundwater and rivers. Temperatures throughout the Valley depend greatly on elevation, with differences between Aspen and Glenwood Springs temperatures by about 10°F, on average.

Percent of Precipitation As

Snow: 80%
Rain: 20%

Average Monthly Temperatures – Aspen[8]

Month	Average High (°F)	Average Low (°F)	Mean (°F)
January	33	1	17
February	37	4	20
March	42	13	27
April	49	21	35
May	61	29	45
June	73	34	54
July	79	40	60
August	78	39	58
September	70	32	51
October	59	23	41
November	42	13	28
December	34	4	19

7 Colorado Water Conservation Board, Planning for Drought, May 2000.
8 The Weather Channel, Monthly Averages for Aspen, Colorado, *http://www.weather.com/outlook/travel/vacationplanner/climatology/monthly/USCO0016*.

Average Monthly Temperatures – Glenwood Springs[9]

Month	Average High (°F)	Average Low (°F)	Mean (°F)
January	36	13	25
February	44	19	31
March	53	26	40
April	63	31	47
May	72	39	55
June	84	45	64
July	89	52	70
August	87	51	69
September	79	43	61
October	66	33	50
November	49	23	36
December	37	15	26

Average Annual Precipitation[10]

Monthly Precipitation (inches)			
Region	**Aspen**	**Basalt**	**Glenwood**
Period of Record	**1900-1979**	**Interpolated***	**1900-1997**
Elevation (feet)	**7,910**	**6,620**	**5,910**
January	1.81	1.57	1.43
February	1.63	1.39	1.25
March	1.80	1.53	1.38
April	1.68	1.59	1.54
May	1.48	1.42	1.38
June	1.16	1.09	1.05
July	1.44	1.31	1.24
August	1.72	1.54	1.44
September	1.58	1.48	1.43
October	1.48	1.44	1.42
November	1.48	1.22	1.08
December	1.69	1.41	1.26
Annual	**18.93**	**17.17**	**16.19**

***** Precipitation for Basalt interpolated between data from Glenwood Springs and data from Aspen, based on relative elevations.

9 The Weather Channel, Monthly Averages for Aspen, Colorado, *http://www.weather.com/outlook/travel/vacationplanner/climatology/monthly/USCO0016*.

10 Matrix Design Group, Stormwater Evaluation Report Town of Basalt, Colorado, September 30, 2001.

Average Annual Snowfall[11]

Monthly Snowfall (inches)			
Region	**Aspen**	**Basalt**	**Glenwood**
Period of Record	**1900-1979**	**Interpolated***	**1900-1997**
Elevation (feet)	**7,910**	**6,620**	**5,910**
January	24.8	19.4	16.4
February	22.5	15.1	10.9
March	22.6	12.0	6.1
April	11.5	5.2	1.7
May	3.1	1.3	0.3
June	0.7	0.3	0.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
September	1.5	0.5	0.0
October	5.9	2.8	1.1
November	17.8	9.5	4.9
December	23.0	16.9	13.5
Annual	**136.6**	**84.2**	**55.0**

***** Precipitation for Basalt interpolated between data from Glenwood Springs and data from Aspen based on relative elevations.

11 Matrix Design Group, Stormwater Evaluation Report Town of Basalt, Colorado, September 30, 2001.

III. FLOODING/DROUGHT HISTORY

Flood flows in the Roaring Fork River result from rapid melting of mountain snow pack during the period from May to early July. Snowmelt runoff is characterized by sustained periods of high flows and diurnal fluctuations (flow is higher during the day when the sun is out).

Historical Flood Years[12,13,14]

Roaring Fork River at Glenwood Springs

Year	**Peak Flow** (cfs)	**Actual Date**
1914	13,900	June 14, 1914
1918	17,600	June 14, 1918
1921	17,600	June 14, 1921
1938	13,400	June 22, 1938
1952	13,000	June 11, 1952
1958	13,900	June 6, 1958
1995	13,000	July 13, 1995

Castle Creek
1918 (largest, with a peak flow of 1,090 cfs)

Hunter Creek
1953 (largest, with a peak flow of 1,010 cfs)

Crystal River
1957 (largest, with a peak flow of 3,980 cfs)

Maroon Creek
1980 (largest, with a peak flow of 836 cfs)

Historic Drought Years

Colorado Mainstem in Colorado[15]
1579-1598 (based on tree rings)
1899-1905
1950-1952
1954
1956-1957
1963-1964
1972-1973
1976-1978

12 Federal Emergency Management Agency, Flood Insurance Study, Pitkin County, Colorado and Incorporated Areas, Volume 1 of 3. June 4, 1987. pages 6-8.
13 Wright-McLaughlin Engineers, Floodplain Information Report, Roaring Fork and Fryingpan Rivers, February 1978.
14 U.S. Geological Survey, Peak Streamflow for Glenwood Springs, *http://waterdata.usgs.gov/co/nwis/peak?site_no=09085000&agency_cd=USGS&format=html*
15 Colorado Water Conservation Board, Planning for Drought, May 2000.

IV. GEOLOGY/TOPOGRAPHY

Geologic History of Area[16]

Precambrian Era (more than 545 million years ago (Ma))
During this era, three or more periods of mountain building occurred in the present Rocky Mountains. Rocks were tightly folded, partly melted, and recrystallized, with granite intrusions that formed rocks such as Quartz Monzonite, a granite-like igneous rock.

Paleozoic Era (545 mya to 248 Ma)
Covered by an ancient sea, Colorado received deposits of marine sandstone, limestone, and shale during the early periods of this era. Between 323 and 310 Ma, depositions of marine shale and limestone include remains of marine animals, especially shellfish. After 310 mya, the Ancestral Rocky Mountain Orogeny, an uplift of two great island ranges of the Ancestral Rockies, created an inland sea in the present Roaring Fork Valley. One of these ranges was located west of the Roaring Fork Valley. These ranges began eroding during the later two periods of the era depositing thick quantities of muds, sands and gravels that eventually were cemented by iron oxide, forming the red-beds of the Maroon Formation that makes up so much of the Roaring Fork Valley.

Mesozoic Era (248 Ma to 65 Ma)
During this era, erosion of the Ancestral Rockies had reduced these mountains to very low elevations, creating coastal environments throughout parts of Colorado. During the Jurassic period, floodplain, marsh and dune deposits were made in a lowland climate supporting lush vegetation and dinosaurs. During the Cretaceous period, marine, near-shore and lagoon deposits also included some dinosaur remains. Late in this period, the Sawatch Range and other Colorado mountain ranges began their final uplift known as the Laramide Orogeny.

Cenozoic Era (65 Ma to present)
During the Laramide Orogeny (70 to 40 Ma), a long and intense mountain building period created the main structure of the Rockies. Deposition of oil shale occurred in a huge western lake, while volcanic activity (usually in the form of small extrusions) occurred in places such as Basalt. The erosion of these new mountains led to deposition of sand and gravel in the intermountain valleys and on the plains. During the Miocene-Pliocene uplift, the Rockies gained about 5,000 feet in elevation to their current elevations. In the Pleistocene Ice Age (in the last 1.6 Ma to 10,000 years), periods of glaciers formed the current topography of the Rocky Mountains, carving out the U-shaped valleys of the high mountains and creating large lateral and terminal moraines on the valley floors. Examples of tiered moraines are found below Red Mountain just north of the Roaring Fork River and just east of the Aspen Airport. The melt waters of the glaciers deposited several terraces of outwash sediment along McClain Flats Road near Woody Creek. These melt waters mixed with large quantities of sediment led to the carving of canyons such as Glenwood Canyon and Snowmass

16 Moran, Mary. Geology: Top of Aspen Mountain, 1987.

Canyon. The last glaciers receded about 10,000 years ago.

Predominant Rock Types[17]

Sedimentary: Sandstone, Mudstone, Siltstone, Claystone, Shale, Conglomerate, Limestone
Igneous Extrusive: Basalt, Pyroclastics
Igneous Intrusive: Granite, Monzonite, Granodiorite
Metamorphic: Quartzite, Gneiss, Schist

Specific Rock Types[18]

Basalt – examples include flows from caprock on the Flat Tops and on the south flank of Basalt Mountain (thickness: approximately 250 feet)
Mancos Shale – a thick accumulation of black mud and silt deposited in a vast ocean which covered western north America about 75 Ma; example at Shale Bluffs between Brush Creek Road and The Aspen Airport on Highway 82.
Dakota Sandstone – ancient beach deposit accumulated about 100 Ma as marine waters flooded the continents; examples found on the cirque of Snowmass Mountain.
Morrison Formation – sandstone layer that contains fossils from Jurassic period; examples throughout the Valley.
Leadville Limestone – formed around 340 Ma; examples on Aspen Mountain.
Manitou Dolomite – examples found on Aspen Mountain.
Maroon Formation – red-colored accumulation of sand and gravel from about 300 Ma; examples throughout the Valley, most notably at the Maroon Bells south of Aspen (thickness: 3,000 to 4,000 feet).
Quartz Monzonite – crystalline intrusive igneous rock that contains two types of feldspar, some quartz, and several types of dark minerals; best example is Mt. Sopris.

Geologic Activity

- ✓ Earthquakes (mild) (see below)
- ❑ Volcanic eruptions
- ✓ Landslides/Mudslides (see below)
- ❑ Other _____

Earthquakes[19]

The Roaring Fork Valley has experienced numerous, small earthquakes in recent history. Most of these quakes have been in the Aspen area. Most recently, on January 1, 2003, residents in Aspen felt a quake that registered 2.9 on the Richter scale and occurred 25 miles from Aspen. In October of 2002 another small earthquake, measuring 2.8 on the Richter scale occurred in Aspen. In 1986 three

17 Colorado Geological Survey, Guide to the Geology of the Glenwood Springs Area, Earth Science Week Field Trip, Oct. 13, 2000, h*ttp://geosurvey.state.co.us/pubs/field_trips/GlenFieldTripGuidebook.pdf.*
18 Chronic, Halka. Roadside Geology of Colorado, 1988.
19 Gardner-Smith, Brent. "Small quake shakes Aspen into New Year." The Aspen Times. January 2, 2003.

earthquakes occurred within a 25-mile radius of the town, the largest of which measured 3.4 on the Richter scale. In 1971 an earthquake that measured 3.8 on the Richter scale occurred in Glenwood Springs. Five miles south of Carbondale, a series of one hundred small earthquakes occurred in 1984, the largest measuring 3.1 on the Richter scale. In 2002, a 4.0 earthquake occurred about 10 miles northwest of Glenwood Springs.

Landslides[20,21]

In 1998, 600 feet of County Road 109 was buried beneath 9 feet of mud and rock. The cause of the flow was attributed to heavy rain that had occurred prior to the event as well as irrigation practices in nearby neighborhoods. In 1977, a severe thunderstorm unleashed water, mud, rock and tree limbs that flowed over 200 acres of the city of Glenwood Springs causing over $2 million in damage.

20 Baca, Leslie. "Guide to the Geology of the Glenwood Springs Area, Garfield County, Colorado." 2000.
21 Matrix Design Group, Stormwater Assessment and Education Report of the Watershed Improvement and Education Project, City of Glenwood Springs, 2003.

Watershed's Physical Characteristics

	Upper Reaches Headwaters to Aspen	**Middle Reaches** Aspen to Basalt	**Lower Reaches** Basalt to Glenwood
Uplands (mountains, hills or flat)	Mountainous	Mountainous	Mountainous to hilly
Valley (broad, medium, narrow)	Narrow, medium in certain sections	Narrow (Snowmass Canyon) to medium	Broad to medium
River Gradient (steep, medium, gentle)	Steep 80+ feet per mile	Medium 80-60 feet per mile	Medium 40-25 feet per mile
Channel Type (straight, meandering)	Straight	Meandering	Meandering, Braided
Channel Bottom Substrate (boulder, cobble, gravel, fine sediment)	Boulders Cobbles Gravel	Cobbles Boulders Gravel	Cobbles Boulders Gravel Sediment

Relevant Elevations

Castle Peak (highest point)	14,265 feet
Aspen	7,910 feet
Basalt	6,620 feet
Carbondale	6,100 feet
Glenwood Springs (lowest point)	5,916 feet

V. WATER RESOURCES

Headwaters

Originate From:

___ Glaciers _x_ Snowmelt _x_ Rain
_x_ Wetlands _x_ Lakes _x_ Groundwater
___ Spring

The headwaters of the Roaring Fork Watershed begin at the Continental Divide and high mountain peaks and passes of the Elk and Wasatch Mountain Ranges.

Roaring Fork River Stream Order at Glenwood Springs: 4

Tributaries[22]

The Roaring Fork River's major tributaries (2nd order creeks and above) include:

- Avalanche Creek
- Brush Creek
- Capitol Creek
- Castle Creek
- Cattle Creek
- Coal Creek
- Crystal River
- Difficult Creek
- Four-mile Creek
- Fryingpan River
- Hunter Creek
- Ivanhoe Creek
- Lime Creek
- Lincoln Creek
- Maroon Creek
- Owl Creek
- Snowmass Creek
- Sopris Creek
- Thompson Creek
- Woody Creek

Lakes

- American Lake
- Avalanche Lake
- Beaver Lake
- Capitol Lake
- Cathedral Lake
- Chapman Lake
- Crater Lake
- Diemer Lake
- Dinkle Lake
- Fryingpan Lakes
- Geneva Lake
- Granite Lakes
- Independence Lake
- Ivanhoe Lake
- Lilly Lake
- Linkins Lake
- Lost Man Lake
- Maroon Lake
- Midway Lake
- Moon Lake
- Pierre Lakes
- Savage Lakes
- Sawyer Lake
- Sellar Lake
- Snowmass Lake
- Thomas Lakes
- Warren Lakes
- Williams Lake
- Willow Lake

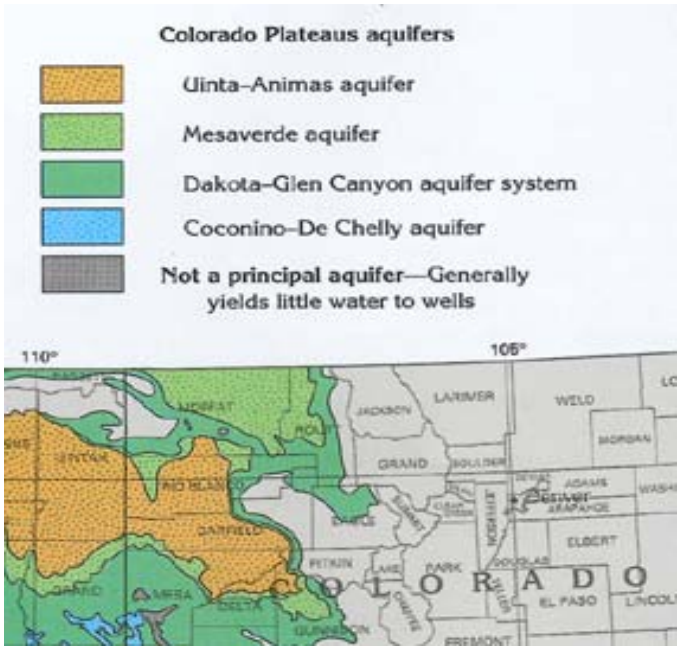
Wetlands

Due to the dry climate, steep topography and mountain setting, the Roaring Fork Watershed has no large-sized wetlands. Most of the Watershed's wetlands are found along stream and river courses from the alpine tundra to the outflow of the Watershed. There are examples of all four types of Colorado wetlands in the Roaring Fork Watershed: riparian wetlands, marshlands, wet meadows, and peatland fens. Overall in Colorado, the state has lost about 50% of its wetlands since 1850. The peatland fens at Warren Lakes are an example of a unique wetland area in the watershed.

Aquifers

22 DeLorme Mapping, Colorado Atlas and Gazetteer. 1995.

The western part of Pitkin County and southern part of Garfield County are underlain with the Colorado Plateaus aquifers. These include the Dakota-Glen Canyon and the Uinta-Animas aquifers (see below).[23]



Reservoirs

(See Section XII)

Flow Gauging Station Locations

U.S. Geological Survey[24]

Roaring Fork River above Difficult Campground near Aspen
Roaring Fork River near Aspen
Hunter Creek near Aspen
Fryingpan River near Ruedi Reservoir
Roaring Fork River near Emma
Crystal River above Avalanche Creek near Redstone
Roaring Fork River at Glenwood Springs

Colorado Division of Water Resources[25]

23 U.S. Geological Survey, Ground Water Atlas of the United States, 2002, *http://capp.water.usgs.gov/gwa/ch_c/jpeg/C011.jpeg*
24 U.S. Geological Survey, *http://water.usgs.gov/.*
25 Colorado Division of Water Resources, *http://dwr.state.co.us/Hydrology/flow_search.asp***.**

North Fork Fryingpan River near Norrie
Fryingpan River near Thomasville
Rocky Fork Creek near Meredith
Fryingpan River at Meredith
Ruedi Reservoir near Basalt
Roaring Fork River above Lost Man near Aspen
Lincoln Creek below Grizzly Reservoir near Aspen
Roaring Fork River below Maroon Creek near Aspen
Snowmass Creek
Thompson Creek near Carbondale

Whitewater Profile

Section	Class	Length	Gradient
Slaughterhouse Br. to Upper Woody Creek Br.	IV_{+6} (V_6 over 1,500 cfs)	5 miles	80 ft./mi.
Upper Woody Creek Br. to Basalt	III_4 (IV over 2,000 cfs)	12 miles	60 ft./mi.
Basalt to Carbondale	II (III over 4,000 cfs)	13 miles	45 ft./mi.
Carbondale to Glenwood Springs	II (III above 4,000 cfs)	13 miles	25 ft./mi.

VI. SOILS

Soils on all the private lands, within the survey boundaries, are mapped and contained in either the Rifle Soil Survey Area or the Aspen/Gypsum Soil Survey Area. Most of Roaring Fork Valley is covered in the Aspen/Gypsum Soil Survey. The Rifle Survey covers the area from Cattle Creek to the confluence of the Roaring Fork and Colorado River. These complete surveys are available at the USDA Natural Resources Conservation Service, local libraries, and the Roaring Fork Conservancy office.

Soil Survey maps show the location of soils within the survey boundaries. Descriptions of each soil type are included in the survey book.

Descriptions of each soil type include:

- Depth of each major soil layer.
- Soil chacteristics such as, color, texture, structure, aspect, setting, and parent material.
- How well water will infiltrate the soil and how easily root can penetrate it.
- The rate at which water moves downward through the soil.
- How much water the soil can store for plants.
- The pH range for each soil.
- The soil's susceptibility to erosion by water and wind.

Soil surveys can help people manage their land. The survey describes a soil's potential for many uses, such as agriculture or forestry, crop yields, range production, habitat and feed values for wildlife. More importantly, the survey highlights a soil's limitations for some uses, and their risk of damaging the soil or the environment through improper use. For example, the survey includes interpretations of a soil's potential and limitations for agricultural uses. It includes definitions of common agricultural crops and land characteristics that may affect soil management. The survey identifies:

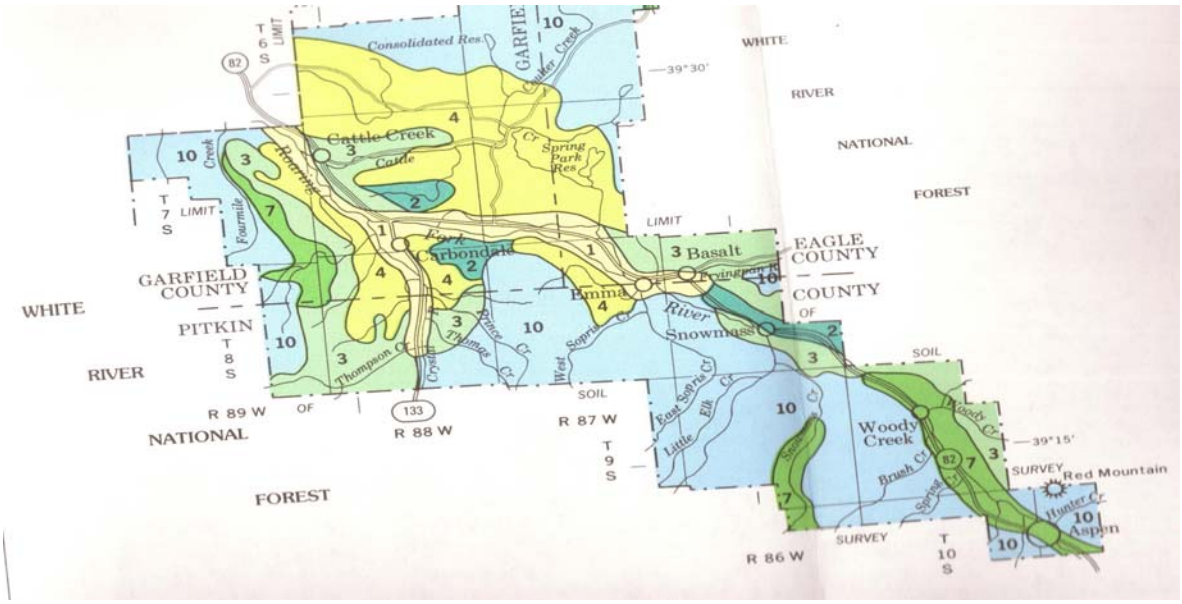
- Areas where wind or water erosion is a major concern, and what can be done to control it.
- The most suitable hay and pasture plants for specific soils, and practices that can overcome shortcomings in a particular soil.
- Average expected yields per acre of principal crops raised under a high degree of management over time.

Soils are also rated for their potential to produce trees, support livestock and provide habitat for wildlife.

In addition soils are rated for their suitability for recreation, such as camping areas, picnic areas, playgrounds, paths and trails for hiking and horseback riding, and golf fairways.

The survey can be used by community planners to interpret the suitability of soils for the construction of dwellings and small commercial buildings, local roads and streets, septic tank absorption fields, sewage lagoons, landfills, ponds, and dikes and levees. [26]

Predominant soil types[27]



Map Source: Soil Survey of Aspen-Gypsum Area, Colorado, Parts of Eagle, Garfield, and Pitkin Counties. 1981.

1. Atencio-Redrob-Azeltine: Gently sloping and strongly sloping, somewhat poorly drained and well drained, deep soils; on alluvial valley floors, flood plains, fans, and terraces

2. Brownsto-Showalter-Tridell: Strongly sloping to very steep, well drained and somewhat excessively drained, deep soils; on fans, terraces, and mountainsides

3. Earsman-Cushool-Rentsac: Moderately steep to very steep, well drained and somewhat excessively drained, shallow and moderately deep soils; on

26 Dennis Davidson, Natural Resource Conservation Service, Glenwood Springs, Colorado.

27 U.S. Department of Agriculture, Soil Conservation Service; U.S. Department of the Interior, Bureau of Land Management, Colorado Agricultural Experiment Station, General Soil Map: Aspen-Gypsum Area Parts of Eagle, Garfield, and Pitkin Counties, Colorado.

mountainsides, ridges, hills, and mesa side slopes

4. Empedrado-Morval-Evanston: Gently sloping to very steep, well drained, deep soils; on hills, fans, and valley sides

5. Forelle-Yamo-Almy: Gently sloping to very steep, well drained, deep soils; on alluvial fans, terraces, valley sides, and hills

6. Gypsum Land-Gypsiorthids: Gypsum land and moderately steep to very steep, well drained, shallow and moderately deep soils; on eroded hills, mountainsides, and breaks

7. Jerry-Uracca-Mergel: Gently sloping to very steep, well drained, deep soils; on alluvial fans, terraces, valley sides, and hills

8. Vandamore-Coulterg: Moderately steep to very steep, well drained, moderately deep and deep soils; on mountainsides and fans

9. Callings-Yeljack: Moderately steep to very steep, well drained, deep soils; on ridge tops, mountainsides and benches

10. Jerry-Cochetopa-Forsey: Gently sloping to very steep, well drained, deep soils; on alluvial fans, hills, valley sides, mountainsides, and ridges

11. Leavittville-Anvik-Ansel: Gently sloping to very steep, well drained, deep soils; on mesas, alluvial fans, and mountainsides

12. Moen-Woodhall-Ipson: Gently sloping to very steep, well drained, moderately deep and deep soils; on uplands, valley sides, mountainsides, ridges, terraces, and fans

Areas with soil suitable for farming
Can be determined from the Soil Survey Publication and maps.

Areas with soil unsuitable for development
Can be determined from the Soil Survey Publication and maps.

Areas with potential soil erosion problems
Any of the Soils with slopes greater than 12% and in situations where vegetative cover might be destroyed, from any cause such as, fire, development, drought, and overuse of the land.

VII. VEGETATION

Note: The Conservancy is working to obtain a comprehensive plant list for the Roaring Fork Watershed. We hope this list will be available in future versions of the Roaring Fork Watershed Inventory.

Please reference the following publications:
Colorado Flora: Western Slope by W.A. Weber
Guide to Wildflowers of Colorado by G.K. Guennel
Snowmass Village: Wild at Heart by Janis L. Huggins
Trees and Shrubs of Colorado by Jack L. Carter

VIII. FISH

Native Species

Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*
mottled sculpin	*Cottus bairdii*
bluehead sucker	*Catostomus discobolus*
flannelmouth sucker	*Catostomuslatipinnis*
speckled dace	*Rhinichthys osculus*
mountain sucker	*Catostomus platyrhynchus*

Non-native Species[28]

mountain whitefish	*Prosopium williamsoni*	(native to White River drainage)
rainbow trout	*Oncorhynchus mykiss*	(hatchery introduced, Pacific native)
brook trout	*Salvelinus fontinalis*	(introduced from eastern U.S.)
brown trout	*Salmo trutta*	(introduced from Germany, 1880s)

Threatened or Endangered Species[29]

Colorado special concern

Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*

State Fish Hatcheries[30]

Glenwood Springs Fish Hatchery
Mitchell Creek Road
P.O. Box 578
Glenwood Springs, CO 81601

28 Shook, Mike, Roaring Fork & Fryingpan Rivers Fishing Map & Guide, Shook Book Publishing, 2002.
29 Colorado Division of Wildlife, Endangered & Threatened List, *www.wildlife.state.co.us.*
30 Colorado Division of Wildlife, Personal Communication with Crystal and Glenwood Springs Fish Hatcheries, November 20, 2002.

(970) 945-5293

Types and their numbers (in 2002):

- Colorado River cutthroat (pure strain)
  Produced 1.2 million eggs; stocked 270,000
- Colorado River rainbow trout (captive/wild brood stock)
  Produced 1.9 million eggs; stocked 154,000
- Splake (a cross between lake trout and brook trout)
  Stocked 146,000
- Kokanee salmon (land-locked sockeye salmon)
  Stocked 2.2 million

Crystal River Fish Hatchery
2957 Highway 133
Carbondale, CO 81623
(970) 963-2665

Types and their numbers (in 2002):

- rainbow trout-Tasmanian
- rainbow trout-Bellaire
- Snake River Finespotted cutthroat trout

(Crystal Hatchery produces pure strains from each of these species and two hybrids)
Produce 12-13 million eggs/year total
Stock 50,000 of the sub-catchables from all species (less than 3 inches)*
Stock 35,000 10" fish
Stock 4,000 brewed (19" or more)
*The hatchery will cut back on the number of sub-catchable fish stocked in 2003 due to the drought. It doesn't feel that there will be as much of a demand for these fish.

Whirling Disease
Whirling disease is a parasitic infection that affects trout and salmon.
Life cycle: Microscopic spores, found on the river bottom are ingested by bottom-dwelling tubifex worms. Inside the tubifex worm, the spore changes form and become a Triactinomyon (TAM). The TAM's are released from the tubifex worm and into the water. Trout become infected when the tiny TAM's cling to the fish's body and work their way into the fish's nervous system. Once inside the fish, the TAM changes form again and moves into the fish's cartilage near the head where it develops into a mature spore. After several weeks, infected fish may exhibit a "whirling" behavior, spinal deformities, and black tails. When the infected fish dies and decomposes or is eaten by a predator, the spores in its body are released into the water and the cycle starts over.[31]

31 Montana Fish, Wildlife & Parks, The Wide World of Whirling Disease, 1993,*fwp.mt.gov*.

Whirling Disease in Roaring Fork Watershed Rivers

River	Year Tested Positive[32]
Fryingpan River	1988
Roaring Fork River	1988
Crystal River	Has not been formally tested, assumed positive

Gold Medal Waters[33]

Gold Medal Waters are lakes or streams in Colorado offering the greatest potential for trophy trout fishing.

Roaring Fork River: From Crystal River downstream to Colorado (12 miles)
Fryingpan River: Ruedi Dam downstream to Roaring Fork River (14 miles)

IX. WILDLIFE

Native Species

32 Personal Communication, Colorado Division of Wildlife, January 8, 2003.
33 Colorado Division of Wildlife, Colorado Fishing Season: Information & Wildlife Property Directory, 2003.

Mammals[34,35]

Family: Soricidae	
masked shrew	*Sorex cinereus*
montane shrew	*Sorex monticolus*
dwarf shrew	*Sorex nanus*
water shrew	*Sorex palustris*
Family: Vespertilionidae	
Western small-footed myotis	*Myotis ciliolabrum*
little brown myotis	*Myotis lucifugus*
long-legged myotis	*Myotis volans*
hoary bat	*Lasiurus cinereus*
silver-haired bat	*Lasionycteris noctivagans*
big brown bat	*Eptesicus fuscus*
Townsend's big-eared bat	*Pecotus townsendii*
Family: Ochotonidae	
pika	*Ochontona princeps*
Family: Leporidae	
snowshoe hare	*Lepus americanus*
mountain cottontail	*Sylvilagus nuttallii*
white-tailed jackrabbit	*Lepus townsendii*
Family: Sciuridae	
Hopi chipmunk	*Tamias rufus*
Uinta chipmunk	*Tamias umbrinus*
least chipmunk	*Tamias minimus*
yellow-bellied marmot	*Marmota flaviventris*
Wyoming ground squirrel	*Spermophils elegans*
golden-mantled ground squirrel	*Sermophilus lateralis*
rock squirrel	*Spermophilus variegates*
red pine squirrel	*Tamiasciurus hudsonicus*
Family: Geomyidae	
Northern pocket gopher	*Geomys bursarius*
Family: Castoridae	
American beaver	*Castor candensis*
Family: Muridae	
canyon mouse	*Peromyscus crinitus*
deer mouse	*Peromyscus maniculatus*
pinion mouse	*Peromyscus truei*
bushy-tailed woodrat	*Neotoma cinerea*
southern red-backed vole	*Clethrionomys gapperi*
heather vole	*Phenacomys intermedius*
long-tailed vole	*Microtus longicaudus*
montane vole	*Microtus montanus*
meadow vole	*Microtus pennsylvanicus*
common muskrat	*Ondratara zibethicus*
Family: Zapodidae	
western jumping mouse	*Zapus princeps*
Family: Erethizontidae	
common porcupine	*Erethizon dorsatum*
Family: Canidae	
coyote	*Canis latrans*
red fox	*Vulpes vulpes*
Family: Ursidae	
black bear	*Ursus americanus*
Family: Procyonidae	
ringtail	*Bassariscus astutus*
raccoon	*Procyon lotor*
Family: Mustelidae	
American marten	*Mates americana*
mink	*Mustela vison*
long-tailed weasel	*Mustela frenata*
short-tailed weasel	*Mustela erminea*
striped skunk	*Mephitis mephitis*
wolverine	*Gulo gulo*
American badger	*Taxidea taxus*
western spotted skunk	*Spilogale gracilis*
Family: Felidae	
bobcat	*Lynx rufus*
mountain lion	*Felis concolor*
lynx	*Lynx lynx*
Family: Cervidae	
mule deer	*Odocoileus hemionus*
American elk	*Cervus elaphus*
Family: Bovidae	
bighorn sheep	*Ovis canadensis*

34 Motel, Cornelia and John Emetic, From Grassland to Glacier, 1992, pp.84-5.
35 Fitzgerald, James P., Carrion A. Meaner, & David M. Armstrong, Mammals of Colorado. 1994.

Birds[36]

Loon	
common loon*	*Gavia immer*
Grebes	
eared grebe	*Podiceps nigricollis*
pied-billed grebe	*Podilymbus podiceps*
horned grebe*	*Podiceps auritus*
western grebe	*Aechmophorus occidentalis*
Pelicans & Cormorants	
double-crested cormorant*	*Phalacrocorax auritus*
Bitterns, Herons, Egrets & Ibis	
white-faced ibis*	*Plegadis chihi*
American bittern*	*Botarus lentiginosus*
great blue heron	*Ardea herodias*
great egret*	*Ardea alba*
snowy egret	*Egretta thula*
green-backed heron*	*Butorides virescens*
black-crowned night heron*	*Nycticorax nycticorax*
Waterfowl	
tundra swan*	*Cygnus columbianus*
snow goose*	*Chen caerulescens*
Ross's goose*	*Chen rossii*
Canada goose	*Branta candensis*
wood duck*	*Aix sponsa*
green-winged teal	*Anas crecca*
mallard	*Anas platyrhynchos*
northern pintail	*Anasa acuta*
blue-winged teal	*Anas discors*
northern shoveler	*Anas clypeata*
gadwall	*Anas strepera*
American wigeon	*Anas americana*
redhead	*Aythya americana*
canvasback*	*Aythya valisineria*
ring-necked duck	*Aythya collaris*
lesser scaup	*Aythya affinis*
white-winged scoter*	*Melanitta fusca*
common goldeneye	*Bucephala clangula*
Barrow's goldeneye*	*Bucephala islandica*
bufflehead	*Bucephala albeola*
common merganser	*Mergus merganser*
hooded merganser*	*Lophodytes cucullatus*
ruddy duck	*Oxyura jamaicensis*
Vultures	
turkey vulture	*Cathartes aura*
Hawks, Eagles & Falcons	
Osprey*	*Pandion haliaetus*
bald eagle	*Haliaetus leucocephalis*
golden eagle	*Aquila chrysaetos*
Northern harrier	*Circus cyaneus*
sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Northern goshawk	*Accipiter gentilis*
Swainson's hawk	*Buteo swainsoni*
red-tailed hawk	*Buteo jamaicensis*
ferruginous hawk*	*Buteo regalis*
rough-legged hawk	*Buteo lagopus*
American kestrel	*Falco sparverius*
Merlin*	*Falco columbarius*
peregrine falcon*	*Falco peregrinus*
prairie falcon	*Falco mexicanus*
Fowl Like Birds	
blue grouse	*Dendragapus obscurus*
sage grouse*	*Centrocercus urophasianus*
white-tailed ptarmigan	*Lagopus leucurus*
turkey	*Meleagris gallopavo*
Rails & Cranes	
sora	*Porzana carolina*
Virginia rail	*Rallus limicola*
American coot	*Fulica americana*
sandhill crane	*Grus canadensis*
Plovers, Stilts & Avocets	
lesser golden-plover*	*Pluvialis fulva*
semipalmated plover*	*Charadrius semipalmatus*
killdeer	*Chradrius vociferous*
black-necked stilt*	*Himantopus mexicanus*
Sandpipers & Phalaropes	
greater yellowlegs	*Tringa melanoleuca*
lesser yellowlegs	*Tringa flavipes*
willet*	*Catoptrophorus semiplmatus*
spotted sandpiper	*Actitis macularia*
long-billed curlew*	*Numenius americanus*
marbled godwit	*Limosa fedoa*
Western sandpiper*	*Calidris mauri*
least sandpiper*	*Calidris minutilla*
stilt sandpiper*	*Calidris himantopus*
long-billed dowitcher*	*Limnodromus scolopaceus*
common snipe	*Gallinago gallinago*
red-necked phalarope*	*Phalaropus lobatus*
Wilson's phalarope	*Phalaropus tricolor*
Gulls & Terns	

36 Roaring Fork Audubon Society, Bird Check List for Aspen and the Roaring Fork Valley.

Franklin's gull	*Larus pipixcan*
Bonaparte's gull	*Larus philadelphia*
ring-billed gull	*Larus delawarensis*
California gull	*Larus californicus*
Sabine's gull*	*Xema sabini*
Forster's tern*	*Sterna forsteri*
black tern	*Chlidonias niger*
band-tailed pigeon	*Columba fasciata*
mourning dove	*Zenaida macroura*
yellow-billed cuckoo*	*Coccyzus americanus*
Owls	
flammulated owl*	*Otus flammeolus*
great horned owl	*Bubo virginianus*
Northern pygmy owl	*Glaucidium gnoma*
long-eared owl*	*Asio otus*
boreal owl	*Aegolius funereus*
Northern saw-whet owl	*Aegolius acadicus*
Goatsuckers	
common nighthawk	*Chordeiles minor*
common poorwill*	*Phalaenoptilus nuttallii*
Swifts & Hummingbirds	
white-throated swift	*Aeronautes saxatalis*
black-chinned hummingbird	*Archilochus alexandri*
broad-tailed hummingbird	*Selasphorus platycercus*
rufous hummingbird	*Selasphorus rufus*
calliope hummingbird	*Stellula calliope*
Kingfisher	
belted kingfisher	*Cerylce alcyon*
Woodpeckers	
Lewis's woodpecker	*Melanerpes lewis*
red-naped sapsucker	*Sphyrapicus nuchalis*
Williamson's sapsucker	*Sphyrapicus thyroideus*
downy woodpecker	*Picoides pubescens*
hairy woodpecker	*Picoides villosus*
three-towed woodpecker*	*Picoides tridactylus*
Northern flicker	*Colaptes auratus*
Flycatchers	
olive-sided flycatcher	*Contopus cooperi*
Western wood-pewee	*Contopus sordidulus*
willow flylcatcher	*Empidonax traillii*
Hammond's flycatcher	*Empidonax hammondii*
dusky flycatcher	*Empidonax oberholseri*
gray flycatcher	*Empidonax wrightii*
cordilleran flycatcher	*Empidonax difficilis*
Say's phoebe	*Sayornis saya*
ash-throated flycatcher*	*Myiarchus cinerascens*
Cassin's kingbird*	*Tyrannus vociferans*
Western kingbird	*Tyrannus verticalis*
Eastern kingbird	*Tyrannus tyrannus*
scissor-tailed flycatcher*	*Tyrannus forficatus*
Larks	
horned lark	*Eremophila alpestris*
Swallows	
purple martin*	*Progne subis*
tree swallow	*Tachycineta bicolor*
violet-green swallow	*Tachycineta thalassina*
bank swallow*	*Riparia riparia*
cliff swallow	*Petrochelidon pyrrhonota*
barn swallow	*Hirundo rustica*
Jays, Magpies & Crows	
gray jay	*Perisoreus canadensis*
Steller's jay	*Cyanocitta stelleri*
blue jay	*Cyanocitta cristata*
Western-scrub jay	*Aphelocoma californica*
pinyon jay	*Gymnorhinus cyanocephalus*
Clark's nutcracker	*Nucifraga columbiana*
black-billed magpie	*Pica pica*
American crow	*Corvus brachyrhynchos*
common raven	*Corvus corax*
Chikcadees, Titmice & Bushtits	
black-capped chickadee	*Parus atricapillus*
mountain chickadee	*Parus gambeli*
juniper titmouse	*Baeolophus ridgwayi*
common bushtit	*Psaltriparus minimus*
Nuthatches & Creepers	
red-breasted nuthatch	*Sitta canadensis*
white-breasted nuthatch	*Sitta carlinensis*
pygmy nuthatch	*Sitta pygmaea*
brown creeper	*Certhia americana*
Wrens	
house wren	*Troglodytes aedon*
rock wren*	*Salpinctes obsoletus*
canyon wren*	*Catherpes mexicanus*
marsh wren	*Cistothorus palustris*
Dippers	
American dipper	*Cinclus mexicanus*
Kinglets, Gnatcatchers	
golden-crowned kinglet	*Regulus satrapa*
ruby-crowned kinglet	*Regulus calendula*
blue-gray gnatcatcher	*Polioptila caerulea*
Thrushes & Mimic Thrushes	
mountain bluebird	*Siala currucoides*
Western bluebird*	*Sialia mexicana*
Townsend's solitaire	*Myadestes townsendi*
veery	*Catharus fuscescens*
Swainson's thrush	*Catharus ustulatus*
hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*

varied thrush*	*Ixoreus naevius*
gray catbird	*Drumetella carolinensis*
sage thrasher	*Oreoscoptes montanus*
brown thrasher	*Toxostoma rufum*
Pipits	
American pipit	*Anthus rubescens*
Waxwings	
bohemian waxwing*	*Bombycilla garrulus*
cedar waxwing	*Bombycilla cedorum*
Shrikes	
Northern shrike*	*Lanius excubitor*
loggerhead shrike	*Lanius ludovicianus*
Starlings	
European starling	*Sturnus vulgaris*
Vireos	
gray vireo*	*Vireo vicinior*
plumbeous vireo	*Vireo plumbeus*
Cassin's vireo	*Vireo cassinii*
warbling vireo	*Vireo gilvus*
red-eyed vireo*	*Vireo olivaceus*
Wood Warblers	
blue-winged warbler*	*Vermivora pinus*
Tennessee warbler*	*Vermivora peregrina*
orange-crowned warbler	*Vermivora celata*
Nashville warbler*	*Vermivora ruficapilla*
Virginia's warbler	*Vermivora virginiae*
yellow warbler	*Dendroica petechia*
chestnut-sided warbler*	*Dendroica pensylvanica*
magnolia warbler*	*Dendroica magnolia*
yellow-rumped warbler	*Dendroica coronata*
black-throated gray warbler	*Dendroica nigrescens*
Townsend's warbler	*Dendroica townsendi*
black-throated green warbler*	*Dendroica occidentalis*
palm warbler*	*Dendroica plmarum*
blackpoll warbler*	*Dendroica striata*
black and white warbler*	*Mniotilta varia*
American redstart*	*Setophaga ruticilla*
Northern waterthrush*	*Seiurus noveboracensis*
Kentucky warbler*	*Oporonis formosus*
MacGillivray's warbler	*Oporornis tolmiet*
common yellowthroat	*Geothlypis trichas*
Wilson's warbler	*Wilsonia pusilla*
yellow-breasted chat	*Icteria virens*
Tanager, Grosbeaks & Buntings	
Western tanager	*Piranga ludoviciana*
rose-breasted grosbeak*	*Pheucticus ludovicianus*
black-headed grosbeak	*Pheucticus melanoceophalus*
lazuli bunting	*Passerina amoena*
indigo bunting*	*Passerina cyanea*
painted bunting*	*Passerina ciris*
Towhees & Sparrows	
green-tailed towhee	*Pipilo chlorurus*
spotted towhee	*Piplo maculatus*
American tree sparrow	*Spizella arboorea*
chipping sparrow	*Spizella passerina*
Brewer's sparrow	*Spizella breweri*
vesper sparrow	*Pooecetes gramineus*
lark sparrow	*Chondestes grammacus*
Savannah sparrow	*Passerculus sandwichensis*
fox sparrow	*Passerella iliaca*
song sparrow	*Melospiza melodia*
Lincoln's sparrow	*Melospiza lincolnii*
white-throated sparrow	*Zonotrichia albicollis*
white-crowned sparrow	*Zonotrichia leucophrys*
dark-eyed junco	*Junco hyemalis*
Blackbirds, Meadowlarks & Orioles	
red-winged blackbird	*Agealaius phoeniceus*
Western meadowlark	*Sturnella neglecta*
yellow-headed blackbird	X*anthocephalus xanthocephalus*
Brewer's blackbird	*Euphagus cyanocephalus*
common grackle	*Quiscalus quiscula*
brown-headed cowbird	*Molothrus ater*
Bullocks oriole	*Ferus bullockii*
Finches & Weavers	
gray-crowned rosy finch	*Leucosticte tephrocotis*
black rosy finch	*Leucosticte atrata*
brown-capped rosy finch	*Leucosticte australis*
pine grosbeak	*Pinicola enucleator*
Cassin's finch	Carpodacus cassinii
house finch	*Carpodacus mexicanus*
red crossbill	*Loxia curviostra*
white-winged crossbill*	*Loxia leucoptera*
common redpoll*	*Carduelis flammea*
pine siskin	*Carduelis pinus*
lesser goldfinch	*Carduelis psaltria*
American goldfinch	*Carduelis tristis*
evening grosbeak	*Coccothraustes vespertinus*
house sparrow	*Passer domesticus*

** Rare: Seen at intervals of 2 to 5 years.*

Amphibians[37]

tiger salamander	*Ambystoma tigrinum*
Western chorus frog	*Pseudacrus triseriata*
Northern leopard frog	*Rana pipiens*
boreal toad	*Bufo boreas*

Reptiles

smooth green snake	*Liochlorophis vernalis*
Western terrestrial garter snake	*Thamnophis elegans*
bullsnake/gopher snake	*Pituophis catenifer*
sagebrush lizard	*Sceloporus graciosus*
prairie lizard	*Sceloporus undulates*
tree lizard	*Urosaurus ornatus*
side-blotched lizard	*Uta stansburiana*
racer	*Coluber constrictor*

Aquatic Insects[38,39,40]

Order: *Ephemeroptera* (Mayflies)*
Families:
Baetidae
Ephemerellidae
Heptageniidae
Leptophlebiidae
Isonychiidae
Polymitarcyidae
Siphlonuridae
Tricorythidae
Caenidae

Order: *Plecoptera* (Stoneflies)*
Families:
Capniidae
Chlorperlidae
Leuctridae
Nemouridae
Perlidae
Perlodidae
Pteronarcyidae
Taeniopterygidae

Order: *Trichoptera* (Caddisflies)*
Families:
Brachyntridae
Glossosomatidae
Hydropsychidae
Hydroptilidae
Lepidostomatidae
Leptoceridae
Limnephilidae
Philopotamidae
Psychomiyiidae
Rhyacophilidae
Uenoidae

Order: *Diptera* (trueflies, midges, mosquitoes, damselflies)
Family:
Chironomidae

Order: *Odonata* (Damselflies, dragonflies)
Families:
Coenagrionidae
Aeshnidae

Order: *Hemiptera* (Water Beetles)
Family:
Corixidae

**Note: These families are known to exist in the Colorado River Basin*

37 Hammer son, Geoffrey A., Amphibians and Reptiles in Colorado, 1999.
38 Scholl Meyer, Jim. Hatch Guide for Western Streams, 1997.
39 Scholl Meyer, Jim. Hatch Guide for Lakes, 1995.
40 Ward, J.V. and, B.C. Kondratieff, An Illustrated Guide to the Mountain Stream Insects of Colorado, 1992.

Non-native Species

Mammals

mountain goat	*Oreamnos americanus*

Birds

European starling	*Sturnus vulgaris*
rock dove	*Columba livia*

Threatened or Endangered Species[41,42]

Colorado Endangered

boreal toad	*Bufo boreas*
lynx	*Felis lynx Canadensis*
wolverine	*Gulo gulo*

Colorado Threatened

bald eagle	*Haliaeetus leucocephalus*
American peregrine falcon	*Falco peregrinus anatum*
golden eagle	*Aquila chrysaetos*
osprey	*Pandion haliaetus*

Key Wildlife Habitat Areas

See pages 33-34 of the Roaring Fork Watershed Biological Inventory 1997-1999.

41 Colorado Natural Heritage Program, Roaring Fork Watershed Biological Inventory 1997-1999, 1999.
42 U.S. Fish & Wildlife Service, Threatened and Endangered Species, Colorado, *http://ecos.fws.gov/servlet/TESSWebpageUSALIsts?state=CO*.

X. HISTORICAL

Earliest Human Inhabitants[43]

In the 1990s, scientists determined that a skeleton found in the White River National Forest, was about 8,000 years old and presumably that of a Ute Indian. The Ute Tribe once occupied the enormous area encompassing the western slope of Colorado, southern Wyoming, northern Arizona and New Mexico, and eastern Utah. The Utes were a tribe of hunter-gatherers who moved frequently (unlike most natives of the Southwest). Since they inhabited the rugged mountains, they were one of the last tribes to be heavily influenced by "the white man." In 1640, the Utes obtained horses from the Spanish and became more mobile, healthier (ease of gathering food), and a more powerful tribe. The Utes of the Roaring Fork (or Thunder River as the Utes called it) were probably the Yampah (or Uncompahgre). They hunted deer and elk in the mountains around Aspen in the summer, camping at traditional sites such as the one at Glory Hole Park in Aspen. The Utes spent winters soaking and healing in the Yampah Hot Springs at Glenwood. By 1880 most of the Utes were forced to migrate westward due to an influx of trappers, prospectors, and settlers. By 1880 no Utes were left on their native lands in Colorado. The Utes have two present day reservations: the Uintah & Ouray Reservations in northeastern Utah and the Ute Mountain/Southern Ute Reservation in the Four Corners area.

The following are direct quotes from Charles Marsh's book on the Utes, People of the Shining Mountains:

"Chief Colorow, whose clan of northern Utes spent each summer hunting in the beautiful Roaring Fork Valley between Glenwood Springs and Aspen, discovered the Graham party [mining prospectors] poaching game. The Indians reminded the Graham party of the recent treaty [Treaty of 1868 gave Utes all of western Colorado] and promptly drove them out of the area, burning all of their belongings."

After the Meeker Massacre (1879): "News about the "Ute War" traveled by wireless throughout the West, and eventually reached the remotest trapper's cabin and prospector's camp. A new tent city of silver prospectors which had been set up only months earlier on the site of Aspen, Colorado, was quickly dismantled. All but a few brave souls fled east over Independence Pass to the safety of Leadville."

Settlement of the Watershed

In the 1860s the Hayden and Sopris expeditions explored the Roaring Fork Valley and "discovered" the Yampah (Glenwood) Hot Springs. In 1879, James Landis first settled Glenwood Springs and was the first owner of the hot springs. Glenwood would be known as Defiance until 1885 when the City of Glenwood Springs was incorporated.

43 Marsh, Charles, People of the Shining Mountains: The Utes of Colorado, 1991.

Glenwood is the only town in the state founded and still operating as a tourist town.

Further up the valley, prospectors from Leadville established the Ute City mining camp in the summer of 1879, and the name changed to Aspen the following year. In 1887, Aspen Junction (or Frying Pan Junction) was founded as a railroad town and eventually changed its name to Basalt.

Mining Prospectors & Agriculture[44]

When prospectors arrived in the Roaring Fork Valley in 1879, they quickly discovered the rich mineral deposits in the Valley. In Aspen, they mined silver, at one time producing 1/6th of the nation's silver and 1/16th of the world's silver. The silver mining heyday lasted from 1879 until the Silver Crash of 1893 when silver was devalued. Throughout the Roaring Fork Valley, mining played an important part in its settlement. In 1887, coal mining began in Redstone and marble quarrying began in Marble. The township of Cardiff, three miles south of Glenwood Springs became a huge coking community with the addition of the Colorado Midland and Denver Rio Grande & Western Railroads in 1887.

By the 1920s the Roaring Fork Valley had lost a majority of its population due to the mining bust and those who remained turned to agriculture for their subsistence. Crops in the Roaring Fork Valley included: potatoes, hay, and grain. Founded in 1888, Carbondale became an agricultural hub for the mid-valley, and established itself as a potato-farming town. Although ranching and farming has continued to the present day in the Roaring Fork Valley, many ranchers have felt the pressures from low prices and high land costs, selling their property to developers.

Recreation & Tourism

Ever since European settlers descended on the Yampah Hot Springs, the City of Glenwood Springs has been a tourist town. Established originally as a destination for soaking in the hot springs, hunting, and fishing also proved popular around Glenwood Springs. President Theodore Roosevelt's hunting trip to Glenwood in 1905 put Glenwood Springs on the national tourism map. With the addition of Holiday Hills ski area in 1948 (which later became Sunlight Ski Area), and a ski lift on Red Mountain in 1941, Glenwood became know for year-round recreation.

Up valley in Aspen, skiing made its unofficial debut in the 1930s on Aspen Mountain and was contemplated for Ashcroft and Mt. Hayden. Not until after World War II did skiing and the cultural revolution in Aspen gain speed. On December 14th, 1946, Walter Paepcke and fellow investors officially opened Aspen Mountain for skiing. In addition to skiing, which benefited the body, Paepcke envisioned Aspen as a place

44 Roaring Fork Conservancy, Roaring Fork Valley History, *http://www.roaringfork.org/images/other/RoaringForkValleyHistory.pdf*

where one could enhance the “mind, body and spirit.” He called this the Aspen Idea and brought influential people to Aspen to start various cultural institutions such as the Aspen Institute, the Aspen Center for Environmental Studies, the Aspen Music Festival, and the Aspen Skiing Company. Today, Aspen is a major summer and winter destination for visitors interested both in recreational and cultural pursuits.

Historical Resources

Aspen Historical Society
620 West Bleeker Street
Aspen, CO 81611
(970) 925-3721
www.aspenhistory.org

Basalt Regional Heritage Society
0081 Lewis Lane
Basalt, CO 81621
(970) 927-4693
www.basaltheritage.org

Frontier Histoical Museum
1001 Colorado Avenue
Glenwood Springs, CO 81601
(970) 945-4448
www.glenwoodhistory.com

Mount Sopris Historical Society
PO Box 2
499 Weant Boulevard
Carbondale, CO 81623
(970) 963-7041
www.mtsoprishistoricalsociety.org

XI. DEMOGRAPHICS

Watershed Population

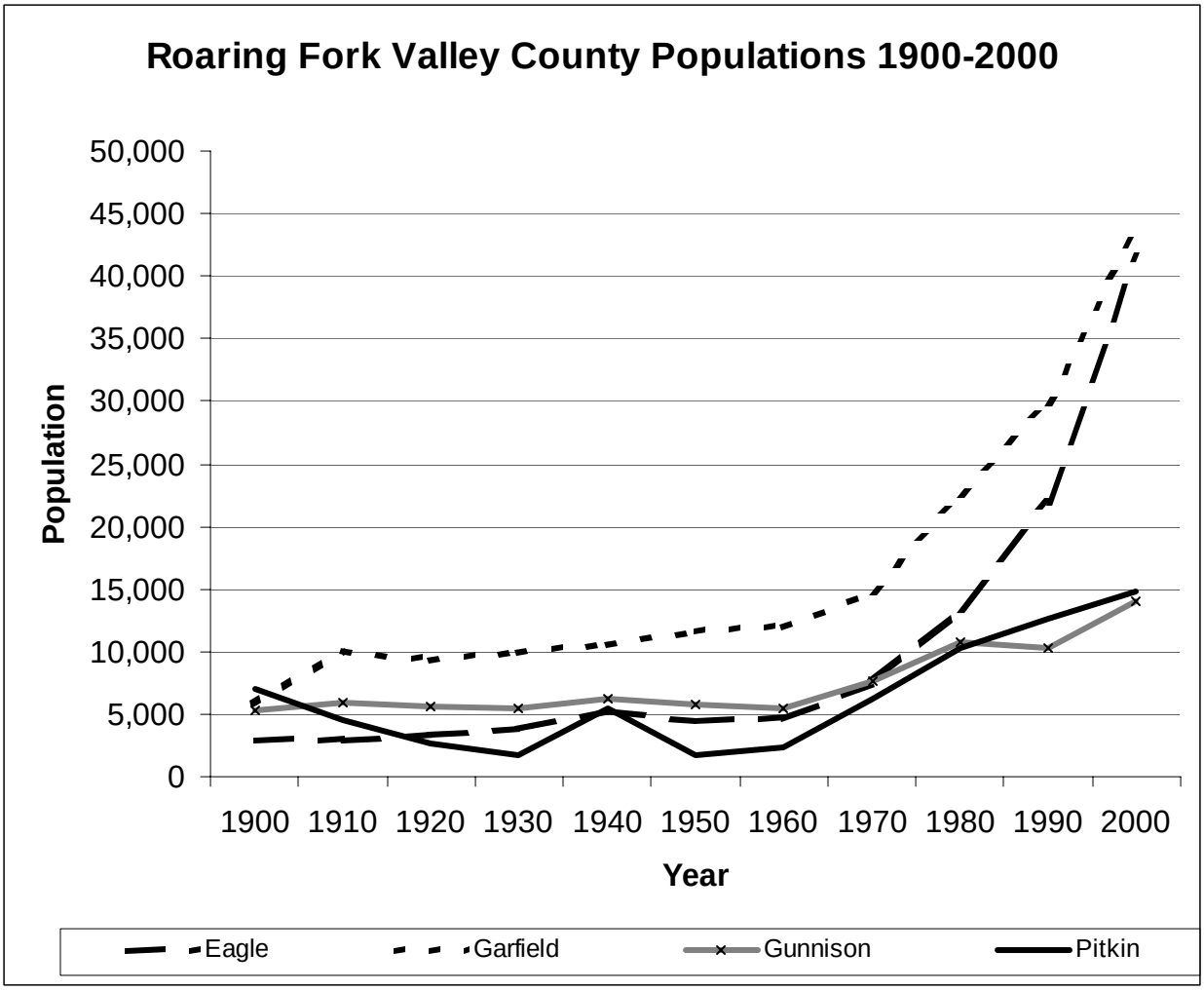
Watershed Population (2000): **36,873 (estimate)**[45,46]
Watershed Population (1995 USGS): **31,020**
Watershed Population (1990 USGS): **28,470**[47]
Watershed population (1950): **8,223 (estimate)**[48]
Watershed population (1900): **9,771 (estimate)**

County Populations[49]

County	1900	1910	1920	1930	1940	1950
Eagle	3,008	2,985	3,385	3,924	5,361	4,488
Garfield	5,835	10,144	9,304	9,975	10,560	11,625
Gunnison	5,331	5,897	5,590	5,527	6,192	5,716
Pitkin	7,020	4,566	2,707	1,770	5,527	1,646

County	1960	1970	1980	1990	2000
Eagle	4,677	7,498	13,320	21,928	41,659
Garfield	12,017	14,821	22,514	29,974	43,791
Gunnison	5,477	7,578	10,689	10,273	13,956
Pitkin	2,381	6,185	10,338	12,661	14,872

45 U.S. Census Bureau, Colorado, *http://www.census.gov/census2000/states/co.html*
46 2000 Population Methodology: Since most of the Watershed's county lines are not based on hydrologic boundaries, determining the Watershed's population can only be done by estimate. In some cases, the county populations were multiplied by the percent of the county's land area within the Watershed. The following figures were used to determine the total population, many of which are based on U.S. Census Data for 2000[46]: Pitkin County (14,872) + Carbondale (5,196) + Glenwood Springs (7,736) + Unincorporated Garfield County (19,345)[46]x (6.2%) + Eagle County in Watershed[46] (7,410) + Gunnison County (13,956)x(3.3%).
47 U.S. Geological Survey, 1990 Water Use for Roaring Fork Watershed, http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.
48 Past watershed populations are estimated using the average rate of growth over the time period (10, 50, 100 years) and multiplying that average rate by the 2000 watershed population. This is in a sense an estimate of an estimate and should be seen as such. Methodology will be improved in future editions of this inventory.
49 U.S. Census Bureau*, http://www.census.gov/population/cencounts/co190090.txt*



County Lands within Watershed

County	Area in Watershed[50] (sq. mi.)	Area in Watershed (sq. km)	% of Watershed	Total Area for County[51] (sq. mi.)	% of County in Watershed
Pitkin	957	612,480	65.9%	970.4	98.6%
Eagle	208	133,120	14.3%	1,700.7	12.2%
Garfield	181	116,480	12.5%	2,958.2	6.2%
Gunnison	104	67,840	7.3%	3,259.2	3.3%
Total	**1,451**	**929,920**	**100.0%**		

50 Shekel, Mike, Colorado Watershed Network, GIS Mapping work. November 20, 2002.
51 Colorado Watershed Partnership, GIS Mapping Project (Version 2.0), Map Tips.

Town & City Populations and Land Area

Town/City	Population (2000 Census)	Land Area (square miles)	Percent of Watershed
Aspen	5,914	3.53	0.24%
Snowmass Village	1,822	25.57	1.76%
Basalt	2,681	1.94	0.13%
Eagle County	*1,952*	*1.11*	0.08%
Pitkin County	*729*	*0.83*	0.06%
El Jebel CDP	4,488	6.74	0.46%
Carbondale	5,196	2.01	0.14%
Marble	105	0.37	0.03%
Glenwood Springs	7,736	4.81	0.33%
Total Urban	**30,623**	**38.23**	**2.63%**
Total Watershed	**36,873**	**1,451.00**	**100.00%**

CDP = Census Designated Place

Percent Rural/Urban

	Population	Land
% Rural	17.0%	97.4 %
% Urban	83.0%	2.6%

Population Projections

County Population Projections[52,53]

Year	Pitkin	%	Eagle	%	Garfield	%	Gunnison	%
2000 (actual)	*14,872*		*41,659*		*43,791*		*13,956*	
2010	18,148	22.0	55,489	33.2	56,822	29.7	16,647	19.3
2020	21,721	19.7	69,092	24.5	72,301	27.2	19,713	18.4

Watershed Population Projections

Watershed Population (2010): 45,870 (estimate based on 24.4% increase)[54]
Watershed Population (2020): 55,594 (estimate based on 21.2% increase)

Most Populated Areas

The majority of people in the Roaring Fork Valley live in incorporated towns or cities.

52 Northwest Colorado Council of Governments, Population and Housing, *http://www.nwc.cog.co.us/MembersDemographics/PitkinCounty/pitkincty.htm*
53 Colorado Department of Local Affairs, Colorado Population Projections, *http://www.dola.colorado.gov/demog/Population/widepro2.cfm*
54 Percent population increase based on weighted average of county population projections.

These concentrations of population have historically reduced the impacts to the environment. As the Watershed is developed and the population grows, more people are building homes in areas between population centers. Ranches and farms that once filled the area between the islands of populations are now being developed as residential neighborhoods. Currently, Glenwood Springs has the highest population of valley towns, followed by Aspen and Carbondale.

Why People Live in the Watershed

People want to live in this watershed because of its natural beauty and quality of life. The valley boasts five ski areas, hundreds of miles of hiking trails and gravel roads, two stretches of Gold Medal Trout streams, and is surrounded by the White River National Forest and BLM land. Culturally the Valley boasts over 300 non-profits who provide programs in the arts, sciences, social services, environment and education.

Why People Leave the Watershed

Cost of living is the major factor for people leaving the watershed. The average price of a three bedroom, two bath single family home in Glenwood Springs is $304,000.[55] In 1998, the average home price in Aspen was $2,404,245 and in Snowmass Village was $1,239,246.[56] Although jobs are generally plentiful, seasonal turnover is high and people must commute long distances from areas of affordable housing to areas of employment.

55 Colorado Real Estate, Glenwood Springs, Colorado. *http://www.relocate-america.com/states/CO/cities/glenwood.htm.*

56 Northwest Colorado Council of Governments, Population and Housing, *http://www.nwc.cog.co.us/MembersDemographics/PitkinCounty/pitkincty.htm.*

XII. LAND & WATER USES

Roaring Fork Watershed Land Use[57]

Land Use	Acres	Square Miles	Percent
Forest/Tundra-Undeveloped	556,758.30	869.93	59.92%
Rangeland	318,686.73	497.95	34.30%
Agricultural	34,507.08	53.92	3.71%
Urban residential	6,741.73	10.53	0.73%
Rural residential	4,108.64	6.42	0.44%
Water - Lakes & Reservoirs	2,540.56	3.97	0.27%
Commercial	1,565.71	2.45	0.17%
Forestry	1,493.62	2.33	0.16%
Wetlands	1,489.67	2.33	0.16%
Mining	1,213.67	1.90	0.13%
Industrial	58.35	0.09	0.01%
Totals	**929,164.06**	**1,451.82**	**100.00%**

Public Land: 75% (National Forest, 70%; Bureau of Land Management, 5%)
Private Land: 25% (Most of the private land is located along the major streams where flooding potential is the highest)[58]

Water Use[59]

Type of use	Total Amount Used (1990) (Mgal/d)	Total Amount Used (1995) (Mgal/d)
Ground water withdrawal	4.19	3.93
Surface water withdrawal	194.50	175.20
Reclaimed wastewater	0.00	0.20
Consumptive use	46.01	34.43
Conveyance loss	55.34	50.11

57 Schlegel, Mike, Colorado Watershed Network, using GIS software, January 2003.
58 Northwest Colorado Council of Governments, Roaring Fork Watershed Management Plan, 2002.
59 U.S. Geological Survey, 1990 & 1995 Water Use for Roaring Fork Watershed, *http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.*

Wastewater Treatment[60]

	1990		1995	
Wastewater Treatment	2.26 MGD returned	0.00 MGD reclaimed	2.96 MGD returned	0.20 MGD reclaimed

MGD: Million Gallons/Day

Reservoir Evaporation[61]

	Reservoir Surface Area	1990	1995
Reservoir Evaporation	1,000 acre feet surface area	3,540 acre feet	3,530 acre feet

Water Use by Type[62]

	1990		1995	
Water Use	**Total Withdrawal** (Mgal/day)	**Total Consumptive Use** (Mgal/day)	**Total Withdrawal** (Mgal/day)	**Total Consumptive Use** (Mgal/day)
Public Supply	8.53	N/A	10.4	N/A
Commercial	0.49	0.45	0.49	0.51
Domestic	0.39	1.32	0.33	1.33
Industrial	0.10	0.03	0.01	0.04
Thermoelectric Power	0.00	0.00	0.00	0.00
Mining	0.55	0.18	0.26	0.07
Livestock	3.78	0.12	0.12	0.12
Irrigation	184.94	43.91	167.52	32.36
Hydroelectric Power	0.00	0.00	0.00	0.00

60 U.S. Geological Survey, 1990 & 1995 Water Use for Roaring Fork Watershed, *http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.*

61 U.S. Geological Survey, 1990 & 1995 Water Use for Roaring Fork Watershed, *http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.*

62 U.S. Geological Survey, 1990 & 1995 Water Use for Roaring Fork Watershed, *http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.*

Domestic Water Use[63]

	1990		1995	
Domestic Water Source	**Population**	**Per capita domestic water use**	**Population**	**Per capita domestic water use**
Self-supplied (ground, surface)	5,240	74.43 gal/day	4,360	75.69 gal/day
Public-supplied (groundwater)	11,560	169.18 gal/day	13,140	150.79 gal/day
Public-supplied (surface water)	11,670		13,520	
Totals	**28,470**		**31,020**	

Municipal Water Supplies

City of Aspen:
Maroon Creek
Castle Creek

Town of Basalt:
Basalt Springs on Basalt Mountain
Well by the Public Works Shop
Well by the Middle School

Town of Carbondale:
Nettle Creek drainage (on the North Face of Mt. Sopris, senior water rights)
Well at the Crystal Hatchery
Well east of town near the Roaring Fork River

City of Glenwood Springs:
No Name Creek
Grizzly Creek
Roaring Fork River (Emergency pump near the 7th St. Bridge)

Wastewater Treatment Plants[64]

Aspen Consolidated Sanitation District
Capacity: 3.00 MGD (million gallons per day)

63 U.S. Geological Survey, 1990 & 1995 Water Use for Roaring Fork Watershed, *http://water.usgs.gov/cgi-bin/wuhuc?huc=14010004.*
64 Northwest Colorado Council of Governments, Roaring Fork Watershed Management Plan, 2002.

Office: 565 N. Mill St., Aspen, CO 81611 (970) 925-3601
Plant: Service Center Rd., Aspen, CO 81611 (970) 925-7262

Snowmass Village Water & Sanitation District
Capacity: 1.60 MGD
Office: 0177 Club House Dr., Snowmass Village, CO 81615 (970) 923-2056

Aspen Village Wastewater Treatment Plant
Capacity: 0.051 MGD
Office: 31300 Highway 82, Snowmass Village, CO 81615 (970) 923-4337

Woody Creek Wastewater Treatment Plant
Capacity: 0.032 MGD
Office: 0125 Woody Creek Plaza, Woody Creek, CO 81656 (970) 923-1065

Lazy Glen Wastewater Treatment Plant
Capacity: 0.045 MGD
Office: 101 Lazy Glen, Snowmass, CO 81654 (970) 927-3632

Basalt Sanitation District
Capacity: 0.80 MGD
Plant: 0123 Emma Road, Basalt, CO 81621 (970) 927-3698

Sopris Village
Capacity: 0.05 MGD
Sopris Village Homeowners Association

Ranch at Roaring Fork Wastewater Treatment Plant
Capacity: 0.10 MGD
Office: 14913 Highway 82, Carbondale, CO 81623 (970) 963-3500

Mid-valley Metropolitan District
Capacity: 0.50 MGD
Office: 0031 Duroux Lane, Basalt, CO 81621 (970) 927-4077

El Jebel Mobile Home Park
Capacity: 0.14 MGD
Office: 60 El Jebel Rd, Unit 105, El Jebel, CO 81628 (970) 963-2684

Redstone Water & Sanitation Plant
Capacity: 0.05 MGD
Plant: 1091 Redstone Blvd, Redstone, CO 81623 (970) 963-2898

Carbondale Wastewater Treatment Plant
Capacity: 0.96 MGD
Plant: 0171 Highway 133, Carbondale, CO 81623 (970) 963-3140
Mailing: 511 Colorado Ave., Carbondale, CO 81623 (970) 963-2733

Aspen Glen Wastewater Treatment Plant
Capacity: 0.107 MGD
Plant: 2550 County Rd. 109, Carbondale, CO 81623 (970) 963-3059

Mountain Meadows
Capacity: 0.01 MGD
Mountain Meadows Homeowners Association

Spring Valley
Capacity: 0.499 MGD
Colorado Mountain College
Office: 3000 County Road 114, Glenwood Springs, CO 81601 (970) 945-7481

H Lazy F
Capacity: 0.04 MGD
Office: 5445 County Rd. 154, Glenwood Springs, CO 81601 (970) 945-0404

El Rocko
Capacity: 0.01 MGD
Office: El Rocko Mobile Home Park

Ski Sunlight
Capacity: 0.03 MGD
Office: 10901 117 Road, Glenwood Springs, CO 81601 (970) 945-7491

Glenwood Springs Wastewater Treatment Plant
Capacity: 2.30 MGD
Plant: 401 W. 7th St., Glenwood Springs, CO 81601 (970) 945-7685

Areas that rely on septic tanks
Most rural areas rely on individual septic tanks or leech fields.

Snowmaking[65]

Resort	Location	Source of Water	Snowmaking[66] (acres)	Water Used 2001-02 (gallons)
Aspen Mountain	Aspen	Castle & Maroon Creeks	210	49,000,000
Aspen Highlands	Aspen	Castle & Maroon Creeks	110	18,500,000
Buttermilk	Aspen	Maroon Creek	108	43,489,648
Snowmass	Snowmass Village	Snowmass Creek	160	45,000,000
Sunlight Mountain	Glenwood Springs	Fourmile Creek	21	N/A
Totals			**609**	**155,989,648**

Hydrologic Modifications

Trans-Basin Diversions (100% consumptive)[67]

Name	Stream	Annual Flow *(acre feet)*	Receiving Stream	Basin
Boustead Tunnel	Fryingpan River	50,061	Lake Fork Creek	Arkansas
Twin Lakes Tunnel (Grizzly & Lost Man Reservoirs)	Roaring Fork River	41,854	North Fork Lake Creek	Arkansas
Busk-Ivanhoe Tunnel	Fryingpan River	5,208	Lake Fork Creek	Arkansas

The West Slope Collection System, located upstream of Ruedi Reservoir in the upper Fryingpan River and Hunter Creek watersheds, is a series of 16 stream diversion structures and eight tunnels. The system collects spring snowmelt runoff for diversion, by gravity, to the inlet of the Boustead Tunnel. The Boustead Tunnel conveys water collected by the West Slope Collection System under the Continental Divide and into Turquoise Lake on the East Slope. The tunnel is five miles long and has a water conveyance capacity of 945 cubic feet per second (ft/s).[68]

65 Aspen Skiing Company, 2002 Sustainability Report, *http://www.aspensnowmass.com/environment/.*
66 Delores Publishing, Colorado Atlas and Gazetteer, 2002.
67 Northwest Colorado Council of Governments, Roaring Fork Watershed Management Plan, 2002.
68 U.S. Bureau of Reclamation, Annual Operating Plan Fryingpan-Arkansas Project Water Year 2000 Operations,

Transbasin Diversions

Eight percent of the water in the Watershed is currently diverted to the Eastern Slope (eastern side of the Continental Divide, to the Arkansas River Basin and Eastern Slope cities including Pueblo) through tunnels such as the 5.4 mile long Boustead Tunnel. For more information on transbasin diversions, visit the website: *http://www.secwcd.org/collection.htm*.

In-Basin (10-50% consumptive)

Name	Stream	Purpose
Ruedi Reservoir	Fryingpan River	Storage/Recreation
Wildcat Reservoir	Wildcat Creek	Residential Water Use
Chapman Reservoir	Fryingpan River	Recreation
Spring Park Reservoir		Residential Water Use
Hughes Reservoir	Threemile Creek	
Hopkins Reservoir	Landis Creek	
Consolidated Reservoir	West Coulter Creek	
Van Springs Reservoir	East Coulter Creek	

Ruedi Dam/Reservoir Statistics[69]

Type: Earth and rock fill
Location: On the Fryingpan River about 15 miles east of Basalt, Colorado
Construction period: 1964 - 1968
Ruedi Reservoir: Total capacity to Elevation 7766:102,369 acre feet
Surface area: 997 acres
Height above streambed: 285 feet
Top width: 30 feet
Maximum base width: 1,453 feet
Crest Length: 1,042 feet
Crest Elevation: 7788.0 feet
Total volume (embankment): 3,745,200 cubic yards of soil

69 *http://www.gp.usbr.gov/aop/fa/00/2000operations.htm*

XIII. WATER QUALITY/QUANTITY CONCERNS

Water Quality Classifications[70]

#	Stream Segment	Classification	Physical/ Biological	Inorganic mg/l		Metals ug/l		
1	All tributaries to the Roaring Fork system including all lakes and reservoirs, within the Maroon Bells/Snowmass and the Hunter/Fryingpan **Wilderness Areas**		No Degradation Allowed	No Degradation Allowed		No Degradation Allowed		
2	Mainstem of the **Roaring Fork**, including all tributaries, lakes and reservoirs from source to a point immediately below confluence with Hunter Creek, except those tributaries included in Segment 1	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
3	Mainstem of the **Roaring Fork**, including tributaries below confluence with Hunter Creek, to confluence with Colorado River except for those tributaries included in Segment 1 and in Segments 4 through 10	Aq Life Cold 2 Recreation 2 Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
4	Mainstem of **Brush Creek** from the source to confluence with Roaring Fork River	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05	As(ac)=100(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=1000(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=TVS Ag(ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)

70 Colorado Department of Public Health and Environment Classifications and numeric standards for Upper Colorado River Basin and North Platte River (planning region 12) p.8: Denver Water Quality Control Commission, Denver, Colorado, 1999. 70 pgs.

5	Mainstem of the **Fryingpan River** from source to confluence with North Fork	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
6	Mainstem of the **Fryingpan River** from confluence with North Fork to confluence with Roaring Fork, including Ruedi Reservoir	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
7	All tributaries to **Fryingpan River** system, including lakes and reservoirs, except for those tributaries in Segment 1	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
8	Mainstem of **Crystal River**, including all tributaries, from source to confluence with Roaring Fork, except for specific listings in Segments 9 and 10	Aq Life Cold 1 Recreation 1 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-200/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
9	Mainstem of **Coal Creek** including all tributaries from source to confluence with the Crystal River	Aq Life Cold 1 Recreation 2 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-2000/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)
10	Mainstem of **North Thompson Creek**, including all tributaries from the source to the confluence with the Crystal River	Aq Life Cold 1 Recreation 2 Water Supply Agriculture	DO=6.0 mg/l DO (sp)=7.0 mg/l pH=6.5-9.0 F.Coli-2000/100ml	NH_3(ac)=TVS NH_3(ch)=0.02 Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=250	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=300(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=50(dis) Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ch)=10(Trec) Ag(ch)=TVS U(ac/ch)=TVS Zn(ac/ch)=TVS Eff. 3-2-98 Ag(ch)=TVS(tr)

DO: Dissolved Oxygen; ac: acute, ch: chronic, TVS: Table Value Standards, dis: dissolved, tot: total, Trec: Total Recoverable Fraction, tr: trout[71]

71 Personal Communication: Bill McKee, Colorado Department of Public Health and the Environment, February 6, 2003.

Point Source Discharges[72]

Source	Effected Area	Pollutants
Anshultz Coal Mine	North Thompson Creek-Crystal River Basin	Dissolved solids High iron concentrations
Mid-Continent Resources Coal Mine	Coal Creek Basin- Crystal River Basin	Excessive metals Excessive suspended sediment concentrations
Waste Water Treatment Plants (See Section XII)	Various	Nutrients Organic Enrichment Thermal Alterations

Non-point Source Discharges

Activities and Associated Pollutants[73]

Category	Nutrients	pH	Sediment	Organic Enrichment	Pathogens	Toxic Organics	Toxic Metals	Oil & Grease	Salts (TDS)	Hydrologic Alterations	Thermal Alterations	Pesticides
Agriculture	x	x	x	x	x		x	x				x
Construction			x		x	x		x	x	x	x	
Urban Land	x		x	x	x	x	x	x	x	x	x	x
Land Disposal	x	x	x	x	x	x	x	x	x	x	x	x
Hydrologic Modification	x	x	x	x						x	x	
Other Sources	x	x	x	x	x	x	x	x	x			x

72 Northwest Colorado Council of Governments, Roaring Fork Watershed Management Plan, 2002.

73 Matrix Design Group, Handbook: Urban Runoff Pollution Prevention and Control Planning, 1993 Town of Basalt Stormwater Evaluation & Recommendations Report of the Watershed Improvement and Education Project, 2001.

Urban Runoff Pollutants[74]

Constituents	Sources	Effects
Sediments- Total Suspended Solids, Turbidity, Dissolved Solids	Construction sites Urban/agricultural runoff Landfills Septic Fields	Habitat changes, stream turbidity, recreation and aesthetic loss, contaminant transport, bank erosion
Nutrients-Nitrate, Nitrite, Ammonia, Organic Nitrogen, Phosphate, Total Phosphorus	Lawn/agricultural runoff Landfills Septic fields Atmospheric deposition Erosion Carried within sediments	Algae blooms, nitrate toxicity, changes in aquatic species composition, ammonia toxicity
Pathogens-Total and Fecal Coliform, Fecal Streptococci Viruses, E. Coli, Enteroccus	Urban/Agricultural Runoff Landfills septic systems	Dissolved oxygen depletion, odors, fish kills
Organic Enrichment-BOD, COD, TOC and DO	Urban/Agricultural Runoff Pesticides/Herbicides Underground storage tanks Hazardous Waste Sites Landfills Illegal disposals Industrial discharges	Toxicity to humans and aquatic life, bioaccumulation in the food chain
Salts-sodium chloride	Urban runoff snowmelt	Contamination of drinking water, harmful to salt intolerant plants

74 Matrix Design Group, Handbook: Urban Runoff Pollution Prevention and Control Planning, 1993, Town of Basalt Stormwater Evaluation & Recommendations Report of the Watershed Improvement and Education Project, 2001

River Watch[75]

The Colorado Division of Wildlife (CDOW) has developed an exciting and far-reaching program that involves volunteers in protecting the quality of Colorado rivers. Called "Rivers of Colorado Water Watch Network", or "River Watch", the program links environmental protection with education in a meaningful, hands-on project for Colorado residents. Participants currently are made up of middle and high school students, their teachers, watershed management groups and stakeholders.

The program began in 1990 with 19 schools along the Arkansas, Eagle, and Yampah rivers. Presently, 140 groups are actively monitoring water quality within all eight major watersheds in Colorado. River Watch is sponsored by CDOW and administrated through a non-profit organization entitled Colorado Watershed Network (CWN). CWN provides staff to train volunteers, analyze samples, and provide administrative expertise.

Collected data is used by federal, state, and local agencies to assist in decision-making regarding river/water management. As an example, the Colorado Department of Health and Public Environment utilized data collected from Clear Creek in hearings to re-classify water-quality standards for the stream.

River Watch Parameters[76]

River Watch schools and organizations test for the following parameters:

pH is measured on a scale from 0 (acidic) to 14 (alkaline); seven being neutral, and is the measure of the hydrogen (H+) concentration within the water. pH determines what organisms can live in the water because it influences the blood's ability to hold oxygen. Most cold-water organisms, such as trout, mayfly and stonefly nymphs, and caddisfly larvae, can only live in water that has a pH range of 6.5 to 9. This range represents the State standard.

Hardness measures the sum of calcium and magnesium ions in the water and is expressed as $CaCO_3$. Hardness usually ranges from 1-500 mg/L in rivers and streams. There is no State standard for hardness; however, hardness values are used to calculate many metals' standards. Hard water is usually alkaline and well buffered. Soft water will have a value less than 75 mg/L $CaCO_3$, moderate to hard water is 75-120 mg/L $CaCO_3$, hard water is 120-200 mg/L $CaCO_3$, very hard water is more than 200 mg/L $CaCO_3$.

Alkalinity measures the acid neutralizing capacity of water, or its ability to resist

75 Colorado Division of Wildlife, RiverWatch Program, *http://wildlife.state.co.us/riverwatch/About/about_river_watch.htm*

76 Weiner, Eugene R. Applications of Environmental Chemistry. 2000.

changes in pH concentration when either acid (H+) or base (OH-) is added to the water. Highly alkaline systems are able to neutralize acid without large changes in pH. In natural waters that are not highly polluted, alkalinity is more commonly found than acidity.

Temperature determines how much oxygen can dissolve in the water and thus affects the ability of different organisms to survive. The State standard is a maximum of 20 degrees Celsius.

Dissolved Oxygen is the form in which oxygen is available to organisms in the river. Oxygen becomes dissolved in surface waters by diffusion from the atmosphere and from aquatic plant photosynthesis. The State regulated minimum for aquatic cold systems is 6 mg/L, with a 7mg/L level during trout spawning. The colder water is the more dissolved oxygen it can hold. When dissolved oxygen is above 8.0 mg/L in a body of water the water quality is considered good, 6.5-8.0 mg/L indicates slightly polluted, 4.5-6.5 mg/L indicates moderately polluted, 4.0-4.5 mg/L indicates heavy pollution and severely polluted water will have a level of dissolved oxygen below 4.0 mg/L.

Metals are usually found in trace amounts in surface waters. The concentrations are so small that they are measured in units of micrograms per liter (ug/L) or parts per billion (ppb). Metals in these trace amounts are required by all life forms to carry out normal cellular functions (e.g. iron, copper, zinc). Total metals represent a form of metals that are bound up and not available to aquatic life, creating a potentially harmful environment, while dissolved metals refer to metals whose molecules have been broken apart within the aquatic environment. Excess amounts of dissolved metals (e.g. lead and cadmium) are toxic to aquatic organisms.

Flow is measured as the volume of water moving in a stream or river. Flow is measured in cubic feet per second, or cfs. The concentration (or dilution) of any parameter discussed above is influenced by amount of flow.

Nutrients

Sulfate is sulfur combined with oxygen. Sulfur can combine with metals and lower the pH of the river, making the pH level too low for living organisms.

Chlorine transforms into chloride in water. High concentrations of chlorine make it difficult for aquatic insects and fish to regulate the balance of ions in their cells.

Total Suspended Solids are the mineral materials (e.g. sediment, other examples) that are suspended in the water column. Too many solids in a river can clog or abrade the gills on fish and insects and cover spawning beds.

Nitrogen is necessary for all forms of life. However, plants and animals cannot use nitrogen in its' natural, gaseous form. The Nitrogen cycle occurs to change atmospheric nitrogen into usable forms such as ammonia (NH_3), nitrite (NO_2) and nitrate (NO_3). In these forms, plants and animals can obtain nitrogen as it is found in the soil and air. Fish excrete ammonia as waste, as too much ammonia in a fish's bloodstream causes brain damage. However, an excess of ammonia in the water would inhibit fish to excrete their own ammonia. If the pH in the water is 9.4 or greater, NH_3 will turn into NH_4, or ammonium, which is toxic to fish. High concentrations of nitrite and nitrate in the water cause oxidation of the iron molecule in hemoglobin. Oxidized hemoglobin cannot carry oxygen; in human infants this condition is known as "blue baby syndrome."

Phosphorous is essential for plants and animals. It is the major limiting element in water for algal growth. Higher levels of phosphorous in the water cause increases in algae growth or eutrophication, which reduces dissolved oxygen concentrations.

Macroinvertebrates are biological indicators of a stream's health. The type, quantity, and diversity of macroinvertebrate species provide an indirect way to assess the water quality of the river. For example, caddis fly, mayfly, and stonefly species are sensitive to a number of stream conditions, including pH level and dissolved oxygen, and are associated with good levels of water quality. Species such as cranefly and blackfly can tolerate greater ranges and levels of such parameters and therefore tend to indicate a degraded stream environment. The absence of more sensitive species, such as caddis flies and stoneflies also indicates a degraded stream environment.

River Watch Station Locations[77]

#	Stream	Location	Monitoring Group
769	Roaring Fork River	Difficult CG	Roaring Fork Conservancy
770	Roaring Fork River	Mill St. Bridge	Aspen Stream Team
68	Roaring Fork River	Slaughterhouse Br.	Aspen High School
771	Brush Creek	Brush Creek	Aspen Skiing Co. Stream Team
71	Roaring Fork River	Gerbaz Bridge	Roaring Fork Conservancy
773	Capitol Creek	Capitol Creek	Snowmass Stream Team
774	Snowmass Creek	Snowmass Creek	Snowmass Stream Team
72	Roaring Fork River	7-11 Bridge	Basalt High School
776	Fryingpan River	Meredith	Roaring Fork Conservancy
733	Fryingpan River	Baetis Bridge	Roaring Fork Conservancy
73	Fryingpan River	Upper Basalt Bridge	Basalt High School
778	Sopris Creek	Sopris Creek	Basalt Stream Team
779	Roaring Fork River	Emma	Alpine Christian Academy
780	Roaring Fork River	Ranch at Roaring Fork	Carbondale Stream Team
735	Crystal River	Genter Mine Bridge	Roaring Fork Conservancy
736	Crystal River	Redstone	Redstone Stream Team
782	Coal Creek	Coal Creek Rec.	Roaring Fork Conservancy
75	Crystal River	Fish Hatchery	Carbondale Middle School
783	Crystal River	Coryell Ranch	Roaring Fork Conservancy
781	Cattle Creek	Cattle Creek	Colorado Mountain College
784	Roaring Fork River	Sanders Ranch	Roaring Fork Conservancy
785	Four-mile Creek	Four-mile Creek	Colorado Mountain College
786	Roaring Fork River	Park East	Glenwood Springs Stream Team
45	Roaring Fork River	7th Street Bridge	Glenwood Springs High School

As of January 1, 2003

77 Roaring Fork Conservancy, State of the Rivers Report, Roaring Fork Watershed: 2000, 2001.

XIV. ORGANIZATION & AGENCY CONTACTS

Local Agencies

Basalt Water Conservancy District
Dan Kerst, Attorney
302 8th Street
Glenwood Springs, CO 81601
Phone: (970) 945-2447

Ruedi Water and Power Authority
Mark Fuller, Director
238 Fawn Court
Carbondale, CO 81623
Phone: (970) 963-4959
www.rwapa.org

State Agencies

Department of Natural Resources

Colorado Division of Wildlife
Glenwood Springs Office
50633 Highways 6 & 24
Glenwood Springs, CO 81601
Phone: (970) 947-2920
http://wildlife.state.co.us

Colorado Water Conservation Board
1313 Sherman St. Room 721
Denver, CO 80203
Phone: (303) 866-3441
Fax: (303) 866-4474
http://www.cwcb.state.co.us/

Division of Water Resources
Colorado River Basin
Water Division 5
50633 US Hwy 6 & 24
P.O. Box 396
Glenwood Springs, CO 81601
Phone: (970) 945-5665
http://water.state.co.us/

Colorado Department of Public Health and Environment

Water Quality Control Commission
4300 Cherry Creek Drive South
Denver, CO 80246-1530
Phone: (303) 692-3469
Fax: (303) 691-7702
http://www.cdphe.state.co.us/op/wqcc/wqcchom.asp

Colorado Department of Public Health and Environment
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, CO 80246-1530
Phone: (303) 692-3500
http://www.cdphe.state.co.us/wq/wqhom.asp

Federal Agencies

U.S. Army Corps of Engineers
Western Colorado Office
402 Rood Avenue, Room 142
Grand Junction, CO 81501-2563
Phone: (970) 243-1199
Fax: (970) 241-2358
http://www.usace.army.mil

U.S. Bureau of Land Management
Glenwood Springs Field Office
50629 Highways 6 & 24
P.O. Box 1009
Glenwood Springs, CO 81602
Phone: (970) 947-2800
Fax: (970) 947-2829
http://www.co.blm.gov

U.S. Bureau of Reclamation
Western Colorado Area Office
PO Box 60340
2764 Compass Drive
Grand Junction, CO 81506
Phone: (970) 248-0690
Fax: (970) 248-0601
http://www.usbr.gov

U.S. Fish and Wildlife Service
134 Union Boulevard
Lakewood, CO 80228
Phone: (303) 236-7917
http://mountain-prairie.fws.gov/

U.S. Forest Service
White River National Forest
9th & Grand Ave.
P.O. Box 948
Glenwood Springs, CO 81602
http://www.fs.fed.us/r2/whiteriver/
Phone: (970) 945-2521
Fax: (970) 945-3266

Aspen Ranger District
806 West Hallam
Aspen, CO 81611
Phone: (970) 925-3445
Fax: (970) 925-5277

Sopris Ranger District
620 Main Street
PO Box 309
Carbondale, CO 81623
Phone: (970) 963-2266
Fax: (970) 963-1012

Natural Resources Conservation Service
P.O. Box 1302
401 23rd St. Suite 106
Glenwood Springs, CO 81602
Phone: (970) 945-5494 x. 101
http://www.nrcs.usda.gov/

Colorado Division of Minerals & Geology
Grand Junction Office
101 South 3rd Street, Suite 301
Grand Junction, CO 81501
(970) 247-5523
http://www.mining.state.co.us

U.S. Environmental Protection Agency
Region 8 Office
999 18th St., Suite 300
Denver, CO 80202-2466
Phone: (303) 312-6312
Toll-Free: (800) 227-8917
http://www.epa.gov/region8/

U.S. Geologic Survey
Western Slope Subdistrict
764 Horizon Drive
Grand Junction, CO 81506
Phone: (970) 245-5257
http://www.usgs.gov

Water Commissioners

Bill Blakeslee
District 38 Water Commissioner
Division 5 Water Resources
Phone: (970) 945-5665
Pager: (970) 945-1750
Brian Epstein

District 38 Water Commissioner
Division 5 Water Resources
Phone: (970) 945-5665
(Area includes: Roaring Fork Watershed above Emma including Fryingpan and Roaring Fork Rivers and tributaries)

Water Court[78]

Hon. Thomas W. Ossola
Water Judge
Suite 104
Garfield County Courthouse
109 8th Street
Glenwood Springs, CO 81601-3303
Phone: (970) 945-5075

Daniel B. Petre
Water Referee
Garfield County Courthouse
Suite 104
109 8th Street
Glenwood Springs, CO 81601-3303
Phone: (970) 947-3860

Peggy Jordan
Water Clerk
Garfield County Courthouse
Suite 104
109 8th Street
Glenwood Springs, CO 81601-3303
Phone: (970) 945-5075

78 Water Colorado LLC, Water Division 5, *http://www.watercolorado.com/div5c.cfm.*

Elected Officials[79]

As of September 25, 2007

Governor

Governor August William 'Bill' Ritter (Democrat)
Lt. Governor Barbara O'Brien (Democrat)

U.S. Senate

Senator Wayne A. Allard - U.S. Senate Senior Seat (Republican)
Senator Ken Salazar - U.S. Senate Junior Seat (Democrat)

U.S. House

District 2 - Representative Mark E. Udall (Democrat)
District 3 - Representative John T. Salazar (Democrat)

Colorado Senate & House of Representatives

Representative Kathleen E. Curry - State House District 61 (Democrat)
Senator Gail S. Schwartz - State Senate District 5 (Democrat)
Senator Jack Taylor - State Senate District 8 (Republican)

Non-Profit Organizations*

Colorado Watershed Network
Jacob Bornstein, Executive Director
810-A Union St.
Golden, CO 80401
(303) 291-7437
www.coloradowatershed.org

Colorado River Water Conservation District
P.O. Box 1120
Glenwood Springs, CO 81602
(970) 945-8522
www.crwcd.gov

Colorado Watershed Assembly
Jeff Crane, Executive Director
29163 Gulch Road
Hotchkiss, CO 81419
970-872-2433
www.coloradowater.org

Northwest Colorado Council of Governments
P.O. Box 2308
Silverthorne, CO 80498
(970) 468-0295
www.nwc.cog.co.us

*For a complete list of partnering organizations see www.roaringfork.org**.**

79 Vote Smart, *http://www.vote-smart.org/index.phtml.*

XV. APPENDIX

A. Stream Order

In any major watershed:
88% of streams are Order 1 to 3
10% of streams are Order 4 to 6
2% of streams are Order 7 to 12

B. River Miles

River Miles in Colorado: 170,000
River Miles in U.S.: 3,692,830
Miles Assessed in 2000: 699,946 (39% did not meet water quality standards)

C. Statistics for Colorado[80]

Colorado's allotment of Colorado River water: 3.86 million acre-feet
Percentage of allocation that is developed: 56 percent
Colorado population served by Colorado River water: 2.3 million (80 percent from transbasin diversions)
Irrigated acres in Colorado served by Colorado River water: 1.9 million
Major Colorado crops under irrigation: Hay, alfalfa, grains, vegetables, and fruit
Percentage contribution of Colorado River water to meeting state's needs: 35 percent
Watershed area in square miles in Colorado: 38,542 (37 percent of state)
Precipitation in Colorado watershed: 7" to 58" a year
Federal lands in Colorado portion of Colorado River Basin: 23.5 million acres (35 percent of state)
National Forests in Colorado portion of Colorado River Basin: 11
National Parks & Monuments in Colorado portion of Colorado River Basin: 11

Although less than 20 percent of the land area of the Colorado River Basin lies within Colorado, 70 to 75 percent of the river's total flow originates within the state.

D. Conversions

Velocity
1 mph = 1.4767 ft/s = 0.447 m/s
1 ft/s = 0.6818 mph = 1.097 km/hr
Volume
1 cubic foot = 7.48 gallons
1 acre foot (af) = 43,560 cubic feet (cf) = 325,872 gallons

80 Colorado River Water Users Association, *http://www.crwua.org/co/crwua_co.htm*

Discharge

1 million gallons/day (MGD) = 1.547 cfs

1 cfs = 0.0283 m^3/s

1 cfs/day= 1.98 acre feet