draft wild and scenic river study
draft environmental statement

february 1979

COLORADO AND LOWER DOLORES RIVERS

COLORADO / UTAH

This report was prepared pursuant to Public Law 90-542, the National Wild and Scenic Rivers Act. Publication of the findings herein should not be construed as representing either the approval or disapproval of the Secretary of the Interior. This report provides information for further consideration by the National Park Service, the Secretary of the Interior, other Federal and State agencies, and the public.

The Heritage Conservation and Recreation Service (formerly the Bureau of Outdoor Recreation) conducted the field investigations for this study and drafted an initial report and environmental statement. Following reassignment in July of 1978, the National Park Service completed the study, prepared the graphics, finalized, and printed this document.

United States Department of the Interior / National Park Service

United States Department of the Interior

DRAFT WILD AND SCENIC RIVER STUDY
and
DRAFT ENVIRONMENTAL STATEMENT

COLORADO AND LOWER DOLORES
WILD AND SCENIC RIVERS

Prepared by
National Park Service
Denver Service Center

in cooperation with

The Colorado Department of Natural Resources
and
The Utah Department of Natural Resources

Regional Director
Rocky Mountain Region

FEB 5 1979

C O N T E N T S

DRAFT WILD AND SCENIC RIVER STUDY

SUMMARY OF FINDINGS AND RECOMMENDATIONS

FINDINGS

1. The Colorado River from the Loma launch site, 20.7 miles (33.3 km) upstream from the Colorado-Utah border, downstream to its confluence with the Dolores River in Utah is eligible for inclusion in the National Wild and Scenic River System. This 55.7-mile (88.8-km) portion of the river contains outstandingly remarkable scenic, geologic, cultural, recreational, and fish and wildlife values.

2. The Dolores River from Gateway, Colorado, downstream 31 miles (49.9 km) to its confluence with the Colorado River in Utah is eligible for inclusion in the National Wild and Scenic River System and possesses outstandingly remarkable scenic, geologic, recreational, and wildlife values.

3. The lower 11-mile (17.7 km) reach of the Dolores qualifies for the system as a scenic river area, on the basis of geologic, wildlife, and recreational values. This reach, however, lacks the scenic value of the upper 20 miles, in which the most outstanding values are concentrated. It is almost completely covered by mining claims and contains one operating mine. The principal reserves are uranium and vanadium ore.

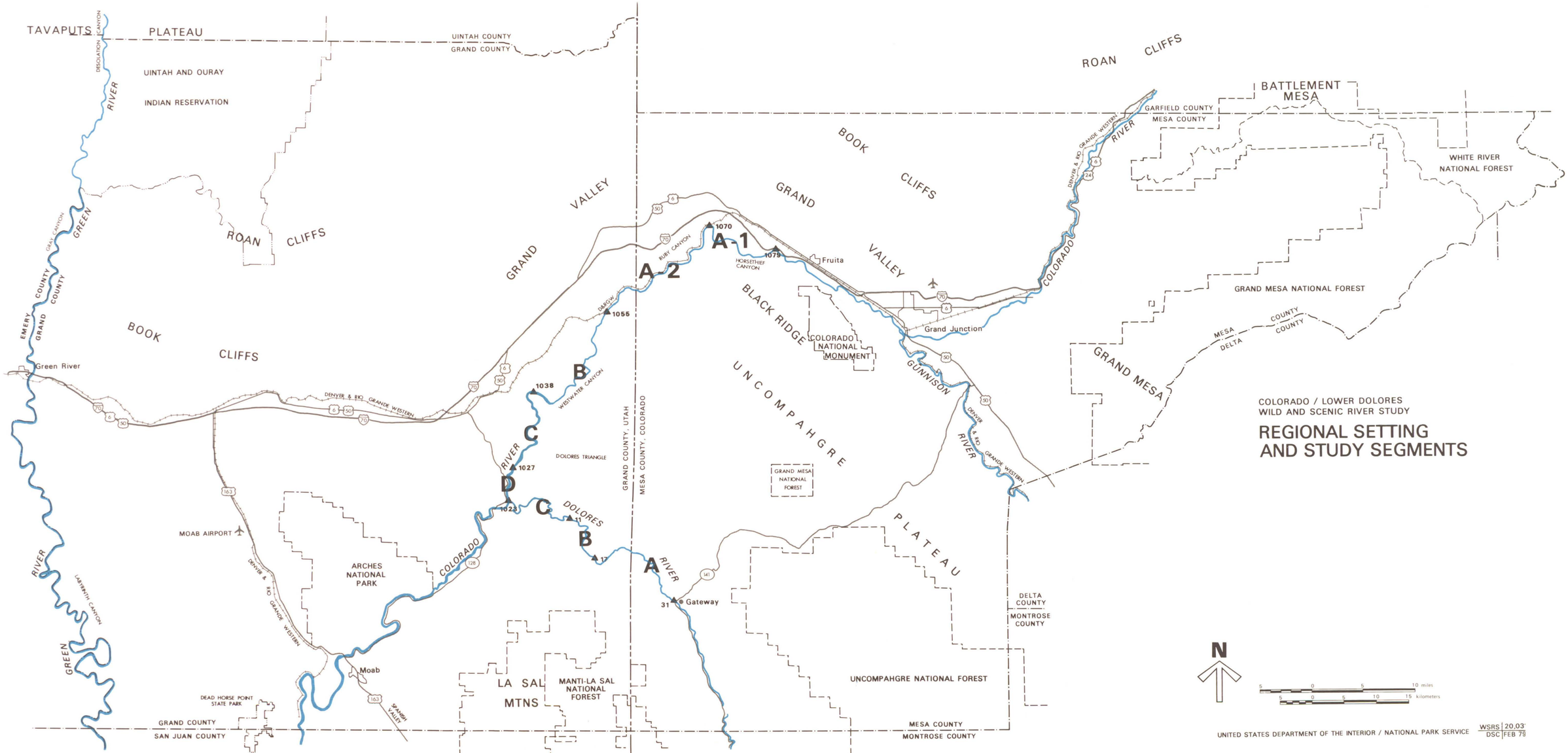
   Some members of the study team felt that designating this reach would serve to unify the segments of the Colorado and Dolores recommended below and provide a greater degree of protection for the natural values of the river corridor. But the combination of marginal scenic values, intrusions, and potential mineral extraction, makes the area qualify more appropriately for multiple use management by the Bureau of Land Management.

4. The Principles and Standards analysis revealed that designating these rivers would protect their outstanding values while making substantial contributions to the regional economy.

RECOMMENDATIONS

1. The Colorado River study segments, including about 25,000 acres (10,100 ha) of associated lands in a corridor averaging approximately 0.35 miles (0.6 km) in width on each shore, should be designated a component of the National Wild and Scenic River System, with the following classification levels:
   (a) Loma Launch to Westwater Canyon (river mile 1,079.2 to river mile 1,051.5), 27.2 miles (43.8 km)--------Scenic
   (b) Westwater Canyon to Rose Ranch (river mile 1,051.5 to river mile 1,038.5), 13 miles (20.9 km)----------Wild
   (c) Rose Ranch to Cisco Wash (river mile 1,038.5 to river mile 1,027.5), 11 miles (17.7 km)----------Scenic
   (d) Cisco Wash to Dolores River (river mile 1,027.5 to river mile 1,023.5), 4 miles (6.4 km)----------Recreational

2. The Dolores River from Gateway to Bridge Canyon, including about 8,000 acres (3,240 ha) of associated lands in a corridor averaging approximately 0.3 miles (0.5 km) in width on each shore, should be designated a component of the National Wild and Scenic River System, with the following classification levels:
   (a) Gateway, Colorado, to Fisher Creek (river mile 31 to river mile 17), 14 miles (22.5 km)----------Scenic
   (b) Fisher Creek to Bridge Canyon (river mile 17 to river mile 11), 6 miles (9.7 km)----------Wild
   (c) Bridge Canyon to Colorado River (river mile 11 to river mile 0), 11 miles (17.7 km)----------No designation



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

REGIONAL SETTING AND STUDY SEGMENTS

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,03
DSC | FEB 79

3. The Bureau of Land Management, which at present administers the rivers, should continue to do so after designation. The management plans for the rivers should be prepared by the BLM in cooperation with the states of Colorado and Utah, with the general goals of preserving existing land uses, protecting the outstanding values which have made the rivers eligible for the system, and encouraging the amounts and types of recreation that will not degrade these values. The plan for the Dolores should include the lower 11 miles (17.7 km) even though the segment is not recommended for designation.

4. The lower 11-mile (17.7 km) segment of the Dolores River should be managed to protect its natural and recreational values and to ensure the continuation of a desirable river-boating experience.

5. Approximately 5,350 acres (2,160 ha) of private land along the Colorado River and 920 acres (370 ha) along the Dolores should be preserved in their present natural or pastoral state. This should be accomplished, if possible, by the present landowners. A notice requirement should be instituted for landowners to inform the Bureau of Land Management of plans for any major changes in land use, so that the agency can determine whether the planned change would degrade the rivers' values. If it were found that the change in land use would degrade the rivers' values, a one-year negotiation period should ensue. During this period an attempt would be made to agree on land use changes acceptable to the landowner that would not degrade the outstanding values of the area. If no agreement on an acceptable land use change could be reached, the Bureau of Land Management would purchase a scenic easement on the lands involved.

ESTIMATED COSTS

If the 55.7-mile (89-km) segment of the Colorado and the 20-mile (32.2 km) segment of the Dolores are included in the national system, the following costs are estimated:

Scenic Easements (Maximum easement purchase on all private lands in the corridor if BLM exercises its right to condemn easements in order to forestall developments threatening the rivers' values) - - - - - - -	$2,508,000
Land Acquisition in Fee- - - - - - - - - - - - -	0
Recreational Developments- - - - - - - - - - - -	49,000
Additional Annual Operations and Maintenance- -	3,500

CHAPTER I
INTRODUCTION

BACKGROUND

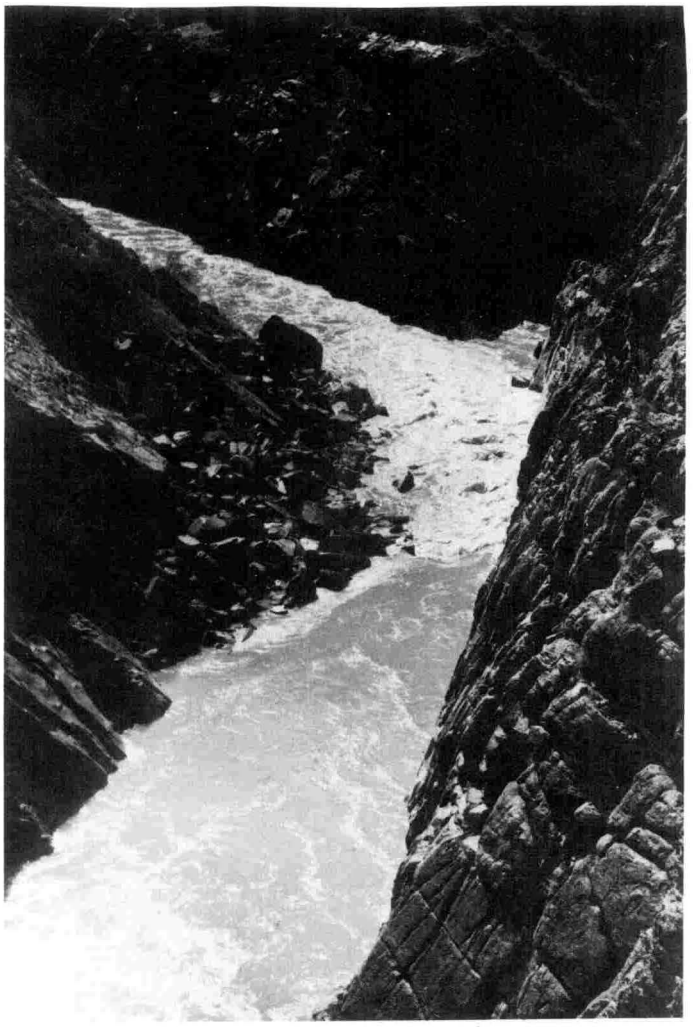
The Wild and Scenic Rivers Act, P. L. 90-542, became law on October 2, 1968. It preserves "certain selected rivers" that "possess outstandingly remakable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values . . . in their free-flowing condition . . . for the benefit and enjoyment of present and future generations."

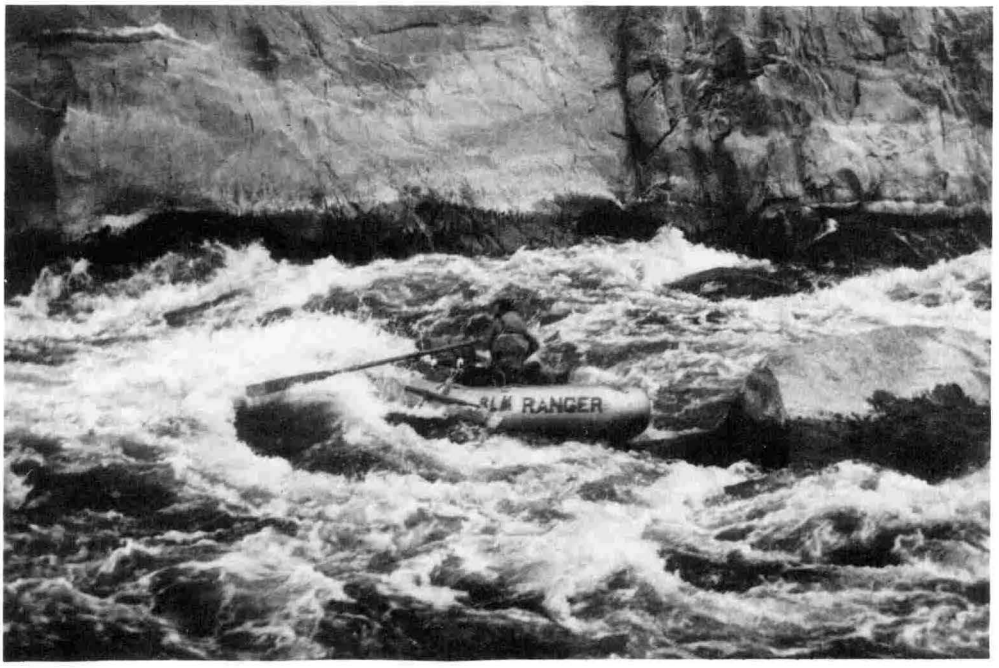
The Act named eight rivers as initial components of the National Wild and Scenic Rivers System. Twenty-seven others were listed as potential additions, and a procedure was framed for assessing their eligibility. The Act defines three possible classifications for eligible rivers: wild, scenic, and recreational; these are predicated on the degree of development in the corridor. It deals with such matters as land acquisition, right and use of occupancy, water resource developments, mining and administration as they affect components of the system.

Since October 1968 there have been six amendments to the Wild and Scenic Rivers Act. As of January 1979 there were 28 rivers or river segments in the National Wild and Scenic Rivers System, 20 of which have been added since passage of the Act. Amendments have also designated 45 additional rivers for study, of which 29 were included by the amendment of January 3, 1975 (P.L. 93-621).

One of the 29 new "study rivers" was "(34) Colorado, Colorado and Utah: The segment from its confluence with the Dolores River, Utah, upstream to a point 19.5 miles (31.2 km) from the Utah-Colorado border in Colorado."

Skull Rapid – Westwater Canyon NPS





The terminus 19.5 miles (31.2 km) above the border was apparently not related either to recreational use, private land, or physiography, so the study team extended the boundary of the area upstream approximately 1.2 miles (2 km) to a more logical area, the Loma boat ramp--the staging area for most river trips on this part of the Colorado. Thus the area of the Colorado River which was studied was 55.7 miles (89.1 km) long.

This same amendment required the study of the Dolores River in Colorado, during 1975. The Departments of the Interior and Agriculture and the State of Colorado jointly recommended in that study that a 105-mile (168 km) segment of the Dolores from the McPhee Damsite to 1 mile (1.6 km) above Bedrock, Colorado, be included in the National Wild and Scenic River System. In addition, the State of Colorado recommended an additional 35 miles (56 km) of the West Dolores. The report noted that "the 8-mile portion of the river between Gateway and the Utah State Line should be included in the national system at such time as the river in Utah is included."[1]

55.7
+ 31
86.7

On November 12, 1976, Governor Rampton of Utah requested the Secretary of the Interior to study that portion of the Dolores River in Utah. Governor Lamm of Colorado supported this extension of the study. The Assistant Secretary of the Interior agreed to this request on December 17, 1976. Consequently, an evaluation of the 31-mile (49.6 km) segment of the Dolores River that runs from Gateway, Colorado, down to the confluence with the Colorado River in Utah is included in this report.

---

1. Dolores River Wild and Scenic River Study Report, Colorado Department of Natural Resources, U.S. Departments of Agriculture and the Interior. (March, 1976). See also Final Environmental Statement, Dolores River, FES 76-56 (November, 1976).

THE STUDY

In June 1976, a joint federal-state team was formed to carry out the Colorado River study. Three agencies shared leadership responsibilities; the Bureau of Outdoor Recreation,[2] the Colorado Department of Natural Resources (represented by the Colorado Water Conservation Board), and the Utah Department of Natural Resources (represented by the Utah Outdoor Recreation Agency). In addition, the Bureau of Land Management, which is the primary land managing agency along the segments of the Colorado and Dolores Rivers under study, was also included on the study team. Many other federal and state agencies actively participated in the study, including the U.S. Fish and Wildlife Service, Bureau of Reclamation, National Park Service, Soil Conservation Service, Energy Research and Development Administration, as well as the fish and wildlife agencies and historical societies of both states. Other federal and state agencies were consulted as needed during the study.

The study proceeded as follows:

Gathering Data

The study team used existing data sources to full advantage. A substantial amount of information concerning the Colorado and Dolores Rivers was included in various reports available to the study team. In addition, data were also provided by various federal and state agencies, consultants, interested groups, and individuals.

---

2. The Bureau of Outdoor Recreation, reorganized as the Heritage Conservation and Recreation Service, transferred the study to the National Park Service on July 5, 1978.

To gain first-hand knowledge of the rivers, the study participants inspected them on foot, by raft, by motor vehicle, and from the air. Basic information gathered on the Colorado and Dolores Rivers is presented in chapters II and III.

Determining Suitability for the System

When information on the two rivers had been amassed, the rivers were evaluated to determine their suitability for the national system. The Wild and Scenic Rivers Act specifies the basic criteria for determining whether a river is eligible for the system. These criteria have been supplemented by the Secretaries of the Interior and Agriculture in a joint document entitled "Guidelines for Evaluating Wild, Scenic and Recreational River Areas Proposed for Inclusion in the National Wild and Scenic Rivers System under Section 2, Public Law 90-542 (February, 1970)."

A four-step process for determining suitability was used:

1) the river segments were evaluated to see if they were eligible for the system;

2) the eligible segments were divided into units on the bases of length, similar physical characteristics, and similar levels of shoreline development;

3) the most restrictive classification (wild, scenic, or recreational) for which each unit qualifies was determined; and

4) all inputs from the public, including information obtained at the public meetings, in letters, and in workshop responses, were carefully evaluated. This information was utilized by the study team to review its suitability determinations and to check for errors and oversights.

The results of this process are presented in chapter IV.

Alternatives

An additional study requirement was imposed by the adoption of "Principles and Standards for Planning Water and Related Land Resources," which was published in the Federal Register, Vol. 38, No. 184, Part III (September 10, 1973). Basically, this process requires formulation of alternative plans based on a national economic development objective and an environmental quality objective. A recommended plan must have net economic benefits, except when the deficiency in net benefits results from benefits foregone or additional costs incurred to serve the environmental quality objective. In other words, a plan with no net economic benefit can be recommended if it has overriding long-term environmental benefits. This process also requires assessment of the effects that the various plans have on regional development and social well being. An outline of this procedure is included in appendix E and the results are presented in chapter XI.

Public Response

Public comment on the study was gathered at two series of public meetings, held in Utah at Moab and Salt Lake City; in Colorado at Grand Junction and Denver. Public involvement packets were submitted to the team after these meetings. Those living close to the rivers, particularly those attending the meeting in Moab, expressed concern about the effect designating the rivers would have on private land in the river corridor, and on uranium mining. They felt there was already enough federal control of the rivers, and in general were opposed to designation.

Those living further from the rivers were mostly familiar with their recreational and natural values. These people--generally non-commercial river runners, outfitters, conservationists, and environmentalists--supported the designation of both rivers to the national system at the classification levels for which they now qualify. These opinions, expressed verbally in three of the meetings, also appeared in the public opinion packets returned to the team, which overwhelmingly favored protection of the outstanding values of the two rivers.

Conclusions and Recommendations

The final step was to evaluate the data, public response, and selection criteria. The findings and recommendations summarized at the beginning of the report and presented in detail in chapter V are the results of this evaluation.

CHAPTER II
REGIONAL DESCRIPTION

PHYSIOGRAPHY AND GEOMORPHOLOGY

The regional setting described in this report is Mesa County, Colorado and Grand County, Utah. These two counties abut one another at the Colorado-Utah border, and by the standards of most of the rest of the United States, are very large--Mesa County contains 3,334 square miles (864,000 ha) and Grand County 3,697 square miles (958,000 ha), for a total area of 7,031 square miles (1,822,000 ha). Rhode Island contains 1,214 square miles (314,500 ha) so the two-county region through which the Colorado and Dolores flow is about 6 times as large as that state. The area lies about 200 miles (320 km) southeast of Salt Lake, and 250 miles west of Denver.

Not only are the two counties very large, but they are relatively empty, and offer impressions not available in most of the rest of the US. In most of the canyon country, starlight is bright enough to follow a trail by and moonlight sometimes is bright enough both to read and to elicit faint colors from the surroundings. In the still desert night it is possible to hear a train at a distance of 20 miles (32 km). Traveling major US highways in the canyon country can be a minor adventure; late at night it may be 70-100 miles (120-160 km) between open gas stations. In the day, in mid-summer, heat can be fierce, and kills some every year who do not have the gallon (4 liters) of water per day that it takes to survive, even in the shade. By air or by car the area can easily be crossed on the traveler's own terms, if the cooling system functions and he does not break down on the four-wheel drive roads in the back country. By river, or especially by foot, the area is crossed only by adopting the techniques of its denizens; the hiker learns to

hoard water like a cactus, shade up like an antelope jackrabbit, or travel at night like a kit fox. Some of the side canyons still contain unknown ruins and burials, untouched by the desert air for 800 years. Rare plants, even unknown plants may still exist high on the sheer walls of unexplored side canyons. Soils are thin and vegetation, except in the highest areas, is sparse; the bare rock with its thousands of colored shapes and contortions, elegant and harsh, subtle and brilliant, is the dominant element.

The two counties lie mostly in the Canyonlands section of the Plateau Province of the western U.S., a 130,000 square mile (33.7 million ha) area where vast areas of exposed rock lie flat or nearly so. But it should not be thought that because the rocks are flat, relief is. The Roan Plateau and Book Cliffs, which bound the counties to the north, overtop the Colorado River nearly 3,400 feet (1040 m) in eastern Mesa County. A ridge and mountain range form the southern physiographic boundary of the two counties. The ridge is the Uncampahgre Plateau in Colorado; which, at about 9,500 feet (2,910 m), lifts nearly 5,000 feet (1,500 m) above the Dolores. The range is the La Sal Mountains in Utah, a laccolith which, with an elevation of over 13,000 feet (3,960 m), is almost 9,000 feet (2,750 m) above the Colorado River.

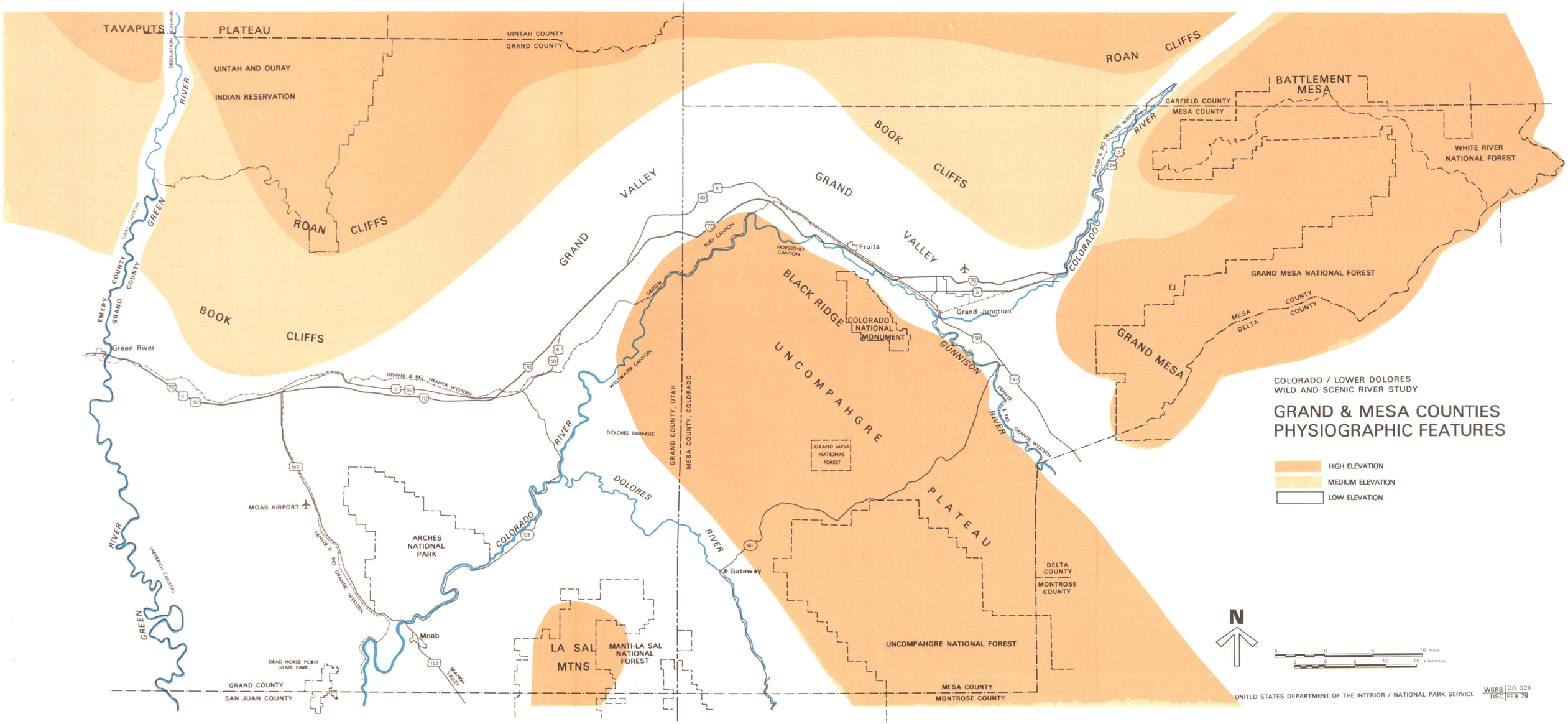
On the east, the two-county region is bounded by Grand and Battlement Mesas; a caprock of Tertiary Lavas has armored the shale oil bearing sediments of the Green River Formation and allowed them to retain an elevation of 10,000-11,000 feet (3,000-3,350 m). To the west the deepening canyons of the Green River (Desolation, Gray, and Labyrinth) bound the region.

Barring the local disturbances of the La Sals and the Uncompahgre Plateau, the rocks of the area slope gradually to the north. Thus each resistant layer caps a plateau which runs many miles to the

north, to the point at which it submerges beneath another capped plateau which towers thousands of feet above it. These giant steps, which run from northern Arizona to northern Utah, are deeply dissected by the four major rivers shown in the Physiographic Features Map. Where, as on Grand and Battlement Mesas in Colorado, these plateaus attain great elevation, they are forested by aspen, subalpine fir, and Engelmann spruce. Where their elevation is not so great, they have ponderosa pine, pinyon, and juniper, as is the case with the Tavaputs Plateau (also called the Roan Plateau in Colorado) through which Desolation and Gray Canyons are cut by the Green River.

The Uncompahgre Plateau and the Sierra La Sal, which disturb these even layers, are two of the most interesting structural features of the region. The Plateau, which trends from the southeast to the northwest about 50 miles (80 km), is a combination of a horst and anticline. The borders of the Plateau are faults, but where the overlying strata are still present, these are covered by monoclinal flexures. The Plateau was first upraised about 300 million years ago. When the ancestral plateau's uplift ceased and it had been eroded, the upper Mesozoic layers were deposited over it, by a succession of rivers, winds, seas, and beaches, burying it thousands of feet. Renewed uplift about the time of the Laramide Orogeny (ca. 70 million years ago) domed those upper layers and attracted the assault of wind and water. The erosional agencies then stripped away many of the layers, revealing the sloping redrocks in which are cut the monoliths and striking canyons of Colorado National Monument and the study segment. Associated with this uplifted block are paralleling synclines to the southwest, so the area near the Plateau is corrugated on an enormous scale.

The Sierra La Sal (La Sal Mountains) have an igneous origin. Infiltrating magma threaded through the Paleozoic sediments lying near what is now Moab. Finding a zone of weakness, the molten



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

GRAND & MESA COUNTIES PHYSIOGRAPHIC FEATURES

HIGH ELEVATION
MEDIUM ELEVATION
LOW ELEVATION

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
WSRS 20,023
DSC FEB 79

rock spread, raising the upper layers into a massive blister. The millions of years since have removed the sedimentary cap and revealed the igneous core; around the margins of these mountains the redrocks slope steeply up toward the heart of the range. Associated with the development of this range is the formation of Spanish Valley, a rift valley in which Moab, Utah, is located.

The region is crossed by four great exogenous streams, the Colorado, Gunnison, Green, and Dolores. These streams are mostly sunken inaccessibly below the surface of the surrounding lands: their canyons can be 2,000 feet (610 m) deep. They and their mostly ephermeral tributaries have deeply dissected the plateaus, breaking them up into canyons, gullies, mesas, outliers, and buttes. The major rivers formed their courses in softer, now vanished, rocks far higher in the geologic column, which now are being re-compacted into new rock in the Gulf of California. These rivers maintained the smoothly meandering courses created in the softer rock when they encountered the underlying bedrock in which their canyons are now cut. The patterns of the deep tributary canyons that join these entrenched meanders sometimes resemble the venation of leaves or the branching of trees. Some parts of the area, seen from the air or the overlooks at the southern tips of the successive plateaus, could be said to resemble a topographic map printed on red paper with red inks: the varying resistance of the different layers to the attack of cloudbursts and their resulting flash floods, combined with the even bedding planes, leave contour-like ledges that are obscured in wetter parts of the country.

One particularly striking geomorphic event took place quite recently, in geologic terms. This was the capture of the ancestral Colorado and Gunnison Rivers. Although geologists differ on the details, it is apparent that one or both of these rivers once flowed across the top of the Uncompahgre Plateau, through a vast gorge

now called Unaweep Canyon. The hard rocks on the top of the Plateau confined the river(s) to a course which flowed south to the vicinity of Gateway, Colorado (the start of the study segment of the Dolores) from which point the river flowed west to the vicinity of Dewey Bridge.

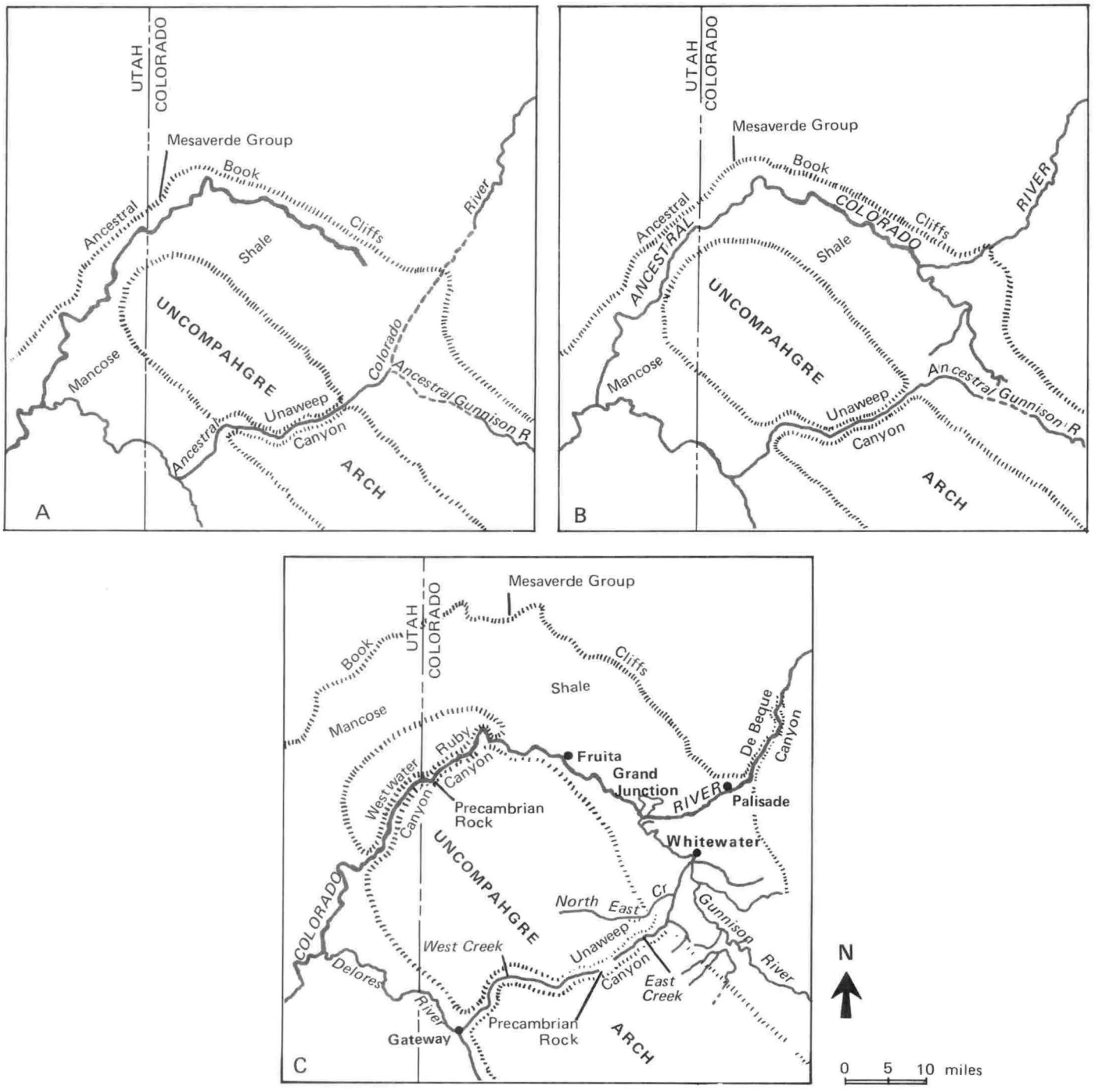
Softer rock, probably the Mancos Shale, which lies far higher in the geologic column, allowed a tributary to work around the western end of the Uncompahgre Plateau, capturing the rivers near the vicinity of Grand Junction and diverting them into their present course through the study area, abandoning Unaweep Canyon to the small, misfit streams of East and West Creeks. This capture, displayed in the drawing of the Piracy of the Colorado and Gunnison Rivers, may have taken place as recently as two million years ago.[1] Once it was completed, the rivers attacked their new bed, lowering it until the rocks of the study segment were exposed.

The sequence of the rocks in the two-county region displays not merely striking color, but striking fullness. Rocks ranging in age from the 1.8 billion years of the Uncompahgre Complex, exposed in the heart of Westwater Canyon, to the Tertiary lava flows of about 30 million years ago, whose armor has kept the Grand Mesa from dwindling, are displayed. Rocks from all eras are represented, in a

---

1. S. W. Lohman, in Geology and Artesian Water Supply of the Grand Junction Area, Colorado (USGS Professional Paper 451, 1965) assigns the capture to Pliocene time, 12-2 million years ago; Charles B. Hunt, in "The Geologic History of the Colorado River" (in The Colorado River and John Wesley Powell, USGS Professional Paper 669, 1969) argues for early Pleistocene time, about 2-3 million years ago. Either date is strikingly recent compared both to the great age of the rocks in the area, and the depth to which the river has cut them in the time since the capture took place.

PIRACY OF THE GUNNISON AND COLORADO RIVERS



Maps of a part of western Colorado and eastern Utah showing probable drainage pattern and topographic features at three successive stages of development. Solid drainage lines taken from Moab and Grand Junction, Utah-Colorado, topographic maps of the Army Map Service; dashed drainage lines are hypothetical. A, just prior to piracy of ancestral Colorado River; B, after piracy of ancestral Colorado River and just prior to piracy of ancestral Gunnison River; C, present drainage pattern, after renewed uplift of the Uncompahgre arch and piracy of East Creek.

SOURCE: After S.W. Lohman, Geology and Artesian Water Supply of the Grand Junction Area, Colorado, USGS Professional Paper 451 (1965).

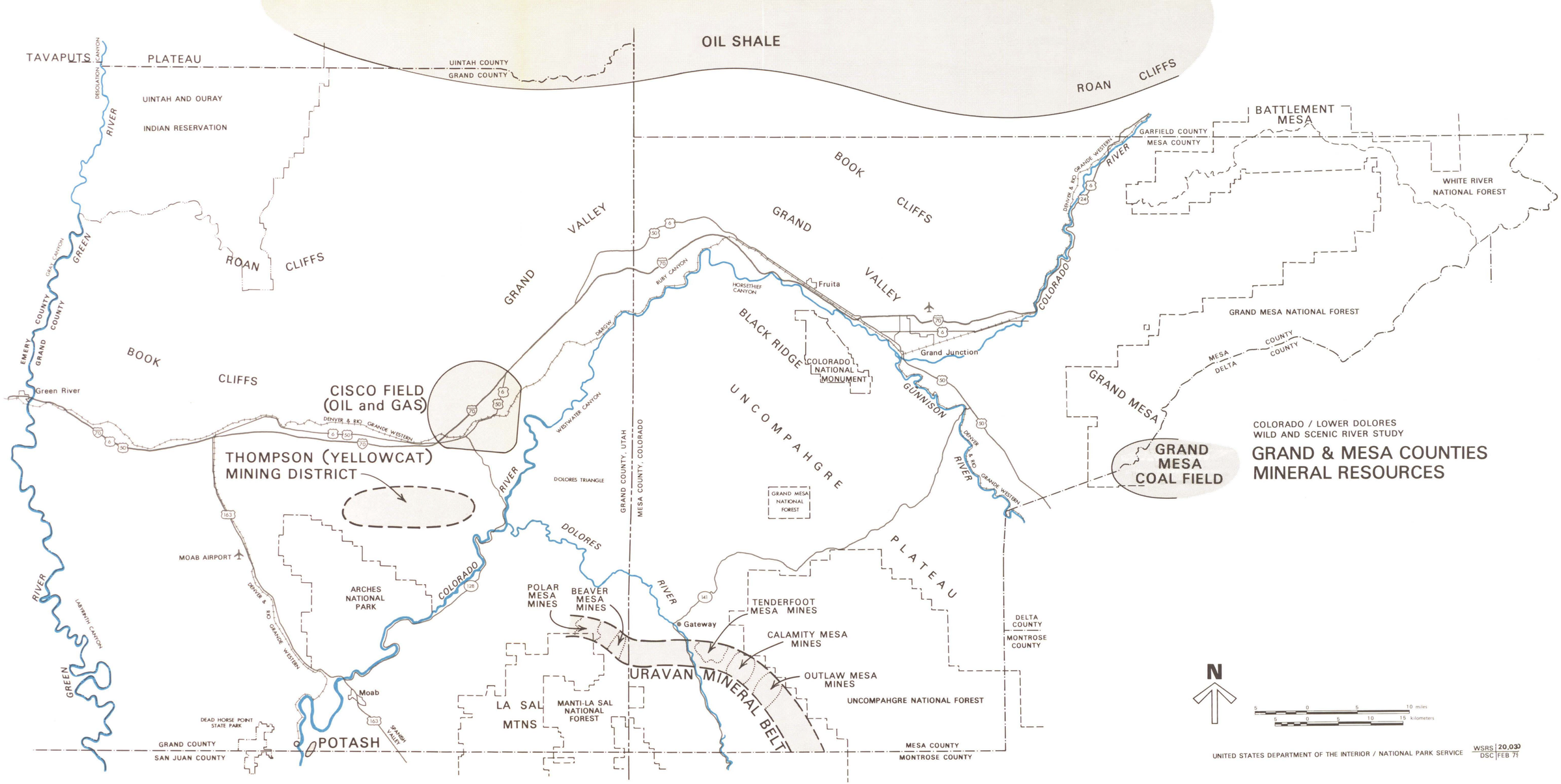
thickness of about 3 miles which overlays the Precambrian. The alternating sandstones, shales, and conglomerates of the Mesozoic system are of particular note for the scenery they cause, and for the uranium and dinosaur fossils of the Morrison Formation.

MINERALS

While detailed information on minerals and energy resources is provided in the corridor description, the Green River Formation is of region-wide interest. It is the source of shale oil: sections of the rock, particularly from the rich strip called Mahogany Ledge, will burn in a campfire. This formation makes up the Roan and Tavaputs Plateaus, forming the northern margin of the two-county region. It contains about 600 billion barrels of high-yield deposits (25 to 100 gallons per ton) and some 1,200 billion barrels in lower grade shale (15 to 20 gallons per ton). Development of the lake sediments and their oil is slated to take place north of the region described in this report, in the Piceance basin, although Grand Junction will probably serve as an important service center for the boom.

There are significant deposits of uranium and vanadium ore in Mesa County, Colorado, and Grand County, Utah, in the Salt Wash Member of the Jurassic Morrison Formation. The Mineral Resources Map shows the location of mineral and energy resources in the region.

By 1975, 396 properties in the two counties had produced 16,235,000 pounds (7,380,000 kg) of uranium oxide--2.82 percent of the total national uranium production. Energy Research and Development Administration records for 2,696,630 tons (2,451,500 metric tons) mined in the same period indicated an average grade of 0.93 percent V_2O_5 and a production of ore of 51,662,730 pounds


OIL SHALE
TAVAPUTS PLATEAU
UINTAH AND OURAY INDIAN RESERVATION
UINTAH COUNTY
GRAND COUNTY
ROAN CLIFFS
BATTLEMENT MESA
GARFIELD COUNTY
MESA COUNTY
WHITE RIVER NATIONAL FOREST
BOOK CLIFFS
GRAND VALLEY
GRAND MESA NATIONAL FOREST
MESA COUNTY
DELTA COUNTY
GRAND MESA
Fruita
Grand Junction
COLORADO NATIONAL MONUMENT
BLACK RIDGE
UNCOMPAHGRE
GRAND MESA NATIONAL FOREST
UNCOMPAHGRE NATIONAL FOREST
PLATEAU
DELTA COUNTY
MONTROSE COUNTY
EMERY COUNTY
GRAND COUNTY
Green River
CISCO FIELD (OIL and GAS)
THOMPSON (YELLOWCAT) MINING DISTRICT
DOLORES TRIANGLE
GRAND COUNTY, UTAH
MESA COUNTY, COLORADO
MOAB AIRPORT
ARCHES NATIONAL PARK
POLAR MESA MINES
BEAVER MESA MINES
TENDERFOOT MESA MINES
CALAMITY MESA MINES
OUTLAW MESA MINES
URAVAN MINERAL BELT
Gateway
LA SAL MTNS
MANTI-LA SAL NATIONAL FOREST
Moab
POTASH
DEAD HORSE POINT STATE PARK
GRAND COUNTY
SAN JUAN COUNTY
MESA COUNTY
MONTROSE COUNTY
GRAND MESA COAL FIELD
COLORADO / LOWER DOLORES WILD AND SCENIC RIVER STUDY
GRAND & MESA COUNTIES MINERAL RESOURCES
N
5 0 5 10 miles
5 0 5 10 15 kilometers
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
WSRS | 20,030
DSC | FEB 75

(23,483,060 kg) of vanadium oxide. The Gateway district has been the most productive, accounting for 80 percent of the uranium and 82 percent of the vanadium that has been produced.

Known ore reserves carried by ERDA for the two counties, as of January 1, 1976, are 1,504,300 tons (1,367,000 metric tons) with 3,333,800 pounds (1,515,000 kg) of uranium oxide. Vanadium ore has been calculated at 1,411,500 tons (1,283,000 metric tons) which contain 13,608,145 pounds (6,185,500 kg) V_2O_5. These reserves are in the $30/pound forward production cost category.

ERDA estimates of potential uranium resources in the $30/pound forward production category that occur within the two-county area are:

Class	Pounds (kg) V_2O_5	Area
Probable	36,000,000 (16,360,000)	Gateway, Thompson, and Green River
Possible	36,600,000 (16,636,000	Gateway, Moab, and Thompson

The Grand Mesa is estimated to have 1,569 million tons (1,426 million metric tons) of coal in the Paonia shale member of the Mesa Verde Sandstone. Most of the mining is in Delta County, rather than in the region.

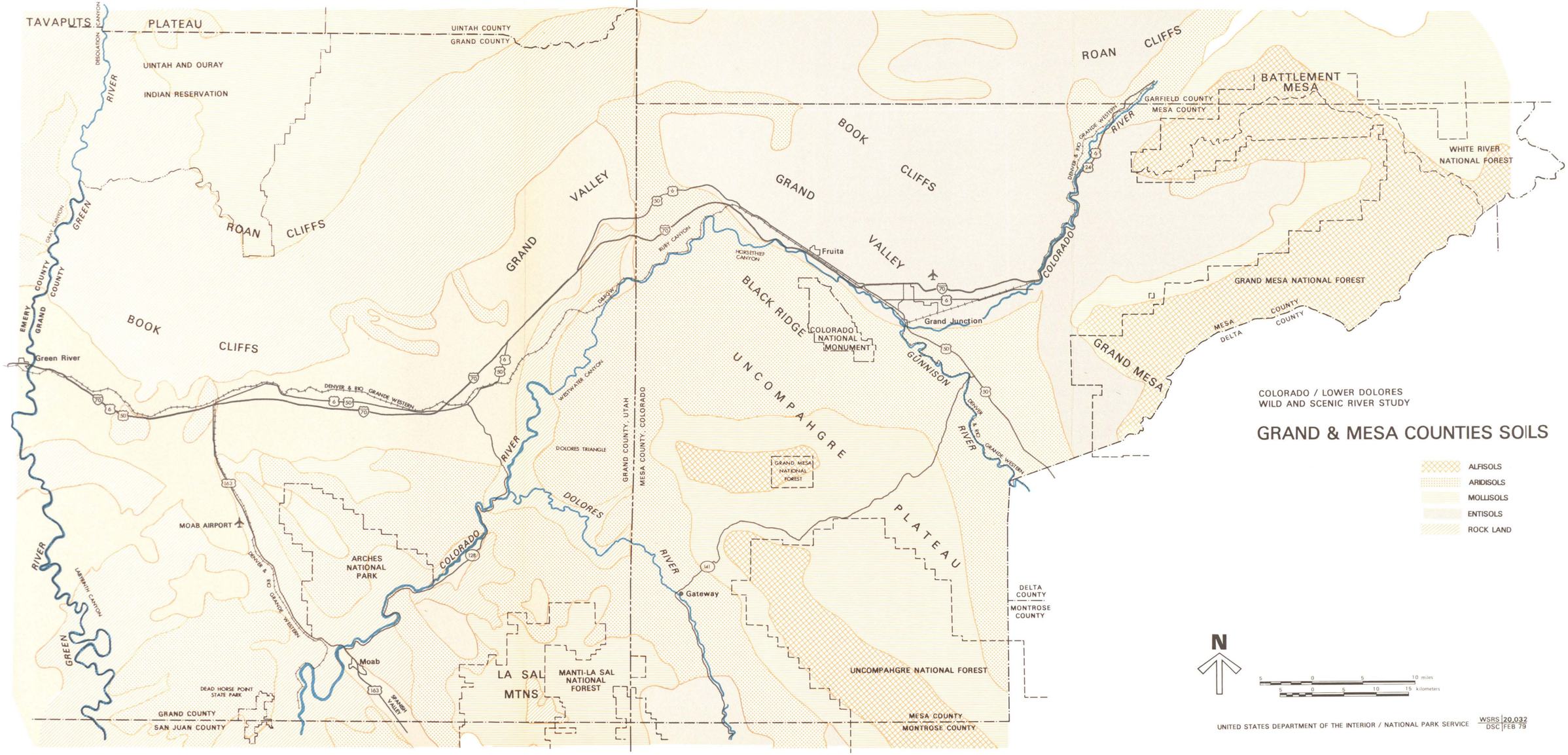
SOILS

Soil associations from four of the ten soil orders in the world are found in Grand and Mesa Counties, as shown in the Soils Map. Both counties share the Aridisols, Mollisols, and Entisols, but Mesa County also has an Alfisol association--a Typic Cryoboralf found high on the sides and top of Grand Mesa. Grand County has large

KEY - SOILS MAP MESA COUNTY COLORADO & GRAND COUNTY UTAH

MAP UNIT	SOIL TYPE	REFERENCE & REFERENCE UNIT NUMBER *	COMPOSITION GREAT GROUP OR SUBGROUP	ELEVATION	MEAN ANNUAL TEMPERATURE (F°)	MEAN ANNUAL PRECIPITATION IN INCHES	DOMINENT PARENT MATERIAL	SLOPE (PERCENT)	MAJOR LAND USE
1	ALFISOLS	Colo. 1	Typic Cryoboralfs, skeletal- Rock Outcrop	7,500-11,000	35-45	20-40	CRYSTALLINE & SEDIMENTARY ROCK	5-65	RANGE,TIMBER, WILDLIFE, RECREATION, WATERSHED
2	ARIDISOLS	Colo. 6,10,12,18,20 Utah 41,55	Typic Haplargids, Ustollic Haplargids, Ustollic Natrargids, Typic Calciorthids, Lithic Ustollic Calciorthids	4,000-6,000	47-59	8-15	SHALE, SANDSTONE, ALLUVIUM	0-30	RANGE,WILDLIFE, SOME IRRIGATED CROPS
3	MOLLISOLS	Colo. 52,56,57,58 Utah 1,5,6,17	Typic Argiborolls, Aridic Argiborolls, Typic Cryoborolls, Argic Cryoborolls, PETROCALCIC CALCIBOROLLS	6,000-11,000	38-45	15-30	SHALE, SANDSTONE, METAMORPHIC ROCK	2-50	RANGE,WILDLIFE, TIMBER & WATER PRODUCTION, RECREATION
4	ENTISOLS	Colo. 28,30,33,42 Utah 51,52,63	TYPIC TORRIFLUVENTS, USTIC TORRIFLUVENTS, TYPIC TORRIORTHENTS, LITHIC USTIC TORRIORTHENTS, AQUIC XEROFLUVENTS, BADLANDS	4,000-7,500	47-59	6-15	SHALE, SANDSTONE, ALLUVIUM	0-45	RANGE,WILDLIFE, RECREATION, SOME IRRIGATED FARMING
5	ROCK LAND	Utah 68,69,70	BADLANDS, CANYON ROCKLAND, ROCKLAND OF THE HIGH MOUNTAINS	3,600-8,000 11,000-13,000	not available	6-12; over 30	SHALE, SANDSTONE, IGNEOUS ROCK	0-100	RECREATION, RANGE,WILDLIFE, RECREATION & WATER PRODUCTION

* The reference is either SOILS OF COLORADO State University Experiment Station and U.S. Soil Conservation Service; or SOILS OF UTAH (Wilson and others and U.S. Soil Conservation Service). The Reference Unit Number is the number applied on the respective state maps to given soil associations; these have been combined to make the map units on the attached map.



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

GRAND & MESA COUNTIES SOILS

- ALFISOLS
- ARIDISOLS
- MOLLISOLS
- ENTISOLS
- ROCK LAND

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,032
DSC | FEB 79

Northwest view near the beginning of Segment C, Colorado River, shows saline soils developed on the distant Mancos Shale. Book cliffs and Tavaputs Plateau in the distance. BLM

areas of Rockland and Rockland-badland land types which are not as common in Mesa County. This distinctive "soil" association is 50-75 percent bare rock, with shallow, poorly developed soils making up the remaining percentage. These rockland associations are of two types--those developed at high altitudes in the Sierra La Sal, with crags, talus slopes, and small pockets of tundra vegetation nurtured by shallow, cold soils. The other type, which helps to give the area its distinctive character, is the rockland association of the redrock country, where large areas of land are rock with small patches of soil. These soils, which support pinyon, juniper, and cactus, are extremely erodible; they melt off the land in a heavy rain, particularly when the crustose lichens which partly armor them have been disturbed.

The soils on the Mancos Shale, which was deposited in a shallow Cretaceous sea, though moderately fertile when irrigated, are saline and subject to quick erosion; their characteristic pale yellow and gray badlands are easily recognized. Contact with bedrock is made at 5-20 feet. This rock type and the soils developed on it are the area's largest diffuse contributor of salinity to the Colorado River system.

The two counties have a total of 5 aridisol soil associations. These dry mineral soils, found in areas of 4,500 to 7,500 feet, support greasewood and big sagebrush at lower elevations, pinyon and juniper at higher. Irrigation near Grand Junction produces alfalfa, orchards, and vegetables from this unit; where unirrigated, these soil associations provide winter range for wildlife.

The two counties have five entisols. These torriorthents, torrifluvents, and one association of Aquic Xerofluvents - Aquic Ustifluvents receive little precipitation (10-15 inches per year) and where not irrigated are used for winter range by wildlife, rangeland by cattle, and recreation. Substantial parts of some of

these associations are bedrock, and where the soils are deep, alkalinity can be a problem.

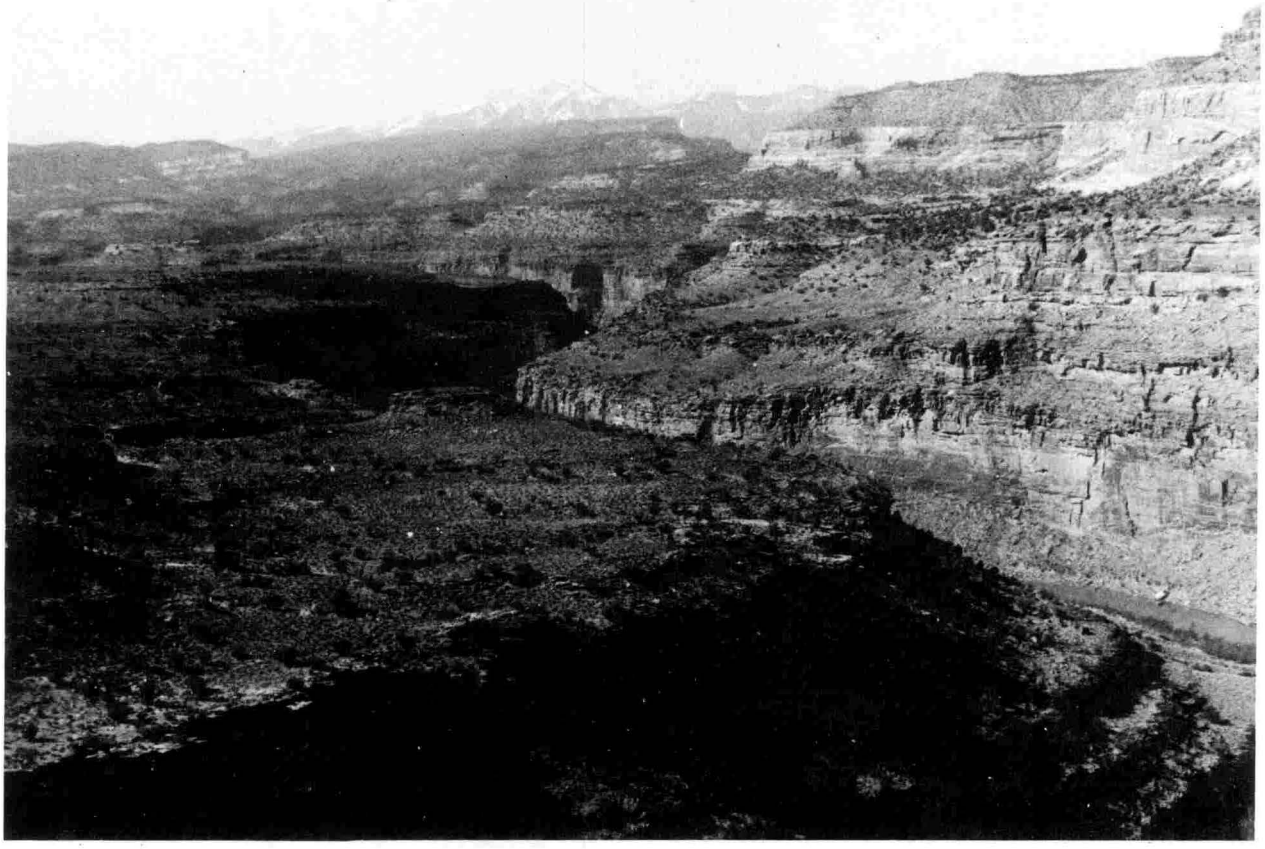
Grand and Mesa Counties contain 5 borolls; the presence of clay at lower elevations names the argiborolls; cool summer soil temperatures are found in the high-altitude cryoborolls. These soils are forested with aspen, spruce, fir, and lodgepole pine in the high country, and with Douglas-fir, oakbrush, sage, and grasses in the lower areas. Range wildlife, timber, and water production are the main uses of these soil associations.

CLIMATE

Most of the two county area lies in a rain shadow caused by mountain ranges to the east, west, and north; precipitation is thus relatively low--about 6 inches (15 cm) a year in Moab and the desert north of that city, and about 8 inches (20 cm) a year in Grand Junction. Only where high elevations are available to drain the clouds does precipitation approach the levels of most of the eastern U.S. Thus the 9,000 feet (2,750 m) of elevation between the canyon of the Colorado River south of Moab, and the peaks of the La Sals, offers an even gradation between a moist Arctic climate and an arid desert--to travel from Grand Mesa to the Colorado River is a climatic journey from northern Canada to north-central Mexico.

Any night of the year may record freezing termperatures in the La Sals, while the frost-free season at Grand Junction is about 185 days.

At the top of the range precipitation is about 40 inches (1 m) a year; down at Moab it is, as stated above, about 6 inches (15 cm). Snowfall in Moab is about 6 inches (15 cm) or about 1/10 the total



Winter snow on the La Sal Mountains, summer in the desert canyon of the Dolores 8000 feet (2400 m) below — an illustration of climatic extremes caused by the regional relief. BLM

annual precipitation; about 10 feet (3 m) falls in the mountains. In the high altitudes of the two counties summers are mild, with mean high temperatures in the 70° F (21° C) range. Winters are chill, the mean January low being 0° F (-32° C), although the insolation at these altitudes makes such temperatures normally quite tolerable.

Temperatures in the lowland deserts nearby are skewed up about 20 degrees above the figures for the high mountains or plateaus of the two counties. The mean January low in the redrock country is about 16° F (-9° C); the mean high in July is about 95° F (35° C), with nights averaging about 65° F (18° C). In side canyons off the river, the temperature goes over 100° F (38° C) many times each year. Sunrise in midsummer comes as a palpable blast of heat, as if the door of an oven had been opened. By mid-day, the heat sets the air to pulsing, producing mirages and making the distant cliff fronts appear to waver. But such temperatures are not unpleasant, if the traveler has water and need not do any hard work, because humidity is very low--generally 22 percent in midsummer.

Prevailing winds come from the southwest at about 5-10 miles (8-16 km) per hour, but as with rainfall, they are so strongly influenced by local variations in topography that the region-wide winds are almost irrelevant to the winds in the traveler's own area. The canyons act as funnels, so the strong winds created by afternoon heating of the cliff faces or by the passage of fronts can gust up to 60 miles (90 kph) an hour along the rivers.

Most of the rain in the desert area falls in late summer. Much of the time it does not reach the ground; afternoon cumulus clouds build into massive lead-gray towers which trail long brushes of rain down toward the mesas, but usually don't reach them. Even when the rain comes, a weather condition peculiar to the desert may rob the land of some of its benefits. By the time an afternoon storm

falls, the rock has been heated, sometimes to a surface temperature over 200° F (93° C). The air also remains hot. The rain which falls quickly evaporates and rises. The next day the moist air is reheated and continues to rise, until it is carried back up to altitudes where it again begins to condense and recirculate. This evaporation is joined by the water transpired by the phreatophytes of the area--a mature Fremont cottonwood apparently transpires about 500 gallons (1,900 l) a day.

When the drops attain sufficient size to fall, they do, and thus the "same" rain falls several days in a row, until the passage of a front pushes that particular moist mass of air out of the area, leaving little for the area's vegetation.

When a large rain does fall the desert areas can receive half a year's precipitation in a day. There being little vegetation to retard the runoff and very large areas of bare rock to accelerate it, the water pours off the land, surges in muddy walls down the arroyos, and drapes the walls of the main canyons with multi-colored waterfalls, so little of this water is also available.

VEGETATION AND WILDLIFE

Nine thousand feet (27.50 m) of relief, and the resulting variations in climate, have produced consequent variations in vegetation; not only in temperature and precipitation, but in plant communities does the area offer the impression of a journey from Canada to Mexico. The successive climates caused by altitude thus evoke wide bands of vegetation which lie on the region like contours; conditions at the top and bottom of each such band are marginal for the species involved. At the highest elevations--the La Sals extend 2,000 feet (610 m) above timberline--there are stunted tiny plants like moss campions, alpine forget-me-nots, and alpine avens. These endure

about 10 months of the year in a relatively dormant state, and suddenly flower during the other two, painting the grassy alpine fields with color.

Below the "tundra" of this highest altitude area are forests whose trees are progressively more spaced as altitude decreases. The highest such forest is the association of Engelmann spruce and subalpine fir which lies between about 8,000 and 11,000 feet (2,400-3,350 m). This dense and dark-colored forest serves as a water reservoir by storing winter snows. These forests shelter varying hares, deer and elk, bear, chickarees, foxes and coyotes, and such birds as kinglets, gray jays, and Clark's nutcrackers.

Overlapping the lower elevations of this forest are aspen, lodgepole pine, and douglas-fir. Still lower are ponderosa pine, Gambel's oak, and lower still, spacious pinyon-juniper forests. Like the upper forest, these lower associations support deer, elk, cougar, turkeys, and coyotes. They have an understory of wheatgrasses, needlegrasses, bromes, elk sedge, American vetch, aspen peavine, yarrow, and fleabane. The pinon/juniper association has an understory of wheatgrass, asters, cactus, phox, squirreltail and Indian ricegrass.

The lowest associations are found in the deserts near the rivers. The overstory--it is only about 3-7 feet tall--consists of shadscale, greasewood, and sagebrush. The grasses of the desert are annual brome, squirretail, Indian ricegrass, galeta, and needle-and-thread; forbs include Indianwheat, golbemallow, buckwheats, paintbrush, and asters. Like the tundra areas, this area can display beautiful wildflowers, if moisture has been sufficient. The most frequently seen wildlife in this area is probably antelope jackrabbit, 13-lined groundsquirrels, chipmunks, coyote, deer, and prairie dogs. Cactus wrens and burrowing owls, kestrels and turkey vultures are often seen.

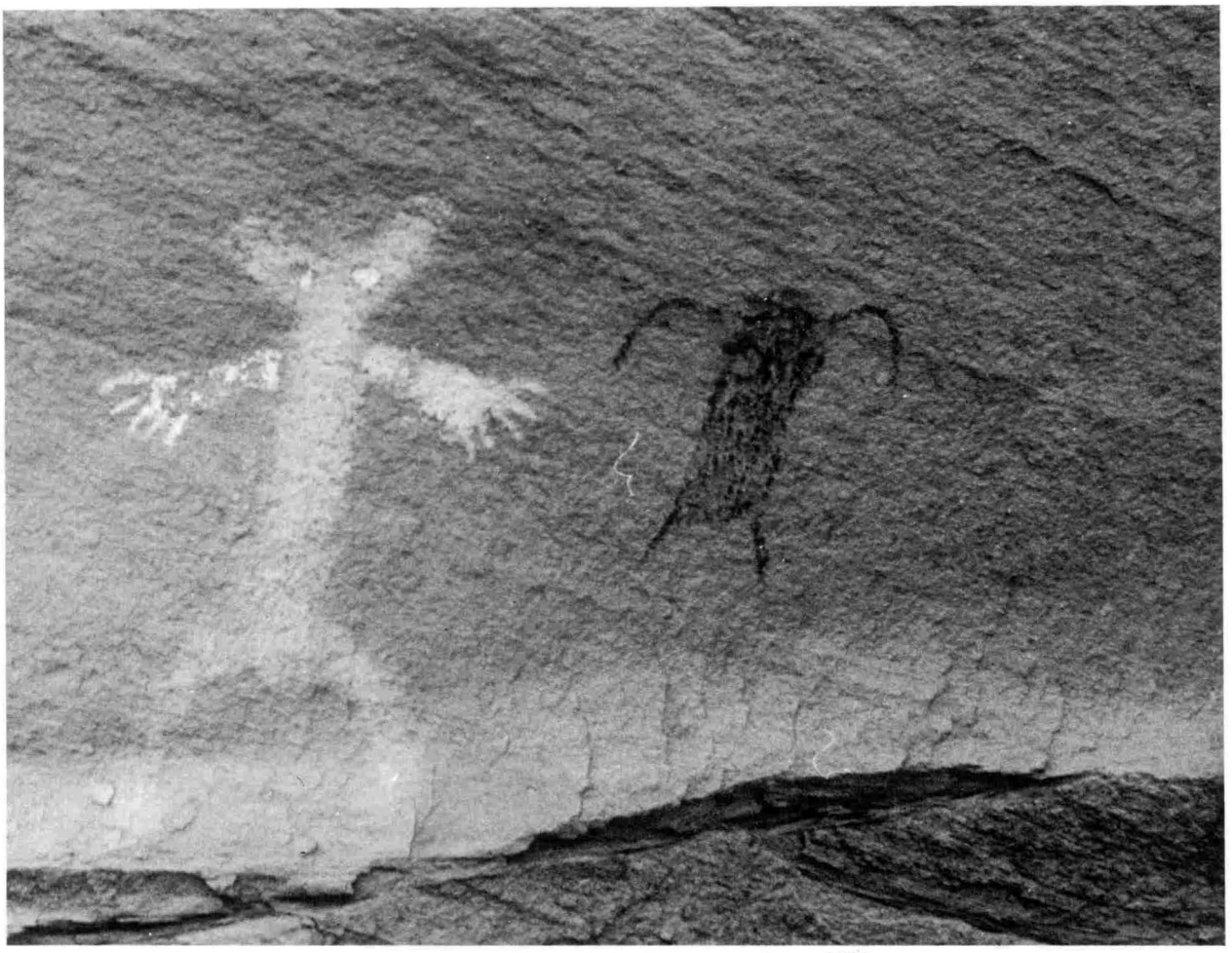
The presence of water alters these characteristic associations. From the highest to lowest parts of the area the riparian vegetation differs from the vegetative communites through which it passes. In the highest area there are willows as stunted as the mat-like plants of the alpine zone. In the middle areas are found Rocky Mountain ash, alders, and willows. Lower still are stream-side borders of narrow-leaf cottonwoods, which in turn cede to the plains or Fremont cottonwood, a huge and noble tree, which has an understory of willow and tamarisk. Specific communities found along the rivers in the study area are discussed in the description of the river corridor.

CULTURAL RESOURCES

Archeology

During prehistory there were two main cultural traditions in the region. These were the Desert Archaic Cultural Tradition (ca. 8,000 B.C.--500 A.D., and later) and the Horticultural Cultural Tradition (ca. 500 A.D.--1,200 A.D., popularly known as the Fremont Culture). The Desert Archaic Culture Tradition continued as an important way of adaptation during this later Fremont Culture period, and (in some guises) survived its demise.

The Desert Archaic Cultural Tradition is represented in the two-county region by archeological sites dating back to about 10,000 B.C. on the Uncompahgre Plateau in Colorado. Other such sites, which display relatively little cultural change, date up into the Historic period. At about the time of the birth of Christ, some of the small bands of Desert Archaic peoples began to adopt introduced horticultural adaptations, which gradually replaced their reliance on hunting and gathering and a lifestyle based on restricted wandering.



Pictographs near the study area are probably artifacts of the Fremont culture. NPS

Simultaneous with this shift was their development into a tribal level of social integration. The Virgin Branch of these people, centered near the river of the same name in western Nevada, produced the Fremont Culture, which eventually extended from the Yampa River near the Colorado-Wyoming border down into what is now Canyonlands National Park. The Fremont branch of the Horticultural Tradition was particularly prominent in the canyonlands near and south of the study area. The small pithouses and masonry cists characteristic of these latter horticultural people are easily found in the region, as is their rock art, which was produced in prodigious quantities.

The Fremont culture disappeared about A.D. 1150 and no distinctive sites have been found dating after A.D. 1200. It is not certain what happened to them, although it is suspected that the Fremont culture, no longer able to cultivate food and thus forced to subsist on the drought-diminished surrounding land, rejoined the Desert Archaic's foraging subsistence style, and were even perhaps known to the first Euroamericans as the Southern Paiutes and Utes.

History

Guided by Ute Indians, Fathers Dominguez and Escalante were the first white men to visit the area. On September 5, 1776, the fathers and their party descended the slopes of Battlement Mesa to the Colorado River. The fathers did not discover their objective in leaving New Mexico, a northern route to the missions of California, but they did mark the land. Escalante and Dominguez Canyons are not far from the study area; the Escalante River, tributary of the Colorado River in Glen Canyon, was apparently the last named major river in the continental United States. Until the 1840's, when a succession of explorers, miners, and farmers entered Colorado, the region remained little known.

After the initial gold strikes in the Denver region in 1859, miners worked their way up the rivers of the eastern slope, over the mountains and into the drainages of the western slope. Many of them eventually settled as farmers on the western slope. Actually, mining and entry of the area had been forbidden by the first of a series of treaties with the Utes. This first treaty in 1863 gained the San Luis Valley along the Rio Grande for the whites and shifted the Utes to the west.

The next treaty,. in 1868, granted the Utes the western third of Colorado; the border was the 107th meridian near Gunnison. But the flow of miners toward the rich strikes of the San Juan Mountains, in violation of the 1868 treaty, brought about yet another treaty.

The Brunot treaty of 1873 again constricted the Utes' lands. Conflicts still arose between the Indians and white settlers, so in 1880 the Southern Utes were sent to the reservation they now occupy in southern Colorado.

After more trouble with the whites, the Uncompahgre Utes, who were first slated to be settled in the vicinity of Grand Junction, were sent to Utah to their current reservation.

The lands of what was soon to become Mesa County were officially opened for settlement in 1882. A series of names for the town eventually yielded to Grand Junction. By 1882, a narrow gage line had reached the area; by 1887, a standard gage. Discovering the 185-day growing season of the area, the new settlers planted the first of the orchards which now fill the valley and began to dig the ditches that would water them.

The first settlement of Moab, Utah, collapsed due to Indian trouble. However, by 1870's ranchers, who were bought out by returning

Mormons, had entered the valley. They established the town of Moab and completed a post office by 1879.

By the early decades of the 1900's, an act of considerable historic note had taken place in the area. John Otto, who had grown fascinated by the warped layers and red sandstone monoliths of the area south and west of Grand Junction, urged citizens to petition the Federal Government to grant the area the status of a national monument. In 1907, the Grand Junction Chamber of Commerce did so; in 1911, the area became Colorado National Monument. Recognition to the red rock wonders near Moab followed with the designation of Arches National Park (originally Arches National Monument), and later by Canyonlands National Park in 1964.

Mesa County's pace was relatively slow through the ensuing decades. This was to change, however, in the 1950's when a uranium boom occurred. Grand Junction and Moab became the centers for much of the activity.

WATER RESOURCES

The Colorado River is the largest in the state and in the region. It is estimated that the actual virgin flow of the river at the Colorado-Utah border is about 6.7 million acre feet (8,264 million m^3), and the flows which can therefore be expected should lie in the range of 4.5 to 5.5 million (5,500-6,780 million m^3), for about 614,000 acre feet (751 million m^3) are exported from the basin and about 1,000,000 acre feet (1,233 million m^3) are used consumptively.[2]

---

2. Critical Water Problems Facing the Eleven Western States. (The Westwide Study), U.S. Department of the Interior, Washington, DC. (April, 1975).

The flow of the river and its tributaries is apportioned by a compact between the states of the Upper and Lower Basin. The states of the Upper Basin have further apportioned their allotment among themselves. Of the 7.5 million acre feet (9,175.5 million m^3) allotted to the Upper Basin, the Department of the Interior has estimated that there are approximately 5.8 million acre feet (7,100 million m^3) actually available. The discrepancy arose because the original compact based its division of the flow on what is now known, from stream gaging records and tree-ring investigations, to have been one of the wettest periods in 600 years.

Colorado, as one of the Upper Basin states, is estimated to have about 750,000 acre feet (917.5 million m^3) per year available for development. This water can be developed from any tributary in the basin that lies within the state. Utah's situation is similar. Once these states have applied the water allotted them to beneficial use, the remaining water in the rivers must be allowed to flow down to the Lower Basin. Thus, it is not easily possible to predict where and when the water remaining to Colorado and Utah under the compact will be developed. It will be possible to develop it on several, but not all, of the tributaries, or on the main stem. Once the entitlement has been put to use on certain tributaries, any developments constructed on others will be "called out of priority", i.e., they will not be able to store or divert water until the requirements of the Lower Basin have been met. They may be thus able to take water only in very wet years, or perhaps not even then, if the allotment is exhausted.

This restriction will apply only to consumptive use. Diversions from the Western Slope of Colorado to the Eastern, or from the Green River Basin of Utah to the Salt Lake Valley, are defined as a total consumptive use, since the water they take leaves the basin. Agricultural diversions generally consume about 50 percent of the water they divert. Hydropower consumes only what evaporates

from the lake above the turbines, and can operate when a senior call requires the stored water. Hydropower projects can thus be constructed when other developments will have become uneconomical for lack of a water supply that is not owed to the Lower Basin.

Since there are, in Colorado, valid rights to develop far more water than is actually available under the compact (some have estimated that on many streams in the state there are rights to as much as four times as much water as exists), the determination of where the water will be used will depend on which conditional rights[3] are actually perfected, by constructing the project and putting the water to use.

Such conditional rights exist for several authorized projects on the upstream portions of both rivers. On the Colorado River these are the Grand Valley, Dallas Creek, Fruitland Mesa, and West Divide projects. Of these, the one which is expected to have the largest direct effect on the study area is the Grand Valley Project. By lining canals and laterals with concrete, installing on-farm improvements, and implementing irrigation management techniques, the project is expected to reduce by approximately one-third the 600,000 tons (545,000 metric tons) of salt added to the river annually in this vicinity. The other projects are not expected to have significant effects on the flows in the study area.

On the Dolores River and tributaries, upstream from the study area, are planned the Dolores Project, San Miguel Project, and Paradox Valley Salinity Control Unit. The Dolores River has

---

3. A conditional right is perfected, or made absolute, when the project for which it is granted is completed. Its priority date, which determines its right to water vis-a-vis all other rights in that basin, is then pushed back to the date of first filing, which may have been 20 years before.

historically been depleted about 105,000 to 130,000 acre feet (128-159 million m^3) by the Montezuma Valley Irrigation Company (MVIC), which operates near the town of Dolores. McPhee Dam, a feature of the Dolores Project, will increase these exports into the basin of the San Juan River by 101,200 acre feet (123 million m^3). An additional 25,400 acre feet (30 million m^3) of project water will be released in the summer and fall for fishery purposes.

During the first 14 years of record, the Dolores at Gateway averaged an annual flow of 749,000 acre feet (917.5 million m^3); during the next 25, at a station 9 miles above the mouth, about 522,400 acre feet (638.6 million m^3). Inflow and depletions between the two are insignificant, so the stations are comparable. The difference between their readings is mostly attributable to increased diversions and lower precipitation. The extant MVIC diversions reduce the flow in the study area by about 14-19 percent. In addition to the exports to the San Juan basin made by the MVIC, there is in-basin consumptive use of about 56,700 acre feet (69 million m^3) or about 8 percent of the flow. The Dolores project depletions will further reduce it by 14-15 percent. If the project water which is released for fish and wildlife is subtracted, since this flow occurs at a time and in such volume as to be unuseable for boating, the flows of the river can be considered to be reduced a further 3.5 percent.

The other project, on the San Miguel, a major tributary of the Dolores which joins it about 35 miles (56 km) above the study area, will utilize 50,000-80,000 acre feet (61-98 million m^3) per year for irrigation, municipal, and industrial purposes. When constructed, this project will deplete the flow in the study area by approximately 7 to 11 percent.

The lower figure in these percent ranges assumes that MVIC diversions will continue at their average historic rate of about

105,000 acre feet; the higher, that they will continue at the figure of 130,000 acre feet (159 million m^3) established in recent years.

The Paradox Valley Salinity Control Unit will remove up to 180,000 tons (163,000 metric tons) of salt from the Dolores river just upstream from its confluence with the San Miguel. In the Paradox Valley area the Dolores flows over a salt anticline, picking up about 200,000 tons (182,000 metric tons) of salt from briny groundwater. Pumping this brine enough to lower the interface between the brine and relatively fresh surface groundwater would permit only the relatively fresh water to enter the river. The recovered salts and sulphur would be pumped to Radium Evaporation Pond, about 20 miles (32 km) from the river. This project would considerably improve water quality in the study area and the Colorado below the confluence, while depleting the flow of the river in the study area about 0.5 percent.

POPULATION

Populations vary greatly between Mesa and Grand Counties. According to the U.S. Bureau of the Census, the 1970 population of Grand County was 6,688 while that of Mesa County was 54,374. Almost half of Mesa County's population resides in Grand Junction (population 23,774). Slightly more than half of the county's population is classified rural farm. For purposes of comparison, the population density of Mesa County is almost 10 times that of Grand County, and about 1/50 that of Rhode Island. Seventy-two percent of Grand County's population is located in Moab with a 1970 population of 4,793. The remaining population is primarily rural farm.

Future energy resource development (coal and oil shale) is expected to have dramatic effects on the population of northwestern

Colorado. According to the BLM's Final Environmental Statement, Northwest Colorado Coal, Colorado State Planning Region 11 (Mesa, Garfield, Rio Blanco, and Moffat Counties) will increase in population from 89,374 in 1974 to 123,781 in 1980 and 168,231 by 1990. This represents a 38 percent increase by 1980 and an 88 percent increase by 1990. The Grand Junction area, one of the major population centers for the region, is expected to grow in a similar pattern.

ECONOMY

The economy of the two-county region is diversified. In Mesa County the primary economic center is Grand Junction, which is the major service center and largest metropolitan area on the Western Slope of Colorado. Services, retail trade, and government comprise over 50 percent of the total employment in the county. Manufacturing and transportation, communication, and public utilities each employ approximately 10 percent. Agriculture, mining, construction, wholesale trade, and finance constitute the remaining employment picture in Mesa County.

In Grand County, Moab is the center for economic activity. Primary economic activities in Moab are oriented toward mining and the tourist trade.

LAND OWNERSHIP AND USE

Of the 2,134,000 acres (864,000 ha) of land in Mesa County, Colorado, approximately 74 percent is in public ownership. The majority (73 percent) of this public land is under federal ownership with the remainder being either state, county, or municipal land. In Grand County, Utah, approximately 90 percent of the total

2,366,080 acres (948,000 ha) is in public ownership. Again, the majority (74 percent) is under federal ownership with the remaining 15 percent being either state, county, or municipal land. Table II-2 shows the land ownership breakdown in acres and in percent of the total land area.

TABLE II-1
Land Ownership
in
Mesa County, Colorado, and Grand County, Utah

Ownership	Acres (Hectares)	Percent
Mesa County		
Private Lands	556,000 (225,000)	26
State, County and Municipal Lands	19,000 (7,690)	1
Federal Lands	1,559,000 (631,175)	73
Total	2,134,000 (863,865)	100
Grand County		
Private Lands	236,608 (95,793)	10
State, County, and Municipal Lands	378,572 (153,270)	16
Federal Lands	1,750,900 (708,870)	74
Total	2,366,080 (957,933)	100

As might be expected in counties containing such vast amounts of public land, the major portions are in a natural state; i.e., open rangeland and woodland. The remaining private land is dominated by agriculture. This productive agricultural land is one of the major resources of the counties. Major crops raised in Mesa County

include fruits, sugar beets, hay, some grains, and a variety of commercial vegetables. The primary agricultural product in Grand County is orchard fruits. Livestock also adds to the agricultural wealth of both counties and, through the grazing permit system, utilizes large segments of federal land.

The mining and processing of minerals is also an important land use in both counties. Uranium, vanadium, coal, natural gas, and oil shale are found in the counties and the production of these energy sources is expected to increase. Potash is also an important mineral found in Grand County.

TRANSPORTATION

Physiography has influenced the transportation pattern of the two counties. In Colorado, the broad river valleys are natural corridors for roads and railroads. In Utah the main roads are on the plateaus. Thus, in Mesa County, Grand Junction is reached by I-70, paralleling the Colorado River and by U.S. 50, following the Gunnison River. Moab lies about 30 miles (48 km) south of I-70 and is reached by Utah 128 along the Colorado River, and U.S. 163. Grand Junction is served by five truck lines; Moab by four. Continental Trailways provides bus service to both, while Grand Junction has two local bus lines.

Both cities have rail service available for freight from the Denver and Rio Grande Western Railroad, although Moab is served by a spur line. Passenger service is available three days a week from Grand Junction to Denver and Salt Lake. Like the interstate, the route of the railroad is along the river in Colorado and across the desert plateau between the Green and Colorado Rivers in Utah.

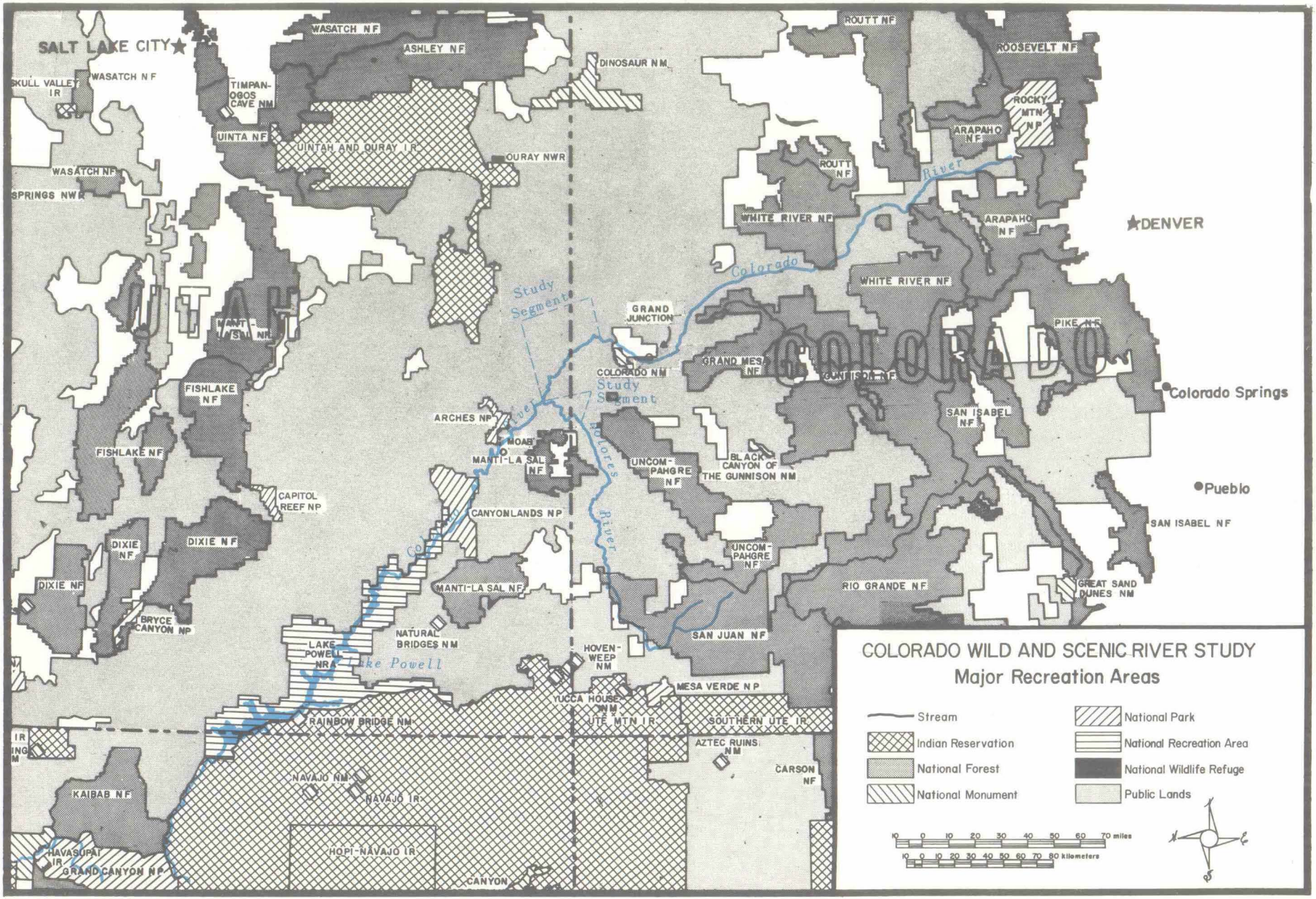
Both cities are served by airports. Moab has a county facility with a 6,900-foot (2,100 m) paved runway. Grand Junction's Walker Field handles class B aircraft (727, 737, DC 10, etc.) and has scheduled passenger service.

RECREATION

The region contains recreation areas of national significance. Colorado National Monument is located at the upstream end of the study area, while immediately downstream in Utah is Arches National Park. Within an approximate 200-mile radius of the study rivers are other areas such as Rocky Mountain, Canyonlands, Capitol Reef, Mesa Verde, and Bryce Canyon National Parks; Great Sand Dunes, Black Canyon of the Gunnison, and Dinosaur National Monuments and Curecanti and Glen Canyon National Recreation Areas, as shown on the Recreation Areas Map.

Notable also among these attractions is Dead Horse Point State Park near Moab, which offers an unparalleled view of the entrenched meanders of the Colorado River near Canyonlands. Plans call for an integration of the visitor interpretation services at this state park with those offered at nearby Canyonlands and Arches National Parks.

The region also has three national forests--Grand Mesa, which is renowned for the hundreds of lakes on the top of the plateau; Uncompahgre, on the Plateau of the same name, and Manti-La Sal, which covers portions of the La Sal Mountains. Hunting in these areas is quite good. In 1975, for instance, 49 bear, 4 antelope, 2,697 deer, and 987 elk were taken in Mesa County. The public lands administered in both counties by the BLM provide outstanding opportunities for desert hiking, scenic driving, four-wheel driving, and geologic study. The new and growing sport of river-running takes place not only in the study area, but on other portions of the 4 major rivers of the area, attracting boaters from all over the nation.


SALT LAKE CITY
WASATCH NF
ASHLEY NF
DINOSAUR NM
ROUTT NF
ROOSEVELT NF
SKULL VALLEY IR
WASATCH NF
TIMPANOGOS CAVE NM
ROCKY MTN NP
UINTA NF
UINTAH AND OURAY IR
OURAY NWR
ARAPAHO NF
WASATCH NF
SPRINGS NWR
ROUTT NF
WHITE RIVER NF
ARAPAHO NF
DENVER
Colorado River
Study Segment
WHITE RIVER NF
UTAH
GRAND JUNCTION
PIKE NF
COLORADO
MANTI-LA SAL NF
GRAND MESA NF
COLORADO NM
Study Segment
FISHLAKE NF
ARCHES NP
SAN ISABEL NF
Colorado Springs
MOAB
FISHLAKE NF
MANTI-LA SAL NF
UNCOMPAHGRE NF
BLACK CANYON OF THE GUNNISON NM
CAPITOL REEF NP
Pueblo
CANYONLANDS NP
Colorado River
Dolores River
SAN ISABEL NF
DIXIE NF
DIXIE NF
UNCOMPAHGRE NF
DIXIE NF
MANTI-LA SAL NF
RIO GRANDE NF
GREAT SAND DUNES NM
BRYCE CANYON NP
NATURAL BRIDGES NM
SAN JUAN NF
LAKE POWELL NRA
Lake Powell
HOVENWEEP NM
MESA VERDE NP
YUCCA HOUSE NM
UTE MTN IR
SOUTHERN UTE IR
RAINBOW BRIDGE NM
AZTEC RUINS NM
CARSON NF
NAVAJO NM
NAVAJO IR
KAIBAB NF
HOPI-NAVAJO IR
HAVASUPAI IR
GRAND CANYON NP
CANYON
COLORADO WILD AND SCENIC RIVER STUDY
Major Recreation Areas
Stream
Indian Reservation
National Forest
National Monument
National Park
National Recreation Area
National Wildlife Refuge
Public Lands
10 0 10 20 30 40 50 60 70 miles
10 0 10 20 30 40 50 60 70 80 kilometers
N
E
S

CHAPTER III
THE RIVER CORRIDOR

PREFACE

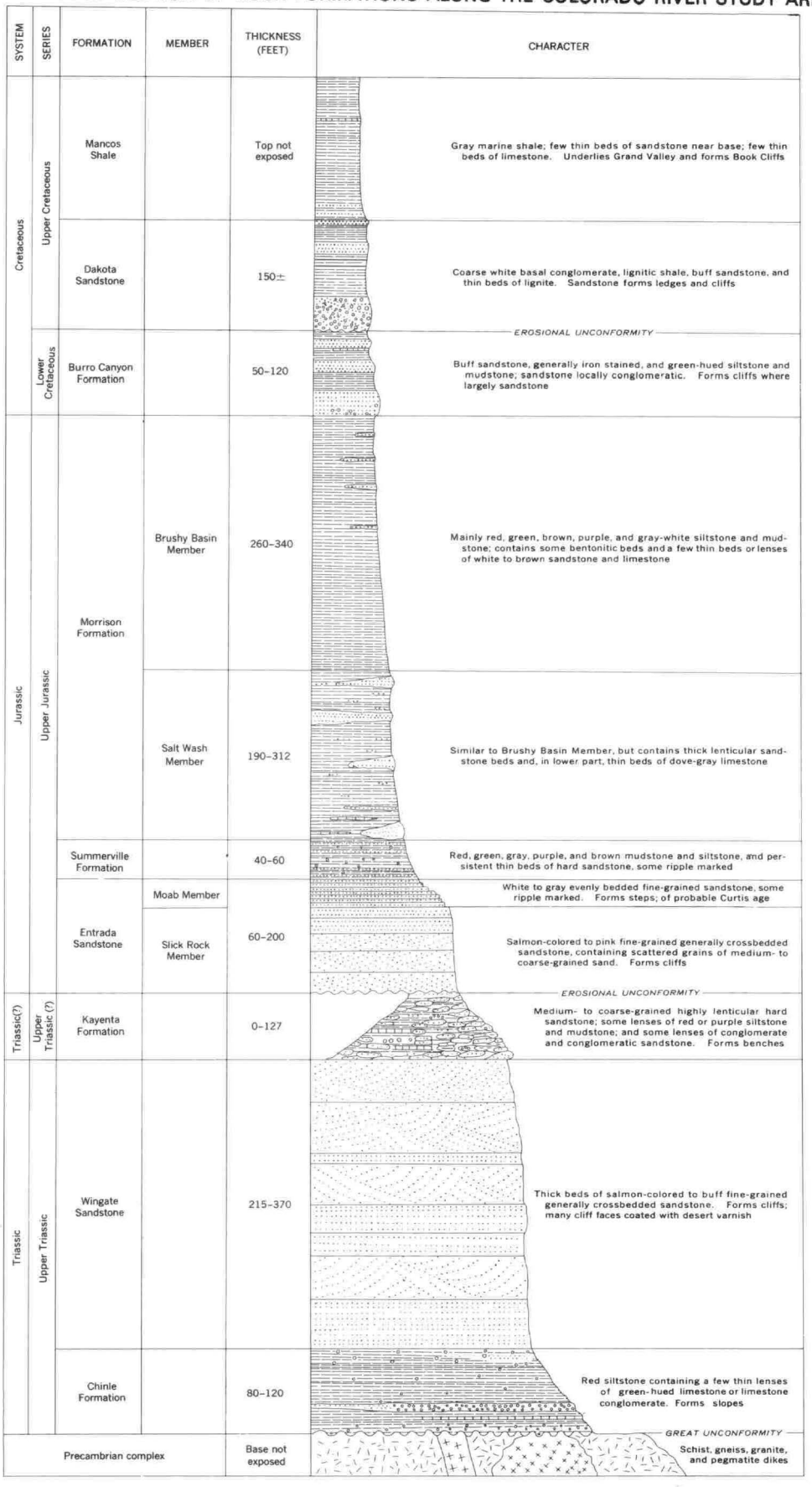
The river corridor described in this chapter is the area seen from the river; it thus varies from a constricted few hundred feet on either shore, where the canyon is narrowest, to about 15 miles (23 km) where the walls fall away. Since the Wild and Scenic Rivers Act contains provisions dealing with mining that apply to an area of 320 acres per mile (a quarter mile or 400 meter strip on either shore) or approximately 80 ha per kilometer, detailed information on the economic resources along the river is given for the area within a quarter mile (400 m) of the rivers.

SCENERY, GEOLOGY, AND GEOMORPHOLOGY

Colorado River

Segment A-1 - Horsethief Canyon (River Mile 1079.2 to River Mile 1070.5). In the arid climate of the study area, little vegetation obscures one's view of the rock, so geology is a major determinant of the scenery in the river corridor. The Colorado's flow, generally northwest for about 10 miles (16 km), then southwest for about 40 miles (64 km), takes it along the margin of the Uncompahgre Plateau, a region-wide anticline plunging northwest across the river's course. Since its course was determined when it flowed through now-vanished soft strata that lay thousands of feet above the rocks now exposed in the study area, the Colorado's course bears little relation to the structure of the rock. The river meanders directly into the uplift, cutting it with canyons, or parallels it, passing between the tilted strata along its

GENERALIZED SECTION OF ROCK FORMATIONS ALONG THE COLORADO RIVER STUDY AREA



AFTER S. W. LOHMAN, GEOLOGY AND ARTESIAN WATER SUPPLY OF THE GRAND JUNCTION AREA, COLORADO PLATE 2, UNITED STATES GEOLOGICAL SURVEY PROFESSIONAL PAPER 451, WASHINGTON, D. C. (1965).

edge and thus leaving hogback ridges. Sometimes it strikes directly across faults bounding the uplift and thus passes from wide valleys into canyons in a few yards.

Just above the beginning of the study area, the Colorado River temporarily abandons the roughly northwest course it has maintained since Grand Junction and the confluence with the Gunnison river. Leaving I-70 it drives briefly west through a hogback capped with the Dakota and Burro Canyon Formations, and through the softer shales and sandstone lenses of the Morrison Formation.

The Morrison Formation is the focus for most of the vanadium and uranium resources of the area. It consists of dark sandstone lenses that form ledges, and slope-forming pastel shale layers covered by blocks riven from the sandstone. Beach, lagoon and stream deposits comprise the formation. The stream deposits contain the uranium. Of considerable paleontologic interest is that the sandstone ledges contain dinosaur fossils in places. Fossil bones have been recovered near, though not within, the study corridor at the upper end of the Colorado segment, and in the lower end of the study area.

Below the Morrison Formation (the Summerville Formation, a thin bed of shales, directly underlines the Morrison in this area, but is not differentiated from it in this report) lie the Jurassic sediments of the Entrada Sandstone, the Kayenta Formation and the Wingate Sandstone. These dip against the river's course, so it quickly cuts a canyon into them.

The Colorado's entry into these brown ledges, pink cliffs, and red bluffs marks the beginning of Horsethief Canyon. At the start of the canyon, the same rocks that encase the Colorado at river level are visible to the south, high on the Black Ridge, revealing the

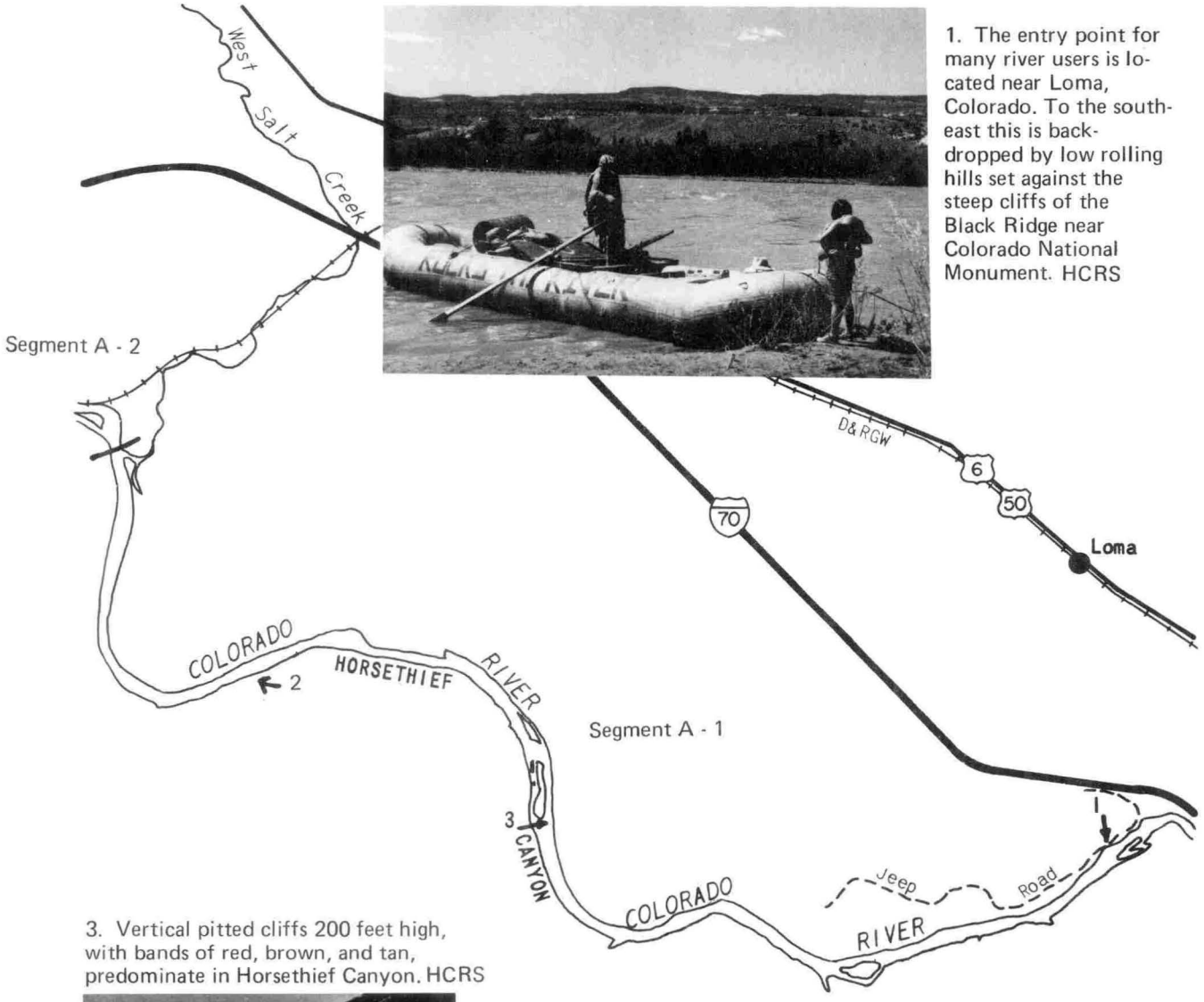
thousands of feet of uplift that have raised the Uncompahgre Plateau. In the first two miles (3.2 km) of the segment, agricultural activities, a small gravel operation and a few farm buildings are visible on the right bank, through a screen of tamarisks, cottonwoods, and willows. At low stage a slightly translucent flow of about 150 feet (45 m) in width, the Colorado rises as much as 8 feet (2.5 m) in this vicinity and spreads to perhaps 600-700 feet (190-230 m) during spring floods. At these times the river is thick with silt. At peak stages, vibrating willow and tamarisk near the shore seemingly grow from the river itself; at low stage islands and gravel bars are exposed.

The 10-mile (16-km) length of Horsethief Canyon exposes a variety of landforms. During its flow to the south and west, the river passes vertical pitted cliffs about 200 feet (65 m) high, banded with red, tan, and brown. In parts of Horsethief Canyon the river flows between two layers of rock which dip transverse to its course, so that one wall of the canyon will be the smooth vertical contours of Entrada Sandstone, while the other will be the blocky ledges of Kayenta, which lie below the Entrada in the geologic column. In the vicinity of Crow Bottom, just above the end of Horsethief Canyon, the river swings north into the higher rocks and the cliffs recede, opening views of jumbled hills and slopes developed on the Morrison Formation.

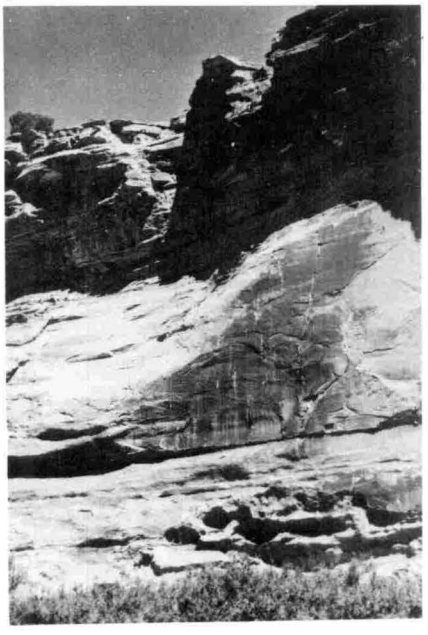
The only man-made intrusions visible in Horsethief Canyon are the agricultural activities and gravel operation mentioned above, a fence near the end, and a no-trespassing sign.

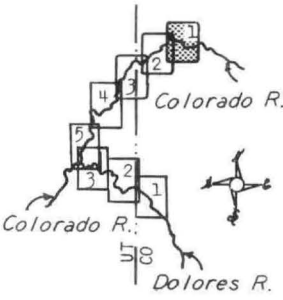
Segment A-2 - Ruby Canyon (River Mile 1070.5 to River Mile 1051.2). The end of Horsethief Canyon and the start of Ruby are marked by both human and geologic phenomena. At the point where the river swings furthest north, and into the highest strata it encounters in this area (the Morrison formation), it is joined by

1. The entry point for many river users is located near Loma, Colorado. To the southeast this is backdropped by low rolling hills set against the steep cliffs of the Black Ridge near Colorado National Monument. HCRS

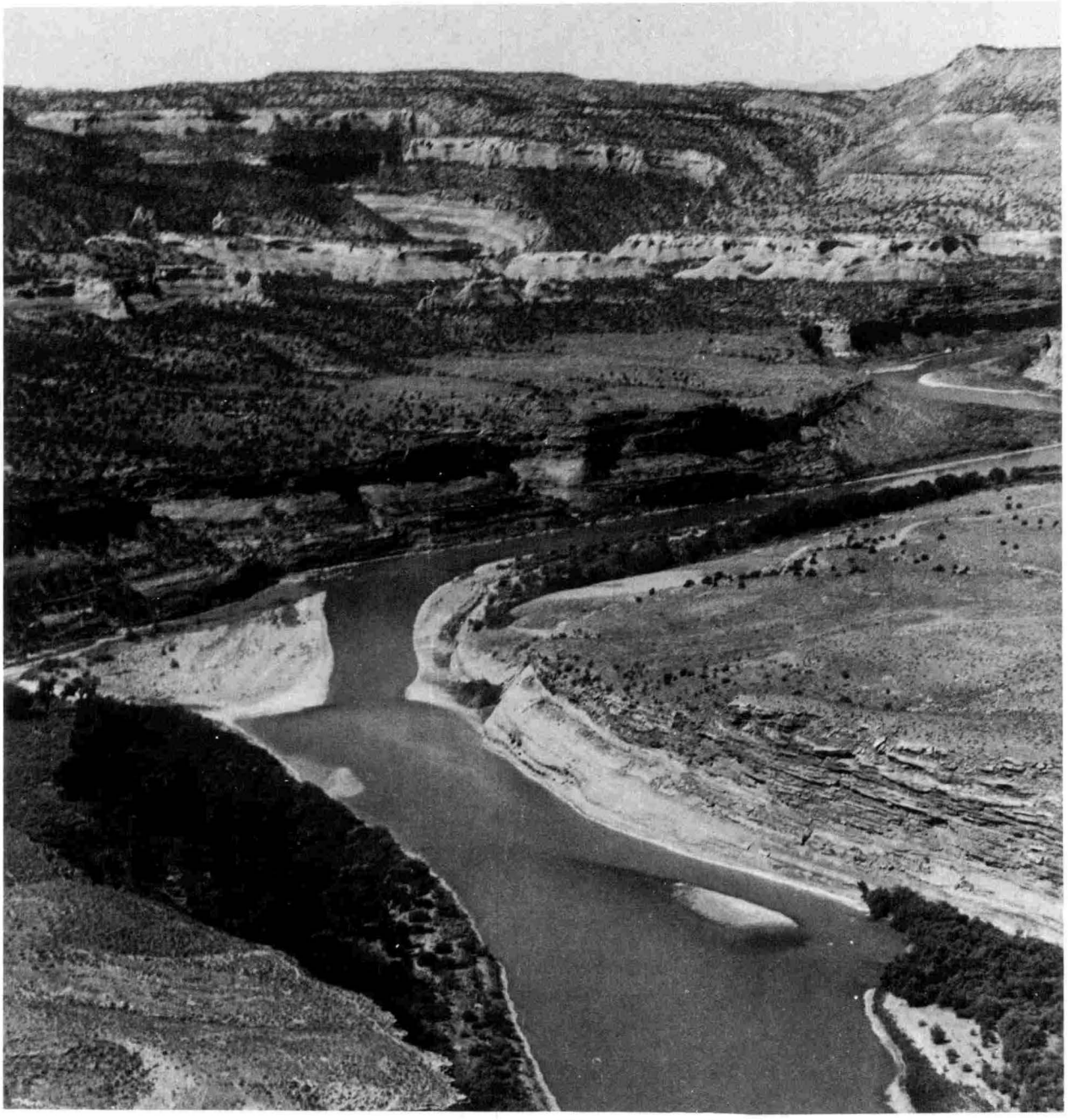


3. Vertical pitted cliffs 200 feet high, with bands of red, brown, and tan, predominate in Horsethief Canyon. HCRS

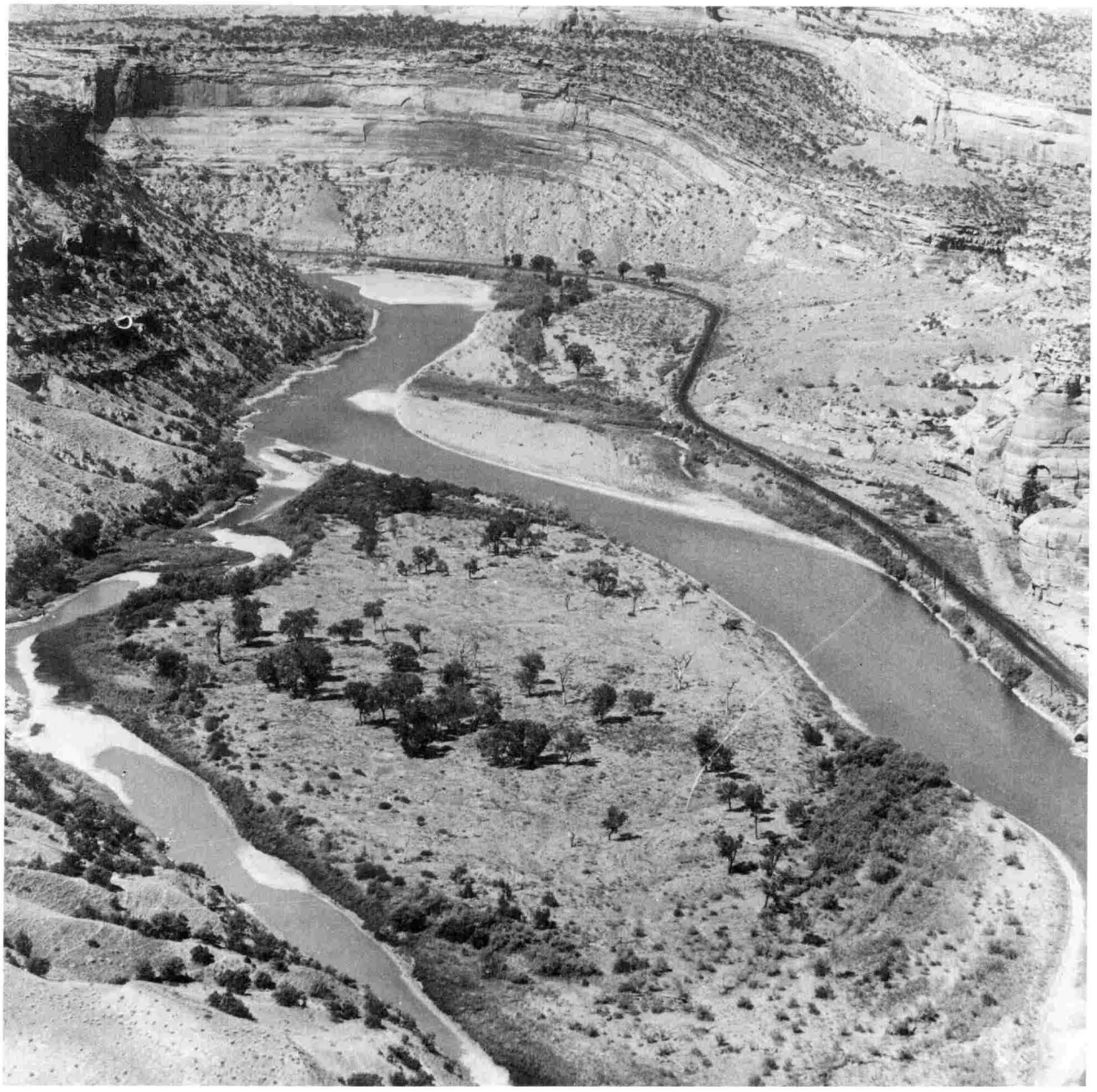




2. Horsethief Canyon marks the beginning of the study segment. Vegetation in this area is primarily cottonwoods, tamarisk, and willows which occupy the flood plain. BLM



A view to the southwest from Horsethief Canyon shows the fold at the edge of the Uncompaghre Uplift. BLM



One of the three folds in Segment A wraps the strata just above Ruby Canyon. BLM

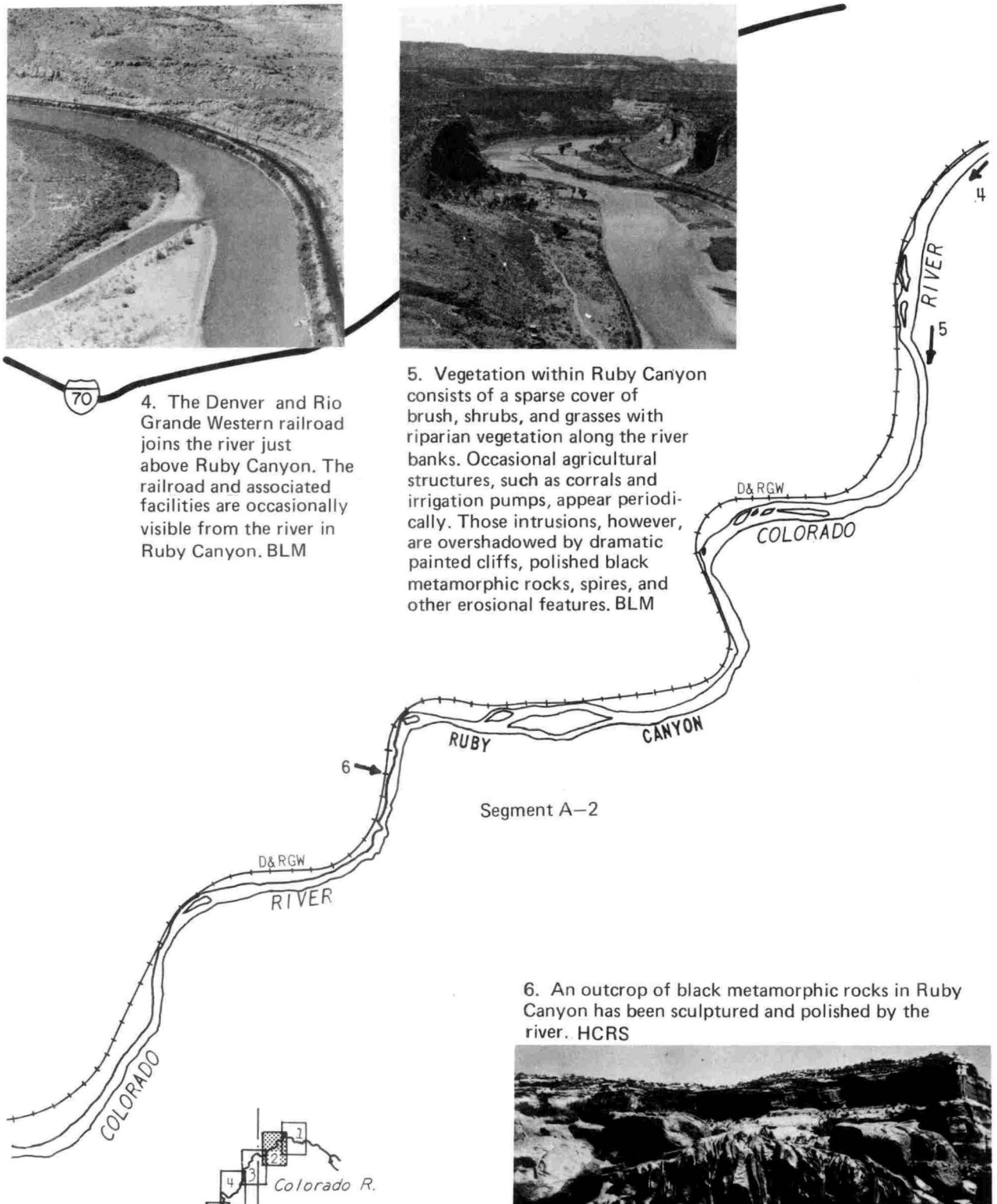
Salt Creek, which mostly carries saline irrigation return flows. The tracks of the Denver and Rio Grande Western, which closely parallel the river from this point to Westwater Ranger Station and the beginning of segment B (about 16 miles or 25 km), enter the canyon via Salt Creek Canyon. The river swings south, toward Black Ridge and the uplift, and almost immediately cuts through the fault at its northern margin. In quick sequence it passes from the Morrison through the Summerville, Entrada, Kayenta, and Wingate Sandstone and begins to flow in the soft brick-red shales of the Chinle. The vertical cliffs of Wingate Sandstone which now tower above it, because of the intense red color that characterizes these cross-bedded aeolian deposits, have inspired the name Ruby Canyon.

Throughout Ruby Canyon the facilities associated with the railroad are intermittently visible, though nowhere obtrusive. A screen of tamarisk and willows, overtopped by massive cottonwoods on some of the bottoms, conceals the tracks, poles, and occasional corrals. The railroad itself is noticeable in most places only when there is a train on the tracks. These intrusions are dwarfed and over-shadowed by the monoliths, spires, towers and curiously sculpted formations of the Wingate. The 500-foot (160 m) red walls, their color varying from dark, flat red at mid-day to shades of brilliant orange and pink at sunrise or sunset, are often plated with desert varnish, a blue, purple, and black reflective skin of iron and manganese oxide deposited on the rock by groundwater. Through cracks and flakes in this dark coating the colors of the rock appear with special brilliance.

The Black Rocks area is scenically and geologically one of the most interesting in Ruby Canyon. A large bench (Moore Bottom) has developed on the early Triassic Chinle Formation. At this point the river has cut into the Uncompahgre Uplift to the rocks which make up its core: the black Precambrian gneiss and schist of the

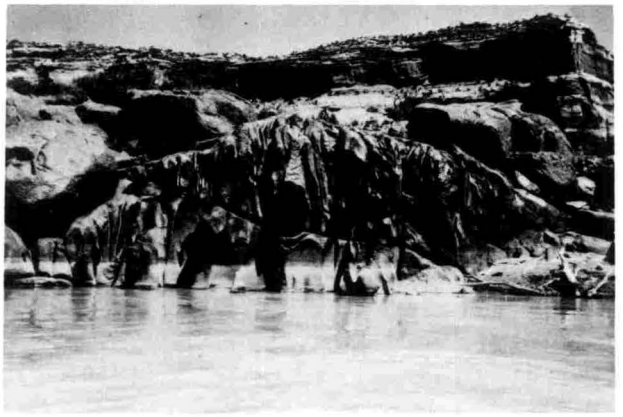
4. The Denver and Rio Grande Western railroad joins the river just above Ruby Canyon. The railroad and associated facilities are occasionally visible from the river in Ruby Canyon. BLM

5. Vegetation within Ruby Canyon consists of a sparse cover of brush, shrubs, and grasses with riparian vegetation along the river banks. Occasional agricultural structures, such as corrals and irrigation pumps, appear periodically. Those intrusions, however, are overshadowed by dramatic painted cliffs, polished black metamorphic rocks, spires, and other erosional features. BLM

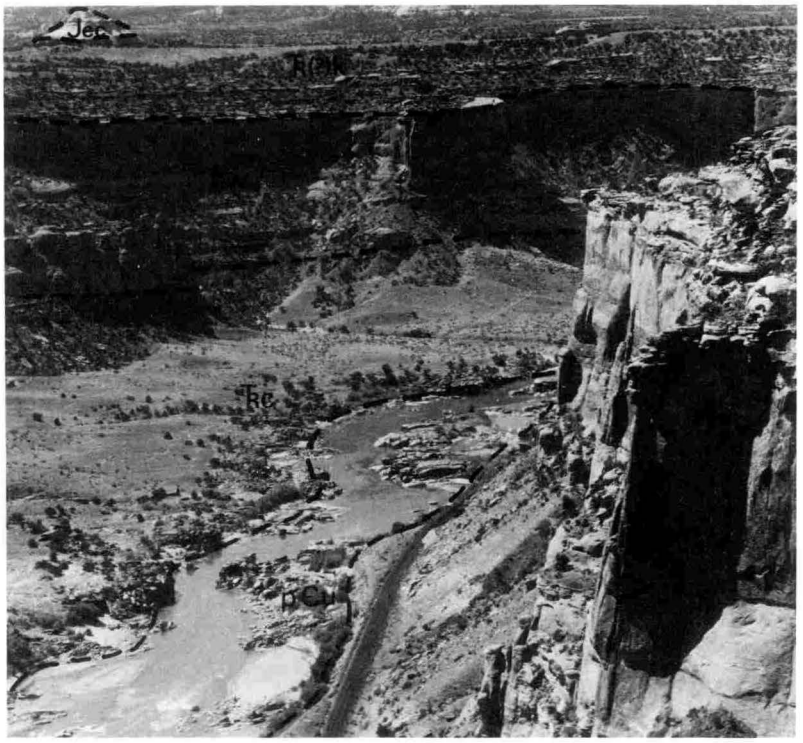


Segment A–2

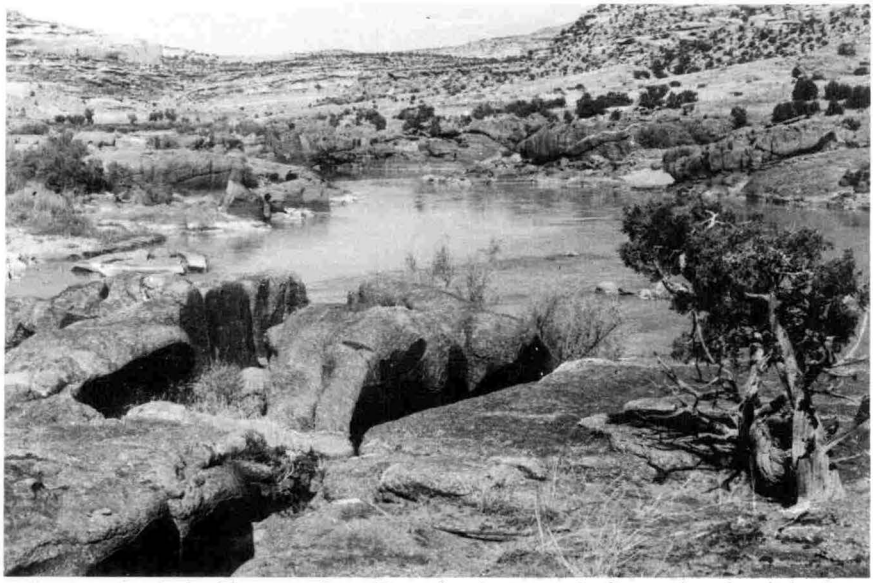
6. An outcrop of black metamorphic rocks in Ruby Canyon has been sculptured and polished by the river. HCRS



Two views of the Black Rocks Area, Ruby Canyon.



Jec — Jurassic Entrada Sandstone
TR(?)k — Triassic (?) Kayenta Formation
TRw — Wingate Sandstone
TRc — Chinle Formation
p€u — Precambrian Uncompahgre Complex



At river level, the Uncompahgre Complex is strangely fissured and polished by the river.

Uncompahgre Complex. The contact between the Chinle and the Uncompahgre Complex is unconformable; about 1.5 billion years are missing. The black rock, which protrudes about 20 feet (5 m) above the water, has been polished and fluted by the river. The smoothly rounded columns sculpted in this black rock by the river, and the almost silvery reflections from them, contrast with the vertical joints and lofty sheer red cliffs that line the pocket which contains this popular camp.

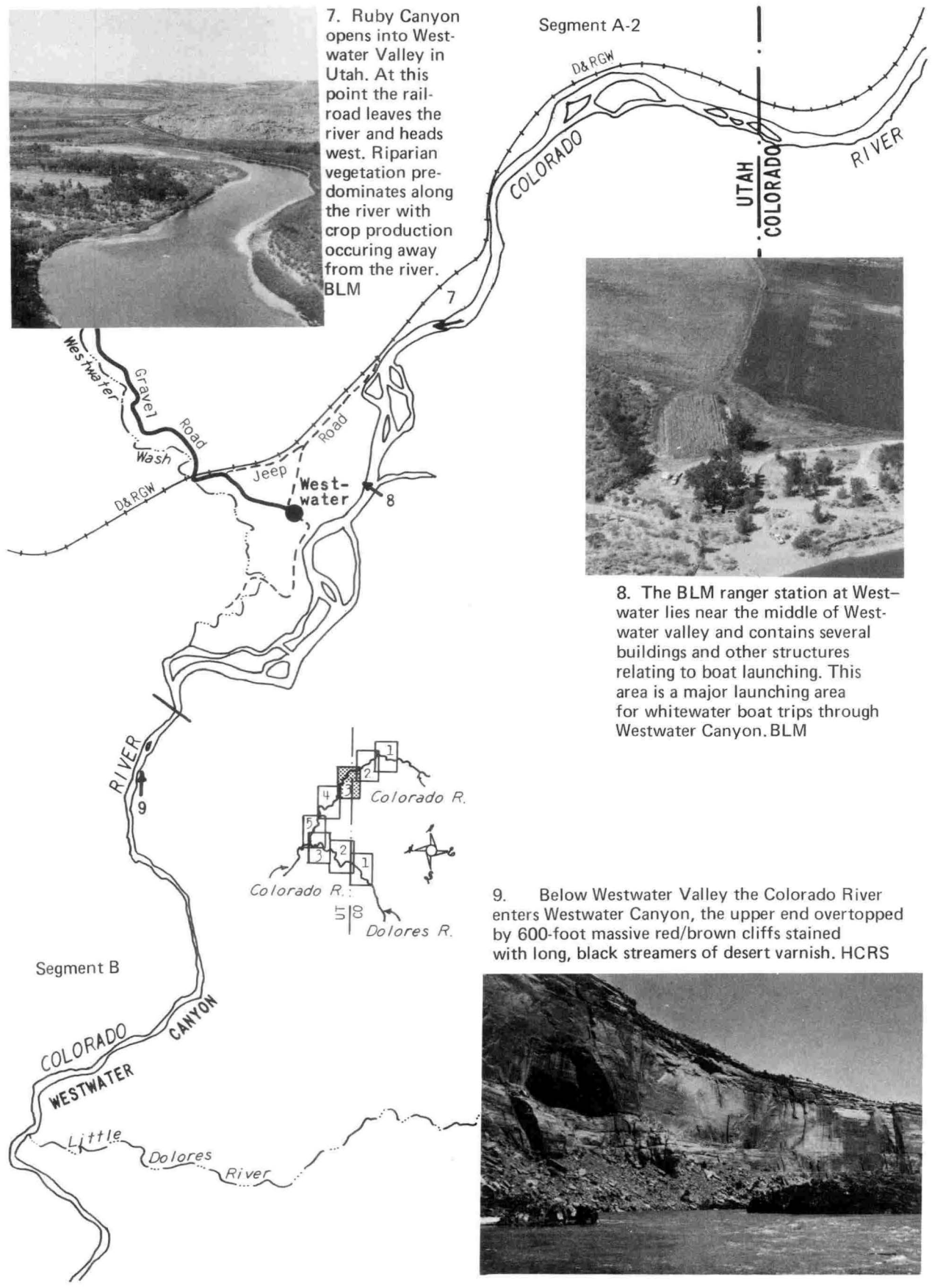
Below this area the river's westward course toward the border between Colorado and Utah takes it downdip into higher and higher rocks; the black rocks, the Chinle, the Wingate, the Kayenta, the Entrada and Summerville successively plunge beneath the river. By the time the boat ramp at Westwater Ranch is reached the river flows into the Morrison, and opens up a large agricultural valley. This 6-mile (9.7 km) portion contains many human influences, such as ranch buildings, hay meadows, the boat launching ramp and ranger station. Temporary sand and gravel operations in this vicinity have provided road material for Interstate 70 nearby. Beyond these intrusions and the riparian association of cottonwoods, willows, and tamarisk which largely screens them, the views from this valley are some of the longest available in the study area--up to 10 miles (16 km). Beyond stark rolling brown hills developed on the Morrison Formation are distant vistas east toward the Uncompahgre Plateau, whose dark-green forest of pinon and juniper are interrupted by pink bands of rock. To the west the barren hills interrupt the view in only a few miles. Downstream, through the green of the cottonwoods, is the imposing upfaulted cliff front that marks the beginning of segment B, Westwater Canyon.

Segment B - Westwater Canyon (River Mile 1051.5 to River Mile 1038.5). About 2 miles (3.2 km) below the Westwater boat ramp the Little Dolores fault's displacement of about 500 feet (160 m) raises the southern block, toward which the river is flowing, until the Uncompahgre Complex is brought into contact with the Entrada

A raft party leaves the Westwater boat ramp area. The upthrust block through which Westwater Canyon is cut is visible in the distance. BLM

7. Ruby Canyon opens into Westwater Valley in Utah. At this point the railroad leaves the river and heads west. Riparian vegetation predominates along the river with crop production occuring away from the river. BLM

8. The BLM ranger station at Westwater lies near the middle of Westwater valley and contains several buildings and other structures relating to boat launching. This area is a major launching area for whitewater boat trips through Westwater Canyon. BLM



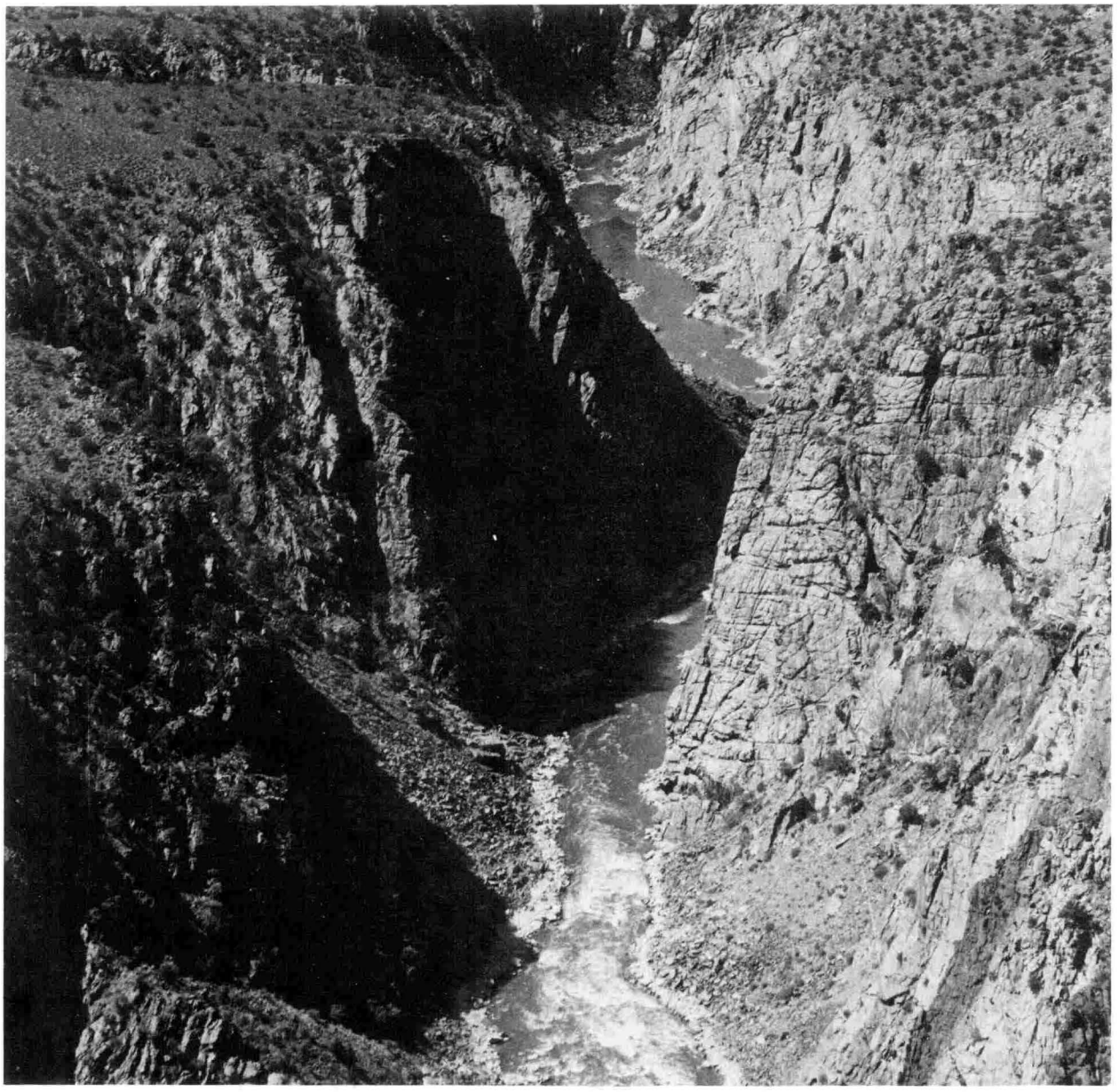
9. Below Westwater Valley the Colorado River enters Westwater Canyon, the upper end overtopped by 600-foot massive red/brown cliffs stained with long, black streamers of desert varnish. HCRS

Sandstone. In front of the river the fault block, a 700-foot (225 m) wall of red Wingate Sandstone and the Chinle Formation, footed with the black pediment of the Uncompahgre Complex, stands athwart the river's course. Instead of being deflected by this massive dam into the softer rocks lying west of the area, the river cleaves it--a confirmation of the theory of stream piracy discussed in Chapter II.

Westwater Canyon, sometimes known as Granite Canyon, is the most scenic, dramatic, and untouched portion of the study area. There are no roads or other vehicle access points. The only evidences of man's presence in the whole 13-mile (21 km) segment are an old dugout cabin at the upper end that was used by miners and trappers in the early 1900s; a cave that was inhabited by outlaws in the early part of the century; and the occasional blue gleam of a bottle in the massive piles of driftwood in some parts of the canyon.

The extremely hard rock through which the river flows has a number of effects. It narrows the stream--upper stretches in the valley parts of segment A permitted the river to widen to 700 feet (230 m) and even in Ruby Canyon it was still, in places, about 400 feet (130 m) wide, but when the Colorado is confined by this resistant rock, its channel is only about 35 feet (10 m) wide in places. The resistance of the rock also causes the rapids which have led to Westwater's nationwide recreational renown. At low stage a series of disconnected steep drops studded with holes and occasional rocks, the canyon is at high water a millrace of 6-8 foot (2 m) waves that offer no respite or landing place for miles.

As is true for the Black Rocks area in Ruby Canyon, the gneiss and schist are polished, scalloped and fluted up to the high water mark. Above that the rock is angular and interpenetrated by light-colored dikes. It has been cut to a depth of about 200 feet

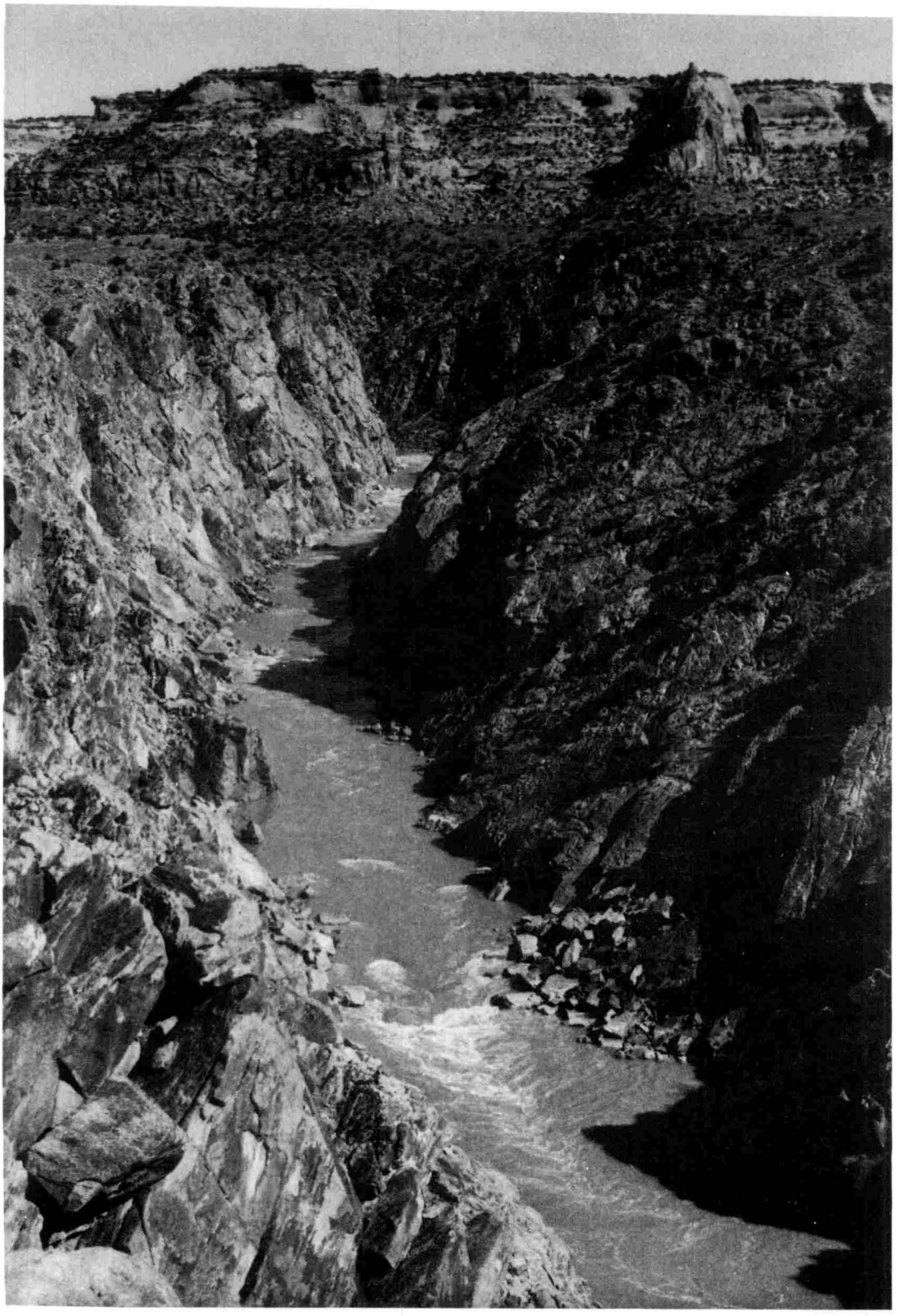


Marble Canyon Rapids – Westwater Canyon. A 6 mile (9.6 km) stretch with 11 major rapids begins at this point. Depth of the inner gorge is about 200 feet (60 m). Flow about 1000 cfs (28 m^3/s). BLM

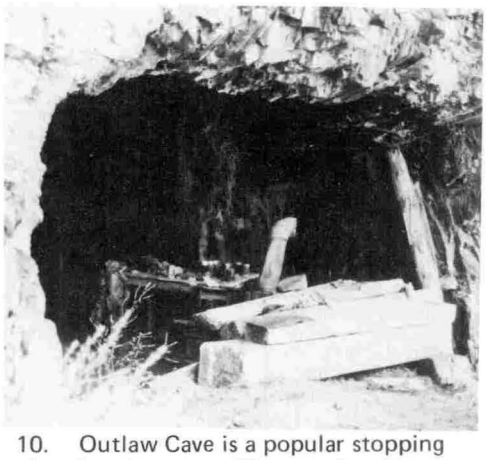
(60 m) in the vicinity of Marble and Star Canyons, creating an extremely narrow, claustrophobic gorge that lies within an outer gorge of flaring red sandstone walls stained with long black streamers of desert varnish. In places these upper walls have been covered by mudflows from the infrequent rains, leaving a braided pink pattern like the veins of a hand.

Near Skull Rapid the characteristic impression of Westwater Canyon is strongest. Such is the roar of the river, in the time of high water, that conversation must be carried on by shouting. In contrast to the wide red bench several hundred feet above and its low vegetation of shadscale and sage, the inner gorge is clamped by the dark iron-like walls; this portion of the canyon provides the impression of claustrophobia and constriction popularly associated with "canyons" but rarely offered by them. There is almost no shore but for occasional spills of massive talus boulders on which landing is difficult at low water and nearly impossible at high. In contrast to the rapids on other large western rivers, those of Westwater have curious fountains, boils, and whirlpools caused by the narrowness, depth, and wall projections; these are found elsewhere only in the Inner Gorge of Grand Canyon and in portions of Hells Canyon of the Snake, at very high water. The walls are mudstained by the passage of previous floods, and up to 35 feet (10 m) above those stains are remainders of the rare, great floods--pieces of silvered driftwood that are wedged into the walls, waiting 50 or 100 years for the next flood that will reach up to them and release them.

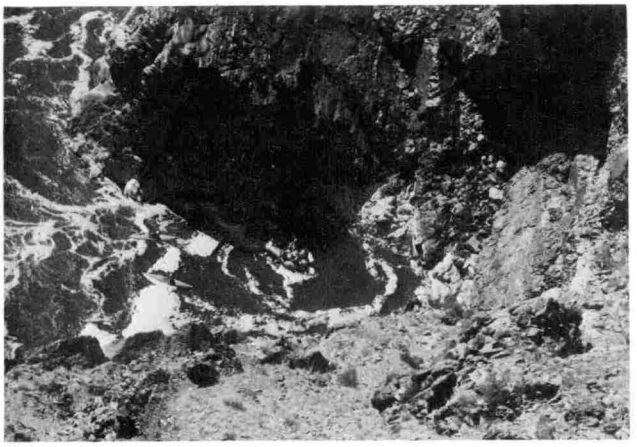
The flutings sometimes reach up to the highest pieces of driftwood. In some places these resemble columns or the folds of great black curtains. In others, the rotating whirl of silt and trapped stones has cut potholes which open through small rounded windows onto the river or to each other. Some of these potholes do not open at all, except at the top, and look like large drilled holes. In one



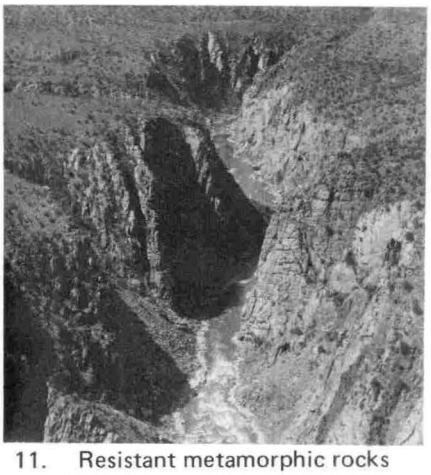
An upstream view from the rim above Skull Rapid toward Funnel Falls reveals the constricted inner gorge and the red sandstone walls above it. River flow about 3500 cfs (100 m^3/s). NPS



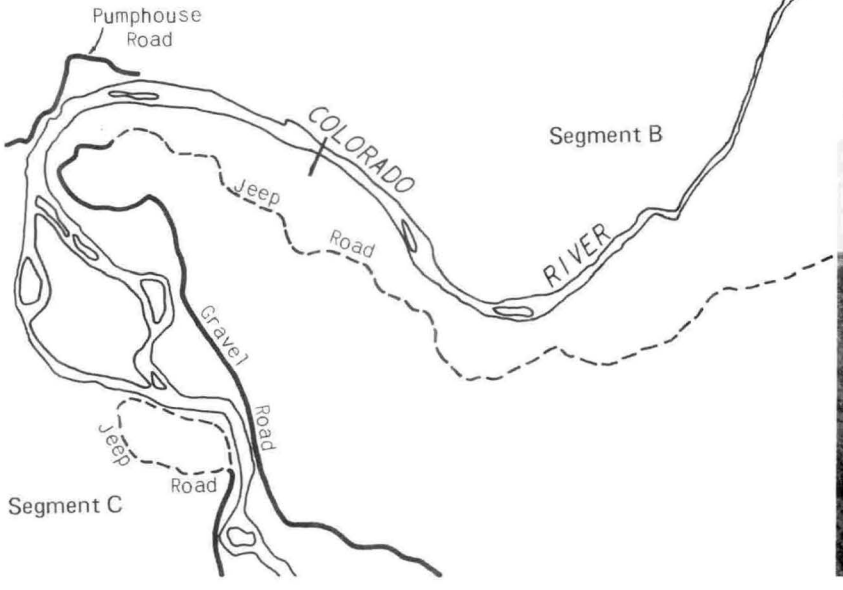
10. Outlaw Cave is a popular stopping place for river users. The cave is said to have been the hideout for outlaws. Remnants of their habitation still remain. BLM

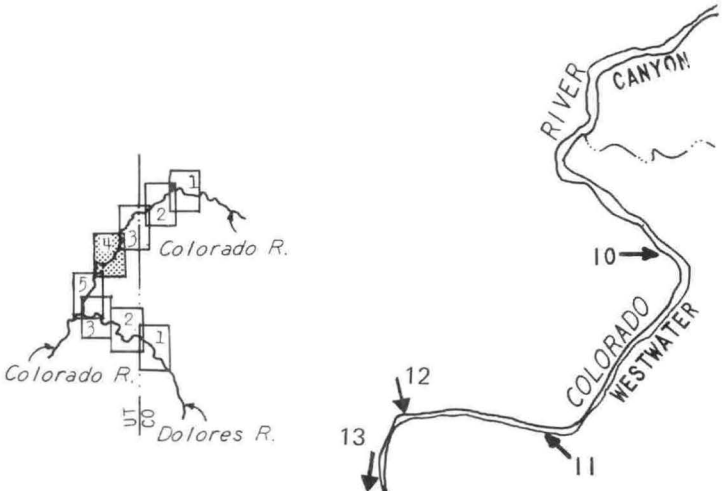


12. Two kayaks and two rafts in the 'Room of Doom' Skull Rapid. Flow about 1000 cfs (28 m^3/s). BLM



11. Resistant metamorphic rocks constrict the canyon to as little as 30 feet at one point. BLM





13. The steep-walled canyon limits vegetation, other than grasses and shrubs, to the benches high above the river. BLM

spot near Last Chance Rapid, the river has carved a huge femur, big enough to dwarf the fossil of a brontosaurus.

At the tail of Skull Rapid the river beats against a cliff. Part of it spills away downstream to rapids named Manila Folder, Sock-it-to-me, and Last Chance. But part surges into a great recess in the walls just below the main drop of Skull Rapid. At high water the river races into this angular bay, converting it to a swirling whirlpool whose outer margins are almost 3 feet (1 m) above the vortex. The grip of this whirlpool on its contents is so tenacious the rapid has sometimes been known as Dead Sheep: their bodies are sometimes found circulating in the whirlpool awaiting low water and release. Even at low or falling stages, when the river is largely free of driftwood, this recess, known to boatmen as the "Room of Doom," is filled with great rafts of twigs, sticks, boards, and logs which rise and fall on the surf driven into the bay by the rapid outside.

Skull Rapid approximately marks the deepest cut into the Uncompahgre Uplift; from that point on the river begins to pass downdip toward the southern margin of the anticline. One notable feature occurs a mile or so downstream on the rim. Big Hole is an abandoned meander. Known in most parts of the southwest as a "rincon" (Spanish for "corner"), this feature has a central tower surrounded by a circular valley. This one was formed at a time when the river's course was about 200 feet (60 m) higher than at present. It made an ox-bow surrounded by walls of Wingate Sandstone. Eventually, after the neck, with current directed against it from both sides, had gradually worn down, the river broke through.

By continuing its downcutting, the river has sunk about 200 feet (60 m) into the black rocks, leaving its former course to a pair of ephemeral tributaries which have gullied but not much deepened it.

By about 4 miles (6.4 km) below Marble Canyon, the Precambrian rocks have passed beneath the river, and will not reappear until they crop out below Hance Rapids in the Grand Canyon, more than 300 river miles (480 km) downstream.

As the dip of the strata continues, the river is again lined by the Wingate Sandstone, the Entrada, and then by the slopes and scattered spall of the Morrison Formation. As the river is released by each hard rock into the softer ones which lie above it, its width increases and its current grows more sluggish. By the Rose Ranch boat ramp the river is as wide as it was at the very beginning of segment A. To the east a few junipers and pinon pines can be seen on the tops of the bluffs, but barring the green stands of riparian vegetation lining the stream, the area seems almost empty of vegetation.

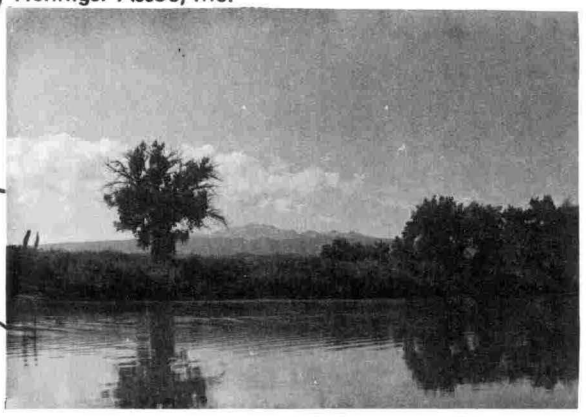
Segment C - Rose Ranch to Cisco Wash (River Mile 1038.5 to River Mile 1027.5). Downstream from the Rose Ranch boat ramp the Colorado flows south, through a valley cut in the Morrison to a width of 2-3 miles (3-5 km). This broad valley is used for agriculture, with hay meadow and grazing lands lying beyond the thick screen of tamarisk that lines the river. This segment shows the influence of man: it contains fences, powerlines, trailers, and some riprapping on the shores, including old car bodies. A few farm buildings--sheds and barns--can be seen; these are old and not well maintained.

About two miles (3.2 km) downstream from the Rose Ranch boat ramp the river crosses the Dry Creek fault, which brings the Entrada Sandstone in contact with the Salt Wash member of the Morrison Formation, a displacement of about 400 feet (130 m). Below the confluence with Coates Creek, the river flows in a relatively narrow canyon cut in the Brushy Basin member of the Morrison Formation, and several small faults in the Ryan Creek zone

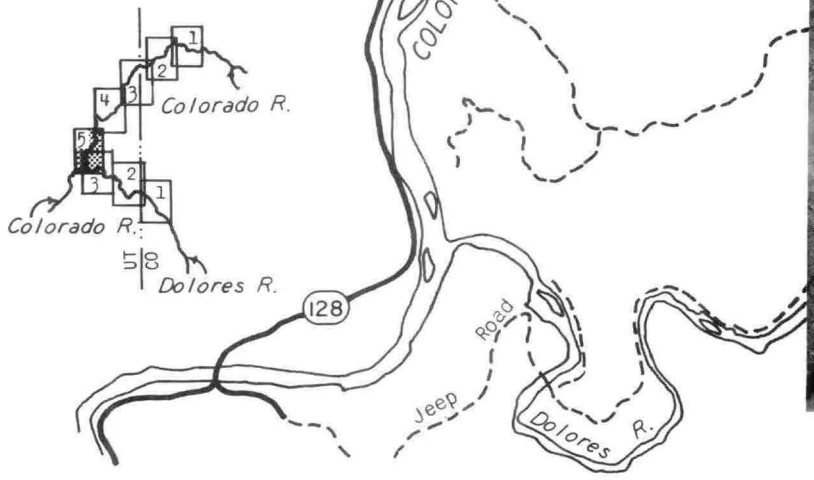
14. Below Westwater Canyon the River opens into a broad valley which is characteristic of the remaining portions of the study **area. BLM**

15. The upper and lower portions of the remaining river segment contain numerous evidences of man's activities. These are primarily agricultural. BLM

16. Riparian vegetation screens much of the agricultural lands adjacent to the river. Toward the lower end the scenic La Sal Mountains loom on the horizon. Harman, O'Donnell & **Henniger Assoc, Inc.**



17. Utah State Highway 128 parallels the last three miles of the study segment. This low-speed road which connects Moab and interstate 70, is becoming **popular as a scenic highway. BLM**



are visible in the interbedded shale and shandstone. The rock is still dipping; mesas made of the Morrison and capped by the Dakota Sandstone eventually diminish until, near Cisco Wash, the river flows in the Dakota.

Segment D - Cisco Wash to Dolores River (River Mile 1027.5 to River Mile 1023.5). In segment D the rock comes under the dominance of the La Sal Mountains, the laccolith near Moab which was described in Chapter II. Between the Uncompahgre Uplift and the uplifted rock ringing that range lies the Sagers Wash Syncline, a regional sag whose axis crosses the river about 1 mile (1.6 km) below the beginning of segment D. Here the river crosses the highest rocks it encounters in the geologic column; a wide valley opens in the soft saline Mancos Shale. Broad open expanses and long views characterize this section, with the dark blue and snow-capped La Sals providing a scenic contrast to the arid bluffs and dense riparian vegetation along the stream.

Human intrusions are also comparatively common in this reach. Houses, shacks, and agricultural land are visible, and the lower two-thirds of the segment is paralleled by Utah State Highway 128, which is occasionally visible from the river. As in segment C, the current is placid, even at high water.

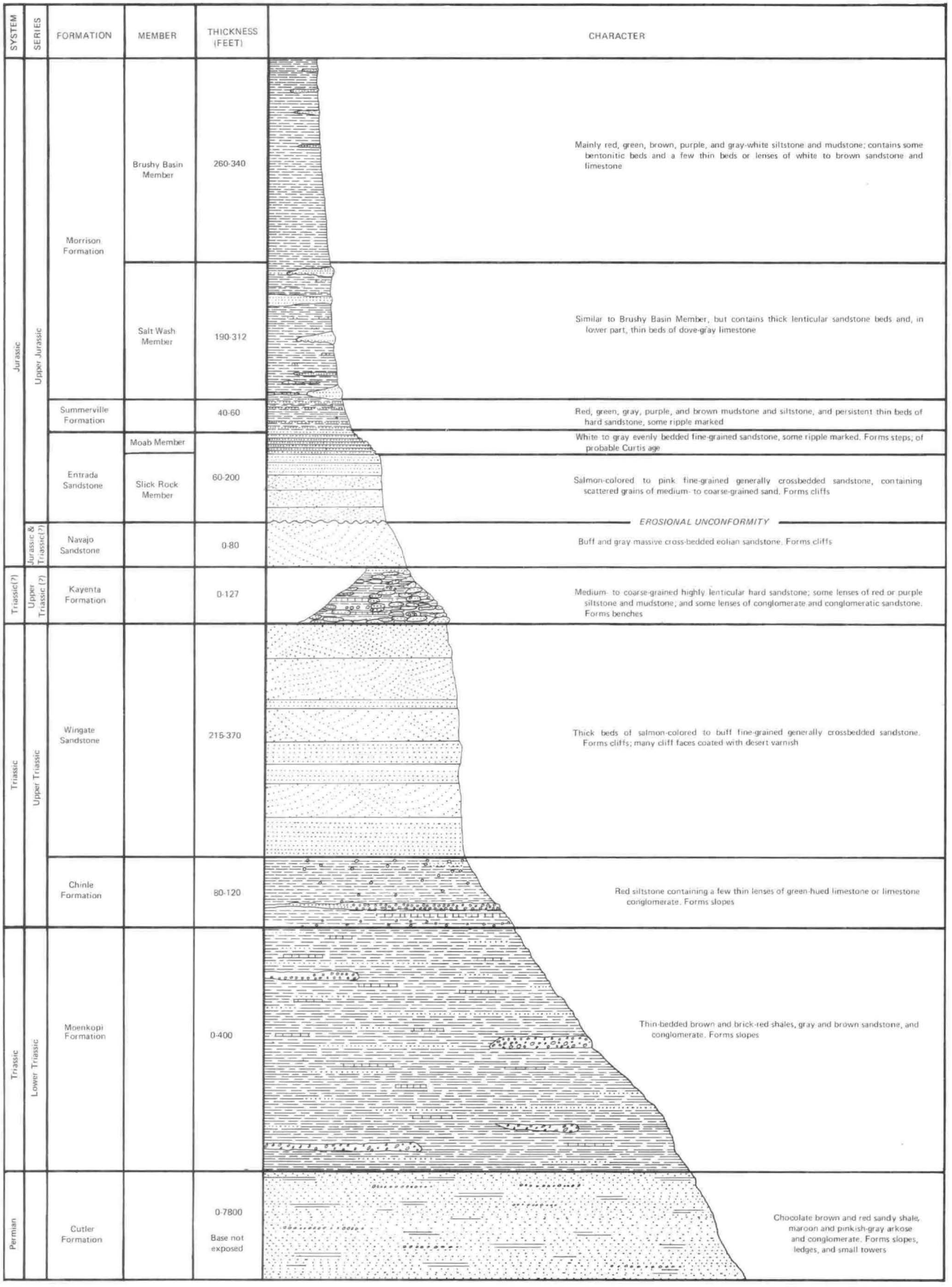
Once the axis of the Sagers Wash Syncline is crossed, the rock begins its slow rise toward the La Sals. From beneath the river successively older formations arise, until a bluff of Entrada Sandstone overtops the river just below its confluence with the Dolores.

Dolores River

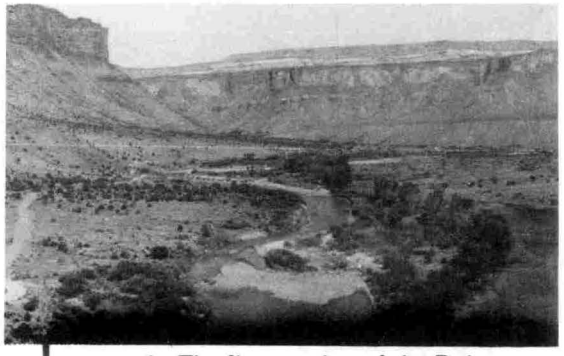
Segment A - Gateway to Fisher Creek (Cottonwood Canyon (River Mile 31 to River Mile 17). The massive Uncompahgre Uplift was a major structural barrier at the time of its first rise (in Pennsylvanian-Permian time, about 300 million years ago), even as it is now. Thus the stratigraphic column south of the Plateau, where the Dolores has its course, is in certain important ways different from that north of it along the Colorado. In particular, along the Colorado the Chinle formation overlies the Precambrian rock. Along the Dolores a period of erosion at the time of that first uplift reduced the summit of the Plateau and deposited the resultant materials in thick red sedimentary sequences which underly the Chinle; the black rocks are not seen. Below the Chinle, in the area of the Dolores, are the three shaly members of the Moenkopi Formation, and the Cutler Formation of purple arkosic sandstone and conglomerate. High above it, atop the Kayenta, are exposures of buff Navajo Sandstone, which also are not present along the Colorado.

The river's course at the start of the study area at Gateway is lined by Quaternary alluvium which veneers the Cutler, one of the rocks not present along the Colorado. Above these maroon sediments are the brick-red slopes and small ledges of the Moenkopi and Chinle, which slope about 800 feet (240 m) up to the vertical cliffs of Wingate Sandstone. The dominant color impression is of reds and greens. An alternation of purple ledges, red slopes, and pink cliffs stands up to 2100 feet (680 m) above the river, reaching high enough to be clothed in a dark-green forest of pinyon and juniper. At river level the intense, shimmering greens of cotton-wood, willow and tamarisk stand boldly out aginst the dark red tones of the cliffs.

GENERALIZED SECTION OF ROCK FORMATION ALONG THE DOLORES RIVER STUDY AREA

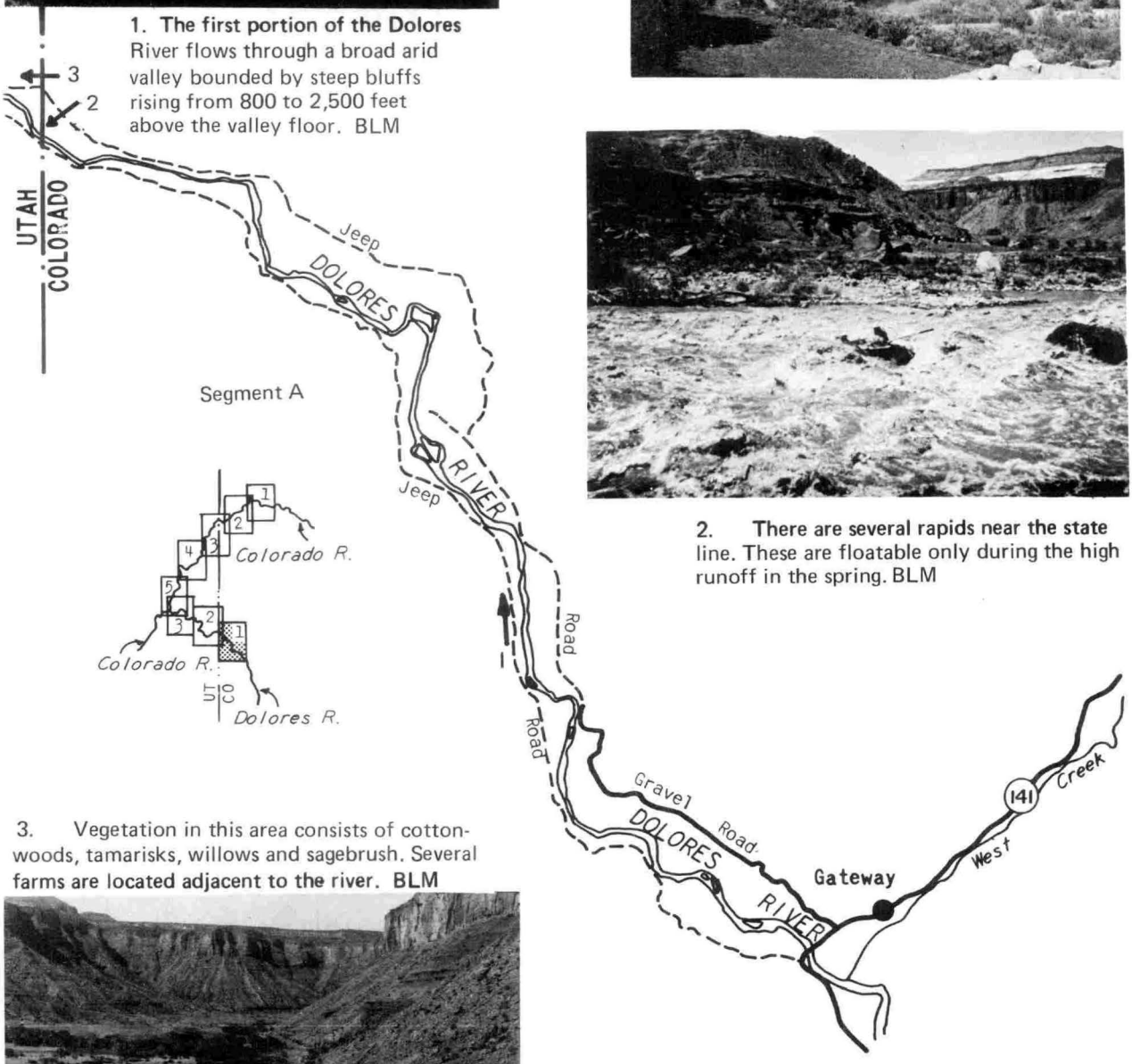


AFTER S. W. LOHMAN, GEOLOGY AND ARTESIAN WATER SUPPLY OF THE GRAND JUNCTION AREA, COLORADO PLATE 2, UNITED STATES GEOLOGICAL SURVEY PROFESSIONAL PAPER 451, WASHINGTON, D. C. (1965).

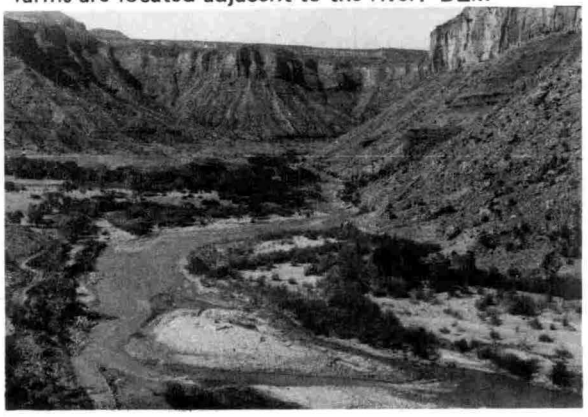


1. **The first portion of the Dolores** River flows through a broad arid valley bounded by steep bluffs rising from 800 to 2,500 feet above the valley floor. BLM

2. **There are several rapids near the state** line. These are floatable only during the high runoff in the spring. BLM



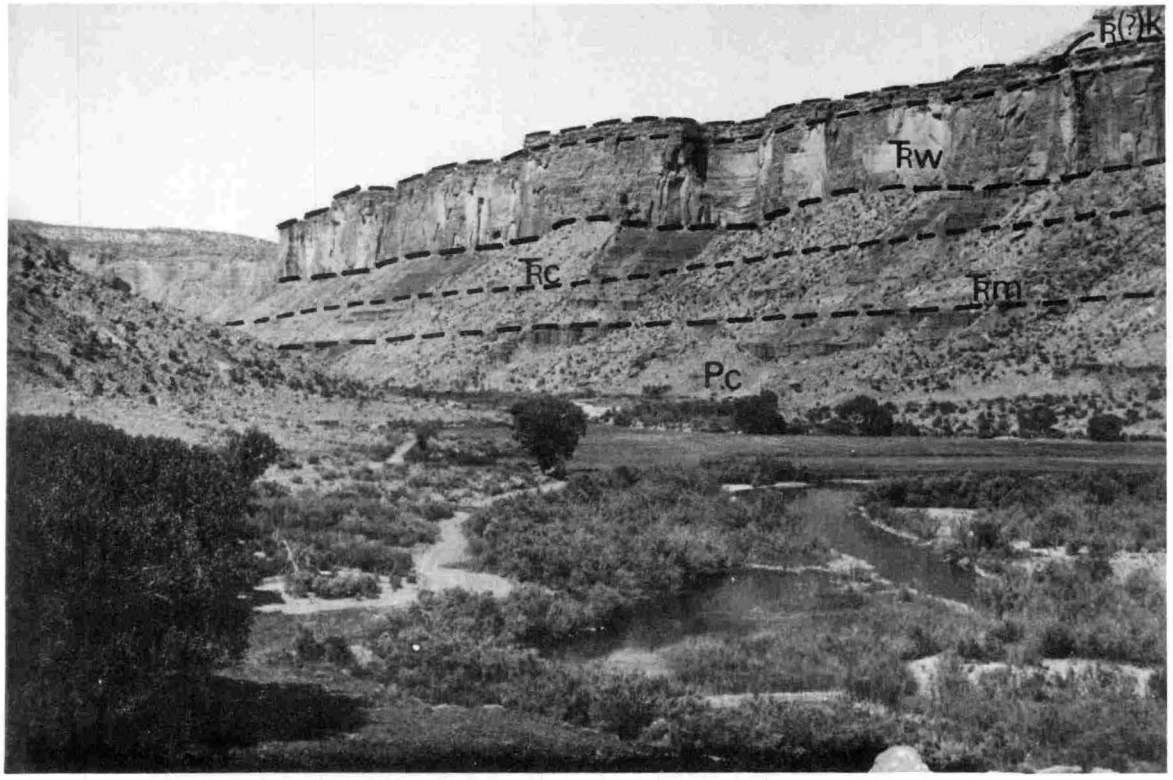
3. Vegetation in this area consists of cottonwoods, tamarisks, willows and sagebrush. Several farms are located adjacent to the river. BLM



The river corridor in most of this portion is about 2 miles (3.2 km) wide. Bounded by cliffs so distant they darken into a purple color, the valley alternates bright green hay and alfalfa fields with barren terraces of ancient cobbles, covered by grayish sage and shadscale. In this valley is one rapid, an irrigation dam which is followed by a series of waves and rocks.

The strata in this valley are dipping toward the northwest, the direction of the river's flow, so they gradually pass beneath the river. As these softer rocks pass under the river, the canyon narrows. The low-standard gravel roads on each shore which have been periodically visible through the intervening vegetation are squeezed closer toward the river by the narrowing walls. By the state line, the southern road immdiately borders the river. At this point is the most impressive rapid in the stretch, known either as Stateline Rapid or The Narrows. Outwash from a gully on the north bank has caused this rapid, and cliff fall from the southern walls of Wingate Sandstone has exacerbated it. The rapid, runnable only in the spring, is a complicated descent past and through holes and waves, through a constriction, and then to the right around the head of an island. Two irrigation ditches head at this point, one on each side of the river, making use of the declivity of the river.

Below this rapid lie others, also complicated by fallen boulders of Wingate Sandstone. On the south shore are fields farmed under a special use permit from the BLM. The north, right shore grows steeper and its angular talus slopes impinge on the river. The south shore has an understory of tamarisk, with large cottonwoods shading them. By this point, near the end of segment A, the north road has stopped and the south is well screened. The river's course is in the upper Moenkopi or lower Chinle, but these red shales are generally covered by fan-shaped talus slopes and detritus accumulations which support sage, shadscale, and



The valley of the Dolores below Gateway displays several formations absent along the Colorado. This photograph near the end of Segment A shows the lower ones.

TR(?)k — Triassic (?) Kayenta Formation
TRw — Wingate Sandstone
TRc — Chinle Formation
TRm — Moenkopi Formation
Pc — Permian Cutler Formation

BLM

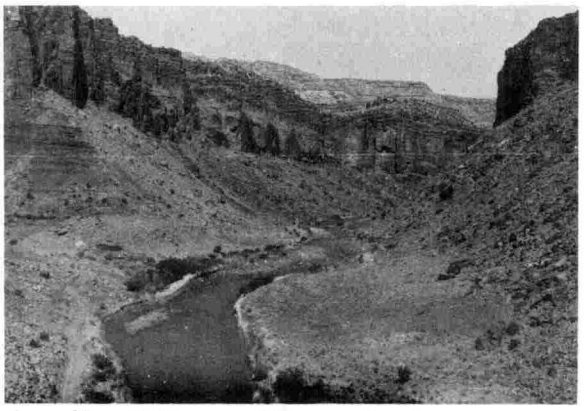
Stateline Rapid (The Narrows) on the Dolores in the fall of a normal year, and the spring of a wet year. Flows of about 75 cfs (2.1 m^3/s) and 9000 cfs (255 m^3/s). The large boulder shown in the first picture at the most constricted point in the rapid, forms the left border of the second. HCRS

greasewood. The canyon has narrowed to perhaps one-half mile (0.8 km) in width.

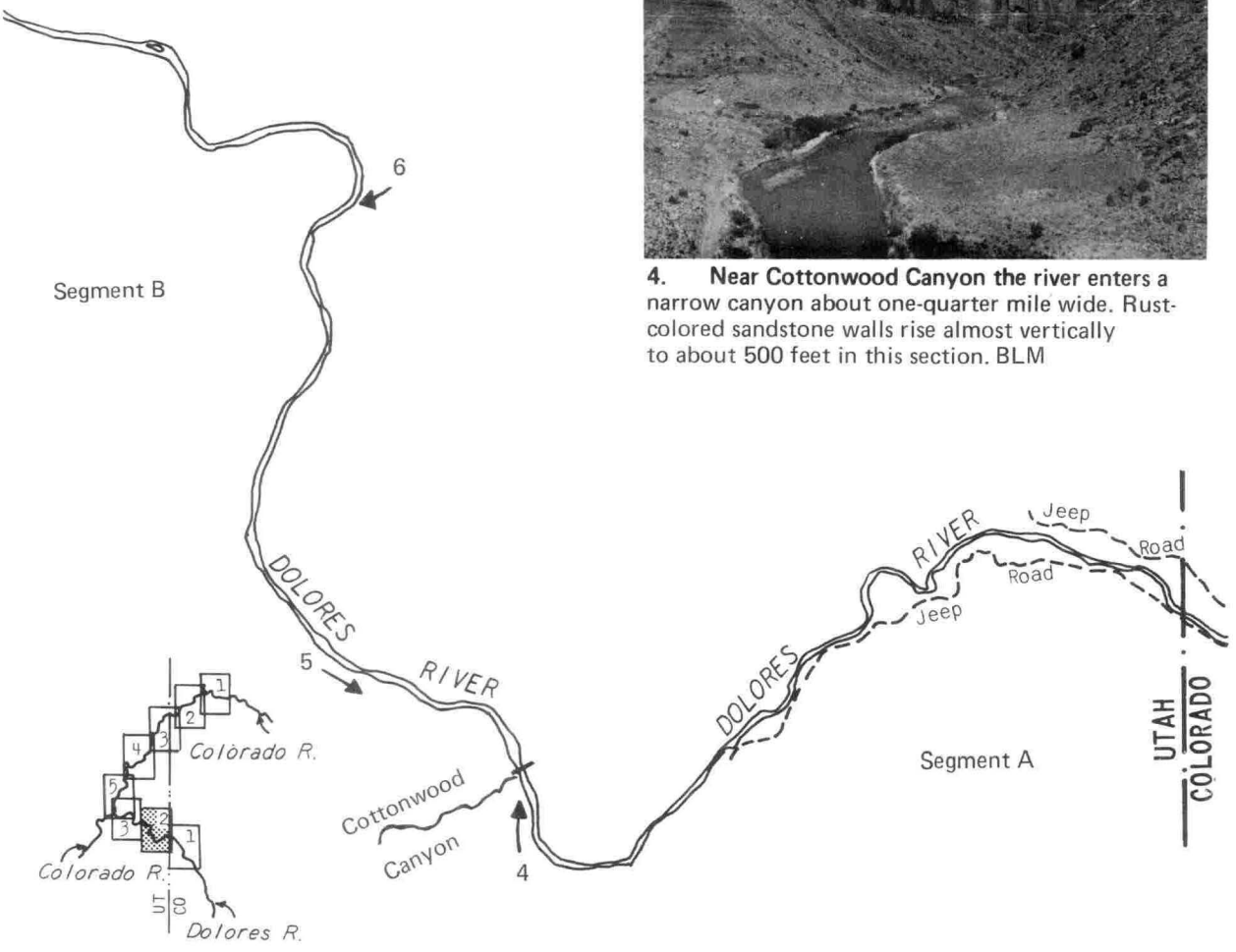
Segment B - Fisher Creek to Bridge Canyon (River Mile 17 to River Mile 11). This segment, barring a placer mine of about 5 acres (2 ha) at its lower end, has no substantial trace of human activity. The canyon is narrow, about one-quarter mile (400 m) wide, with sheer walls of Wingate Sandstone almost 500 feet (160 m) high lining the river's course. The few long vistas available in this narrow canyon reveal the colorful strata above the Wingate, the Kayenta, the Navajo (which makes a distinctive beige cliff), the pink band of the Entrada and the ledgy Morrison Formation. Though the flow of this reach is relatively quick, it has no rapids. Occasional side canyons invite exploration. In time of low water, the muddy shores near these side canyons may display the tracks of deer, great blue heron, coyote, mountain lion, and the drag-marks of beaver hauling brush. Throughout this reach the strata dip, so the rock formations successively plunge beneath the river. The boater gradually leaves behind the Chinle, Wingate Kayenta, and Navajo Formations.

Segment C - Bridge Canyon to the Confluence with the Colorado River (River Mile 11 to River Mile 0). Once it encounters the higher, softer sediments of late Jurassic and early Cretaceous time, the river opens a wider valley. Longer views of mesas capped by the dark brown sandstone ledges of the Morrison and Burro Canyon Formations become more frequent, as do traces of human intrusion. Tamarisk, itself an exotic and therefore an intrusion, dominates the shores, and hides most traces of the placer and uranium mines which were the predominant human use of this area. A low-water ford, ranch buildings, and a gaging station may also be noted.

The upper portion of this reach is lined by the Entrada Sandstone. In the area of Utah Bottom, the axis of the Sagers Wash Syncline

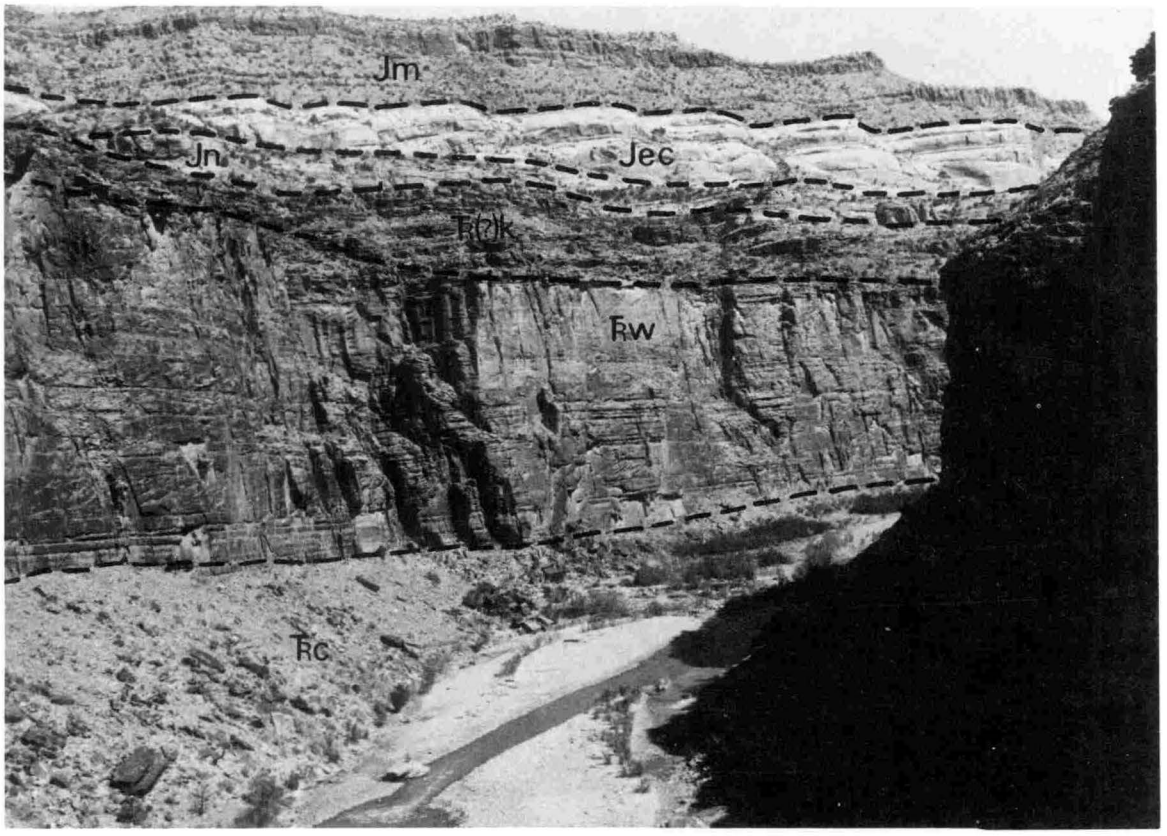


4. Near Cottonwood Canyon the river enters a narrow canyon about one-quarter mile wide. Rust-colored sandstone walls rise almost vertically to about 500 feet in this section. BLM



5. Willows, tamarisks, and other riparian vegetation occupy the narrow benches along the river. HCRS

6. The snow-capped La Sal Mountains are visible south of the canyon area. BLM



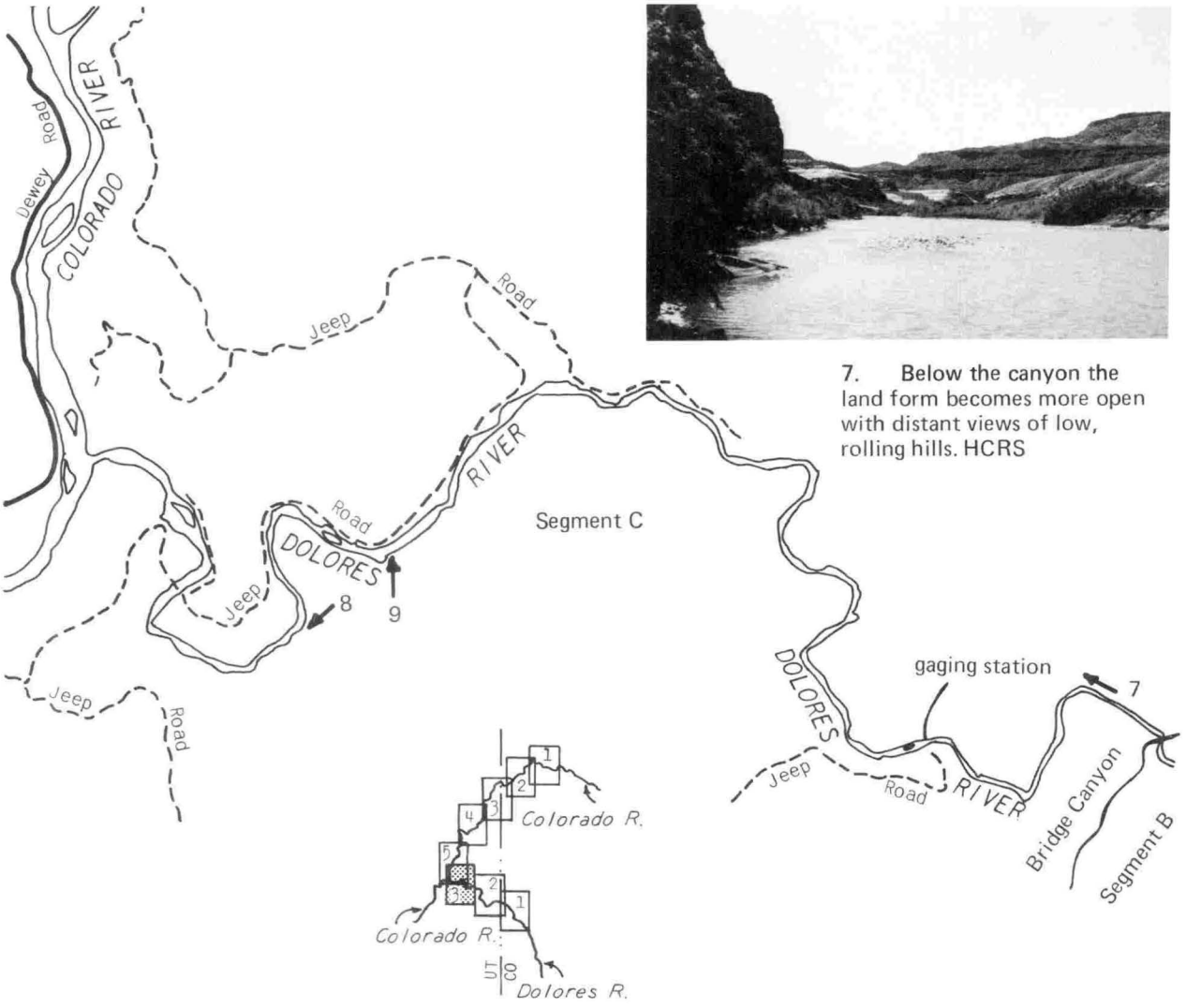
The Dolores Canyon in Segment B reveals one rock type not present on the Colorado – the Navajo Sandstone, near the area where it pinches out against the Uncompahgre Uplift.

Jm — Jurassic Morrison Formation
Jec — Entrada Sandstone
Jn — Navajo Sandstone
TR(?)k — Triassic (?) Kayenta Formation
TRw — Wingate Sandstone
TRc — Chinle Formation (obscured by talus)

(mentioned in the description of the Colorado River) crosses the river, replacing the general southwestern dip of the rock off the Uncompahgre Plateau with a northeasterly dip, the result of the Yellowcat dome that lies west of the Colorado River. Perhaps the most striking geologic feature in the Utah Bottom area is the smooth, sheer pink and white face of the Entrada sandstone. Known as the slickrock or slickrim in many parts of the southwest, it forms a distinct scarp on the cliff. In this area it displays a distinctive X pattern in its joints that is of considerable scenic interest.

Below Utah Bottom the Entrada disappears beneath the river, whose course is then in the Morrison. At first relatively narrow, after about 2 miles (3.2 km) the valley opens up for the remainder of the segment, attaining its greatest width near Lake Bottom. Colors in the rock become more subtle, and appeal to a different taste than in the canyon upstream. The Morrison walls are dominated by spall colored a burnt sienna. Through this accumulation of dark, varnished rock there are sometimes sights of the shale which also comprises the formation; this appears in all the earth tones including reds, purples, white, greens, and even blues. The higher slopes are sparsely covered with sagebrush.

Lake Bottom is the most wooded area in this segment of the Dolores. The river forms a large omega-shaped bend opening to the north. The open area within the meander contains a low-water ford and is thickly grown over with tall tamarisk clumps and cottonwoods that support the nests of great blue herons. Below this point, for the final mile of its course, the Dolores penetrates rising strata, so that by the confluence with the Colorado, it has re-encountered the Entrada Sandstone.



7. Below the canyon the land form becomes more open with distant views of low, rolling hills. HCRS

8. Lake Bottom is dominated by cottonwoods, with willows and tamarisk along the river. BLM

9. Evidence of mining activities that have taken place along the lower portion of the Dolores River. BLM

MINERAL RESOURCES

Important mineral resources found within the study corridors include uranium, vanadium, gold, oil, gas, coal, and sand and gravel. Each is discussed separately below.

Uranium and Vanadium

There are small deposits of uranium and vanadium in the Salt Wash Member of the Morrison Formation in the vicinity of the confluence of the Colorado and Dolores Rivers. During the 1950s, a few prospects within the river corridor produced a total of 50 tons (45 metric tons) of ore containing 180 pounds (81 kg) U_3O_8 and 1,900 pounds V_2O_5 (864 kg).

In its preliminary report on the national uranium resource evaluation program, the Energy Research and Development Administration (ERDA), now the Department of Energy (DOE), has indicated that a portion of the possible potential resources of the Thompson area occur within the corridors of the Colorado and Dolores Rivers near their confluence. The potential resources estimated within the corridors are as follows:

100,000 to 150,000 pounds (45,500 - 68,200 kg) U_3O_8
280,000 to 420,000 pounds (127,300 - 190,900 kg) V_2O_5

These resources are in DOE's $30 per pound forward cost category. Of these, it is estimated that as much as 18,000 pounds (8,180 kg) might be recoverable--3,000 pounds (1,360 kg) in the Colorado corridor and 15,000 pounds (6,820 kg) along the Dolores. Recent increases in the price of uranium will undoubtedly stimulate prospecting and exploration drilling in the confluence area. Uranium minerals have also been reported on the north side of the Colorado

River in the Loma-Mack area, but at the present time, no significant mineral deposits are known in this area. The major deposits near the Dolores are on Beaver Mesa, outside and west of the study corridor.

Placer Gold

While placers have been worked at various places along the Colorado and Dolores Rivers, information about the location of the deposits, numbers, and locations of claims is sketchy and difficult to obtain. From the end of the last century to about 1942, placer operations along the Dolores netted about 1500 troy ounces (47.62 kg). Extensive new placer operations in the corridor of either river are unlikely.

Sand and Gravel

To resurface I-70 the Utah Department of Highways is currently obtaining sand and gravel from bars along the Colorado River near Cisco, Westwater, and Harley Dome. The total amount of sand and gravel that will be extracted from these three sites is approximately 450,000 cubic yards. (344,000 m^3).

Oil and Gas

The nearest oil and gas production has been from the Cisco field, near the town of the same name, approximately 4 miles (6.4 km) west of the Colorado River. This field was discovered in 1954 and shut-in in 1965, after 7 wells produced 9,356 bbls oil from the Morrison and Dakota Formations at depths of less than 2,000 feet (610 m). Although the reservoirs are not large, low drilling costs offer economic incentives.

While it is impossible to estimate oil and gas potential along segments A, C, and D, the possiblity of discovering oil and gas cannot be ruled out. Segment B (Westwater Canyon) has no potential for oil and gas discoveries. Oil and gas interest appears to be high along the Colorado River in T22S, R24E, or approximately the lower half of segment C and upper half of segment D. Application has been made for oil and gas leases in at least 50 percent of this area.

Coal

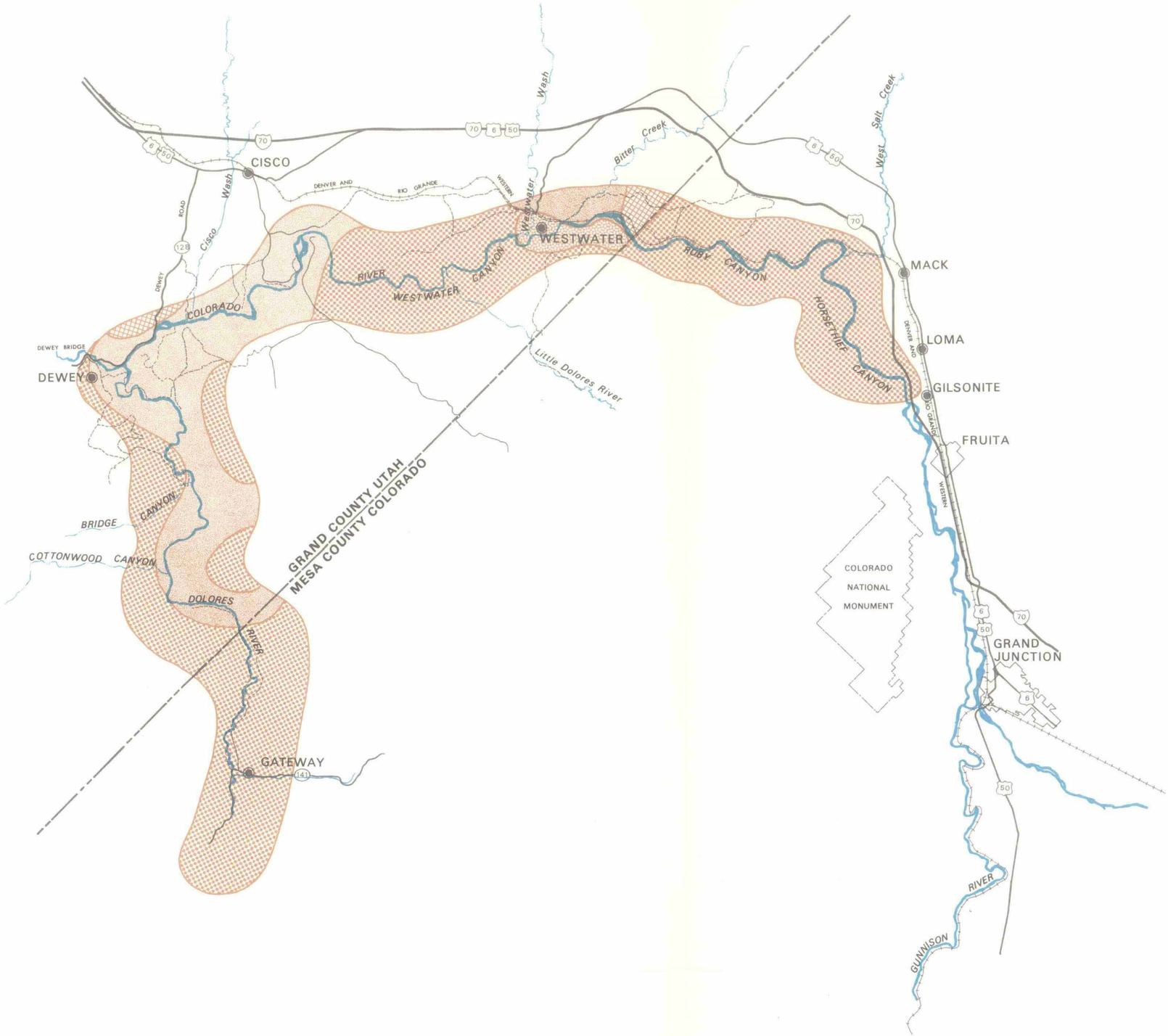
The Dakota Sandstone contains coal in many parts of western Colorado. A bed of subbituminous coal has been prospected on the hogback ridge between the Colorado River and U.S. Highway I-70 in the Loma-Mack area. This ridge lies within the study corridor during about the first 0.5 mile (0.8 km) of segment A. A prospect pit near Mack is about 1.5 miles (2.4 km) northest of Horsethief Canyon.

SOILS

Detailed soil surveys have not been made on the study corridors. By utilizing Soils of Colorado and Soils of Utah[1], a map of the soil associations in the corridors was made. A drawing of the generalized position of soils in the corridor landscape displays the typical position of the associations along the rivers. As is to be expected from the description of geology in the previous section,

---

1. Colorado State University Experiment Station, May 1976; and Utah Agricultural Experiment Station, September, 1973; both prepared in cooperation with the US Soil Conservation Service.



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

GENERAL SOIL ASSOCIATION

GRAVEL ROAD

JEEP ROAD

12/41 - LITHIC USTOLLIC CALCIORTHIDS
LITHIC USTIC TORRIORTHENTS

51 - AQUIC XEROFLUVENTS AQUIC USTIFLUVENTS

63 TYPIC TORRIORTHENTS LITHIC CALCIORTHIDS

68 ROCKLAND

N

1 .5 0 1 2 3 4 miles

1 .5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,020
DSC | FEB 79

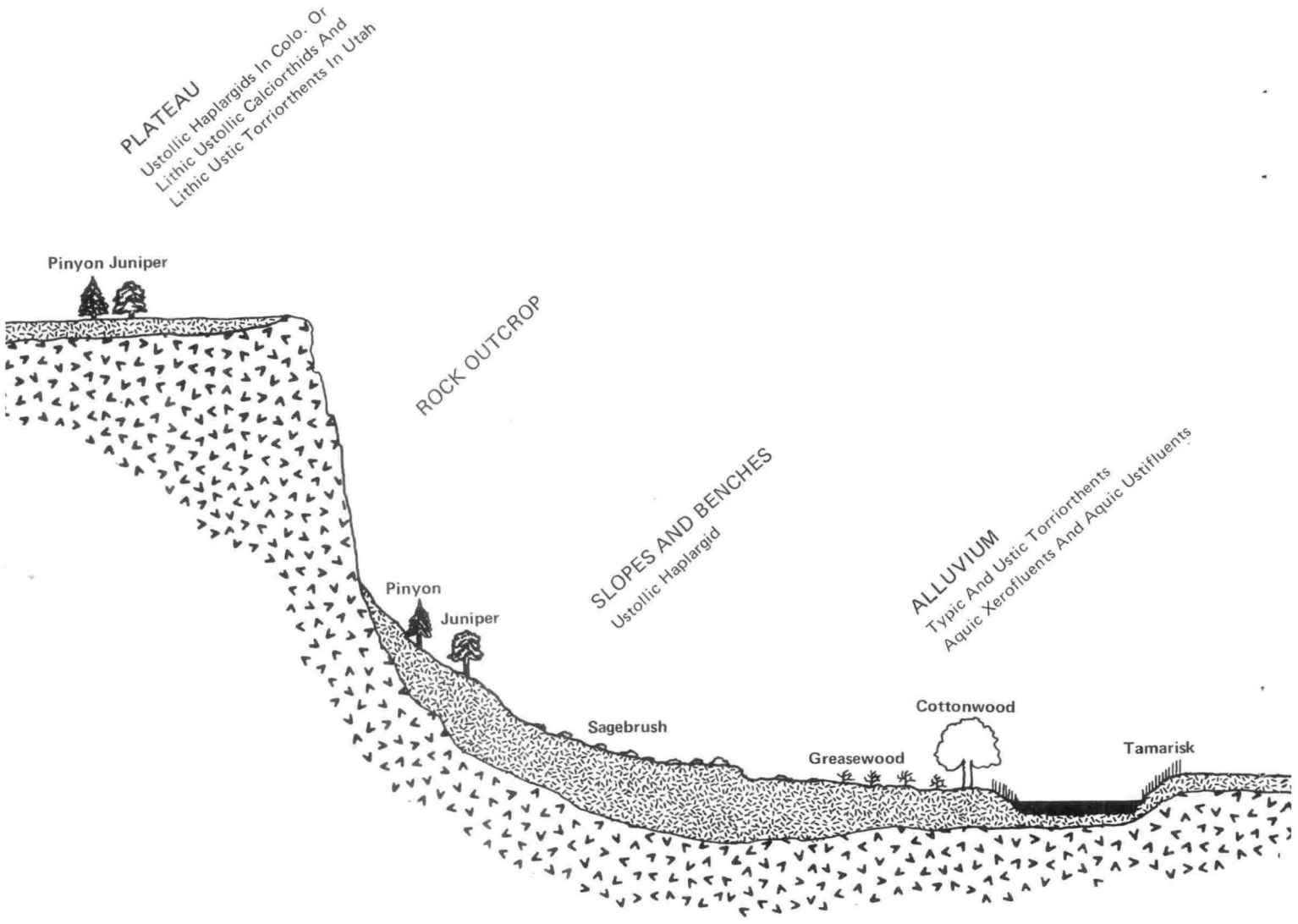
Rock Land is one of the most common "soils" in the area, especially when it is noted that the other soil associations sometimes contain portions of rock outcrop or badland.

In examining the soils map, it should be noted that the title of map unit 12 in Colorado does not match the title of unit 41 in Utah where they meet at the state line. Since these mapping units include the same kinds of soils, a combined mapping unit (12/41) was created by combining the pertinent information of each state's description. The soils associations of the area are described by their numerical key below.

12/41. Lithic Ustollic Calciorthids (30%)--Lithic Ustic Torriorthents (15%), Ustollic Calciorthids (15%), Ustollic Haplargids (15%)--Rock Outcrop (25%). The soils in this unit occupy the mesas, high benches, mountain slopes, and narrow canyons of the study area. Formed in materials weathered predominantly from sandstone, these soils have slopes ranging from 2 to 50 percent. These well-drained soils display moderate to rapid permeability, with medium to rapid runoff and moderate sediment production.

These soils are used primarily for range, wildlife and recreation. Native vegetation is dominated by pinon and juniper with an understory of sagebrush, Mormon tea, mutton grass, and Indian ricegrass.

51. Aquic Xerofluvents (30%)--Aquic Ustifluvents (25%)--Typic Torrifluvents (20%) Association (contains 25% Typic Natrargids and Vertic Fluvaquents). These soils are poorly drained, with water tables high enough to keep them moist for long periods. They are found along recent flood plains and low stream terraces adjacent to the major rivers.



GENERALIZED POSITION OF SOILS IN THE CORRIDOR LANDSCAPE

The permeability of these soils is slow to moderately rapid, with runoff being slow to rapid and sediment production high, mainly because of banks slumping into the rivers. The principal native vegetation on these streamside soils is cottonwood, willow, tamarisk, greasewood, and associated grasses, forbs, and shrubs. Grazing and the nurture of wildlife are the principle uses of this association.

63. Typic Torriorthents (Shallow) (40%)--Lithic Calciorthids (20%)--Lithic Natrargids (20%) Association (contains 20% Lithic Ustollic Calciorthids and Badland). The soils in this association display moderate to slow permeability. Runoff is rapid and sediment production is high.

The principal native vegetation is shadscale, mat saltbush, Nuttall saltbush, greasewood, and associated grasses, forbs, and shrubs.

These soils are used mainly for range and wildlife habitat, with some small areas serving as irrigated pasture.

68. Rock Land. This association occurs mainly on canyon slopes of the Colorado River and its numerous tributaries. It also occurs on geologic folds and faulted areas and includes plateaus, mesas, and some basin areas. The relief varies from very steep canyon walls and fault scarps to undulating and rolling uplands. Elevations range from about 3,600 to 7,600 feet.

The bare rock in this land type is estimated to be from 50 to 75 percent of the area. Shallow and very shallow soils over sandstone bedrock comprise about 20 to 40 percent. The other 5 to 10 percent is deep and moderately deep soils. Runoff is high on this association. The use of this land type is mainly for viewing scenery and recreation.

VEGETATION--COLORADO RIVER

Two major studies, one by Dr. Arthur H. Holmgren of Utah State University and three associates which studied Westwater Canyon for threatened or endangered flora, and one by Randall S. Shin and Frank J. Smith, which resulted in a description of vegetative associations in Horsethief and Ruby Canyons, have been made in the area. The remaining portions of the river were studied by the BLM.

Segment A (Loma, Colorado to Westwater, Utah)

As a result of the study by Shin and Smith, more is known about the flora of this segment than any of the others in the study zone. This study identified four plant communities in the area--streamside, floodplain, island, and slope.

The dominant streamside vegetation is tamarisk, cottonwood, and willow. In small intermittent areas in Ruby Canyon, communities of grasses, forbs, and shrubs appear. The tamarisk, which is not native to this area, is an agressive invader which is generally successful in competing with native vegetation, eventually replacing it.

Floodplains, located at bends in the river or between the river and the slickrock canyon walls in Ruby Canyon, are slightly higher above the water than the typical streamside communities so they are dominated by cottonwoods, greasewood, and a mixed riparian woodland association.

On the slopes and slickrock ledges of Ruby Canyon, a characteristic pinyon-juniper community and various associations of shadscale and sagebrush exist.

The juncture of Mee Canyon with the Colorado River in Ruby Canyon illustrates vegetative communities. Tamarisk lines the river; the floodplains are dominated by cottonwoods, greasewood, and the mixed riparian woodland association; slopes and cliffs support the pinyon-juniper community. Similar communities are found in Segment A of the Dolores. BLM

The major islands, like the shores, are dominated by tamarisk, willow, and cottonwoods, but they contain a much heavier understory of forbs and grasses. The lush growth on the islands can be attributed to a lack of grazing and an adequate water supply.

Man has disturbed the vegetation of the Ruby Canyon area in several ways. The most far-reaching disturbance is probably the spread of tamarisk up to the area from the vicinity of the Mexican border, where it was apparently introduced along the Imperial Canal. Some areas of land have been cultivated. Although these are mostly confined to the Loma and Westwater areas, a small site is located within Ruby Canyon, just above the mouth of Mee Canyon. Other human disturbances have been the clearings for roads and the railroad. A less obvious disturbance, at present, is that a combination of drought and overgrazing has almost completely eliminated the understory in the cottonwood, sagebrush, and greasewood communities.

Segment B (Westwater Canyon)

Westwater Canyon almost totally lacks significant vegetation within the Precambrian rock through which the interior of the canyon is cut. This rock weathers extremely slowly, so it is only in isolated depressions or cracks where soil has been deposited by wind or water that limited stands of forbs, grasses, and even small shrubs have become established.

Above this layer on benches and slopes, or below it, on rare sand bars along the river's edge, vegetation flourishes. The benches above the inner gorge are dominated by shadscale; the steep slopes above them by juniper. The few sandy banks support tamarisk and willow.

Westwater Canyon. Vegetation is almost completely confined to the benches above the inner gorge. BLM

The bottom third of this segment marks a gradual return to the vegetative association which characterizes the river corridor above Westwater Canyon--a meandering stream with large floodplains dominated by stands of tamarisk, cottonwood, and willow. These riparian associations are backed by large communities of shadscale and smaller communities of greasewood where the soils are deeper and moisture is sufficient. Extensive cultivation is occurring across the river from the Rose Ranch take-out.

Segments C and D (Rose Ranch to Confluence with Dolores River)

In spite of the substantial volume of water which flows in the Colorado River, the river influences vegetation only along its immediate banks. Tamarisk forms almost a solid line on both sides of the river for nearly the entire length of both segments. The tamarisk is backed by communities of large cottonwoods in many areas, especially on the floodplains, and greasewood communities which are generally not visible from the river. The shadscale association occupies the slopes and benches near the river. Other major vegetative species found dispersed in the various associations include rabbitbrush, willow, and squawbush.

Clearings for agriculture, roads, and ranches have partially altered the natural vegetation in these segments.

VEGETATION--DOLORES RIVER

The vegetation along the Dolores River is very similar to that of the Colorado River. Streambank vegetation in segment A is primarily cottonwood and mixed riparian woodland association. Areas away from the river are generally shadscale and sagebrush with occasional junipers. Cultivation of hay and alfalfa has altered the natural vegetation to some extent in this segment.

Tamarisk forms an almost solid line on both sides of the rivers in their lower segments. BLM

Vegetation in segment B is primarily restricted to the streambank due to the steep cliffs and talus on both sides of the river. Tamarisk has almost totally taken over these banks although willows still survive in some places.

Segment C of the Dolores is very similar to segments C and D on the Colorado. Floodplains are dominated by cottonwoods, greasewood, and other mixed riparian vegetation. Tamarisk is abundant along the river bank. The area away from the river has shadscale and some greasewood.

Threatened or Endangered Flora

Although only limited investigations of threatened or endangered flora have occurred in the study areas, discussions with Dr. Holmgren, who studied portions of Westwater Canyon, and Dr. Stanley Welsh, a noted plant taxonomist who has made several studies in southeastern Utah, have resulted in a partial species list for the area. The list of threatened, endangered, or narrow endemics for the area includes but is not limited to the following species:

Astragalus eastwoodiae--A narrow endemic of the locoweed family whose type location has been given as Westwater, Utah.

Astragalus sabulosus--This species, also of the locoweed or milkvetch family, is believed to extend into the Westwater area near the river from its type location at Cisco, Utah.

Psoralea aromatica--Though collected near Fisher Towers and the Onion Creek area, this species of scurf-pea may extend into the lower reaches of the study area.

Aquilegia micrantha--This species of the Columbine family is found in many of the "hanging gardens"[2] in southeastern Utah, and thus could be found in any hanging garden in the study area.

Of particular interest is a large lupine which was collected by Edward Blake Payson in the early 1900s in the lower study area. It has not been collected since and is a subject of interest to present-day taxonomists.

A complete listing of these plants can be made only after an extensive on-the-ground inventory has been made of the river corridor. Such an inventory would undoubtedly reveal the presence of several other species.

FISH AND WILDLIFE

Fish--Colorado River

The Colorado River has been a harsh environment for fish. Widely fluctuating flow levels, water temperatures ranging from near freezing to 90° F (32° C), heavy sediment loads in the spring and after thunderstorms, and periods of high salinity produce high stress. Only a few species of fish were originally able to live under these conditions--the Colorado squawfish (Ptychocheilus lucius), the

---

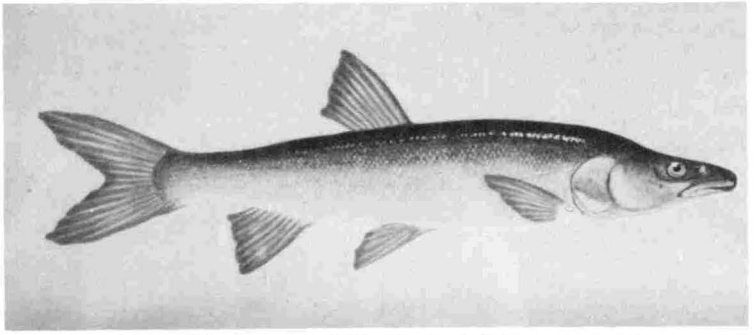
2. A hanging garden is a clump of vegetation up on a cliff, supported by groundwater seeping through the rock. The inaccessible cliffs to which they cling, which in turn are often found in almost inaccesible canyons, have left them little known, so they are possible sites for several threatened, endangered, rare, or narrow endemic species.

bonytail chub (Gila elegans), the humpback chub (Gila cypha), and the humpback or razorback sucker (Xyrauchen texanus). These four species are today in danger of extinction, and are protected by Colorado and Utah state law. In addition, the squawfish and humpback chub are listed as endangered species by the U.S. Fish and Wildlife Service. The bonytail chub has been proposed for endangered status, and the humpback sucker has been proposed for threatened status.

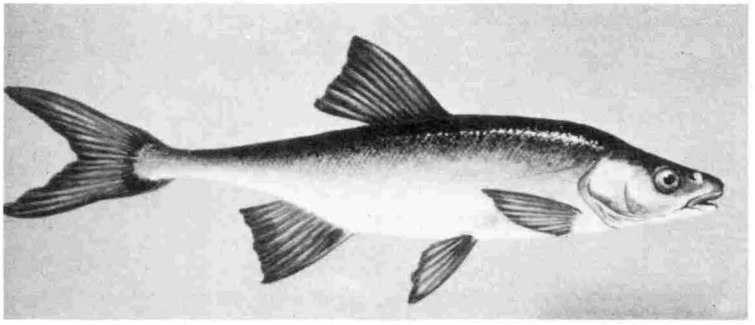
The range of all four of these species has been greatly reduced. Once found in the whole length of the Colorado and its major tributaties, they are apparently almost extirpated in the Lower Basin. The last populations known to exist are in the Green below the Yampa River and in the upper Colorado River above Lake Powell, which includes the study area. Recent inventories have found all but the bonytail chub in the study area, although it has been found in the area within the last 15 years.

Because these native fishes are adapted to the natural environment, they have survived where alterations of it have been least. Although there have been changes in the flow and chemical parameters of the Colorado River, the general physical conditions of the study area have remained much as they were originally. Because of the presence of the endangered species and to ensure their continuation by maintaining natural conditions, the Colorado River Fishes Recovery Team has proposed that much of the upper Colorado River, including the study area, be listed as critical habitat for the Colorado squawfish.

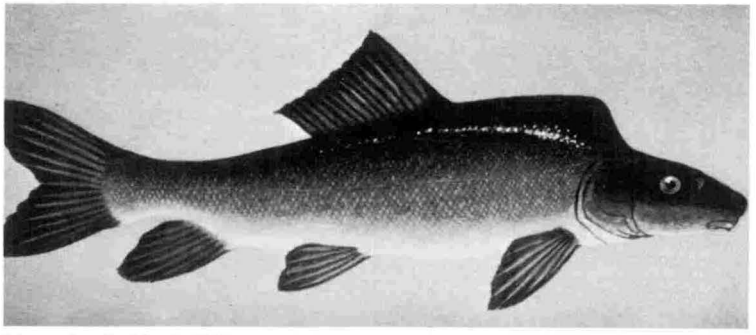
With the coming of the settlers, new species were introduced. These introduced fishes are by far the most numerous. Some of these, such as the carp, channel catfish, black bullhead, large-mouth bass, and the sunfishes, were introduced for sport purposes. Others, such as the red shiner, sand shiner, and



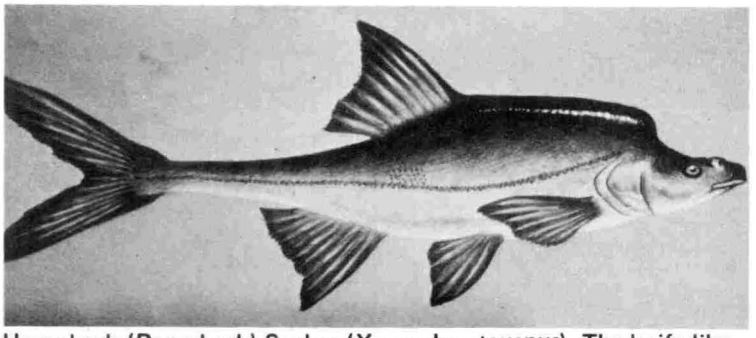
Colorado Squawfish (Ptychocheilus lucius). These giant minnows may reach 6 feet and 80 pounds (36 kg). Colorado Division of Wildlife



Bonytail Chub (Gila elegans). Another large minnow, which may attain lengths of 18 inches (0.5 m). Colorado Division of Wildlife



Humpback Chub (Gila cypha) This remarkably-shaped large minnow may grow to 18 inches (0.5 m). Colorado Division of Wildlife



Humpback (Razorback) Sucker (Xyrauchen texanus). The knife-like dorsal hump helps stabilize the fish in the rapid currents of high water. May grow to 16 pounds (7.3 kg). Colorado Division of Wildlife

fathead minnow, were probably introduced when people dumped bait fish into the river. Fish population trends, based primarily on studies by Holden and Kidd, are shown in Appendix C.

Current trends are for native fishes to remain static in number or to continue to decline as introduced fishes increase both in number and species. Alterations in the river that moderate conditions, such as reducing sediment levels or removing flood flows, favor survival of the introduced forms at the expense of the native species. The introduced fish have also evolved in competition with many other species, so they tend to outcompete the native species.

Fish--Dolores River

The Dolores study segment contains good rearing areas, in addition to the riffles and rapids that produce food. Historically the river contained good populations of fishes, including some of the threatened and endangered Colorado River species. In recent years, however, fish populations have declined markedly and shifted to smaller, more tolerant forms.

Three factors have led to the change in fish populations. The first was the desiccation resulting from upstream irrigation diversions. This sometimes reduced flows in the lower portion of the river to less than 4 cfs (0.1 m^3/s) although they are usually above 50 cfs (1.4 m^3/s). The second factor was the high salt concentration. Ground water entering from Paradox Valley contains very high levels of dissolved solids. With low flows this highly saline inflow can raise salt levels in the Dolores to levels that exceed fish tolerances. The third factor was the pollution caused by uranium processing upstream, particularly at Uravan. This pollution was one factor in a sharp decline in fish populations in the 1950s and 1960s. Once the decline occurred, the low flows resulting from

upstream withdrawals and high salinities precluded recovery of the populations even though pollution from the uranium industry has been reduced.

Today shiners and suckers are the predominant fish species. Depending upon the time of year and flow level, other species, such as channel catfish, roundtail chub, and carp can be found. Populations tend to be best near the mouth, indicating movement upstream from the Colorado River. Sampling in late summer during low water has produced no fish at all in some areas.

The river has the potential for excellent fish production, particularly if the Bureau of Reclamation desalinization project in Paradox Basin is implemented. It would, however, require more consistent downstream flows in order for fish populations to be maintained over the dry summer months.

Wildlife

The two segments under study provide very similar wildlife habitat. While wildlife species are found all along both rivers, certain portions of the rivers are more attractive than others. The riparian habitat contains the greatest abundance and largest variety of wildlife, as shown in appendix C. The presence of water results in the riparian habitat providing more food and cover than other habitats.

The most common mammal species present are mule deer, coyotes, cottontail rabbit, and numerous species of rodents.

Most of the mule deer are residents since the river bottoms provide year-round habitat. However, some migrate to and from the surrounding high country. The Dolores Triangle area between the

two rivers is deer winter range and has been utilized quite heavily in past years.

The Utah Division of Wildlife Resources believes that Westwater and Dolores Canyons could support desert bighorn sheep, and is considering a program to introduce them in these areas. Bighorn sheep do not compete well with man or his activities, including livestock grazing, mineral exploration, or the pressures created by heavy recreational use. At present these canyon areas are fairly isolated and there is very little evidence of human activity. Even though recreational use of Westwater Canyon is moderately heavy (7,000 visitor days in 1976), this canyon would still make excellent bighorn sheep habitat, since recreationists mostly confine themselves to the bottom of the inner gorge.

The most common bird species present are rock doves, mourning doves, rock wrens, canyon wrens, Canada goose, mallard ducks, blue-winged teal, great blue heron, and a variety of raptors such as the turkey vulture, bald eagle, golden eagle, and sparrow hawk. Except for the golden eagle, which can be found throughout the year, these birds are all relatively abundant in certain seasons.

The only endangered terrestrial species positively occuring in the study area are the American peregrine falcon (Falco peregrinus anatum) and the bald eagle (Haliaeetus leucocephalus). Several sightings of peregrine falcons have been reported in Westwater Canyon and one suspected active eyrie has been identified. Because of the abundance of prey species, such as ducks, geese, rabbits, and rodents, along with the steep canyon walls adjacent to the river, this area is excellent peregrine falcon habitat. Although none have been sighted in the Dolores Canyon area, this is also excellent peregrine falcon habitat.

The bald eagle is generally present along both river segments during the winter months. However, the frequency of late spring and early summer sightings suggests bald eagles are becoming more common. This indicates that there may be an active bald eagle nest present in the area.

On great blue heron rookery has been identified near the Westwater Ranch and one at Lake Bottom on the Dolores. Canada geese are known to nest near the Utah-Colorado state line. This population is believed to be increasing.

There are several species of reptiles and amphibians present. The most common are the red-spotted toad, bullfrog, side-blotched lizard, striped whip snake, gopher snake, and collared lizards.

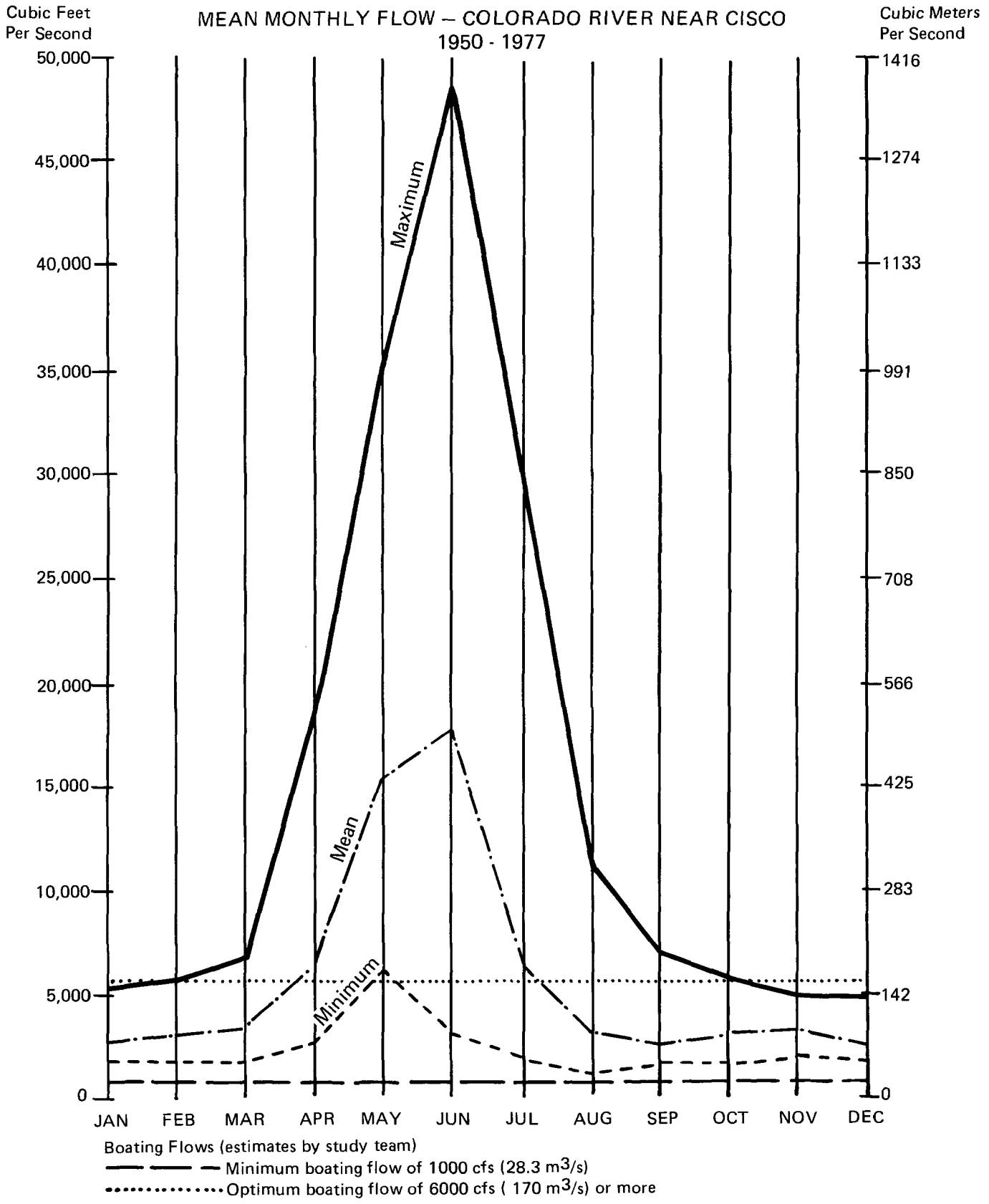
WATER RESOURCES

Colorado River Stream Flow

The flows of the Colorado are extremely variable. Its total annual flows, its maxima and minima, and its monthly averages betray very large variance. The lowest recorded flow of 558 cfs (15.8 m^3/s) contrasts with the highest, 76,800 cfs (2175 m^3/s) in June of 1917; a factor of almost 140 separates the two.

The greatest flood since white settlers reached the area, on July 4, 1884, reached an estimated 125,000 cfs (3540 m^3/s), or 224 times the lowest flow. Normal annual crests are in the range of 20,000-30,000 cfs (560-850 m^3/s).

The high water period of May and June produces the greatest range in monthly flows, with the month of June averaging as little as 6000 cfs (170 m^3/s) and as much as 43,830 cfs (1240 m^3/s). In


MEAN MONTHLY FLOW – COLORADO RIVER NEAR CISCO
1950 - 1977
Cubic Feet Per Second
Cubic Meters Per Second
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1416
1274
1133
991
850
708
566
425
283
142
0
Maximum
Mean
Minimum
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Boating Flows (estimates by study team)
Minimum boating flow of 1000 cfs (28.3 m3/s)
Optimum boating flow of 6000 cfs (170 m3/s) or more

November and December, when the flows are sustained by groundwater, the monthly flows cluster more closely around the yearly mean value. These offseason flows are in the range of 2,000-4,000 cfs (57-114 m^3/s).

Just as there is a wide range in daily and monthly flows, there is also a wide range in total annual flows. At the state line station, 2.3 million acre-feet (2,813 million m^3) in 1954 was the smallest volume of water measured in the last 27 years. This represents an average flow of about 3,200 cfs (91 m^3/s). In contrast, 8.9 million acre-feet (10,888 million m^3) of water flowed down the river in 1957, for an average of 12,280 cfs (347 m^3/s).

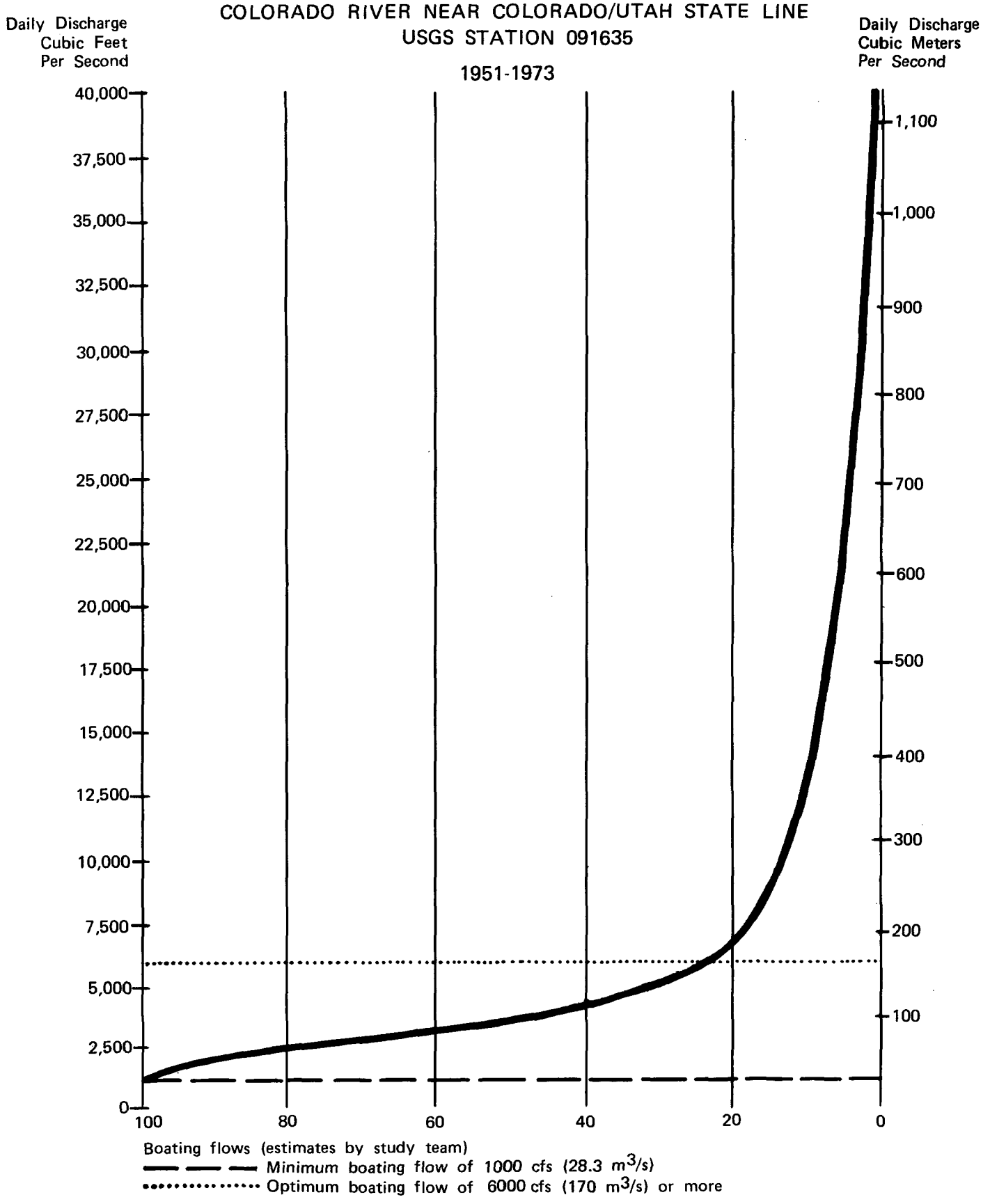
When the Colorado rises from its winter flow to its spring crest, the river is first dotted with melting ice blocks. The melt gathers the waters of the foothills first, and gradually ascends the mountains to the elevations where most of the water is stored. Over the course of weeks the river widens to almost 1,000 feet (300 m) in the valley parts of the study area, and rises some 6 to 8 feet (1.8-2.4 m). The translucent brown color of lower stages gradually thickens to beige; an occasional beaver-cut stick drifting on the low stages becomes great rafts of driftwood released as the river slowly rises into driftwood piles stacked up years, and sometimes decades, previously. The current may double in speed. Beneath the surface of the calmer areas, the river scours its bed, sometimes several feet. Down in the narrows of Westwater Canyon, where the bed material cannot be scoured, the river may rise 10 or 15 feet (3-5 m), and its increases in velocity are huge. Individual rocky rapids merge into a turbulent millrace where the waves reach 8 feet (2.4 m) high.

PERCENT OF FLOWS THAT EQUAL OR EXCEED A GIVEN RATE OF FLOW

COLORADO RIVER NEAR COLORADO/UTAH STATE LINE

USGS STATION 091635

1951-1973



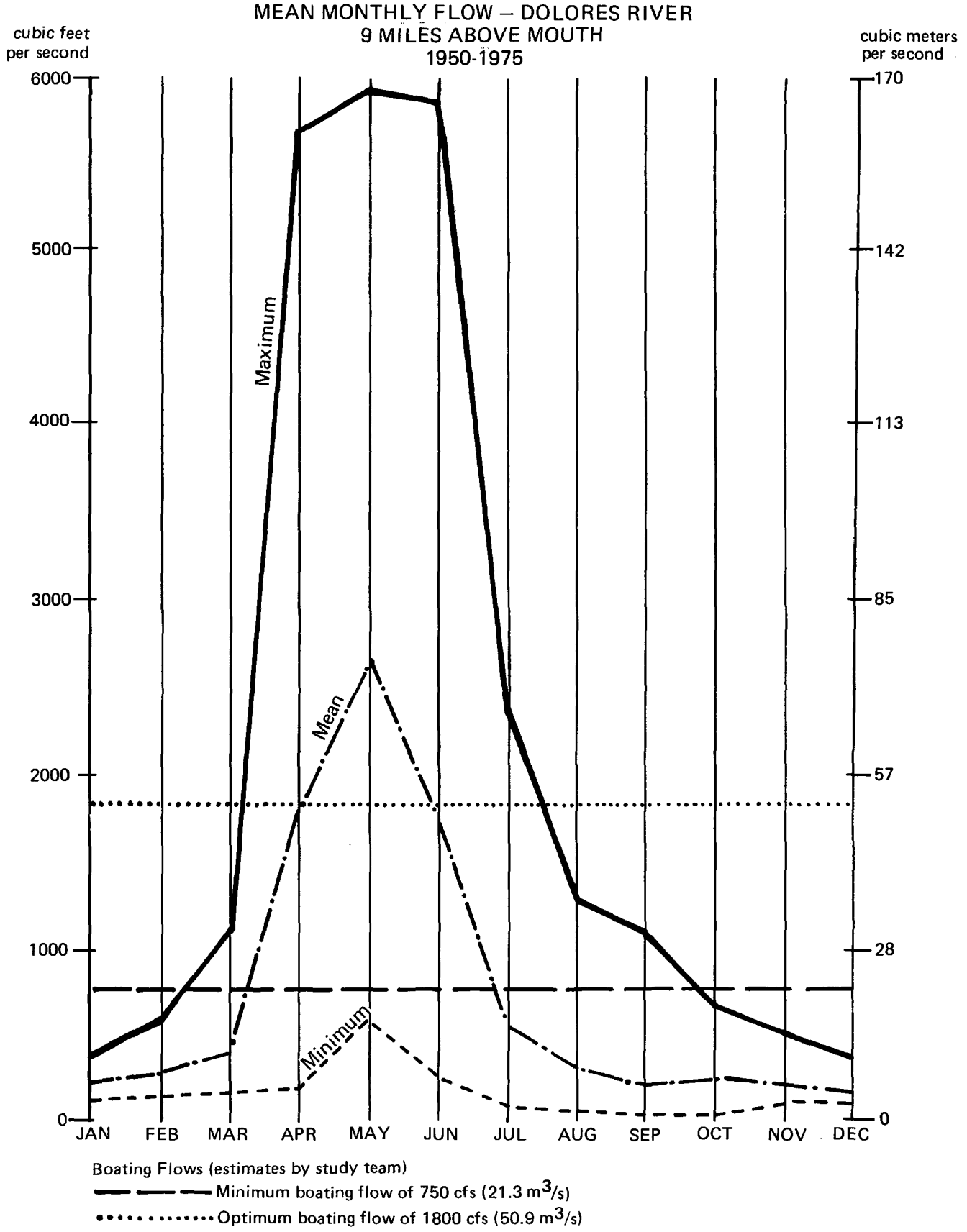
Dolores River Stream Flow

Even compared to other southwestern rivers like the Colorado, the Dolores in the study segment has spectacularly variable flows. The river has flowed as high as 1,086,000 acre feet (1328.6 million m^3), and as low as 164,000 (200 million m^3) in two successive years (1951, 1952 or 1958, 1959), a factor of almost seven. There is a factor of over 5,000 between the highest recorded discharge, 17,400 cfs (493 m^3/s), and the lowest, 3.4 cfs (0.09 m^3/s). As with the Colorado, the greatest range in monthly flows coincides with the period of maximum runoff. In November through January maximum and minimum flows are very close to the mean values.

Almost twice as many years have flows below the mean as have them above it; this indicates that peak flows tend to be well above the mean.

The river reaches its high stages in April, May and June, when it passes 50 to 80 per cent of a year's water. It turns a thick tan, rises 3 to 8 feet (1-2.3 m), and usually attains volumes between 3,000 and 7,000 cfs (85-200 m^3/s). Through the other nine months, it has relatively low even flows of 50-250 cfs (1.4-7 m^3/s) and occasional rain crests in the summer and fall, tinted red-orange by the redrock country upstream.

As with the Colorado, most of these changes in flow represent season-long climatic variation. Heavy snowpack in the mountains and moist spring weather lead to higher runoff while periods of drought lead to greatly reduced streamflow. The highs and lows are accentuated by irrigation patterns; during drier years, proportionately more water is withdrawn than during wet ones. Localized intense thunderstorms can more than double the low summer flows for a short period.

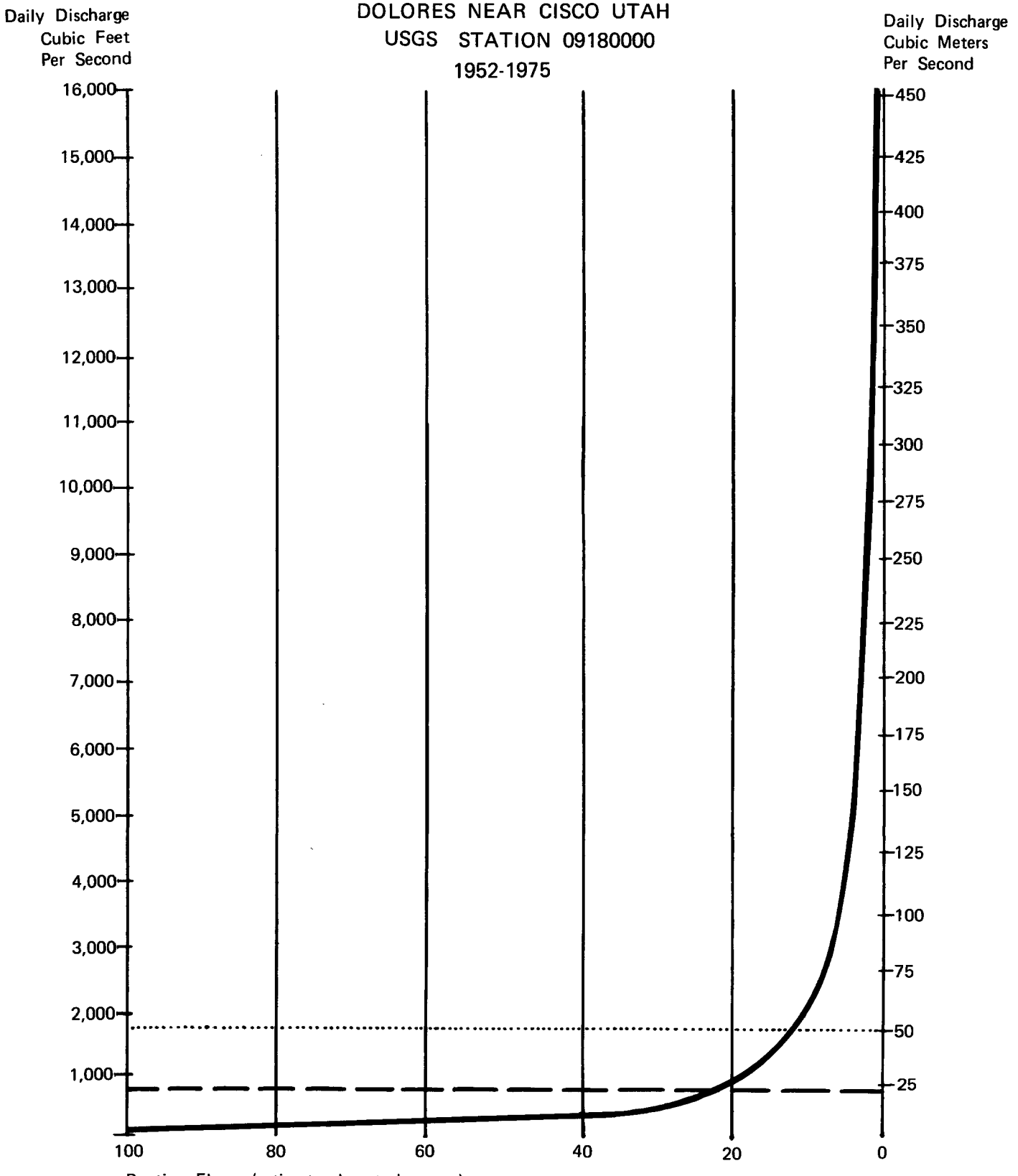

MEAN MONTHLY FLOW – DOLORES RIVER
9 MILES ABOVE MOUTH
1950-1975
cubic feet per second
cubic meters per second
6000
5000
4000
3000
2000
1000
0
170
142
113
85
57
28
0
Maximum
Mean
Minimum
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Boating Flows (estimates by study team)
Minimum boating flow of 750 cfs (21.3 m3/s)
Optimum boating flow of 1800 cfs (50.9 m3/s)

PERCENT OF FLOWS THAT EQUAL OR EXCEED A GIVEN RATE OF FLOW

DOLORES NEAR CISCO UTAH

USGS STATION 09180000

1952-1975



Boating Flows (estimates by study team)

— — — Minimum boating flows of 750 cfs (21.3 m^3/s)

····· Optimum boating flow of 1800 cfs (50.9 m^3/s)

Water Rights, Colorado and Dolores Rivers

Water rights located on the Colorado and Dolores rivers within the study area are shown in table III-1. The table shows that 16 water rights on the Colorado River total 383.55 cfs (10.86 m^3/s) of total annual appropriations. The Dolores River has 7 water rights for a total annual appropriation of 15.65 cfs. (0.44 m^3/s).

Approximately 80 percent of the water rights are for irrigation, with the primary use period from July through October.

Existing Development

Very little water resource development along the Colorado River study area has occured in the past. Existing developments are limited to small irrigation diversions, usually in the form of pumps which irrigate lands adjacent to the river.

The same is true of the Dolores River. On the Dolores River the diversions do not use pumps but instead use small diversion dams that feed water to irrigation ditches.

There are no authorized federal projects within the study areas of the Colorado or Dolores Rivers.

Other Projects

The Federal Energy Regulatory Commission (FERC) has identified the Dewey site, approximately 2 miles (3.2 km) downstream from the confluence of the Colorado and Dolores rivers, as a potential location for a hydropower dam. If constructed, this would back water to the top of the Colorado study area and more than halfway up the

TABLE III-1

WATER RIGHTS - COLORADO AND DOLORES RIVERS

Reference Number	Applicant	Source	QUANTITY c.f.s.	QUANTITY ac.-ft.	Use 1/	LOCATION T.	LOCATION R.	LOCATION Sec.	Status 2/
1.	Mack Pipeline	Colorado River	300.0		N,D,M,R	10S	103W	8	Cond.
2.	Horsethief Forebay	Colorado River		38,408	P,N,D,M,R	10S	103W	8	Cond.
3.	J. Loren Luster	Colorado River	10.0		I	20S	25E	13	App.
4.	H. P. Pennington	Colorado River	5.0		I	20S	25E	12	Cert.
5.	Emmett Elizondo	Colorado River	13.9		I,S	20S	25E	11	Cert.
6.	Emmett Elizondo	Colorado River	10.92		I	20S	25E	11	Dili.
7.	Greald Laughter	Colorado River	2.0		I,D,S	20S	25E	1	Unapp.
8.	Floyd W. Nielson	Colorado River	9.21		I,S	21S	24E	27	Cert.
9.	J. Perry Olsen	Colorado River	3.86		I	21S	24E	15	Cert.
10.	J. Perry Olsen	Colorado River	8.663		I	21S	24E	15	Dili.
11.	Cameron B. Grant	Colorado River	3.0		I,D,S	22S	24E	28	App.
12.	Robert J. Barnes, et al	Colorado River	2.0		Misc.	22S	24E	29	Unapp.
13.	State Land Board	Colorado River	2.0		I,S	22S	24E	3	App.
14.	Gerald Laughter	Colorado River	2.0		M	22S	24E	3	Unapp.
15.	Gerald Laughter	Colorado River	5.0	+400	I,S,D	22S	24E	28	Unapp.
16.	Paul Fritz	Colorado River	4.0		I,S	23S	24E	8	App.
17.	George W. Wister	Dolores River	2.14		I	22S	24E	20	Cert.
18.	Gerald Laughter	Dolores River	2.0		M	23S	25E	17	App.
19.	L. L. Hubbard	Dolores River	2.23		I	24S	26E	4&7	Dili.
20.	L. L. Hubbard	Dolores River	3.29		I	24S	26E	4&7	
21.	Wines	Dolores River	.86		I	15S	104W	21	Abs.
22.	Wines #1	Dolores River	5.81		I	15S	104W	27	Abs.
23.	Boyd	Dolores River	.9		I	15S	104W	27	Abs.
24.	Boyd	Dolores River	.42		I	15S	104W	27	Abs.

1/ I - Irrigation S - Stock N - Industrial M - Municipal
D - Domestic P - Hydro power R - Recreation

2/ Cond. - Conditional Cert. - Certificate Unapp. - Unapproved
App. - Approved Dili. - Diligence Abs. - Absolute

Dolores river study area. According to the FERC there is no interest at present by anyone to develop this site.

Industrial Resources, Inc., has a conditional decree in and near segment A of the Colorado. This project would install a 38,000 acre-foot (46.9 million m^3) reservoir slightly above the mouth of Salt Creek, which would back water through Horsethief Canyon. From this reservoir, 300 cfs (8.5 m^3) would be withdrawn for consumptive use north of the study area. An additional 2,020 cfs (57.2 m^3/s) would be withdrawn above the study area, of which 2,000 cfs (56.6 m^3/s) would be used non-consumptively for cooling water and the rest consumptively used. Of the 320 cfs (9 m^3/s) for consumptive use, 10 cfs (0.28 m^3/s) has been conveyed to Sheridan Enterprises, Inc., which has indicated the water will be diverted upstream from the study area. The uses to which the water would be put are irrigation, municipal, and industrial, including a thermal generating plant.

WATER QUALITY

Colorado River

The Colorado River in the study section is moderately saline. The river acquires salts from springs in the Glenwood Canyon area, and from several mostly ephemeral tributaries like Salt and Bitter Creek which flow off highly saline substrates. In particular, the Mancos Shale, north of the study area, is one of the largest diffuse sources of salinity in the entire Colorado River system.

Within the study area, the principal salts are sodium and calcium sulfates, bicarbonates, and chlorides. The average total dissolved solid (TDS) load is 720 milligrams per liter, with a maximum measurement of 1230 mg/1. This averages 10,764 tons (9,785 metric

tons) of dissolved solids per day in the Colorado study area. The measurement goes up about 30 percent below the mouth of the Dolores river, rising to a mean TDS of 1026 mg/1; this is the result of the saline waters--a mean TDS value of 1870 mg/1--in the Dolores River.

Total suspended sediment values were not available for any station except the Dewey gaging station, where the mean concentration was 5,177 mg/1, or an output of 103,653 tons (94,230 metric tons) per day. The highest value recorded was 1,350,000 tons (1,227,000 metric tons) per day of suspended sediments. Turbidities are accordingly high; 41.5 Jackson Turbidity Units (JTU) at the state line and climbing to 133 JTU at Dewey. An overall total of nearly 115,000 tons (104,500 metric tons) of dissolved and suspended solids wash down the river each day.

Many of these suspended and dissolved solids are natural, the result of erosion from the arid regions of the Colorado Plateau. This erosion has been hastened by the activities of man, including overgrazing of much of the area, construction, lumbering, and farming. A potential for a further source of erosion lies in possible development of shale oil deposits in the Book Cliffs north of the study area, and from the oil and gas exploration now underway in the region.

Human use of the water, as well as the land, increases salinity. Almost 3,000 cfs (90 m^3/s) of water for irrigation, domestic, and industrial use can be withdrawn in the Grand Valley area. The return flows carry a much higher load of chemicals from fertilizers added than does the withdrawn water. Besides adding many chemicals, the withdrawal-return cycle reduces the overall flow, concentrating the chemicals present. Phosphates, in particular, show comparatively high levels. Nitrogen values are usually lower, but occasionally have shown very high temporary peaks.

TABLE III-2

SUMMARY OF WATER QUALITY
Colorado and Dolores Rivers

Factor	Unit	Colorado River		Dolores River		
		State Line	Dewey	Utah Bottom	Standard[2/]	Limiting Use
pH		7.7	7.74	7.42	6.5-9	(1) + (3)
Total Coliform	*Colonies/100 ml.*	256	1/	1/	1/	
Fecal Coliform	Colonies/100 ml.	127.3	89.8	1/	200	(1)
Fecal Strep	Colonies/100 ml.	193	136.3	1/	1/	
Dissolved Oxygen	mg/1	10.5	10	12.6	5	(3)
Total PO_4	mg/1	0.135	0.155	0.14	1/	
Sulfate	mg/1	377.6	434.4	408.4	1/	
Total Dissolved Solids	mg/1	719.5	1025.7	1870	1/	
Turbidity	*J.T.U.*	41.5	133.2	1/	1/	
Bicarbonate	mg/1	191	185	130.6	1/	
Arsenic	mg/1	0.0014	0.0041	1/	0.05	(3)
Boron	mg/1	0.0826	0.114	117.7	0.75	(2)
Cadmium	mg/1	0.01	0.01	1/	0.004-0.01	(2) + (3)
Calcium	mg/1	99.2	112	112.5	1/	
Chloride	mg/1	102.7	140.7	653	1/	
Chromium	mg/1	0.0033	0.0051	1/	0.1	(2) + (3)
Copper	mg/1	0.01	0.284	1/	0.01-0.04	(3)
Fluoride	mg/1	0.472	0.367	0.40	1/	
Iron	mg/1	1.277	5.244	1/	1.0	(3)
Lead	mg/1	0.1	0.1	0.004	0.004-0.1	(2) + (3)
Magnesium	mg/1	36.6	45.12	48.3	1/	
Manganese	mg/1	0.067	0.17	0.025	0.2	(2)
Mercury	mg/1	0.00003	0.00002	1/	0.00005	(3)
Potassium	mg/1	3.85	6.09	23.5	1/	
Selenium	mg/l	0.01	0.008	1/	0.02	(2)
Silica	mg/1	10.24	13.09	6.4	1/	
Sodium	mg/1	115.4	159.8	439.4	1/	
Zinc	mg/1	0.04	0.05	0.03	0.05-0.6[3/]	(3)

1/ Information not available

2/ These standards were taken from the proposed Colorado Water Quality Standards, which do not yet have legal status. These standards depend on the uses to which the water will be put; different uses have different levels proposed. Since the rivers have not been classified by the Water Quality Control Commission, the study team assumed that the Colorado and Dolores Rivers would fit 3 use classifications:

(1) recreation--primary contact (small amounts of water might be ingested inadvertantly by a boater or swimmer)
(2) agriculture
(3) aquatic life--warm water biota class

The standards listed are the most stringent in each of the 3 classes; the "Limiting use" column of the table tells which type of use provided the standard applied. The study team assumed the water of the two rivers was not used for domestic supply; some of the parameters for which standards are not given only apply to domestic water supplies.

3/ Varies directly with hardness.

Another indication of human use is bacteria levels. These have generally been low in the study area, with an average value of 256 colonies/100 milliliters at the state line gaging station. Fecal coliform counts, an indication of pollution by warm-blooded animals, average 127/100 ml; interestingly, the few fecal strep counts made have been high, close to 200/100 ml. The Colorado River is listed by Utah as a Class C River. Under current State of Utah Standards for Class C waters, 2,000 colonies per 100 ml for total coliform and 200 colonies per 100 ml fecal coliform are permitted.

As is shown in table III-2, the Colorado generally meets the quality standards that will probably be imposed on it by the State of Colorado. Lead and cadmium ions are excessive, but these are probably caused by naturally mineralized areas on the headwaters.

Dolores River

When the Dolores River enters the Colorado, the main stream's water quality declines. Two major sources of pollution in the Dolores River, the saline seepage in Paradox Valley discussed in Chapter II and the industry along the San Miguel River, contribute to this degradation.

Mining and processing of uranium and vanadium have occurred along the Dolores River and its major tributary, the San Miguel River, since the turn of the century. Effluent from the Union Carbide mill on the San Miguel River grossly polluted the San Miguel and Dolores Rivers during the late 1950s and early 1960s. Effluent from the mill contained toxic wastes, suffered extreme variations in pH, and contained radioactive materials. Prior to 1956, the Dolores River below the confluence of the San Miguel had been considered a good catfish stream and a source of broodstock that was harvested for transplanting to other areas. Wastes

discharged from the mill resulted in severe population declines by 1966.

The investigations in 1966 showed that radioactivity, namely Radium-226, increased in the San Miguel from 0.23 picocuries/liter (pc/1) above the Uravan mill to 2.33 pc/1 below the mill. Radioactive levels have been reduced to 0.5 pc/1 in recent years (1970-1974, Colorado Health Department data) because of cleanup efforts by Union Carbide. Radioactivity in the Dolores River does not now constitute a health hazard.

Currently, the greatest water-quality problem on the Dolores is the exfiltration of ammonia from holding ponds at Uravan. Excessive concentrations of un-ionized ammonia are toxic to aquatic life, but there is no agreement on the toxic level. Research by Union Carbide Corporation indicates that catfish are returning to and surviving in the Dolores and San Miguel Rivers. Their most recent discharge permit requires them to maintain un-ionized ammonia levels in the San Miguel at concentration that are not toxic to the aquatic life in the river.

Of the total dissolved solids discharged by the Dolores River into the Colorado each year (600,000 tons or 545,000 metric tons), one-third are derived from the 12-mile (19.3 km) reach in Paradox Valley. This is about 11-14 percent of the salt content of the Colorado below the confluence. As discussed in chapter II, as much as 180,000 tons (163,000 metric tons) of this may be removed by the Paradox Valley Salinity Control Unit.

The Dolores exceeds the potential standards in table III-2 in two areas--boron and manganese. Lead is just within the proposed standard. The very large amounts of boron are due to the Paradox salt anticline; the others are probably due to the mineralized headwater area.

CULTURAL RESOURCES

Archeology

Even though some time periods between the first peopling of area (which would have been about 14,000 B.C.) and the Historic period are known to have had a wetter climate than at present and may thus have supported larger populations, the total population density of the study area was probably very low for the period of circa 14,000 years B.C. to circa A.D. 500. For the later Prehistoric Horticultural period of circa A.D. 500 to A.D. 1,200, the Fremont culture's population density may well have been greater than the current white population adjacent to the river.

Along the Colorado, 52 archaeological, 11 historic, and 9 paleontologic sites were found. The known archeological sites consist of rockshelters and overhangs, open sites, vast amounts of rock art, and other miscellaneous archeological resources such as prehistoric steps cut into rocks, the remains of Pre- and Proto-Historic rain collection systems, fish weirs, etc. The "rockshelters" are found with and without interior stone structures (typically stone walls and caches). The rockshelters with such architectural features are probably from the Prehistoric Horticultural period, or even occasionally the Historic period. The rockshelters are not typically deep caves, but rather small overhangs with cultural material very close to the drip line. The "open-air" sites may be multicomponent and consist of Archaic campsites, small villages of the Horticultural Prehistoric period (Fremont), Proto- and Historic Ute encampments, or some mixed combination of these.

History

The Denver, Colorado Canyons, and Pacific Railroad, organized by F. M. Brown in 1889, began to survey the Colorado River from

Grand Junction down all the canyons of the Colorado to the vicinity of Needles, California, and then to the Pacific. Brown's chief engineer, Robert Brewster Stanton, is known to railroad buffs as the builder of the Georgetown loop in Colorado, and to boaters for his book, Down the Colorado. Members of this party were probably the first to run the river in the study stretch, though they carried their survey (and boats) on a bench above 12 miles (19 km) of Westwater Canyon.

Most of the historical sites along the Colorado and Dolores Rivers are related to early railroad, mining, farming, and ranching efforts. Two sites of interest are located in Westwater Canyon. One, a small dugout structure used by early miners and trappers, has been stabilized by the BLM. The other, Outlaw Cave, is reported to have been the hideout for outlaws about the turn of the century, and evidence of their habitation still remains.

LAND USE AND OWNERSHIP

Colorado River

More than 70 percent of the land fronting on the Colorado from Loma, Colorado, to the confluence of the Dolores River in Utah is federally owned, as is shown on the Corridor Land Ownership Map. All of this is administered by the Bureau of Land Management. It is classified for retention in federal ownership and management for multiple uses pursuant to the Federal Land Policy and Management Act of 1976. Consistent with this, the land is used primarily for outdoor recreation, grazing, protection of watershed, and wildlife habitat.

In addition, all but a mile of public land along the study segment of the river has been withdrawn for reclamation, water power projects,

COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

CORRIDOR LANDOWNERSHIP

GRAVEL ROAD
JEEP ROAD
BUREAU OF LAND MANAGEMENT
STATE
PRIVATE

N

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,019
DSC | FEB 79

and power site projects. These withdrawals, some of which date from 1918, segregate the land from surface and mineral entry, except that rights-of-way and some temporary uses may be permitted with concurrence of the withdrawing agency. Most of this land has subsequently been opened to mineral exploration and extraction. Several rights-of-way have been granted for powerline and railroad uses within the corridor.

Private land within this corridor is concentrated in three sections. The upper reaches of the river corridor, around the Loma area, are primarily under private ownership and are predominantly agricultural. Private land holdings are also concentrated below Ruby and Westwater Canyon. These lands are predominantly agricultural and used for grazing and to some extent, crop production. The private land comprises about 21 percent of the total corridor acreage, or roughly 5,350 acres (2,160 ha).

State holdings total under 10 percent of the river study area and touch the river at two places for 1-1/2 miles (2.4 km) of the total river frontage. The Colorado Division of Wildlife owns the Loma launch site.

Dolores River

About 86 percent of the Dolores River study area is administered by the Bureau of Land Management. The federal land is managed for multiple uses pursuant to the Federal Land Policy and Management Act of 1976. Private land is under the control of approximately eight landowners and is primarily agricultural. In addition to the private land, two parcels near the border in Utah are farmed under special land use permit from the BLM. There are

about 1,640 acres (670 ha) of private land in the Dolores study area, of which about 920 acres (370 ha) are located in the upper 10-mile (32.2 km) reach.

All of the federal lands in the corridor are also under a withdrawal for reclamation water power projects and power site purposes. Several utility rights-of-way have been granted in the corridor.

Nearly all of the federal land in the corridor is under lease for oil and gas. However, to protect the visual corridor, all of the federal land for one-half mile (0.8 km) on each side of the river is in a "no surface occupancy" leasing category: Any drilling for oil and gas must be done from outside the area using slant-drilling methods.

Present land use is agricultural, recreation, livestock grazing, wildlife habitat, and watershed protection.

RECREATION

Colorado River

The study area is generally primitive and contains very few developed use facilities. A raft launch area, restrooms and parking area are maintained at the Westwater BLM Ranger Station. These facilities, however, are primitive. Restrooms are also located at the Rose Ranch takeout area.

Future plans discussed in chapter VI, call for increased development at both of these locations, including improved parking, sanitation, camping, and launch facilities.

Whitewater Boating. Whitewater boating, with camping, is the main recreation in the area; fishing and hunting also take place. Although the entire study segment is suitable for boating, past use has been concentrated mainly in segment B (Westwater Canyon). This virtually isolated segment contains a series of challenging rapids and high scenic values. Up until the late 1960s, when considerable interest was generated in whitewater rafting, relatively few people had run this part of the river. By the 1970s use had increased to the point that the principal managing agency, the Bureau of Land Management, recognized the need to protect the values of the area and reduce the possiblity of environmental damage from overuse. In 1973 a BLM ranger station was established within this segment of the river. In 1974 criteria were established for allocating commercial permits to river guides and outfitters and the private use sector (50 percent allocated to guides and outfitters and 50 percent to the private sector). Permits are applied for in advance, so that the timing of the trips and use of camping areas can be scheduled to avoid crowding and overuse. An interim ceiling, pending the completion of a detailed management plan for the river, has been set at 10,000 passenger days[3] use annually. A passenger day is one person on the river for one day.

Use figures for 1973 recorded nearly 5,000 passenger days for commercial and about 760 passenger days for private. Commercial use has remained relatively constant, but private use has grown so that in 1976 it equalled that recorded in the commercial sector. Total use in 1976 was about 6,900 passenger days. Use in the

---

3. Passenger days are similar to the recreation days used as the unit of analysis in chapters VIII and XI; recreation days are defined as an individual's participation in a recreational activity for a significant portion of a 24-hour period. Passenger days are used in river management because they exclude the recreation days amassed by an outfitter and his paid staff and therefore do not count against his allotment of river use.

study segment above Westwater Canyon was considerably lower and was estimated to be about 2,500 passenger days in 1976. Use from below Westwater Canyon to the confluence of the Dolores was estimated to be about 1,500 passenger days. Most of the use in both of these areas is by commercial outfitters. Minimum and optimum boating flows are shown on the water resource graphs in this chapter.

In Westwater Canyon, inflatable rafts are mostly used, although kayaks are rapidly growing more popular. Open canoes, rowboats, and similar craft cannot be used in this section of the canyon because of the challenging rapids (rated at Class III-V on the International Scale of Whitewater Difficulty, with the higher rating registered in the time of high water). Trips usually require 1-2 days, although some trips of 3-5 days duration run the whole study segment, ending at Dewey Bridge or Moab.

Segments A, C, and D contain no rapids and are suitable for use by canoes and other small craft. This type of use is increasing primarily in segment A due to the outstanding scenic and wildlife values in this area. With canoeing growing more popular, use will continue to grow.

One or two outfitters take parties up and down segment A in jet boats. At present this use is not extensive. Low water during the summer and fall hampers the use of outboard motors throughout the entire study area.

Fishing. Although use statistics are not available, fishing use is light in the area. Occasionally fishermen will put in at the Loma area and fish segment A. Some fishing also takes place in segments C and D. Little fishing takes place in segment B in connection with whitewater float trips. Catfish is the main species of interest to the fishermen, although bass, bluegill, and black bullhead are

found in small numbers. Because of the warm and turbid water, trout and other game fish are generally not found in this area.

Hunting. Some waterfowl and big game hunting takes place in the study corridor. Ducks and geese are hunted mainly in segment A, although some hunting takes place in segments C and D. Successful big game hunting in the corridor depends primarily on how early and severe the winter is. A hard winter will push the deer far enough down from the higher elevations to reach the study corridor in hunting season. Use pressures are light and most hunting occurs away from the river.

Limiting Factors. Several factors limit the type and amount of recreation that takes place within the corridor. The greatest limiting factor is the difficulty of the rapids in Westwater Canyon, which limits boating to those craft specifically designed for white-water use, and to those with the knowledge and skill to pilot the craft safely through the canyon. Low water during the rest of the year and in drought years such as 1977 limits the size of craft and use of motors.

The number of sites available for camping in Westwater Canyon is another limiting factor. Although there are many camping areas on the sand bars exposed at low water, high water covers most of these, leaving less than three areas available.

Within segments A, C, and D, campsite opportunities are relatively unlimited and do not limit public use, although some private land-owners have restricted shoreline access to their property.

Dolores River

Between Gateway and the confluence with the Colorado, the Dolores contains no developed recreation use facilities. No facilities are currently planned for construction along the river segment.

Whitewater Boating. The Dolores River is usually floatable by river rafts, kayaks, and other craft during the spring runoff, usually during the last part of April, May and June. At other times of the year water volume is insufficient to support this type of activity. The season length varies with the snowpack; during periods of drought such as was experienced in 1977, the river could not be floated. During high water years like 1975 it can be run from April to August. Minimum and optimum boating flows for the Dolores are shown on the water resource charts in this chapter.

The Dolores River also received relatively little use before the late 1960s. In the early 1970s the Bureau of Land Management, recognizing the need for increased management, established use ceilings. These allocated approximately 5,000 passenger days to private use and 5,000 passenger days to commercial use. Actual use has remained considerably below this ceiling. It is estimated that during 1976 about 500 people floated the river for a total of 700-800 passenger days. Users sometimes put in at Gateway and float to Dewey Bridge on the Colorado. Others put in upstream at Bedrock, Slickrock, or near Cahone and float the entire length to the Colorado. Putting in at these higher locations offers an uninterrupted trip of up to 183 miles (294 km), one of the longest float trips available in Colorado.

Fishing and Hunting. Some fishing and hunting use takes place in the corridor although use is very light. The species hunted are mainly waterfowl and deer. Fishing is for catfish, and is limited by the habitat problems discussed under "Fish and Wildlife."

Other Recreational Uses. The only other significant recreational use known to be taking place in the area is sightseeing, and this is limited by inconvenient access.

CHAPTER IV
ELIGIBILITY AND CLASSIFICATION

ELIGIBILITY

The eligibility of the Colorado and Dolores rivers for the National Wild and Scenic River System was determined by comparing the information in chapters II and III with the criteria in the Wild and Scenic Rivers Act. These criteria are supplemented by the Guidelines, a document jointly issued by the Secretaries of Agriculture and the Interior.[1] The most important criterion is the Act's requirement that a river offer at least one "outstandingly remarkable" value. The categories suggested are: scientific, cultural, geologic, recreational, historical, fish and wildlife and "other." The Act also requires the river to be free-flowing i.e., without significant impoundments, channelization, or riprapping.

The Guidelines elucidate these basic criteria, and supplement them with others which require the river to meet certain standards of water quality, length, and volume. The river must be long enough to provide "a meaningful recreational experience", which is defined to be about 25 miles (40 km) long. It should have "sufficient volume of water during normal years to permit, during the recreation season, full enjoyment of water-related outdoor recreation activities generally associated with comparable rivers." The rivers should also, according to the Guidelines, contain high quality water or water which can be restored to high quality. Those rivers

---

1. Guidelines for Evaluating Wild, Scenic, and Recreational River Proposed for Inclusion in the National Wild and Scenic River System; Departments of the Interior and Agriculture; Washington, D.C. (February, 1970).

considered for wild designation should meet the criteria for primary contact recreation (basically, waters which can inadvertantly be swallowed in small amounts by a recreationist) unless natural background conditions exceed these standards. These criteria are summarized in table IV-1.

Both rivers meet these mechanical criteria from the Act and Guidelines. The Colorado has few diversions and no impoundments in the study reach, and the small bank alterations caused by the railroad in Ruby Canyon do not significantly affect either scenery or flow; they do not constitute rip-rapping or channelization. The study segment of the Dolores has three diversions, two of which are located at Stateline Rapids, where they are not noticed. None of these creates a slack-water pool and all are in keeping with the pastoral character of the area.

Both rivers are sufficiently long to be included, at 55.7 miles (89 km) for the Colorado, and 31 miles (49.6 km) for the Dolores. If the final section of the Dolores is excluded, as is discussed in Chapter V of this report, the segment is still long enough to provide a meaningful recreational experience, since it requires a minimum of one day to float the reach, with two being usual.

As the data in chapter III indicate, there is sufficient water in the Colorado to permit recreation all year long (barring periods of freeze-up). The river thus permits a far longer season for recreation than is normal in the region. The Dolores's recreation season (April to August in a wet year, May and June in a dry) is limited by its flows, but that season is comparable in length with the season on other rivers of its type, and the flows available are sufficient to permit full enjoyment of the river.

Both the Dolores and Colorado meet minimum criteria for primary contact recreation. Both rivers are too cold to meet these criteria

TABLE IV-1

Summary of Factors Determining Eligibility

	Colorado River						Dolores River	
	Loma Launch Site (mi. 1079.2) to Railroad Intersection (mi. 1070.5)	Railroad Intersection (mi. 1070.5) to Westwater Canyon (mi. 1051.5)	Westwater Canyon (mi. 1051.5) to Rose Ranch (mi. 1038.5)	Rose Ranch (mi. 1038.5) to Cisco Wash (mi. 1027.5)	Cisco Wash (mi. 1027.5) to Dolores River (mi. 1023.5)	Gateway (mi. 31) to Fisher Creek (mi. 17)	Fisher Creek (mi. 11) to Bridge Canyon (mi. 11)	Bridge Canyon (mi. 11) to Colorado River to Bridge (mi. 0)
	A-1	A-2	B	C	D	A	B	C
Characteristics								
Free-flowing Nature Affected by:								
Impoundments	None	None	None	None	None	None	None	None
Diversions	None	None	None	None	None	3	None	None
Road fills	None	Some	None	None	Some	1	None	1
Length	8.2 miles	19 miles	13 miles	11 miles	4 miles	14 miles	6 miles	11 miles
Water Quality Meets Criteria for:								
Primary Contact Recreation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Secondary Contact Recreation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Aesthetics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fish and Aquatic Life Propagation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Outstandingly Remarkable								
Scenic Values	Yes	Yes	Yes	No	No	Yes	Yes	No
Recreation Values	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Geologic Values	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Fish and Wildlife Values	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historic Values	No	No	No	No	No	No	No	No
Archeologic Values	Yes	Yes	Yes	Yes	Yes	No	No	No
ELIGIBILITY FOR NATIONAL WILD AND SCENIC RIVERS SYSTEM	Eligible	Eligible	Eligible	Eligible	Eligible	Eligible	Eligible	Eligible

at certain times of the year, and both sometimes carry floating debris, but these are characteristics of free-flowing snowmelt rivers, and enhance rather than detract from the experience of boating them. As noted in chapter III, both slightly exceed potential water quality standards in a few parameters, but these variances are naturally caused.

The criteria discussed above are necessary but not sufficient for including a river in the system; they ensure it is a river and not a sewer or a lake that is included, but they do not ensure that river is worthy of the preservation, protection, and enhancement mandated by the Act. The outstandingly remarkable values required by the Act make sure it is a great river, or at least a great segment, which is preserved and protected.

Both the Colorado and the Dolores are eligible for the system; both demonstrate outstandingly remarkable values of several types, as shown in table IV-1.

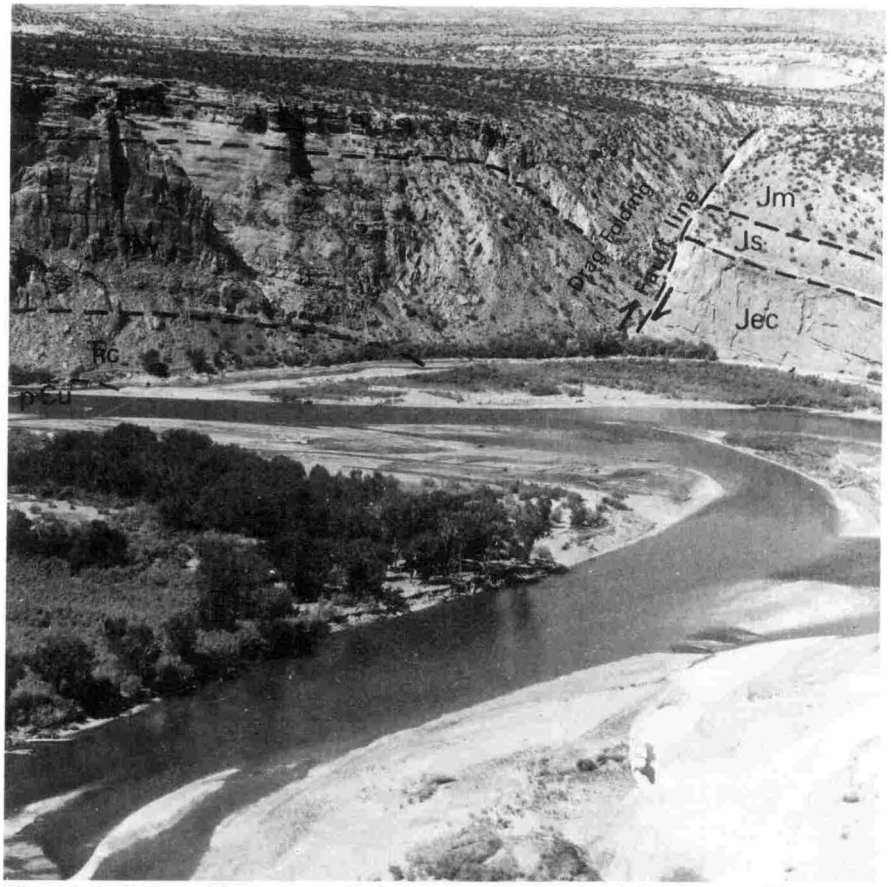
Determining the outstanding values displayed by a river is one of the study team's most difficult tasks, since no guidance is offered by either the Act or the Guidelines. In the course of several river studies it has been agreed that such values are rare or unique when compared to other rivers, and that they are of national, or at least of regional significance. Within this general definition more specific definitions of outstandingly remarkable values have been made for each category, and these are discussed in each explanation of the study team's findings. Many of the outstandingly remarkable values, such as fish and wildlife values, must be certified by specialists in that field.

In the following discussion each type of value is discussed, with reference to the segments of the two rivers.

Geologic Values

Both the Colorado and the Dolores display outstanding geologic values. These, the study team concluded, would be an unusually long sequence of rocks in the geologic column, particular fullness of a given series or rocks, excellent visibility of geologic processes, the presence or possiblity of important paleontological finds or scientific discoveries, or the presence of important rock types. In both Ruby and Westwater Canyons, the rock sequence runs from Precambrian to Cretaceous; along the Dolores this sequence is present with the addition of the Pennsylvanian-Permian rocks which lie between the Chinle and the Uncompahgre Complex. The rock sequence is unusually long, and the Jurassic-Triassic series of sediments is especially well represented. It is possible in this area to learn many of the important rock types for the whole Plateau Province.

Geologic processes in the area are both interesting and highly visible, given the aridity of the climate. At several points in Ruby Canyon, and at the very head of Westwater, are classic examples of faults and folds which lend themselves well to interpretation. The most impressive of these, the Little Dolores fault at the head of Westwater Canyon, brings the Precambrian rocks in contact with the Entrada Sandstone, a displacement of about 500 feet (160 m) m a textbook example of a reverse fault. Also of interest is the unconformity between the Uncompahgre Complex--about 1.8 billion years old, with quartz monzonite intrusions about 1.48 billion years old--and the overlying Chinle Formation, visible along the Colorado River. This represents a time gap of about 1.3 billion years. Along the Dolores the presence of other formations above this erosion surface allows important inferences to be drawn about the age of the Uncompahgre Uplift.



The Little Dolores Fault, an easily interpreted example of the geomorphic processes that have formed the area, is at the head of Westwater Canyon.

Jm — Jurassic Morrison Formation
Js — Summerville Formation
Jec — Entrada/Carmel Formations undifferentiated
Trk — Triassic (?) Kayenta Formation
Trw — Wingate Sandstone
Trc — Chinle Formation
p-Cu — Precambrian Uncompahgre Complex (obscured)

The capture of the ancestral Gunnison and Colorado, the details of which are still somewhat controversial among geologists, is rare in rivers of this size and importance. Traces of this piracy, though best studied in nearby Unaweep Canyon, increase the geologic values of the Colorado and Dolores Canyons. Also of interest is the wide variety of rock types available in the study area; this demonstrates how different rocks respond to the erosive agencies, from the recession of the walls to form a wide valley when the Chinle or Cutler Formations line the river, to the narrow, polished and fluted gorge that is cut in Westwater Canyon, when the river encounters the resistant black rock of the Uncompahgre Complex.

At the upper and lower end of the Colorado segment, and the lower end of the Dolores, are extensive exposures of the Morrison Formation. Sandstone ledges in that formation have, in many parts of the west, produced dinosaur fossils; they have been quarried near the upper end of the study area. Nine such finds have been made in the river corridor, which adds to the geologic value of the area.

Fish and Wildlife Values

A wide diversity of wildlife in an area, healthy populations, or the presence or rare, endangered, or threatened species were deemed outstandingly remarkable wildlife values. The Colorado and Dolores rivers, in all segments, offered outstanding values due to the presence of endangered species. The Colorado River itself contains the humpback chub and Colorado River squawfish, which have been listed as endangered species. This reach has been proposed by the U.S. Fish and Wildlife Service as critical habitat for the squawfish, although the proposal may need modification due to changes in the Endangered Species Act. The study area also contains the bonytail chub and humpback sucker, which are on the Utah and Colorado River state lists of endangered species.

The endangered American peregrine falcon has been sighted in the Westwater Canyon area, and the whole study segment of the Colorado River contains a wintering population of bald eagles, another endangered species.

The canyons of the Dolores also contain wintering bald eagles--at present the only known endangered species along that study segment. However, the U.S. Fish and Wildlife Service notes that the areas surrounding the Dolores provide potential habitat for peregrine falcons. Abundant prey species, limited human access, and reasonable proximity to active eyries make the portion of the Dolores in Utah increasingly important for the recovery efforts for this species. The Dolores area is also used by a variety of other raptors including several species of hawks and the golden eagle. The presence of these birds, as well as many species of big game, small game, furbearers, nongame species, fish, birds, and reptiles mentioned in appendix C, all indicate a healthy and relatively undisturbed ecosystem with outstanding wildlife values.

Archaeological and Historic Values

The Colorado and Utah State Archaeologists agreed that the archaeological values of the Colorado study segment are outstandingly remarkable. A recent study[2] of the Colorado River Area revealed 52 archaeologic sites along the river, of which 7 were judged highly significant and another 20 of scientific value. About 20 historic and paleontologic sites add to the value of the area. Part of the uniqueness of these sites is due to their being

---

2. Historical Museum and Institute of Western Colorado. Antiquities Inventory for the Wild and Scenic River Designation of the Colorado River. Xerox copy, Bureau of Land Management contract, Grand Junction (1976).

controlled directly by the availability of water. Most of the more sedentary sites were located within a kilometer or two of the Colorado. Long stretches of inaccessible waterline, particularly in Westwater Canyon, resulted in a linearly interrupted settlement pattern. Part of the value of the Colorado also lies in the probability that more sites will be discovered in future studies of the area.

The Dolores Canyon has been studied,[3] and it is the consensus of the state archaeologists of both states that the archaeological values of that area are not outstandingly remarkable. Most sites found were lithic scatter areas where stone tools were chipped and shaped; these did not provide particularly important information, nor were they unusual in the region.

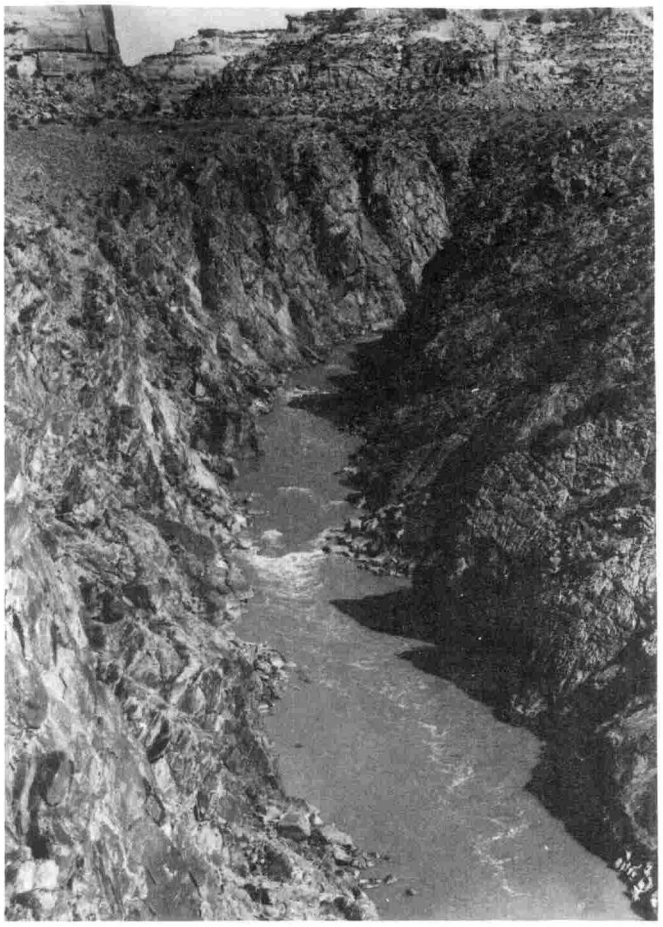
Neither the Dolores nor the Colorado study areas offered outstanding historical values. Historic sites like the outlaw cave add interest to a trip through Westwater Canyon, and the tales of the first descent of the Colorado by members of the F. M. Brown party are also of interest to boaters, but these events and sites are not of much significance either regionally or nationally, nor are they associated with persons prominent in the nation's history.

Scenic Values

The two rivers flow around three sides of the Uncompahgre Uplift, through a vast sequence of different rock formations. The different colors of these rocks, from the black polish of the

---

3. Toll III, Henry Wolcott, Dolores River Archeology: Canyon Adaptations as Seen Through Survey. Cultural Resources Series No. 4. Bureau of Land Management, Denver (1977).



Pink sandstone cliffs and the black inner gorge provide outstanding scenery in Westwater Canyon. NPS

The series of rock formations along the Dolores contrasts both in form and color with the brilliant green of the riparian vegetation. BLM

riverside rock in Westwater Canyon up through the towering red walls above, into the purple, red, green and blue shales of the Morrison Formation, are in striking and pleasant contrast with the brilliant green of the vegetation that lines most of the shores. The two river areas also offer notable contrast in texture: still quiet reaches are followed by the shattered water in the rapids; stream-side meadows in the open areas are counterpointed by shaggy pinon-juniper forests; smooth red conchoidal fractures and jagged spires in the Wingate Sandstone contrast with both the rounded flutings of the Uncompahgre Complex below and the jumbled cliff spall from the Morrison above. Through the heart of the area flow the two rivers, whose annual color changes from the translucent beige of low flows to the muddy orange and buff tones of the flood witness the processes by which these canyons are carved.

These values are of national significance; comparable sites are available in the region, to some extent, but are not found in the rest of the U.S.

Scenic values are also furnished by animate nature and cultural sites; the diversity of wildlife and the presence of a number of endangered species provide important viewing experiences which are also conducive to the finding of outstandingly remarkable scenery. The archaeological sites, particularly the rock art sites, also heighten one's experience of the canyons.

Recreation Values

The study team felt that four factors could produce outstandingly remarkable recreation values. Particularly high quality recreation of a certain type, an extraordinary diversity of recreational opportunities, evidence that the recreation values drew visitors from all over the nation and not just the region, could all be termed

outstandingly remarkable recreational values. The presence of outstanding values of other types could also contribute to outstanding recreation. By these measures both rivers are outstandingly remarkable for their recreation. Both rivers do have the value of the recreation associated with them increased by outstanding values in other categories; opportunities for geological study and wildlife observation are particularly valuable supplements to the boating or hiking. The rivers draw boaters from all over the nation, as has been confirmed by user studies on the Colorado segment and informal contacts on the Dolores. Segments A, C, and D of the Colorado, a total of 41.5 miles, offer open canoeing in a beautiful desert setting; water this gentle in such a setting is uncommon in most of the west. The whitewater boating on the Dolores is, with the exception of Stateline Rapid (which is Class IV--expert water), challenging without being too severe, if proper craft are used. Westwater Canyon is known nationally for its rapids, which offer one of the few opportunities left in the United States to try "heavy water"[4] boating in a sombre and lovely setting. Canoeing on the gentler segments of the Colorado, and whitewater boating on both rivers, are recreation of particularly high quality. All these features combine to produce truly outstanding recreational values.

CLASSIFICATION

After the rivers were found eligible for the national system, they were evaluated to determine the most restrictive classification (wild,

---

4. Heavy water means waves of about 6 feet (1.8 m) or more.

scenic, or recreational river area) for which they qualified. This step is taken in order to conduct the Principles and Standards Analysis contained in chapter XI, and to aid in making the management recommendations found in chapter V. The actual classifications into which the rivers will be placed, if they are included in the system, will be determined by the agency which manages them, within a 1-year period after inclusion during which a management plan must be prepared.

The classifications provided in the Act are determined on the basis of shoreline development, or degree of human intrusion. The definitions in the Act are supplemented by the Guidelines, which stress that evaluations are to be made from the perspective of the river users, that the dominant impression produced by an area is to be considered rather than local peculiarities, and that while exceptions to the specified levels are permissible, too many exceptions should lower a river's classification.

To perform this analysis the rivers were broken into segments, on the basis of physiography, shoreline development, and the suggestion in the Guidelines that short segments (which are difficult to administer) be avoided. The segments were then measured against the specific criteria summarized below.

Wild river areas - Those rivers or sections of rivers that are free of impoundments, generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic river areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

TABLE IV-2

Classification Level Criteria

The following criteria, summarized from the evaluation "Guidelines" and the Wild and Scenic Rivers Act, were used to determine the classification suitability of the river segments.

WILD

1. Flow - Free flowing. Low dams, diversion works, or other minor structures which do not inundate the natural riverbank may not bar consideration. Future construction restricted.

2. Accessibility - Generally inaccessable by road. No roads in narrow, incised valley. If broad valley, no road within 1/4 mile (0.4 km) of riverbank. One or two inconspicuous roads to the area may be permissible.

3. Shorelines - Shorelines essentially primitive. One or two inconspicuous dwellings, limited amount of domestic livestock, and land devoted to production of hay may be permitted. Watershed natural in appearance.

4. Water Quality - Water quality meets minimum criteria for primary contact recreation except where such criteria are exceeded by natural background conditions. Also, water must be capable of supporting propagation of aquatic life normally adapted to habitat of the stream.

SCENIC

1. Flow - Same as for wild.

2. Accessibility - Accessible by roads which may occasionally bridge the river area. Short stretches of conspicuous and well-screened roads or railroads paralleling river area may be permitted, but consider type of road use.

3. Shoreline - Shoreline and immediate river environs still have overall natural character. Small communities limited to short reaches of total area. Agricultural practices which do not adversely affect river area may be permitted. This could include unobtrusive row crops and timber harvest.

4. Water Quality - Water quality should meet minimum criteria for desired types of recreation except where such criteria are exceeded by natural background conditions. Also, water must be capable of supporting propagation of aquatic life normally adapted to habitat of the stream or is capable of and is being restored to that quality.

RECREATIONAL

1. Flow - May have undergone some impoundment or diversion in past. Water should not have characteristics of an impoundment for any significant distance. Future construction restricted.

2. Accessibility - Readily accessible, with likelihood of parallel roads or railroads along riverbanks and bridge crossings.

3. Shoreline - Some shoreline development. May include all agricultural uses, small communities, dispersed or clustered residential dwellings.

4. Water Quality - Same as for scenic.

Recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

These criteria from the Act were supplemented by those in the Guidelines, as summarized in table IV-2. The team also used criteria in a professional paper[5] to crosscheck its evaluations, as well as public input.[6]

These three methods agreed quite closely in the classification findings they produced.

Thus, for example, the team divided the upper section of the Dolores (which has paralleling dirt roads, three diversions, some irrigated fields, and largely invisible buildings) from the middle (which has no traces of men) at the point where the roads ended and a major side drainage reached the main stream. The team found that the upper reach was largely primitive, though accessible in places by roads, with a pastoral character. It was assigned the scenic classification on the basis of the Act and Guidelines. Applying the filter system mentioned in Terry's paper, which assigns human intrusions various point values and sums them for each segment, produces an average "intrusion value" per mile,

---

5. Terry, Claude. "A Filter System for Determining River Suitability for National Wild, Scenic, and River Status." In Proceedings: River Recreation, Management and Research Symposium. General Technical Report NC-28, U.S. Forest Service North Central Forest Experiment Station, Minneapolis (1977), p. 372 et seq.

6. Of these methods, only the Act and its criteria have legal force; the others were used as an aid.

which in this part of the study area was 14 points per mile. Scenic river areas are considered to fall in the range of 11-30 points per mile, so the area also would receive a scenic classification using this technique. Public input, such as the University of Colorado Wilderness Study Group proposal of 1975, suggested a scenic classification for the reach from Gateway to Beaver Creek, which is slightly above the point at which the study team split the segments; this is in substantial agreement with the study team's determination.

The following table shows the segments into which the Colorado and Dolores Rivers were divided and the classification for which each was suited.

TABLE IV-3
Classification Levels

Segment		Length	Classification
COLORADO RIVER			
A-1.	Loma Launch site to intersection with Railroad	8.7 miles (14 km)	Scenic
A-2.	Railroad intersection to Westwater Canyon	19 miles (30.4 km)	Scenic
B.	Westwater Canyon to Rose Ranch	13 miles (20.8 km)	Wild
C.	Rose Ranch to Cisco Wash	11 miles (17.6 km)	Scenic
D.	Cisco Wash to Dolores	4 miles (6.4 km)	Recreational
DOLORES RIVER			
A.	Gateway to Fisher Creek	14 miles (22.4 km)	Scenic
B.	Fisher Creek to Bridge Canyon	6 miles (9.6 km)	Wild
C.	Bridge Canyon to Colorado River	11 miles (17.6 km)	Scenic

In determining these classifications, the team considered whether the river is free-flowing, its water quality, accessibility, and its shoreline development. Since both rivers are free-flowing in the study area, and both have adequate water quality, only accessibility and shoreline development were determinants, so only these are discussed in the following section.

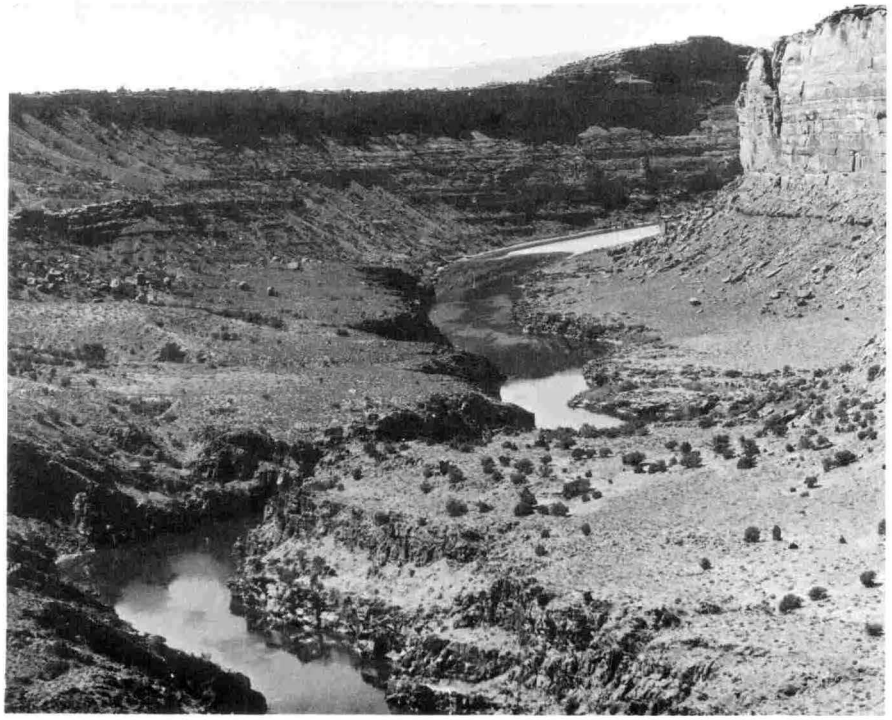
Colorado River

Segment A-1--Loma Launch Site (mile 1079.2) to Railroad Intersection (mile 1070.5). In this segment there is access to the launch site by gravel road, and two unimproved dirt roads lead to the canyon rim. Farm buildings in the first mile and fences for about three miles are the shoreline developments; these factors make the most restrictive classification for which the river is now eligible "Scenic."

Segment A-2--Railroad Intersection (mile 1070-5) to Westwater Canyon (mile 1051.5). The Denver and Rio Grande Western Railroad parallels the Colorado here, and five unimproved dirt roads lead to the vicinity of the river. At the lower end, a gravel road leads to the Westwater Ranger Station. On the shores, the railroad and its associated poles and bridges are visible in places. There are also three irrigation pumps, occasional fences, and structures at Westwater Ranger Station. The most protective classification for this segment is "Scenic."

The effect of the paralleling railroad on the classification of this segment is not immediately apparent. However, the Guidelines contain two statements relative to determining the classification for this segment. First, the Guidelines state that they are not absolutes but are to be used as a guide in assisting the investigator in making judgements in cases with extenuating circumstances.

Occasional dirt roads, a railroad, and agricultural activities make 'scenic' the most restrictive classification of Ruby Canyon. BLM



Access only by foot or boat and the lack of human intrusions produce a 'wild' classification for Westwater Canyon. BLM

The document also notes that long stretches of screened road or railroad do not necessarily preclude scenic classification and that consideration should be given to the use for which the road or railroad is intended.

The railroad in Ruby Canyon is seen primarily when trains are passing through, although some bridges and other railroad facilities are occasionally visible. Since the trains do not stop, the railroads does not provide access to the canyon as would a road. These factors, combined with the outstanding scenery in this area, led the study team to its decision to classify this section as "Scenic."

Segment B--Westwater Canyon (mile 1051.5) to Rose Ranch (mile 1038.5). This area is inaccessible except by boat and foot; its shorelines are undeveloped; its most protective classification is "Wild."

Segment C--Rose Ranch (mile 1038.5) to Cisco Wash (mile 1027.5). There are two improved gravel roads and two unimproved dirt roads in the reach as well as a gravel road to Rose Ranch. There are two irrigation pumps and two powerlines in the corridor above Rose Ranch, and one powerline, one irrigation pump, and one fence below it. There is a structure at the Rose Ranch take-out. These levels of development make the most protective classification for which this segment is eligible, "Scenic."

Segment D--Cisco Wash (mile 1027.5) to Dolores River (mile 1023.5). This segment is very accessible: One unimproved dirt road lies in the corridor and the river is paralleled by State Highway 128. In addition, some roadfill, a powerline, a fence, and buildings are visible from the river. This relatively developed stretch is eligible for the "Recreational" classification.

Dolores River

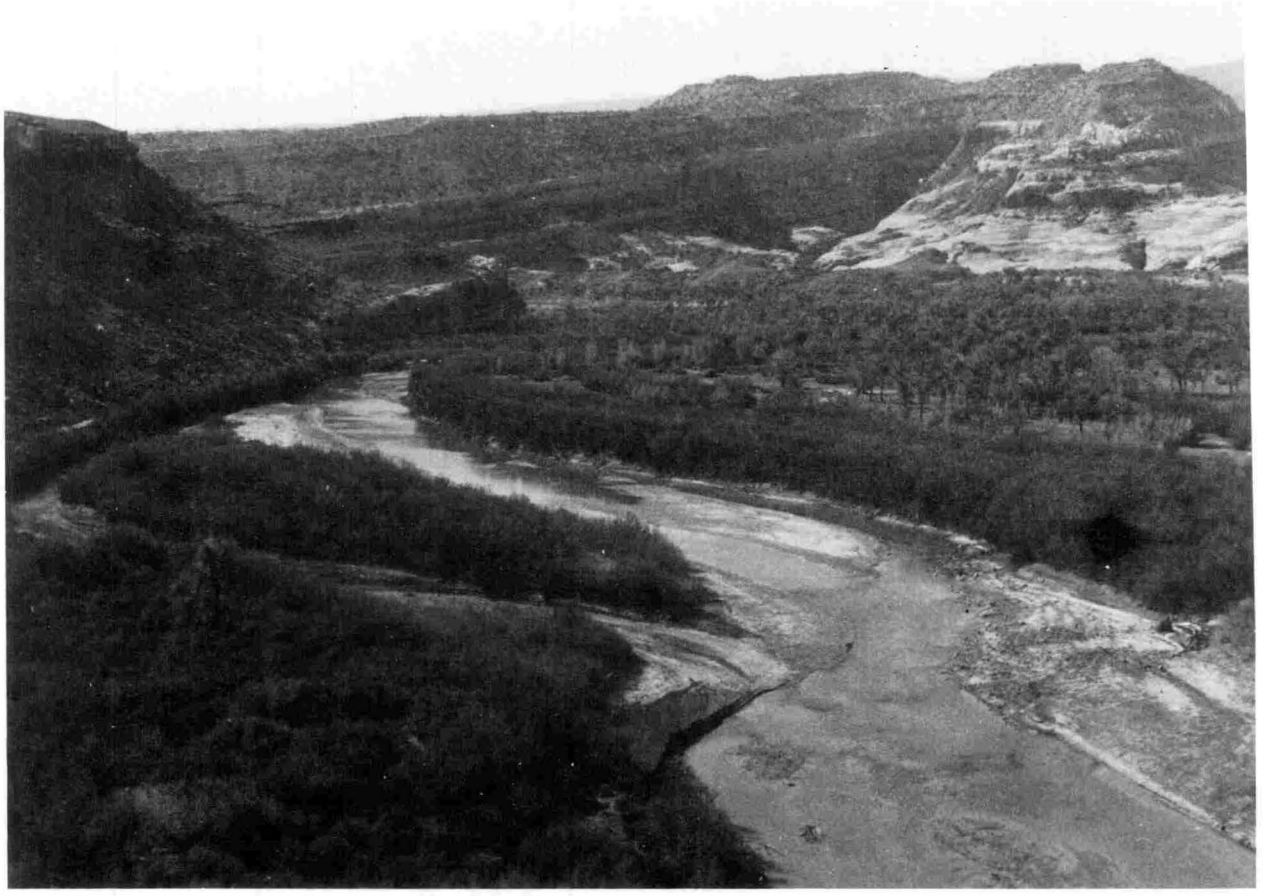
Segment A--Gateway (mile 31) to Fisher Creek (mile 17). A dirt road parallels the river on the west bank down to Fisher Creek; a dirt road on the east side extends for about eight miles. There are three diversions, some agricultural land away from the river, farm buildings near the state line, and a small roadfill at State Line Rapid. The most protective classification for this segment is "Scenic." Although it would seem that since the river is paralleled by two dirt roads, it would qualify only for "Recreational River Area" classification, they are generally screened from the river. They are primarily used for access to the agricultural lands near the state line, so there is very little traffic.

Segment B--Fisher Creek (mile 17) to Bridge Canyon (mile 11). There is no access within the segment, although it is accessible at either end by dirt roads. The shorelines are undeveloped except for one abandoned mining operation near the lower end, so this segment qualifies for a "Wild" classification.

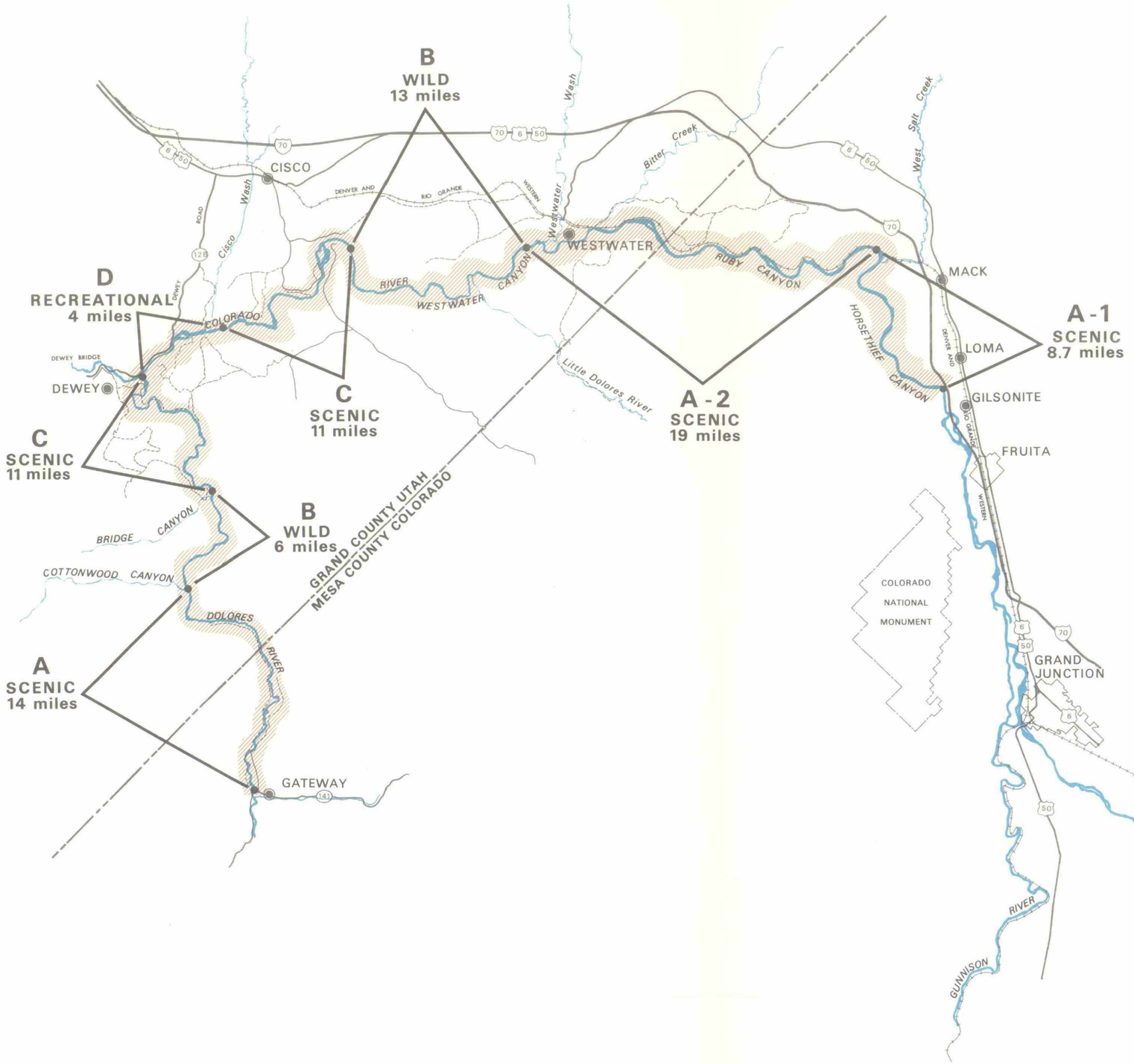
Segment C--Bridge Canyon (mile 11) to Colorado River (mile 0). A dirt road reaches Utah Bottom and another extends from Lake Bottom up the river for about three miles. Shoreline intrusions include two abandoned mining operations, one current mining operation, one powerline crossing, some buildings associated with mining, and some roadfill. This segment is eligible for "Scenic" classification, since the developments are relatively well-screened from the river.

Ranching activities and a road make 'scenic' the most restrictive classification for Segment A of the Dolores. BLM

The 'wild' reach of the Dolores (Segment B) can be reached only by hiking or boating. BLM



In Segment C, where there are ranches, some dirt roads, and generally well-screened mining operations, the most restrictive classification is 'scenic'. BLM



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

ELIGIBILITY AND CLASSIFICATION

GRAVEL ROAD
JEEP ROAD
ELIGIBLE SEGMENTS

1 5 0 1 2 3 4 miles
1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,028
DSC | FEB 79

CHAPTER V
FINDINGS AND RECOMMENDATIONS

The data in the previous chapters were used to make the following findings, designation and management recommendations, and cost estimates.

FINDINGS

1. The Colorado River, from the Loma launch site, 20.7 miles (33.3 km) upstream from the Colorado-Utah border, downstream to its confluence with the Dolores River in Utah is eligible for inclusion in the National Wild and Scenic River System. This portion of the river contains outstandingly remarkable scenic, geologic, cultural, recreation, and fish and wildlife values.

2. The Dolores River from Gateway, Colorado downstream to its confluence with the Colorado River in Utah is eligible for inclusion in the National Wild and Scenic River System and possesses outstandingly remarkable scenic, geologic, recreation, and wildlife values.

3. The lower 11-mile (17.7 km) reach of the Dolores qualifies for the system as a scenic river area, on the basis of geologic, wildlife, and recreational values. This reach, however, lacks the scenic value of the upper 20 miles, in which the most outstanding values are concentrated. It is almost completely covered by mining claims, and contains one operating mine. The principal reserves are uranium and vanadium ore.

Some members of the study team felt that designating this reach would serve to unify the segments of the Colorado and Dolores recommended below and provide a greater degree of protection for the natural values of the river corridor. But the combination of marginal scenic values, intrusions, and potential mineral extraction makes the area qualify more appropriately for multiple use management by the Bureau of Land Management.

4. The Principles and Standards Analysis revealed that designating these rivers would protect their outstanding values while making substantial contributions to the regional economy.

RECOMMENDATIONS

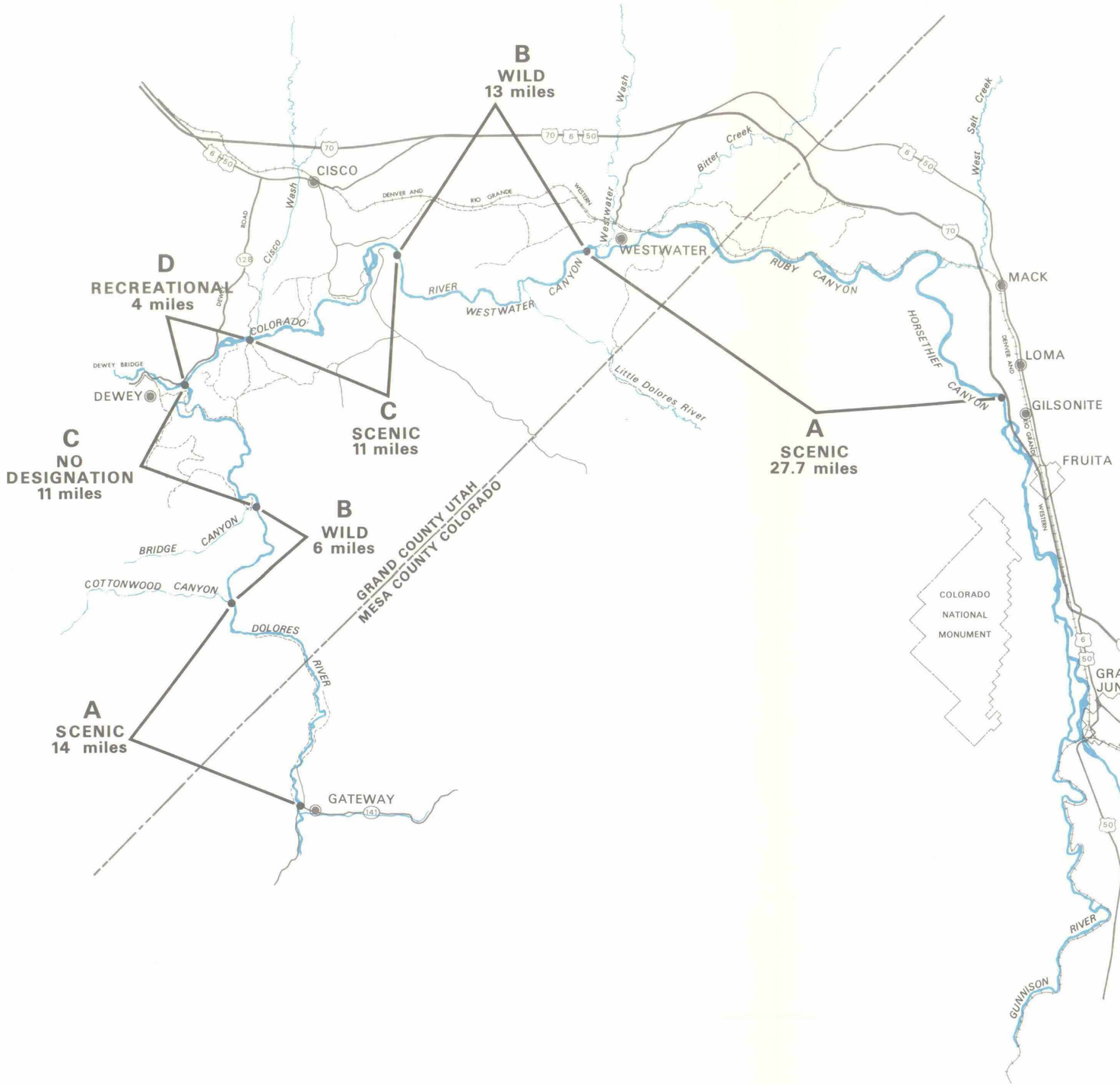
1. The Colorado River study segments, including a corridor of associated lands averaging approximately 0.35 (0.6 km) in width on each shore and containing about 25,000 acres (10,100 ha), should be designated a component of the National Wild and Scenic River System, with the following classification levels:

   (a) Loma Launch to Westwater Canyon (River mile 1079.2 to river mile 1051.5), 27.7 miles (43.8 km) - - - - - -Scenic

   (b) Westwater Canyon to Rose Ranch (River mile 1051.5 to river mile 1038.5), 13 miles (20.9 km) - - - - - - - -Wild

   (c) Rose Ranch to Cisco Wash (River mile 1038.5 to river mile 1027.5), 11 miles (17.7 km) - - - - - - - - - -Scenic

   (d) Cisco Wash to Dolores River (River mile 1027.5 to river mile 1023.5), 4 miles (6.4 km) - - - - - - - -Recreational



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

RECOMMENDATIONS

GRAVEL ROAD

JEEP ROAD

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,023
DSC | FEB 79

2. The Dolores River from Gateway to Bridge Canyon, including a corridor of associated lands averaging approximately 0.3 miles (0.5 km) in width on either shore and containing about 8,000 acres (3,240 ha), should be designated a component of the National Wild and Scenic River System, with the following classification levels:

   (a) Gateway, Colorado to Fisher Creek (River mile 31 to river mile 17), 14 miles (22.5 km) - - - - - - - - - - - - -Scenic

   (b) Fisher Creek to Bridge Canyon (River mile 17 to river mile 11), 6 miles (9.7 km) - - - - - - - - - - - - - - -Wild

   (c) Bridge Canyon to Colorado River (River mile 11 to river mile 0), 11 miles (17.7 km) - - - - - - - - No designation

3. The Bureau of Land Management, which at present administers the rivers, should continue to do so after designation. The management plans for the rivers should be prepared in cooperation with the states of Colorado and Utah, with the general goals of preserving existing land uses, protecting the outstanding values which have made the rivers eligible for the system, and encouraging the amounts and types of recreation that will not degrade these values.

4. The lower 11 miles (17.7 km) of the Dolores River should be managed to protect its natural and recreational values and to ensure the continuation of a desirable river-boating experience.

5. Approximately 5,350 acres (2,160 ha) of private land along the Colorado River and 920 acres (370 ha) along the Dolores should be preserved in their present natural or pastoral state. This should be accomplished, if possible, by the present

landowners. A notice requirement should be instituted for landowners to inform the Bureau of Land Management of any plans for major changes in land use, so that the agency can determine whether the planned change would degrade the rivers' values. If it be found that the change in land use would degrade the rivers' values, a one-year negotiation period would ensue. During this period an attempt would be made to agree on land-use changes that would be acceptable to the landowner while still preserving the outstanding values of the area. If no agreement on an acceptable land use change could be reached, the Bureau of Land Management should purchase a scenic easement on the lands involved.

MANAGEMENT RECOMMENDATIONS FOR THE COLORADO AND DOLORES RIVERS

Including the Colorado and Dolores Rivers in the National Wild and Scenic Rivers System will provide statutory protection for and preservation of the natural and scenic values of the rivers and their immediate environments. Approximately 25,000 acres (10,100 ha) of the Colorado River corridor should be included in this designation. These lands are within a visual corridor which averages 0.35 miles (0.6 km) on either side of the river. About 8,000 acres (3,240 ha) within a visual corridor averaging 0.3 miles (0.5 km) on either side of the Dolores River should be included in the designation of that river.

The Bureau of Land Management will continue to manage the two rivers after they are included in the system. The Wild and Scenic Rivers Act allows a period of one year after designation for the administrative agency to prepare a management plan, including detailed boundaries (governed by the terrain and by provisions of the Act), classifications, and plans for any necessary developments

that do not conflict with the rivers' classification levels. These management plans must be published in the Federal Register and do not become effective until 90 days after they have been forwarded to the President of the Senate and the Speaker of the House of Representatives.

The objective of these plans is to protect and enhance the values that caused the rivers to be included in the national system, with minimum impact on private landowners. Provisions in these plans determine the nature and the extent of the effects that inclusion in the National Wild and Scenic Rivers System will have on private landowners. It is recommended that these plans be prepared by the BLM in cooperation with concerned federal, state, and local interests.

The general objectives of including these rivers in the system are:

1. to preserve the rivers and their immediate environment, with special emphasis on their outstanding natural qualities.

2. to preserve the free-flowing condition of the rivers.

3. to maintain the excellent recreational opportunities associated with these free-flowing rivers for present and future generations.

4. to provide recreational use of fish and wildlife resources, including hunting and fishing, within the framework of appropriate federal and state laws.

5. to allow for utilizing the area's land and water at only that level which will leave the existing environment unimpaired.

6. to provide for the continuation of current land uses including agriculture, grazing, mining, and recreation.

7. to provide a variety of interpretive, scientific, educational, and wildlife uses.

8. to assure preservation of historic and archeological values.

The actions projected to accomplish these general objectives are stated below.

The proposal will provide, within the capacity of the areas, a wide range of public recreation opportunities in settings that vary from areas without substantial evidence of man's activities to those where there may be substantial past and present activity. The number of people visiting the areas will be monitored and use will be distributed by means of access control and use regulations, if necessary, to maintain existing environmental conditions.

Additional recreational facilities are already planned in the corridor to handle the increasing boating traffic. Most of this increase, as described in chapter XI, is expected whether or not the rivers are designated to the system, so the developments to accommodate it will take place under existing management plans of the Bureau of Land Management. A list of these planned developments follows:

Colorado River

Planned Developments

1. Westwater Ranger Station
   - acquire access road
   - develop 20-unit campground
   - build permanent ranger station

2. Rose Ranch boat ramp
   - acquire 6 acres (2.4 ha)
   - improve boat ramp
   - parking

3. Dewey boat ramp
   - develop boat ramp
   - parking
   - sanitation facilities

Dolores River

Planned Developments

1. Utah Bottoms
   - acquire access easement

Extreme care will be taken in the location of the additional recreation facilities, with primary emphasis on retaining the existing environment setting. Separate environmental assessments will precede construction of these facilities, and construction techniques will be planned to produce minimal pollution and surface disturbance.

To reduce the possibility of water and land pollution from human waste disposal, vault toilets will be installed at all development areas, and portable chemical toilets will be required in the inacces-

sible areas. In addition, a "bring out what you take in" program will be implemented to reduce litter.

Minerals in federal lands designated as wild river areas [13 miles (21 km) on the Colorado and 6 miles (9.6 km) on the Dolores] will be withdrawn from all forms of appropriation under the mining laws and from operation of the mineral leasing laws. Existing claims, if their validity is proved, will be exempt from this withdrawal. The boundaries of the withdrawn areas, which generally will follow the canyon rims, will be drawn during the writing of the management plans. Within the entire river corridor, disposal of lands under the public land laws will be prohibited, again subject to valid existing rights.

Scenic and recreational river areas [42.7 miles (68.7 km) on the Colorado and 14 miles (22.5 km) on the Dolores] will continue to be open to mineral location and entry under the 1872 Mining Laws. However, these areas will be subject to Section 9 of the Wild and Scenic Rivers Act: only a right or title to the mineral deposit will be patented on such claims. This will include use, but not fee title ownership, of the surface, as required to extract the minerals.

Mining in all portions of the corridor will be regulated to protect the rivers' values. The BLM, in consultation with other federal and state agencies and user groups, would implement mining regulations consonant with protecting the river areas.

These regulations will provide safeguards against pollution and unnecessary impairment of the scenery and may require that notice of intent and operating plans be filed with the BLM for mining claim location and assessment work. They will determine the need for retention of topsoil, restoration of topography, screening of operations, replanting or reseeding with native vegetation, removal of sediment from wastewater, and advance notice of intention to

start prospecting or mining activities where substantial alteration of the existing environment might occur. Also, since prospecting and mining activities often require heavy equipment such as bulldozers, stationary engines, water pumps, and generators, these regulations will deal with noise pollution. These regulations will apply to valid existing claims located in scenic and recreational river areas.

Use of off-road vehicles, aircraft, snow machines and motor boats will be strictly regulated within the river area. These regulations will be implemented by the BLM in cooperation with federal, state, and local agencies and user groups. These regulations will assure that access is provided in a manner which protects soil, vegetation and scenery; prevents harassment of wildlife; prevents conflicts with other uses; and abates noise pollution.

Adjacent federal lands will be managed to protect the natural values of the Colorado and Dolores Rivers. This will require the active cooperation of other federal and state agencies in developing and enforcing land use practices that protect the area from surface dumping of garbage, sewage, other contaminants, and unsightly developments located beyond the management zone but within the visual corridor.

The Bureau of Land Management will develop appropriate management programs and enforcement procedures to assure protection of the fauna, flora and their habitats in the proposal area which are listed by the Department of the Interior as Endangered or Threatened or which may be candidates for such status. These programs and actions will require compliance with the procedures outlined in Section 7 of the Endangered Species Act.

Fishing, hunting, trapping, and rockhounding will continue within the Colorado and Dolores Rivers proposal area under applicable federal and state regulations. Except as noted below, national

designation of the Colorado and Dolores rivers will not affect jurisdiction or responsibility of the states of Colorado and Utah over fish and wildlife resources for sport or subsistence purposes. The Secretary of the Interior, however, may designate zones or periods when hunting would not be permitted because of public safety, administration, or public use and enjoyment. Such action would be undertaken only after consultation with the Colorado Division of Wildlife and the Utah Division of Wildlife Resources. No such action is expected in these areas.

Based on current knowledge and materials found by artifact collectors, it is likely that there are many buried and still intact surface deposits containing cultural materials from all time periods. A careful reconnaissance may reveal such larger cultural features as the remains of irrigation systems and horticultural fields, which are very poorly known at present and therefore deserving of special attention. Management plans for the area will devote attention to the protection of any sites found in the corridor.

LAND ACQUISITION

In order to maintain the river area in its present outstanding condition, the Act binds the managing agency with requirements that it preserve and enhance the river's values. It also permits controls on private lands so that changes in the landowner's present activities do not degrade the area's natural qualities. To accomplish such control the Act allows the purchase, or if necessary, the condemnation and purchase of scenic and public access easements.

Scenic easements are agreements in which the administering agency buys certain future uses of the land[1] which might, if exercised, degrade the natural qualities of the river corridor. Thus, for example, land used at present only for grazing, but which had the

potential for supporting clear cutting, sand and gravel operations, high-density building construction, and industrial development might have a scenic easement purchased which would prevent the landowner from exercising these future uses, or developmental rights, in order to preserve the natural values of the river area. Such an easement would also prevent billboards, trash dumping and the like.

The value paid for such an easement is theoretically equal to the value of the development rights which are sold; they are relatively expensive in the case of land with high development potential.

Public access easements on the Colorado and Dolores would probably be limited to a narrow corridor covering the river and a strip of shoreline, in order to permit hiking, floating, and emergency stops without possible trespass.

The study team noted that the current owners of private land in the recommended sections of the rivers have been good stewards of those lands; though there are intrusions these rarely degrade the natural qualities of the river areas. While BLM retains the authority to acquire easements, it was thought that acquiring easements should be held in abeyance until threatened changes in land uses require its exercise. Similarly, the authority to acquire public access easements on the river and its shores probably should be restrained until there is necessity to use it.

This can most efficiently be accomplished by requiring landowners to notify the Bureau of Land Management in advance of any major

---

1. Existing uses of the land cannot be condemned under a scenic easement; they can be altered only on a willing buyer-willing seller basis.

proposed changes in land use; normal maintenance, replacement, and emergency measures would be exempt from notice requirements. If the change in land use were expected to degrade the river's values, the Bureau of Land Management and landowner would negotiate changes in the project, if possible, that would keep it from conflicting with the protection of the river's values. If no agreement could be reached within a one-year negotiation period, the BLM could then purchase a scenic easement on the land.

Within the Colorado River corridor are about 25,000 acres (10,100 ha), of which approximately 21 percent or 5,350 acres (2,160 ha) are in private ownership. The Dolores River corridor will encompass approximately 8,000 acres (3,240 ha), of which about 11 percent or 920 acres (370 ha) are privately owned.

These acreages are found within the critical line of sight from the river, and include the riverbed, banks, and zone of adjacent land which have a visual impact on the river use. If the natural and scenic appeal of the rivers are to be retained, they must be protected from adverse use. In developing the management plans for the rivers, the BLM will determine boundaries for the river corridors and exact figures for the amount of land included. Factors to be considered in determining these lateral boundaries include:

1. preserving the area seen from the river in a natural state.

2. providing river users with a feeling of spaciousness consistent with the type and extent of recreational and other uses in each segment.

3. protecting key fish and wildlife habitat.

4. protecting and making available historical and archeological resources of the river area.

5. protecting unique or important vegetative types.

6. protecting unique scenic or geologic features.

Rehabilitation of the Loma Launch site, mentioned below, will be contingent upon acquiring the area, or negotiating a cooperative agreement with the Colorado Division of Wildlife, which controls it.

DEVELOPMENTS

In addition to the easements that may prove necessary, one additional campground and improvements to the Loma and Gateway launch sites will be required to accommodate increased use in the river corridor caused by designation. The Bureau of Land Management already plans to develop some facilities to handle increases in use expected whether or not the rivers enter the national system, as described above. The following list includes only those which are proposed as a result of river designation.

Colorado River

Proposed Developments

1.	Loma boat ramp	- improve boat ramp - parking - sanitation facilities
2.	Dewey boat ramp	- add 5-unit campground

Dolores River

Proposed Developments

1. Gateway launch site
   - construct boat ramp
   - parking
   - sanitation facilities

COSTS

The costs below are only those attributable to including the Colorado and Dolores Rivers in the system. These costs are in addition to those projected for planned developments and on-going river management.

Colorado River	
Recreation Facilities	$ 38,000
Public Use and Scenic Easements, if all private acreage must be covered	2,140,000
	$2,178,000
Additional AO&M	$ 1,500
Dolores River	
Recreation Facilities	$ 11,000
Public Use and Scenic Easements, if all private acreage must be covered	368,000
	$ 368,000
Additional AO&M	$ 2,000
Totals	
Recreational Facilities	$ 49,000
Easements, if necessary	$2,508,000
Additional AO&M	$ 3,500

DRAFT ENVIRONMENTAL STATEMENT

S U M M A R Y

(X) Draft ( ) Final Environmental Statement

Department of the Interior, National Park Service

1. Type of action:
   ( ) Administrative (X) Legislative

2. Brief description of action:

The Colorado and Lower Dolores Wild and Scenic Rivers Study was conducted pursuant to the Wild and Scenic Rivers Act (PL 90-542) as amended, and the request of the Governor of Utah, and recommends legislative action to include a 55.7-mile segment of the Colorado River and approximately 25,000 acres of adjacent land in the states of Colorado and Utah to the Wild and Scenic River System, classified as 13 miles of Wild River area, 38.2 miles of Scenic River area, and 4 miles of Recreational River area. Legislative action to include 20 miles of the Dolores River in the states of Colorado and Utah, with approximately 8,000 acres of adjacent land, in the system is also recommended, with 14 miles classified as Scenic River area and 6 miles as Wild River area. Both rivers would continue to be managed by the Bureau of Land Management.

3. Summary of environmental impact and adverse environmental effects:

Including approximately 75.7 miles of the two rivers and the associated 33,000 acres of corridor lands will have the overall effect of preserving the existing scenic, geologic, cultural, recreation, and fish and wildlife values for the enjoyment of present and future generations. Adjacent land uses would remain relatively unchanged. Easements on up to 6,270 acres of private land might be necessary to safeguard the rivers' values from adverse developments. Water resource developments in the corridors will be

prohibited. Mining operations along the final 4 miles of the Colorado segment will become more expensive. Minor soil, vegetation, and wildlife disturbance will occur at development sites.

4. Alternatives considered:

In addition to the proposed action, other alternatives considered were (1) no action, ie, continuation of present management, (2) a National Economic Development Plan for both rivers based on provision of additional recreation, and (3) classification options allowing different levels of development in the corridor. A total of five plans for each river was considered.

5. Comments were requested from the following:

Advisory Council on Historic Preservation
Water Resources Council
Department of Agriculture
Department of Defense
Department of Commerce
Environmental Protection Agency
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of Transportation
Department of the Interior
    Fish and Wildlife Service
    National Park Service
    Bureau of Land Management
    Bureau of Indian Affairs
    Geological Survey
    Bureau of Reclamation
    Bureau of Mines
Department of Energy
State of Colorado Clearinghouse
State of Utah Clearinghouse

Areawide Clearinghouses in Montrose and Rifle, Colorado and Price, Utah
Southwestern Water Conservation District
The Wilderness Society
Sierra Club
Western River Guides Association
Colorado White Water Association
Colorado Open Space Council
Federal Timber Purchasers Association
Denver and Rio Grande Western Railroad
University of Colorado Wilderness Study Group
American Rivers Conservation Council
Industrial Resources, Inc.
Upper Colorado River Commission
Colorado State Historical Society

6. Date statement made available to CEQ and the public:
Draft -
Final -

C O N T E N T S

Draft Environmental Impact Statement

CHAPTER VI
DESCRIPTION OF THE PROPOSAL

THE PROPOSAL

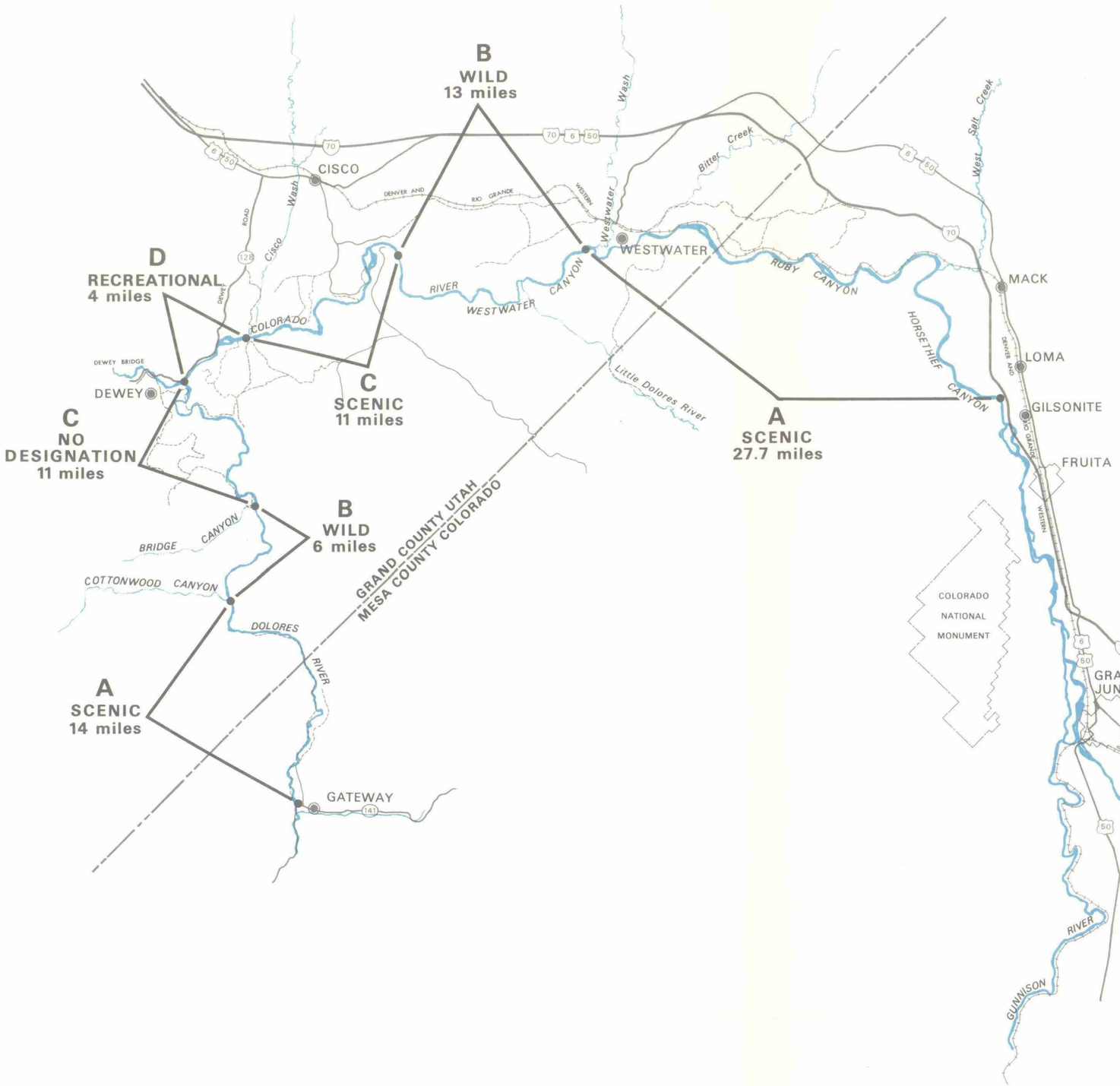
The Department of the Interior proposes that 55.7 miles (89.7 km) of the Colorado River and 20 miles (32 km) of the Dolores River be designated components of the National Wild and Scenic Rivers System. The portion of the Colorado River proposed for designation extends from the Loma, Colorado, launch site downstream to the confluence with the Dolores River in Utah. Of the total, 13 miles (20.8 km) are recommended for designation as "wild," 38.7 miles (60.7 km) as "scenic," and 4 miles (6.4 km) as "recreational."

The Dolores River area extends from the Colorado Highway 141 bridge at Gateway, Colorado, downstream to Bridge Canyon in Utah. Of the total, 6 miles (9.6 km) are recommended for designation as "wild" and 14 miles (22.4 km) as "scenic." The segments, with their classifications, are shown on the Recommendations Map.

Background

The amendment of January 3, 1975 (PL 93-621) to the Wild and Scenic Rivers Act (PL 90-542) required the study of the Colorado from a point 19.5 miles (31.4 km) above the Colorado-Utah border, to the confluence with the Dolores River in Utah.

At the request of Governor Rampton of Utah, a request supported by Governor Lamm of Colorado, the Utah portion of the Dolores was studied. The study team found the two rivers were freeflowing and possessed the "outstandingly remarkable" qualities required for candidate rivers for the system, as is discussed in Chapter IV of



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

PROPOSAL

GRAVEL ROAD

JEEP ROAD

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,022
DSC | FEB 79

the report. It also determined the highest potential classification levels for the various segments of the two rivers, and agreed to recommend inclusion and the management actions which are contained in chapter VI of the report and summarized here.

Management Goals

Administration and management of both rivers will be the responsibility of the Bureau of Land Management (BLM). The BLM will prepare a management and development plan for each of the river corridors that will delineate the boundaries of the areas to be designated and specify development plans for the facilities necessary to accommodate river users. These proposed developments, only two of which are attributable to river designation, are discussed below. The management plans will be filed with the Congress within approximately one year after the rivers are included in the system.

The detailed management plans for these two rivers should emphasize the following general goals:

1. maintaining the free flow of the rivers.

2. preserving the natural values, the undeveloped and nearly primitive character, and the historical and archeological features of the corridor. Using screening techniques such as vegetation and natural rock and non-specular (flat, non-reflective, earth tone pigments) paints to preserve or enhance scenic values.

3. preventing degradation of existing water quality and encouraging water quality improvements so long as these do not adversely affect the river's values.

4. providing access, use, and interpretation of the corridor for the public in a way consistent with the protection and enhancement of the rivers and their associated environment.

5. providing recreational opportunities at a level of use that does not degrade the area's values, lower the quality of experience, or adversely affect riparian landowners.

6. providing for the protection, use, and enhancement of fish and wildlife within the framework of appropriate federal and state laws.

Chapter VI of the report has a fuller discussion of the projected management for the area.

Corridor Area

Table VII-1 shows the ownership of the area involved in the proposal. Because of the varying land parcel shapes, amounts of river frontage owned by the various entities do not reflect the amount of land controlled by each in the corridor.

TABLE VII-1
Corridor Landownership
Acreage and River Frontage

Colorado River

Ownership	River Frontage Miles (km)	Acreage (ha)	Corridor Acreage Percent of Total
Bureau of Land Management	72.9 (117.3)	17,500 (7,080)	70
State	1.5 (2.4)	2,250 (910)	9
Private	37 (59.5)	5,350 (2,160)	21
Subtotal	111.4 (179)	25,100 (10,150)	100
Dolores River			
Bureau of Land Management	35 (56.3)	7,080 (2,870)	88.5
Private	5 (8.1)	920 (370)	11.5
Subtotal	40 (64.4)	8,000 (3,240)	100
Total	154.4 (243.4)	33,100 (13,390)	

Easement Acquisition

Private lands occupy approximately 37 riverbank miles (59.6 km) on the Colorado River; scenic and public use easements may be required on about 5,350 acres (2,160 ha) if any changes in existing land use of these lands threaten the river's outstanding values. On the Dolores River there are about 5 riverbank miles (8.1 km) occupied by private lands; easements may be necessitated on approximately 920 acres (370 ha). The management plans should specifically delineate the boundaries of the river areas and contain specific development and administration plans, a task which will require intensive investigation. Therefore, these estimates of

scenic and access easement which may need to be acquired are tentative. They are approximations made for cost estimates and to aid the administering agency in the more intensive planning which will follow if the rivers are included in the system.

Planned and Proposed Development

In addition to the easements that may be required to protect the river corridors and provide public access, some new facilities will be required to accommodate increased use in the river corridors. The Bureau of Land Management already has plans to develop all but two of the sites, since considerable increases in river use are expected whether or not the rivers are designated. The following list describes both those already planned for development and those proposed to accommodate any extra use if the river is designated.

Colorado River--Developments Planned Under Existing River Management

1. Westwater Ranger Station

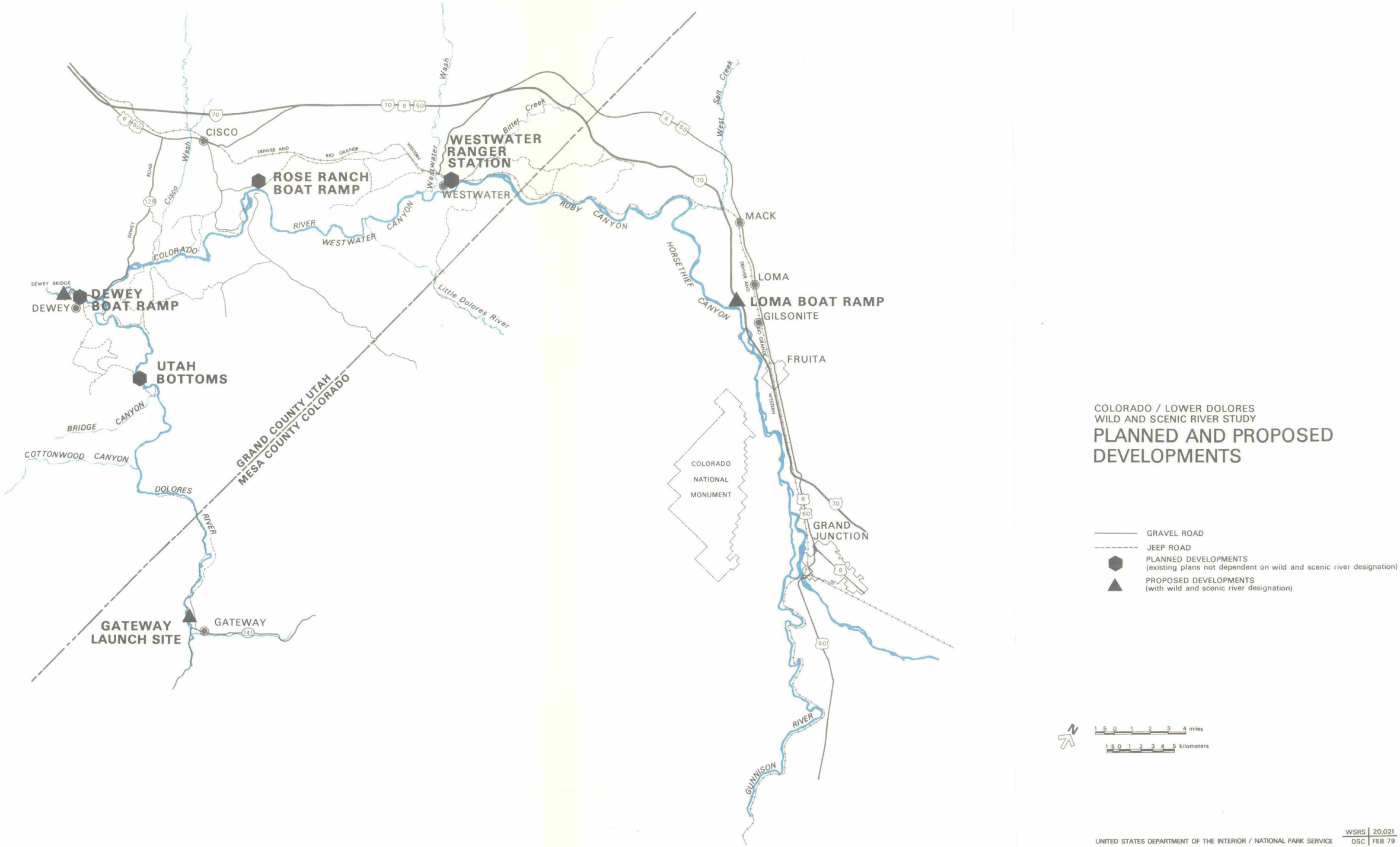
    (a) acquire access road
    (b) develop 20-unit campground
    (c) improve boat ramp
    (d) build permanent ranger station

2. Rose Ranch boat ramp

    (a) acquire 6 acres (2.4 ha)
    (b) improve boat ramp
    (c) parking

3. Dewey boat ramp

    (a) develop boat ramp
    (b) parking
    (c) sanitation facilities



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

PLANNED AND PROPOSED DEVELOPMENTS

GRAVEL ROAD

JEEP ROAD

PLANNED DEVELOPMENTS
(existing plans not dependent on wild and scenic river designation)

PROPOSED DEVELOPMENTS
(with wild and scenic river designation)

N

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,021
DSC | FEB 79

Colorado River--Additional Developments Proposed Due to Designation

1. Loma boat ramp

   (a) improve boat ramp
   (b) parking
   (c) sanitation facilities

2. Dewey boat ramp

   (a) develop 5-unit campground

Dolores River--Developments Planned Under Existing River Management

1. Utah Bottoms

   (a) acquire access easement

Dolores River--Developments Proposed Due to Designation

1. Gateway

   (a) construct boat ramp
   (b) parking
   (c) sanitation facilities

Costs

The following list of costs contains only those attributable to including the Colorado and Dolores river in the system. These costs are in addition to those for on-going river management.

Colorado River

Recreation Facilities	$ 38,000
Public Use and Scenic Easement Acquisition, if necessary	$2,140,000
	$2,178,000
Additional AO&M	$ 1,500

Dolores River

Recreation facilities	$ 11,000
Public Use and Scenic Easement Acquisition	$ 368,000
	$ 379,000
Additional AO&M	$ 2,000

Relationship with Other Programs

Statewide Comprehensive Outdoor Recreation Plans and Nationwide Outdoor Recreation Plan. Preserving segments of the Colorado and Dolores rivers is consistent with the goals expressed in the SCORP for Colorado and Utah. Both states recognize the need for preserving high quality streams and their environs at both the state and federal levels. The proposed action is also in agreement with Outdoor Recreation - A Legacy for America which recommends including additional rivers in the National Wild and Scenic Rivers System.

National Historic Preservation Act and Executive Order 11593. Designating the rivers applies the Act's protection to cultural resources; section 10(a) requires that "primary emphasis" be placed on "protecting . . . historic, archaeologic and scientific features." Although an inventory of the historic and cultural values for the Dolores River has been completed, only preliminary survey information is available for the Colorado River. The BLM will be responsible for continued consultation and compliance with section 106 of the National Historic Preservation Act and E.O. 11593. A survey of the Colorado River may be required as part of the management plan, to be completed within about one year following designation.

If properties listed or eligible for listing in the National Register of Historic Places are affected by designation or development of

facilities, any activities affecting them will be in compliance with section 106 and E.O. 11593.

Endangered Species Act. The Endangered Species Act of 1973 made it a violation of federal law to take any species listed as endangered, except under permit, or to imperil the propagation or survival of the species. Two fish species and two bird species which are listed as endangered occur in the Colorado River corridor. The provisions of the Wild and Scenic Rivers Act that require preservation of the outstanding values of the river are in conformity with the purposes of the Endangered Species Act.

Bureau of Land Management Planning. The Federal Land Policy and Management Act of 1976 authorized the BLM to give priority to the protection of areas of critical environmental concern, such as the river corridors. The management framework plans (MFP) for the units through which the rivers pass recognize the recreational and scenic values associated with each river. The MFP for the Dolores Planning Unit in Utah recommends the development of intensive management plans for the Colorado and Dolores Rivers, which will be completed within about one year following designation of the rivers. The MFP also recommends that access be obtained at Westwater and Rose Ranch for boat launching and takeout and that the river corridors be protected from man's intrusions. These BLM plans for river protection and recreation development are compatible with river designation.

Executive Orders 11988 and 11990 -- Floodplain and Wetland Developments. While no part of the proposal involves wetlands, the developments proposed at Loma, Gateway, and Dewey Bridge will lie partly in the 100-year floodplain. No official designation or mapping of the floodway in the study area has been done.

Recreation is one of the permissible uses of floodplain, and since the facilities must be used at normal and low water stages, there

exists no practical alternative to siting them in the floodplain. Other alternatives would entail environmental damage caused either by floaters descending to the river from the facilities, or failing to use them because of their inconvenient distance from the river. To the extent practicable, these facilities will be floodproofed and designed to minimize pollution during a flood.

In keeping with the provisions of E.O. 11988, public review of the proposal to build these facilities is being sought with the issuance of this report, by submission to the A-95 clearinghouse. Further public involvement will be handled by the BLM during the preparation of the management plan for the rivers, and during site specific planning when the developments are to be constructed. The BLM will also apply for the necessary permits and any required variances in the respective counties and states.

CHAPTER VII
DESCRIPTION OF THE ENVIRONMENT

For a description of the environment, see chapters II and III of the Study Report.

Description of the Probable Future Environment Without the Proposal

The probable future environment without the proposal is described as the no action options for the Colorado and Dolores Rivers in chapter XI.

CHAPTER VIII
ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

COLORADO RIVER

Inclusion of 55.7 miles (89.7 km) of the Colorado River and the 25,000 acres (10,100 ha) comprising its immediate environment in the National Wild and Scenic River System will ensure the river's free-flowing condition and the natural values of the river and its associated land areas are maintained. This action will have two primary effects. Designating the river will preclude federally licensed or assisted water development projects and other incompatible developments within the corridor, and will also increase recreation use and the attendant visitor impacts.

Impact on Mineral Resources

Designating the river will have a different impact on the area classified wild than it will on the scenic and recreational segments. Except for valid existing claims, the federal lands in the "wild" segment (Westwater Canyon) will be withdrawn from mineral entry under the mining laws and operation under the mineral leasing laws. About 4,000 acres (1,620 ha) of steep canyon terrain will be affected.

Existing valid claims in this area will be purchased or made subject to regulations written by the BLM during the management planning period. These will safeguard the river's values by requiring screening, reclamation, and other measures. Invalid claims in this area will revert to the federal government without compensation to the holder.

Since there are no known mineral reserves in the wild segment, withdrawing the area and instituting regulations are not expected to have any significant impacts.

Scenic and recreational river areas are open to mineral entry and leasing, but both exploration and extraction are subject to Secretarial regulation to preserve the river environment. As with wild river areas, unpatented claims revert to the federal government if mineral value cannot be proven.

The regulations designed to preserve the river's outstanding values will add slightly to the cost of exploration and extraction in the scenic and recreational river areas. Those areas may contain possible potential resources of U_3O_8 and V_2O_5 (100,000 to 150,000 pounds or 45,500 to 68,200 kg U_3O_8 and 280,000 to 420,000 pounds or 127,300 to 191,000 kg V_2O_5) near the confluence of the Colorado and Dolores Rivers. Small deposits may also exist near Loma, Colorado. The amounts of these minerals in the corridor are so limited that the impact on their extraction should be insignificant. Gold, oil, gas, and coal are also found in very limited quantities, and impacts on their extraction should not be significant.

Impact on Land Use

Land use practices on federal lands in the corridor (about 70 percent of the total) that would have an adverse effect on river values will not be allowed or will be subject to regulation. Grazing is the primary use on public lands; it will not be affected by designation. The same is true for state lands in the corridor (about 10 percent of the total).

Scenic and/or public use easements may be required on about 5,350 acres (2,160 ha) of private land to provide access and to protect

the wildlife, geologic, cultural, and scenic values of the corridor. Since this is primarily agricultural land, the easements will not significantly alter present land use. However, they will preclude any future developments (homesites, resorts, junkyards, etc.) that would degrade river values. Since such developments are unlikely, this impact is not expected to be significant.

Impact on Water Resource Development Projects

Federally licensed or assisted water resource development projects in the corridor that would diminish the existing scenic, recreation, fish and wildlife, and other values of the river area will be prohibited. Federally licensed or assisted projects upstream could be built if the Secretary of the Interior finds they do not unreasonably diminish the values for which the river is designated. As indicated in chapter III of the study report, the Federal Energy Regulatory Commission (FERC) has identified the Dewey site, located approximately 2 miles (3.2 km) downstream from the confluence of the Colorado and Dolores Rivers, as a potential location for a hydropower dam. This project would back water into both the Colorado and Dolores River study areas. Although at present there is no interest in developing this site, designation of the Colorado River would preclude further consideration of development.

The effect of the proposal on the Industrial Resources conditional decree for a reservoir and other structures in segment A requires some discussion. The Colorado River contains endangered fish, as described in chapter III. Before the BLM could grant a permit for the construction of the reservoir, a consultation with the Fish and Wildlife Service would have to be held to determine whether the reservoir and the other facilities would adversely affect these fish. Since reservoirs and substantial decreases in flow (the decree involves 320 cfs (9 m^3/s) of the normal base flow of about 3,200

cfs or 90 m^3/s) have previously been found to affect the fish adversely, it seems probable the Fish and Wildlife Service would invoke the provisions of the Endangered Species Act of 1973, which does not allow federal agencies to aid measures which adversely affect endangered species or their habitat. If so, the BLM would not issue the permit, and portions of the project would be precluded. In such a case, any impact on the project could not be ascribed to this proposal.

If, however, the Endangered Species Act were nullified, if it were found that the reservoir would not adversely affect the fish, or if an exception were granted under the recent amendments to the Endangered Species Act, then designation under the Wild and Scenic Rivers Act would not permit construction of the project since the BLM, under section 7(a) of the Wild and Scenic Rivers Act, would not be able to issue a permit for the construction of the mainstream reservoir due to its adverse affect on the values for which the river had been designated.

The portions of the project which lie upstream from the study area (the diversion of 2,020 cfs or 57.2 m^3/s for a thermal generating plant) would probably be unaffected by designation. Although only limited information on the operation of the diversion was available, the study team felt that its consumptive use (20 cfs or 0.57 m^3/s) would not affect the river's values. If it is later found by the Secretary of the Interior that this portion of the project did unreasonably diminish the values for which the river had been designated, these upstream portions of the project would also be precluded as an impact of the proposal.

Therefore it seemed probable that preventing the construction of the reservoir is an impact of existing law and management authorities. If conditions change as described above, preventing the construction of the reservoir will be an impact of designation of

the Colorado River. As another consequence of designation, the reclamation and powersite withdrawals on the public lands in the corridor would be lifted.

Impact on Recreation

Including the Colorado River in the National Wild and Scenic Rivers System is expected to result in a greater increase in recreation use and the associated impacts than that which would occur without designation. With the proposal, the use of the river in 1976 (about 16,550 recreation days) is expected to increase to about 37,750 recreation days by 1990 (see Table VIII-I). Of this total, 4,500 recreation days, an increase of about 13 percent, would be the result of river designation, and 33,250 recreation days would be the expected increase without the publicity attendant on designation. Boating, with associated camping and picnicking, constitutes the sole projected increase.

To accommodate the use expected by 1990 with designation, the BLM has plans to develop boat launching, camping, parking, and sanitation facilities. The expected 13 percent increase in use resulting from designation would require the expansion of the Dewey boat ramp facilities with a 5-unit campground. This will occupy about 1 to 2 acres (0.4-1 ha). Development and use of these five units will have minor impacts on soil, vegetation, wildlife, and water quality. Construction will disturb the soil, vegetation, and small animals on portions of the land and may result in slight erosion. After construction, continued use of the area would result in some soil compaction, some loss of vegetation, disturbance of wildlife, and water pollution from erosion and human waste disposal. These impacts will be insignificant.

The Loma launch site will also be rehabilitated under the proposal. About 1 to 2 acres (0.4-1 ha) will be affected in this area. Impacts will be similar to those described for the Dewey facility mentioned above, but there will be a very slight improvement in water quality from the installation of a vault toilet.

The 13 percent increase in recreational use of the area will increase the probability of encounters between recreationists. This would decrease the sense of solitude available, possibly replacing recreationists oriented toward solitude with more socially oriented river runners. This is not expected to be a significant impact.

Impact on Economic and Regional Development

Recreationist expenditures will increase $63,000 above those predicted to occur in 1990 if no action is taken under this study. Recreational facility development under this plan would cost $38,000, and would necessitate annual costs of $6,900, of which $1,500 would be for Annual Operations and Maintenance (AO&M). This plan will increase the costs of extracting the approximately $134,000 worth of uranium and vanadium in Segment D, near the confluence with the Dolores. It will generate approximately $40,000 in increased regional income from recreationist expenditure and federal recreation development costs.

Impact on Social Well-being

The availability of recreational opportunities will increase somewhat; the recreation environment will be legally preserved, generally maintaining the quality and diversity of the recreational experience. The 13 percent increase in recreation above that which is predicted to occur without designation will diminish solitude, increase the

probability of encounters between recreationists, and consequently repel wilderness-oriented boaters while attracting more socially-oriented recreationists.

The increased regional income will provide about five additional man-years of labor, primarily in the service and construction industries. The social environment will not otherwise be affected by the proposal.

Other Impacts

The 13 percent increase in recreation use will result in proportionate impacts on soils, vegetation, wildlife, water quality, and cultural features. Soils will be compacted in camps and along informal trails; this will interfere with the regeneration of certain types of vegetation, such as cottonwoods, and will cause small increases in erosion.

Dead wood in certain camps will probably be burned in campfires. Slight decreases in water quality due to erosion and irresponsible disposal of human wastes will occur. Recreation developments will mitigate these impacts. In Westwater Canyon these impacts will be negligible, since most of the camps are below the high water mark. In other segments about 10 acres (4 ha) will be involved. Most of these impacts will be caused by increased use regardless of designation; the amount caused by designation will consititute a minor increase.

Increased use may result in an increase in vandalism of historic and archeologic sites in the corridor. However, features worthy of preservation will be identified and protected according to the provisions of the National Historic Preservation Act of 1966.

TABLE VIII-I

IMPACT OF THE PROPOSED ACTION ON PROJECTED VISITATION

RIVER	ACTIVITY	PRESENT USE (1976)	PROJECTED USE EXISTING MANAGEMENT	PROJECTED USE WILD RIVER PROPOSAL	IMPACT OF RIVER PROPOSAL
Colorado					
	Boating	14,800	31,500	36,000	4,500
	Fishing	1,150	1,150	1,150	
	Hunting	600	600	600	
	TOTAL	16,550	33,250	37,750	4,500
Dolores					
	Boating	500	4,500	6,450	1,950
	Fishing	300	300	300	
	Hunting	200	200	200	
	TOTAL	1,000	5,000	6,950	1,950
GRAND TOTAL		17,550	38,250	44,700	6,450

One suspected active eyrie of the American peregrine falcon has been identified in the Westwater Canyon vicinity. Increased river use would not pose a threat to this species unless hikers were to get too near the eyrie; this is unlikely. The bald eagle is present in winter months and should not be adversely affected since little recreation takes place at that time of the year. The endangered humpback chub and Colorado squawfish will not be affected by increased use.

Routine maintenance of the Denver and Rio Grande Western trackage would not be affected by this plan. Improvements to the line which adversely affect the river's values or impeded its free flow substantially would either not be permitted or would have to be modified to diminish their impacts.

DOLORES RIVER

Including 20 miles (32.2 km) of the Dolores River and the 8,000 acres (3,240 ha) that comprise its immediate environment in the National Wild and Scenic Rivers System will, by affording statutory protection, ensure the river's free-flowing and outstanding natural values will be maintained.

The principal impacts of inclusion in the National System will be to preclude federally-licensed and assisted water development projects and other incompatible developments in the corridor and to cause increases in recreation use.

Impact on Mineral Resources

Subject to valid existing claims, designation of the 6-mile (9.6 km) "wild" segment will result in the withdrawal of federal lands within

the corridor from all forms of appropriation under the mining laws and operation under the mineral leasing laws. The actual boundaries of the corridor will be determined during management planning, but the area involved averages one-half mile (0.8 km) in width and includes about 1,900 acres (770 ha). Existing valid claims in the "wild" river area will be subject to regulations to preserve the present river values.

Prospecting and extraction of minerals found in the "scenic" segment will be allowed to continue under regulations that will be developed by the BLM as part of their management planning. These regulations will be designed to allow extraction, while at the same time protecting the river values through reclamation, screening, and other requirements.

These regulations will increase the cost of any mining that takes place and thus make mining in this area less probable. This impact is not expected to be significant since deposits of uranium and vanadium in the Uravan Belt are found primarily on Beaver Mesa, south of the "wild" segment and southeast of the "scenic" segment. The mesa is outside the "wild" river corridor that will be withdrawn from mineral entry, so it will not be affected. Although some placer mining for gold has taken place in the corridor, no other minerals are known to exist in significant quantities along the Dolores River.

Future prospecting and mining of gold will be precluded in the "wild" segment and subject to regulation in the "scenic" segment. The small quantities removed in the past suggest that future prospecting for gold should not either be extensive or very successful; impacts should not be significant. The proposal will not affect mining in segment C.

Impact on Land Use

Land use practices on federal lands in the corridor (about 89 percent of the total) that would have an adverse effect on river values will not be allowed or will be subject to regulation by the BLM. Grazing and mining are the primary land uses on public lands in the corridor. Designation should have no effect on grazing practices. The impacts on mining were discussed above.

Scenic and/or public use easements may be required on about 920 acres (370 ha) of private land to provide access and to protect the wildlife, geologic, cultural, and scenic values of the corridor. Since this is primarily agricultural land, the easements will not significantly alter present land use. However, they will preclude any future developments that would degrade river values. As with the Colorado River corridor, developments such as homesites, resorts, and junkyards are not likely, so this is not expected to be a significant impact.

Impact on Water Resource Development Projects

Federally-licensed or assisted water development projects that would diminish the existing scenic, recreation, fish and wildlife, and other values of the river area will be prohibited by designation. As discussed in chapter III of the report, there are no projects planned within the study corridor, although three--the Dolores Project, San Miguel Project, and Paradox Valley Salinity Control Unit--are under construction or planned upstream.

If appropriate, the Secretary of the Interior will determine whether any of the planned projects, or their combination, would diminish the values of the study segment. Existing water rights (see table III-1 of the report) will not be affected by the proposal.

Impact on Recreation

Including the Dolores River in the National Wild and Scenic Rivers System will produce a greater increase in recreation and the attendant impacts than that which would occur without designation.

The estimated 1976 use of the river was about 1,000 recreation days (see table VIII-1). With designation, use is expected to reach about 6,950 recreation days by 1990, about 40 percent above that which would occur without designation (5,000 recreation days). Boating, with associated camping and picnicking, is the total projected increase in recreation use.

These increases will result in more contacts between recreationists and will diminish solitude. More socially oriented recreationists may consequently replace boaters oriented toward solitude. Campsites will become more crowded.

The BLM proposes to develop a boat ramp with sanitation facilities near Gateway, Colorado, to accomodate the recreation use expected with designation. This facility should be sufficient to accommodate the increased use resulting from river designation.

Impact on Economic and Regional Development

Recreationist expenditures will increase $28,000 annually above the amounts expected without designation, by 1990. This plan will cost $11,000 for recreational development and an additional $2,000 per year for AO&M. It will impose no additional cost on mineral extraction and will contribute an additional $14,000 to the regional economy annually by 1990.

Impact on Social Well-Being

The existing quality of recreation opportunities may be degraded in segment C under this proposal, but will be preserved in the two upper segments. The combination of possible degradation of the recreation environment in the lower corridor and increases in recreation use may alter the type of recreationist, replacing wilderness and solitude-oriented boaters with more crowd-tolerant recreationists. Approximately two man-years of labor, primarily in service industries, will be supported by the increased regional income discussed above. The social environment will not otherwise be affected by the proposal.

Other Impacts

Increased recreation use will result in a concomitant increase in the impacts on soils, vegetation, wildlife, and cultural resources.

Impacts on soils and vegetation will be concentrated around the boat ramps and other stopping points along the river. Since most stopping points are located on gravel bars, they should not be significantly affected. Side canyon hiking may produce informal trails in a few areas. Some soil compaction and erosion, loss of vegetation, and disturbance of wildlife will occur near the boat ramps. Due to the small area involved [1-2 acres (0.4-1 ha) at Gateway] and the short season for boating this river, regeneration periods will be longer than on the Colorado, and these impacts should not be significant.

Increased use may also result in increased vandalism of historic and archeologic sites near the river, even though those features eligible for the National Register will be identified and protected according to provisions of the National Historic Preservation Act of 1966.

Impacts at these sites should be less significant than at those along the Colorado, since these have less attraction value.

The endangered bald eagle, generally present along the river during the winter months, has recently been sighted in the spring and early summer. This indicates there may be an active bald eagle nest in the area of the Colorado and Dolores Rivers, although this has not been confirmed. Since little recreation occurs in the winter, the bald eagle would not be affected unless an active nest does exist, and then only if hikers were to get too close to the nest.

CHAPTER IX
MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS OF THE PROPOSED ACTION

This chapter describes the measures designed to mitigate the adverse impacts resulting from the proposed action, and the residual adverse impacts which cannot be avoided or mitigated. The mitigating measures will be included in the management plans which will be drawn up to administer the rivers during the one-year period following designation.

MITIGATING MEASURES

1. The plans will provide for monitoring human use of the area, and will either establish, or provide for the eventual establishment of, visitor use levels which are consistent with preserving the outstanding values for which the rivers are designated.

2. New facilities planned for the Dewey boat ramp will be designed and sited so as to produce the least soil compaction, erosion, and disturbance of vegetation and wildlife. Areas disturbed in construction will be reseeded.

3. To reduce land and water pollution, river floaters will be required to use portable toilets or otherwise containerize wastes on trips requiring overnight camping. Vault toilets will be installed at developed areas. A program of "take out what you take in" will be instituted to reduce littering. If this proves ineffective, then cans, bottles, and other non-burnable containers will be prohibited in the river corridor.

4. Protective measures will be implemented to reduce the threat of fire. This will involve limiting the use of open fires, designating specific areas where open fires will be permitted during periods of high fire risk, or requiring the use of stoves. The plans will provide that driftwood, not deadfall, will be used in campfires.

5. Protective steps will be taken involving the habitat of the American peregrine falcon, the bald eagle, and other threatened or endangered species. These protective administrative actions may include, for example, restricting human encroachment on the habitat of such animals during sensitive periods of their lives, such as the nesting seasons of the endangered birds.

6. Historical and archeological sites eligible for the National Register will be provided appropriate protection. This action will be initiated early in the detailed planning process. As master planning progresses to a more specific state, the criteria of "Effect" as stipulated in section 106 of the National Historic Preservation Act will be applied. All activities that affect cultural resources will follow the procedures outlined under section 106 of the National Historic Preservation Act. Some sensitive sites may be closed or their locations kept confidential.

7. Key scenic and geologic sites will be identified so as to provide adequate protection.

UNAVOIDABLE ADVERSE IMPACTS

Even after the mitigating measures stated above, some unavoidable adverse environmental impacts will result from including the Colorado and Dolores Rivers in the system.

Increased numbers of people visiting the Colorado and Dolores Rivers annually will require regulations designed to protect the environmental values of the area. These regulations potentially will limit use and the distribution of use, causing a loss of personal freedom to go where, when, and how a person might otherwise desire.

The increases in litter, pollution of water and air, and noise caused by increased visitation, especially at the developed sites, will not be fully mitigated. These impacts will not be significant.

Substantial future diversions of water within the Colorado and Dolores River corridors, and any future diversions or water projects upstream from the two river areas which require Federal licensing or assistance, will be foregone if the Secretary of the Interior determines they will unreasonably diminish existing scenic, recreational, fish, and wildlife values within the proposal area.

Mineral exploration and development within the withdrawn area of the wild river segments of the two rivers would be foregone. Since no mineral reserves are known or estimated in these segments, this is not expected to have a significant impact on national or regional energy development programs.

Losses of ground cover (primarily shrubs and grass), wildlife habitat for small mammals, displacement and loss of some small mammals, birds, reptiles, and amphibians will occur during and after construction of recreation facilities on a portion of the 7-acre (3 ha) development sites at Dewey and Loma launch sites. These impacts are not considered to be significant.

The increased threat of wildfires resulting from more people in the proposal areas will not be fully mitigated.

Future federal-aid highway construction which would have an adverse impact upon the wild and scenic rivers would be subject to section 4(f) of the Transportation Act and would be discouraged. Future highway improvement proposals, therefore, might involve less convenient and more expensive routing. At present no future improvements are predicted that would be affected by the proposal.

Although historic and archeologic sites will be protected under existing federal Laws, a limited amount of vandalism and destruction will continue to occur. These impacts will be proportional to the increases in recreation attributed to the proposal--13 percent on the Colorado and 40 percent on the Dolores.

CHAPTER X
RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY; AND IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED IN THE PROPOSED ACTION

By designating segments of the Colorado and Dolores Rivers as components of the National Wild and Scenic Rivers System, their outstanding values as free-flowing rivers will be preserved. There will be no major physical changes to the environment, and no resources will be irreversibly or irretrievably committed (the 5-unit campground proposed in the Dewey Bridge area, the Loma and Gateway launch site improvements, and the access easements at Utah Bottoms, are reversible actions).

The proposed action will devote the natural resources of the area to preservation rather than development; their long-term productivity will remain unimpaired, in case Congress should later find it in the national interest to reverse the designation.

Existing short-term uses of the area will not be affected by the plan. In the wild segments, short-term gains from removing mineral resources that are not covered by valid existing claims will be foregone, but since the geology of these areas makes finding significant minerals very unlikely, the loss of this potential is insignificant. The regulations issued by the Secretary of the Interior to safeguard the river corridor in other designated segments may make mineral extraction more expensive and thus lessen short-term gains.

CHAPTER XI
ANALYSIS OF ALTERNATIVES AND THEIR IMPACTS

In 1971, the Water Resources Council developed and tested a procedure for generating and evaluating alternative plans for water and the related land resources. This procedure was first known as multiple objective planning, since it required planners to create alternative plans for two equally-weighted objectives - national economic development, and environmental quality. The process was published as an Executive Order in the Federal Register[1] under the title "Principles and Standards for Planning Water and Related Land Resources."

Wild and Scenic River designation is considered by the Water Resources Council to be subject to these provisions, so Wild and Scenic River studies include a Principles and Standards analysis. This chapter presents a summary of the effects and impacts of four alternative plans for the Colorado River segments and four plans for the Dolores; the fifth plan for each river is the proposed action, and its effects have already been treated.

PLANNING PROCEDURE

Since a detailed description of the Principles and Standards procedure is included in appendix E, only a simplified description

---

1. "Principles and Standards for Planning Water and Related Land Resources," Federal Register Vol. 38, No. 184, Part III (Sept. 10, 1973).

is offered here. The process is designed to offer those who make decisions affecting the rivers a basis for comparing different plans and their consequences. It does this by producing a series of alternative plans whose effects are calculated or estimated and displayed in a system of four accounts: national economic development, environmental quality, regional development, and social well-being.

The plans must deal with the resources actually present in an area, they must be actions which the planner or those he is planning for are legally allowed to take, and there must be a need for the effects of the plans. As an example, a plan could not consider the effects of mining sand and gravel unless 1) there are deposits of the materials in the river area, 2) the area is open or can be opened to mineral extraction, and 3) there exists or could arise a national need for sand and gravel which the area could economically supply.

Plans are made by selecting a resource in the area, and estimating the value of developing, using or preserving it on some selected date in the future. All such sums and the associated costs are totaled to produce the net economic benefit of that plan in the future, a figure which is then discounted using a rate specified each year by the Water Resources Council. Many of the plans have effects which cannot be quantified; preservation of some members of an endangered species is an example. When a table is produced that shows the effects of the various plans, these effects are described verbally.

Sometimes the process reveals complementarity among the plans, and sometimes conflict. Preserving an area of great scenic beauty and recreational interest, for instance, may not be possible if mining is permited in that area; sometimes the process reveals that it is possible to do both.

Once the effects of all the plans are displayed the study team alters them by using the newly-revealed conflicts and complementarity. The altered plans better satisfy their objective. Effects are again displayed for this range of plans. The study team then selects and recommends the one which best contributes to the national economic development or environmental quality, or more usually, which best mediates between these objectives.

Because the effects of the plans must be quantified if possible, the tables (XI-2 and XI-4) showing their dollar-value effects tend to be quite precise. This apparent precision should not be relied upon too much, since most of these figures have been prepared by 1) estimating the present amount of a type of use or the volume of a resource like uranium ore, 2) estimating the rate of change in use of that resource or activity over a period of future years, and 3) consulting studies, memos, and papers to determine a monetary value for the activity or the resource. Multiplying these estimates compounds the uncertainty of the final figure. At best these figures only approximate what will later be found to have happened.

But while the absolute reliability of the figures is questionable, the relation they bear to one another is useful. If one plan has an effect twice as great as another's, the factor of two by which they differ is more accurate than the dollar values offered. On this basis comparisons should be made between the plans.

ALTERNATIVE PLANS

The study team developed five plans for the Colorado segments and five for the Dolores. For each river a "no action plan" was made; these are baseline plans which represent the continuation of present management if no action is taken to implement proposals in this study. For each river a National Economic Development Plan (NED)

was drafted which increases the output of goods and services, or the efficiency with which they are produced. For each river a series of Environmental Quality Plans (EQ) was generated; these all involve designation under the Wild and Scenic Rivers Act. The variation among these plans is due to the fact that a river qualifying for one level of classification can be designated at less restrictive classification levels and the less restrictive classifications have a smaller effect on the economics of mining.

The following pages describe the series of alternative plans for each river. The no action option is given first, both because it may be chosen at the conclusion of this study, and because it is a baseline against which the effects of other plans are compared. In making such comparisons, some confusion may result since the percentage increases of an activity are those above the levels in the no action plan, which in turn are percentage increases above current levels. For instance, recreation use on the Colorado is expected to increase 125 percent under the no action plan. It is expected, under the national economic development plan, to increase a further 116 percent in the same period. Thus the NED plan actually expects a level of use 4.33 times as great as at present (71,750 recreation days versus 16,500). The impacts of the plans, in capsule form, are shown on Tables XI-1 and XI-3.

No Action Option - Colorado River

This plan is a projection of what will happen in the Colorado River study area if no action is taken as a result of this study. The team assumed that current management authorities and policies will continue, without substantial and unforseeable changes in direction or focus.

TABLE XI-1. Impacts of Alternatives for the Colorado River

	No Action Proposal	Proposal	National Economic Development Option	Environmental Quality Option 2	Environmental Quality Option 3
Description	Present management authorities and actions assumed to continue. Study area used primarily for recreation, with grazing and some potential for mining if economic climate improves. Agricultural use of private land continues. Endangered Species Act probably prevents reservoir construction in Segment A. Grand Valley Project improves water quality in study segments. Cultural features on or eligible for National Register receive protection. Recreation use doubles, most being in Segments A, C, and D.	River designation: Segment A — Scenic Segment B — Wild Segment C — Scenic Segment D — Recreational BLM imposes regulations on mining and possibly limits recreational use to preserve river's values. Preservation of river's values becomes primary management goal. Authority to acquire or condemn scenic easemnts retained, but not exercised unless developments threaten river values.	No river designation — present management continues, but emphasis is on economic rather than environmental values when trade-offs arise. Greater levels of recreational use. Protection of endangered species precludes corridor water development.	River designation: Segment A — Scenic Segment B — Wild Segment C — Recreational Segment D — Recreational River values protected by designation and management to preserve them, but discretionary change in classification in Segment C allows less restriction on mining and private development and more recreation use.	River designation: Segment A — Scenic Segment B — Wild No designation of lower segments allows unimpeded mining in lower segments, as well as no interference with private developments in that area. Management same as proposal in upper segments, same as no action option in lower.
Energy and Mineral Impacts	No interference with mining. Possible extraction of 3,000 pounds U_3O_8 and 8,000 pounds V_2O_5 from Segment D if economic climate improves substantially. Very small likelihood of mining in Segments A and C, none in B.	Wild area (Segment B, Westwater Canyon) withdrawn but no impacts due to lack of resources. Regulations imposed to protect river values in Segments A, C & D raise cost of extracting about $134,000 of vanadium and uranium, making mining less probable.	No interference with mining. Same as no action option.	Lowered classification and less restrictive environmental protection measures increase probability of mining in Segment C, but probability still is smaller than with no action and NED options.	No designation of Segments C & D produces no interference with mining in that area. Interference with mining unlikely in Segments A and B even with designation.
Environmental and Land Use Impacts	BLM requires about 10 acres of land for recreation; land use and ownership otherwise unchanged. Mining and increased recreation may produce undesirable impacts at stopping points and in Segment D.	Present land uses (grazing, recreation, agriculture) unchanged; mining regulated. Scenic and/or public access easements on up to 5,350 acres (2,160 ha) of private land may be necessary to prevent future land use changes that degrade river's values.	Same type of impacts as no action option, but greater by a factor of about 2. BLM installs many more facilities (see below), affecting about 40 acres plus a 6-mile (9.6 km) access road; these concentrate recreation impacts while producing impacts of their own.	Same as proposal, but scenic easements in Segment C, if any are required, are less restrictive than in proposal. Installation of sanitation facilities at Fish Ford disturbs about 1 acre (0.4 ha).	Same as proposal in upper segments; same as no action in lower.
Water Resources Impacts	Presence of endangered fish probably prevents construction of Horsethief Canyon reservoir in Segment A. No known interest in other corridor site. No interference with upstream projects or existing water rights.	Federal licensing or assistance to water development projects forbidden; Horsethief Canyon reservoir precluded if Endangered Species Act does not prevent its construction. No interference with existing water rights. No interference with upstream projects predicted.	Same as no action option	Same as proposal.	Same as proposal.
Recreation Impacts	Increase in recreation use from 16,550 recreation days to 33,250 in 1990.	Increase from 1976 use of 16,550 recreation days to 37,750 in 1990.	Increase to 71,750 recreation days in 1990.	Increase to 39,750 recreation days in 1990.	Increase to 36,250 recreation days by 1990.
Recreation Facilities Planned	Improve Westwater boat ramp area and camp. Acquire and improve Rose Ranch boat ramp area. Improve Dewey Bridge boat ramp area, provide parking and sanitation.	Same as no action option but add Loma boat launch improvements and 5-unit camp at Dewey Bridge.	Same as proposal, but add larger developments and 20-unit camp at Loma, 10-unit camp at Blackrocks, 6-9 miles of trail in Segment A; 5 miles trail in Segment B, 10 unit river camp at Little Dolores, 20-unit camp, overlook and road at Skull Rapid; 10 unit camp and road at Fish Ford.	Same as proposal but add sanitation facilities at Fish Ford.	Same as proposal but subtract campground at Dewey Bridge.
Economic and Regional Development					
Recreation Expenditures, 1990	$459,200	$ 522,400	$999,700	$ 550,400	$ 501,300
Possible Easement Cost	0	$2,140,000	0	$2,140,000	$1,676,000
Total Annual Costs, 1990	$ 69,000	$ 76,000	$159,000	$ 77,800	$ 72,700
AO&M, 1990	$ 55,600	$ 57,100	$109,000	$ 58,100	$ 56,000
Total Non-Annual Costs, 1990	$159,000	$ 223,300	$590,300	$ 233,300	$ 196,300
Regional Income Generated, 1990	$246,000	$ 280,000	$561,000	$ 294,000	$ 263,000
Social Impacts	Increased recreation opportunities but recreation environment possibly degraded by mining in Segment D. Some loss of solitude attracts more socially oriented recreationists. Social environment otherwise unchanged.	Increased recreation opportunities but recreation environment legally preserved. Diminished solitude may attract more socially oriented boaters. Social environment otherwise unchanged.	Large increase in recreation and possible mining in Segment D degrade recreation environment somewhat. Solitude considerably diminished; more socially oriented boaters replace present user types.	Same as proposal, with slight increase in recreation impacts. Slightly increased probability of mining in Segment C may, if actualized, somewhat degrade recreation environment there.	Same as proposal in upper segments; same as no action in lower.
Man-Years of Labor in 1990	38.7	43.8	87.6	46.2	41.5
Other Impacts	Increased recreation and facility construction produce soil compaction and erosion on about 25 acres (10 ha). Increased use and possible mining produce higher incidences of vandalism or destruction of cultural sites. Some disturbance of wildlife near facilities but no substantial impacts on endangered species. No impact on railroad.	Increased soil compaction and erosion on about 10 acres (4 ha) of stopping areas, boat ramps, attraction sites. Increase in use and vandalism of cultural sites. Routine maintenance of railroad unaffected, but improvements that degrade river's values precluded.	Same as no action option but much higher recreation use, and facility development approximately doubles recreation impacts under this option. Same as no action for mining and railroad.	Almost the same as proposal for recreation impacts on soils, wildlife, erosion, and water quality. Disturbance of about 1 acre (0.4 ha) for additional facility. Mining impacts slightly more probable in Segment C than with proposal; slightly less probable than with no action option. Railroad impacts same as proposal.	Same as proposal in Segments A and B; same as no action in Segments C and D.

Existing land use and ownership patterns will continue essentially unchanged, barring the small changes in ownership that will result from BLM's proposed acquisition of lands for boat launching and takeout at Rose Ranch, which involves about 5 acres (2 ha). Private lands will continue to be used for crop production, with grazing and mining occurring on public lands.

Recreation use of the river is expected to increase from 16,650 recreation days[1] in 1976 to approximately 33,250 recreation days in 1990. The increase will be almost solely registered in boating and the associated camping and picnicking. To serve this increase, the Bureau of Land Management proposes, in its Management Framework Plan, to develop the following facilities:

Segment A: Westwater Ranger Station - improved boat ramp, camping facilities, ranger station, and access road.

Segment B: No development proposed.

Segment C: Rose Ranch - improved boat ramp with parking.

Segment D: Dewey Boat Ramp - sanitation, parking facilities, and boat ramp.

---

1. A recreation day is defined as an individual's participation in recreation activities for a reasonable portion of a 24-hour period. All recreation use and values thereof are given for recreation days in this analysis.

Figures for 1976 use are estimated for segments A, C and D; use figures for Westwater Canyon are known accurately due to the permit system used by the BLM.

The extraction of U_3O_8[2] and V_2O_5[3] ore in the segments C and D of the Colorado River and segment C of the Dolores River has occurred in the past--50 tons (45.4 metric tons) have been mined since 1948. If the economic climate were to become more favorable ($42/pound for U_3O_8 without attendant production cost increases), extraction could increase dramatically and would probably have an adverse effect on the recreation environment.

The endangered species of the area will continue to receive protection under the Endangered Species Act of 1973. For this reason, the mainstem reservoir planned by Industrial Resources, Inc., will probably not be built in segment A, since it is likely that a construction permit will have to be denied due to the impact of the reservoir and its 300 cfs (8.5 m^3/s) diversion on the fish (see discussion in chapter VII). Upstream portions of the project may be built, and will probably not have an adverse impact on the endangered fish.

The Grand Valley Project will be completed upstream and will reduce salt loading in the Colorado River by about one-third. If other upstream projects are completed, their impacts on the area will be minimal.

Energy and Mineral Impact. Ore containing 0.15 percent U_3O_8 and 0.42 percent V_2O_5 exists in the visual corridor in segments C and D. Assuming an optimistic selling price of $42 and $1 per pound, respectively, as much as 3,000 lb (1,360 kg) U_3O_8 and 8,400 lb (3,810 kg) V_2O_5 could be mined in these segments. At these prices the total potential value of U_3O_8 and V_2O_5 is $134,000.

---

2. U_3O_8 is an oxide of uranium and is the unit of measure in the uranium industry.

3. V_2O_5 is an oxide of vanadium. Vanadium is used in making some types of steel.

Although information on placer gold is very difficult to obtain, placers were actively worked from late in the 19th century until 1942. During this period, total production was approximately 1,500 troy ounces (47.62 kg). Since the gold is very finely divided and shows little tendency to form rich pay streaks, recovery has been difficult and the operations relatively unsuccessful. Therefore, although placer activity will probably continue along the Utah portions of the Colorado and Dolores Rivers, gold mining is not expected to have a significant adverse effect on the recreation environment of the study area.

Environmental and Land Use Impact. Existing land use trends will continue and will not be significantly affected. The BLM will purchase land near Rose Ranch to develop boat ramps and associated facilities. This purchase, comprising about 5 acres (2 ha), would not significantly impact land use patterns along the river. Preservation of the river environment is expected to improve in the future, due to the increased sanitary facilities and river management activities planned. Preserving the endangered species will also tend to protect the river environment. Increasing production of U_3O_8 and V_2O_5 in the lower corridor will adversely affect the scenery in that area.

Impact on Water Resources. Completion of the Grand Valley Project will have a beneficial effect on the river, especially in the Lower Basin, by reducing the salt concentration in and below the study segment.

Increased recreation use will produce some minor attendant impacts on water quality resulting from soil compaction and erosion and from human waste disposal. These will be most significant at the development sites. However, new or improved boat ramps, campgrounds and sanitation facilities should eliminate or moderate most of these potential impacts.

Mining activity, particularly for uranium and vanadium, near the confluence of the Colorado and Dolores Rivers, will also result in some degradation of water quality. BLM management and existing water quality laws should prevent this from becoming a significant impact.

The effect of Industrial Resources mainstem reservoir in Horsethief Canyon on endangered fish will probably prevent the BLM from issuing a construction permit for the project. Upstream portions of this project and others will probably have minimal effect on the area, if they are constructed.

Impact on Recreation. The 100 percent increase in recreation days, by 1990, when coupled with increased mining activities along the river, could degrade the corridor. BLM is expected to continue to manage the river primarily as a recreation resource and should protect the river corridor from any significant adverse impacts. An increase in the exploration and extraction of uranium and vanadium could result in a significant loss of recreation values near the confluence, and perhaps at the upper end of the corridor. This in turn could repel some users, while attracting a different, more socially-oriented type of recreationist.

Economic and Regional Development Impact. The anticipated increase in recreation use will result in increased on-site recreationist expenditures of approximately $259,000, more than half the expected total 1990 on-site recreationist expenditures (about $459,000).

The recreation developments are expected to cost $159,000. Total annual administration, operation, and management cost (AO&M), including a 25-year sinking fund, are expected to increase by about $57,200 as a result of increased recreation use. Regional income generated from recreationist expenditures and federal recreation

development is expected to increase $299,000 by 1990. The gross income of outfitters operating on the Colorado River in 1977 was approximately $250,000.

Social Impact. Under the no action plan, social, cultural, and recreational opportunities will remain similar to those available at present. The life, health, and safety components of the social well-being account should remain unaffected. The increased regional income discussed under Economic and Regional Development Impact, however, will provide for an additional 39 man-years of labor primarily in the service and construction industries.

Other Impacts. Increased recreation use will result in an increase in soil compaction and erosion, disturbance of wildlife, and loss of vegetation. Development of new facilities will result in short-term impacts on soils, vegetation, and wildlife on about 25 acres (10 ha). However, the new or improved boat ramps, campgrounds and sanitation facilities will control most such impacts, possibly reducing long-term impacts on the resources. The protection afforded threatened or endangered fish and wildlife species will continue.

Increasing recreational use and mineral prospecting in the area will increase the likelihood of vandalism and removal of artifacts at unprotected historical, archeological and paleontological sites. It is anticipated that cultural features on public lands will be identified and protected according to the National Historic Preservation Act of 1966.

This plan would have no effect on the ability of the Denver and Rio Grande Western Railroad either to maintain its trackage or to make improvements.

National Economic Development Option - Colorado River

There is little that federal or state governments can do to promote maximum economic growth within the study area beyond that which is already expected under the No Action Option. Since the greatest economic resource in the visual corridor is the provision of recreation services,[4] this option increases the output and the efficiency of recreation services. It results in diminished environmental values if the environmental values conflict with economically beneficial objectives.

Energy and Mineral Impact. This option would not interfere with any potential energy or mineral development.

Environmental and Land Use Impact. Although recreation use in the visual corridors of the study rivers will double, facilities and management would minimize most adverse environmental impacts, so most of the high quality recreational environment would be preserved. Land use and environmental impacts will be those described under the No Action Option, except that species sensitive to human disturbance may withdraw from the vicinity of camps, or even from the visual corridor.

Water Resources Impact. This option will have no effects on upstream water resource development projects; the Endangered Species Act should prevent construction of the dam in Horsethief Canyon.

---

4. The total, one-time potential value of extracting uranium and vanadium oxides from the corridor is $134,000, which is less than 30 percent of the projected value of one year's expenditures by recreationists in 1990.

Recreation Impact. This option results in an expansion of recreation services to provide for a total of 71,750 recreation days of use, an increase of 38,500 recreation days or 116 percent over that shown in the No Action Option.

Facilities needed to serve this level of recreation use include:

Segment A: Loma - 20-unit campground, sanitation facilities, and upgraded road. Blackrocks--10-unit campground. Rattlesnake Canyon--10-unit campground. Mee Canyon--2 to 3 mile (3-5km) trail. Knowles Canyon--2-3 mile (3-5km) trail.

Segment B: Little Dolores--10-unit campground and a 5-mile (8 km) hiking trail. Canyon overlook at Skull Rapid--10-unit campground with road access.

Segment C: Fish Ford--10-unit campground with access road.

Segment D: Dewey Boat Ramp--5-unit campground with sanitation facilities.

Economic and Regional Development Impact. The anticipated increase in recreation use described under recreation impacts will result in an increase of $540,000 (118 percent) in on-site recreationist expenditures over current expectations for 1990.

Recreation developments will cost $431,300. An increase of $60,400 for annual administration, operation and management costs (AO&M), including a 25-year sinking fund, is also necessary to accommodate the increased recreation use.

Regional income generated from recreationist expenditures and federal recreation development is expected to increase $315,000 by 1990 as a result of this option.

Social Impact. The primary effect of this option on social well-being is an increase in the gross amount of recreation opportunities available in the study area. This will have a two-fold effect. First, by decreasing the quality of the environment, attracting more use, and using recreation lands more extensively, the quality of the experience will be somewhat degraded. To a large extent solitude will be lost, along with the opportunity to view shyer wildlife species. Recreationists oriented toward more crowded, social, non-wilderness experience will tend to replace current users. Second, the increased regional income discussed under Economic and Regional Development Impacts will provide for an additional 54 man-years of labor primarily in the service and construction industries.

Other Impact. Increased recreation use will result in an increase in soil compaction and erosion on about 40 acres at new facility sites; these increases will be largest during construction and will taper off afterward. Some wildlife species will be displaced during construction and use of the facilities, and will be partly replaced by more human-tolerant species. Construction of the access road to the canyon overlook at Skull Rapid will disturb soils and vegetation and wildlife throughout its approximate 6-mile (9.6 km) length. Some filling, cutting, and blasting will be required.

Construction of 11 miles (17.7 km) of hiking trails at Mee, Knowles, and Little Dolores Canyons would disturb soils and vegetation. Increased human use of the remote areas up these side canyons would result in disturbance of wildlife, particularly in the spring and summer months.

While endangered species in the area will continue to receive protection, it is possible that the large increases in recreation use will disturb the peregrine falcon and bald eagle.

The postulated increase in recreation under this plan would cause a proportionate increase in vandalism and theft at historical, archaeological, and paleontological sites, although the features eligible for the National Register would be identified and protected under the National Historic Preservation Act of 1966.

This plan would not effect either maintenance or improvements to the railroad in segment A.

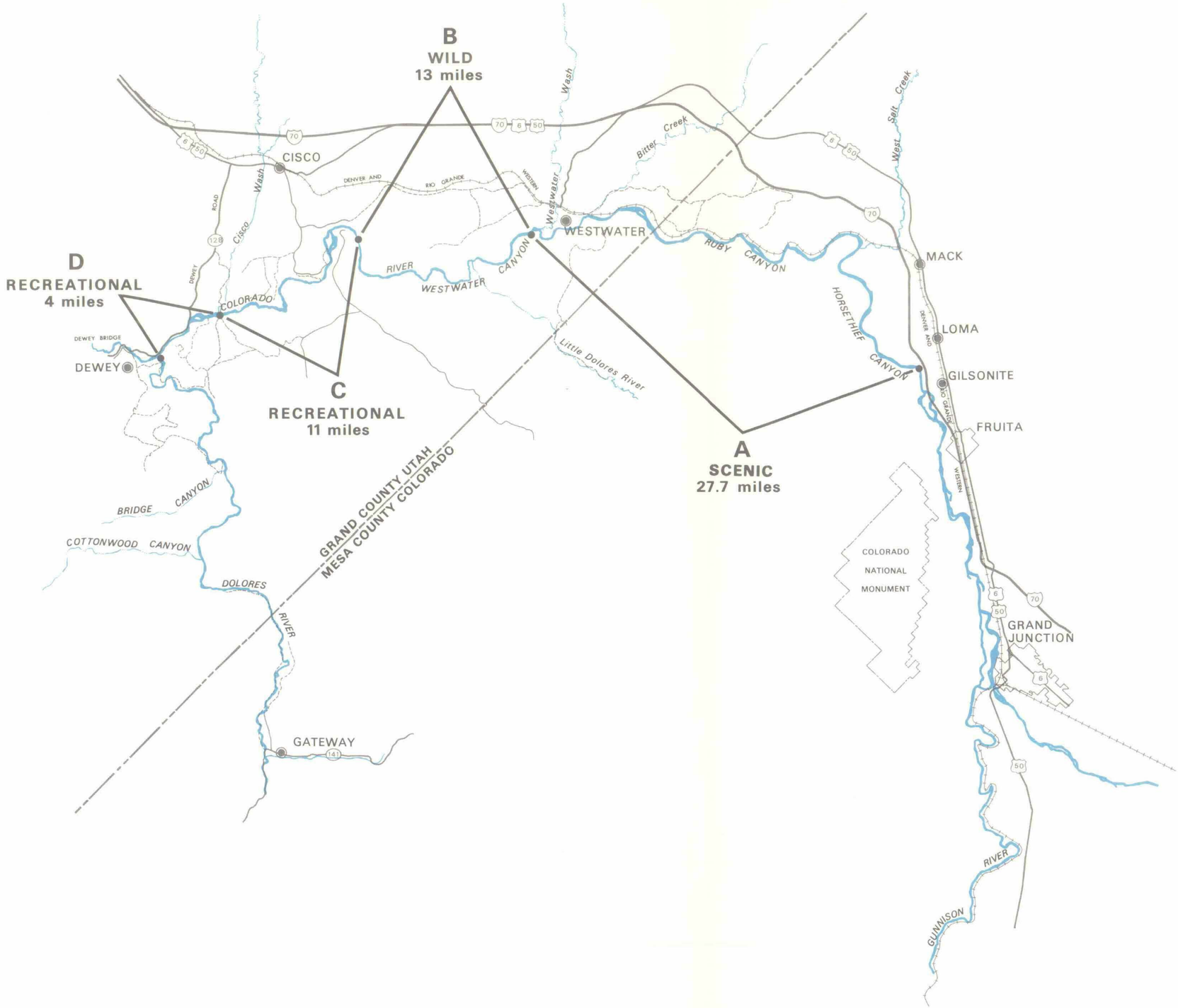
Environmental Quality Options

Three environmental quality options are presented for the Colorado River; all involve some designation of the study area under the Wild and Scenic Rivers Act, and thus offer protection to the outstandingly remarkable values of the river area.

Option 1 - Colorado River. Option 1 is the recommended plan for the Colorado River; its effects and impacts have been discussed in chapters VI and VIII.

Option 2 - Colorado River. Under option 2 the Colorado River would receive the following classification:

Segment		Classification
Segment A	27.7 miles (44.3 km)	Scenic
Segment B	13 miles (21 km)	Wild
Segment C	11 miles (16 km)	Recreational
Segment D	4 miles (6.4 km)	Recreational



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

OPTION 2 - COLORADO RIVER

GRAVEL ROAD

JEEP ROAD

N

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS	20,024
DSC	FEB 79

The discretionary change in classification from scenic to recreational in the lower segments would have two main results. First, it would place less restriction on mineral exploration and development within these two segments since regulations regarding extraction would presumably be less restrictive. Second, by 1990, the recreation use is expected to increase 6,500 recreation days (19 percent) beyond the amount described in the No Action Option, or about 2,000 more recreation days than in Option 1, to a total of approximately 39,750 recreation days in 1990.

This use would require a five-unit campground at Dewey boat ramp, rehabilitation of the Loma launch site, and additional sanitation facilities at Fish Ford. By changing the classification of segment C to recreational, this option will allow the river corridor to be degraded slightly more, by recreation and mineral extraction, than Option I would, while still applying legal protection to the area.

Energy and Mineral Impact--The classification of segment C would presumably allow the Secretary of the Interior to issue less restrictive regulations governing mineral extraction, so long as the outstandingly remarkable values of the area were preserved. This would lower the cost of mining, so there would be a higher potential for it to occur.

Environmental and Land Use Impact--By increasing the potential for mineral extraction and recreation use, but retaining some environmental safeguards, the possibility of deleterious environmental and land use impacts is increased, but the impacts will be similar to those described in chapter VIII for the proposed action.

Water Resources Impact--This option would have the same effects on water resource development projects as the proposed action; impoundments in the designated area would be prohibited,

and upstream developments that unreasonably invaded the area or diminished its values could not receive federal licensing or assistance. The data furnished on upstream projects on the Colorado indicates they would apparently not diminish the river values, so this impact would be insignificant. Like the proposed action, this plan would forbid construction of the dam in Horsethief Canyon if the Endangered Species Act did not.

Impact on Recreation--An increase of 2,000 recreation days of use in segments A and C would necessitate additional sanitation facilities at Fish Ford and an additional five campground units at the Dewey boat ramp. Less restriction on mining activities is likely to cause a degradation of the scenic values and, thereby, adversely affect the recreation environment.

Economic and Regional Development Impact--Recreationist expenditures will increase $91,000 annually (about 20 percent) by 1990. This option will cost $41,000 for recreation developments and $4,500 annually for AO&M. Annual regional income will increase $48,000.

Social Impact--Recreational opportunities will increase while the quality of the recreational environment is slightly decreased. Solitude will diminish. The increase in regional income discussed under Economic and Regional Development Impact will support an additional eight man-years employment in the region.

Other Impacts--Increased recreation use and mineral exploration would cause a proportionate increase in impacts on soils, vegetation, fish and wildlife and cultural features; these will be concentrated in and around the developed sites. About 1 to 2 acres (0.4-1 ha) will be disturbed at Dewey to construct the additional five campground units and less than 1 acre (0.4 ha) at Fish Ford to build the additional sanitation facilities. After

temporary increases, these new facilities would reduce the potential for impact on soils and vegetation. Endangered and threatened fish and wildlife species will continue to be protected.

Any increase in mining activity along segments A and C will also disturb soil, vegetation and wildlife and perhaps lower water quality. Although these activities would be regulated by BLM, some degradation of the river values would probably occur.

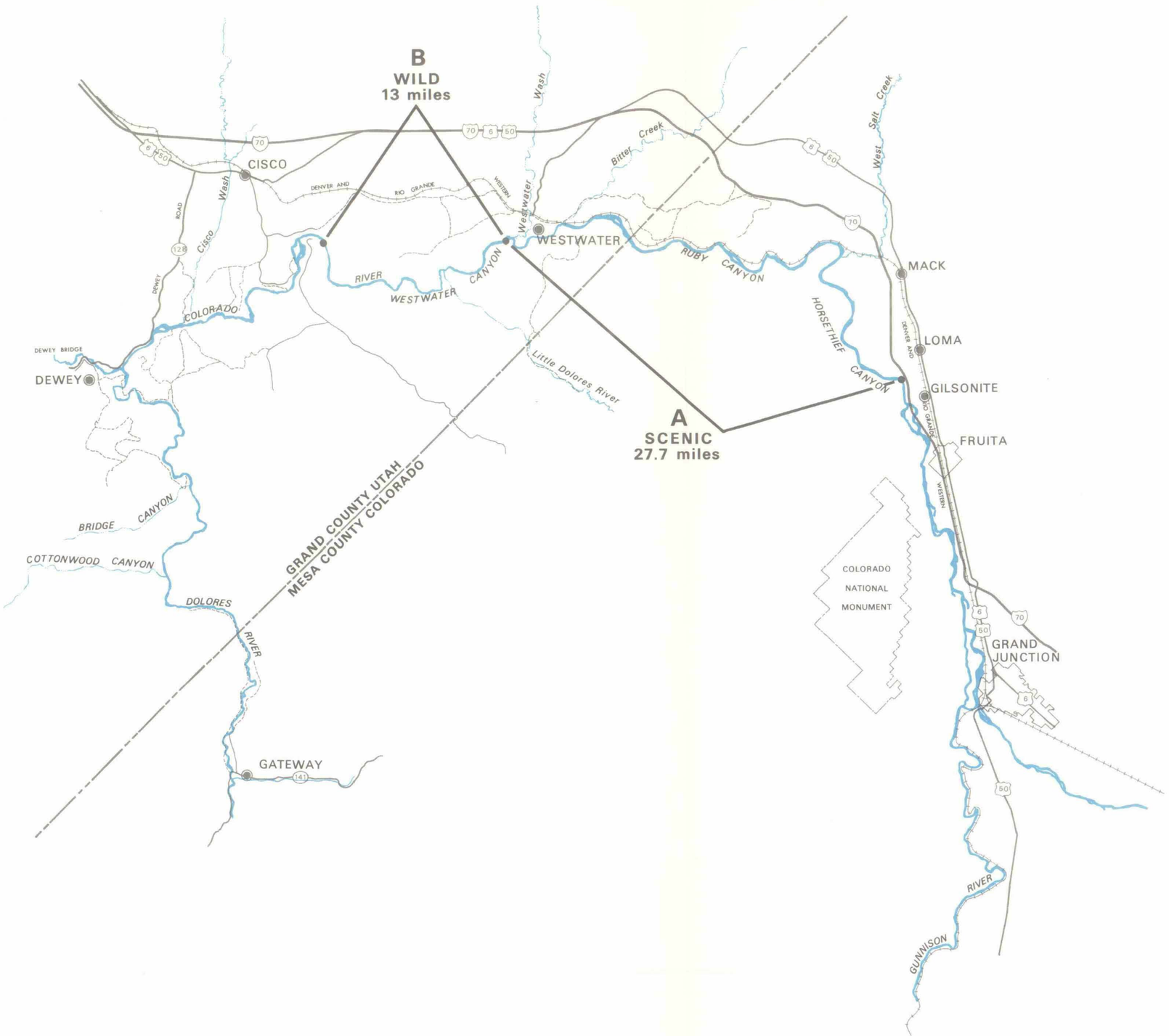
Increasing recreational use and mineral extraction will increase the likelihood that historical and archeological sites will be vandalized, even though cultural features eligible for the National Register on public lands will be identified and protected according to the National Historic Preservation Act of 1966.

This plan would affect the ability of the Denver and Rio Grande Western Railroad to improve their trackage in segment A, if the improvements adversely affected the values for which the river were designated; it would not affect routine maintenance.

Option 3 - Colorado River. Under option 3 the Colorado River would receive the following classification:

Segment		Classification
Segment A	27.7 miles (44.6 km)	Scenic
Segment B	13 miles (21 km)	Wild
Segment C	11 miles (17.7 km)	No Designation
Segment D	4 miles (6.4 km)	No designation

This alternative would allow mineral exploration and extraction, particularly for uranium and vanadium, in the area of the confluence of the Colorado and Dolores Rivers, without the restrictions that would result from river designation. The impacts of this alternative would be the same as for the proposed action except for those incurred in segments C and D.



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

OPTION 3 - COLORADO RIVER

GRAVEL ROAD
JEEP ROAD

N

1 5 0 1 2 3 4 miles
1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,026
DSC | FEB 79

Energy and Mineral Impact--This option is not expected to have any effect on potential energy and mineral developments.

Environmental and Land Use Impact--The loss of 11 miles (17.7 km) of scenic river characteristics and 4 miles (6.4 km) of recreational river characteristics might occur. Areas of natural beauty and environmental qualities will be preserved along 40.7 miles (65.1 km) of river.

Land use and ownership would remain essentially unchanged. Scenic and public use easements may be required on about 4,710 acres (1,900 ha) of private land in segments A and B. These lands are used as cropland or for grazing and the easements will not alter their present use.

Water Resources Impact--Although this option would designate a shorter reach of river, its effects would be similar to those of the proposed action. This option would prevent the construction of the Horsethief Canyon dam planned by Industrial Resources, if it is not precluded by the Endangered Species Act. Since there is no interest at present in developing the Dewey site, discussed in chapter III, no other impacts on corridor development are predicted.

Recreation Impact--Recreation use will increase by 3,000 recreation days under this option; total use would be about 36,250 recreation days in 1990.

The increase would be expected due to the increased notoriety of the area after part of it had been designated. With the possible loss of the outstanding qualities of the undesignated segments, a smaller increase than in the other options was expected. This relatively small increase could utilize existing recreation facilities with rehabilitation of the Loma launch site. Since 15 miles (24 km) of the Colorado River study area would not be protected by wild

TABLE XI-2. Effects of Options for the Colorado River in 1990

Account	Components	ENVIRONMENTAL QUALITY OPTIONS									
		No Action Option		National Economic Development Option		OPTION 1 Segment A – Scenic Segment B – Wild Segment C – Scenic Segment D – Recreational		OPTION 2 Segment A – Scenic Segment B – Wild Segment C – Recreational Segment D – Recreational		OPTION 3 Segment A – Scenic Segment B – Wild Segment C – No Designation Segment D – No Designation	
		Total[2]	Net[3]	Total	Net	Total	Net	Total	Net	Total	Net
NATIONAL ECONOMIC DEVELOPMENT	RECREATION USE[1]										
	Boating	31,500	14,789	70,000	38,500	36,000	4,500	38,000	6,500	34,500	3,000
	Fishing	1,164	1,164	1,164	0	1,164	0	1,164	0	1,164	0
	Hunting	585	585	585	0	585	0	585	0	585	0
	Total Annual Recreation Day	33,249		71,749	38,500	37,749	4,500	39,749	6,500	36,249	3,000
	Annual Recreationist[4]										
	Expenditures	$459,000	$259,000	$999,000	$540,000	$522,000	$63,000	$550,000	$91,000	$501,000	$42,000
	Annual Government[5]										
	Expenditures		$ 69,000		$ 89,000		6,900		8,800		3,700
	Household Income[6]		$348,500	$798,000	$449,500	$395,000	$46,500	$416,300	$67,800	$362,600	$14,100
	MINERALS AND ENERGY	Ore containing .15% U_3O_8 and .42% V_2O_5 occurs in the lower visual corridor. *Since 1948 a total of only 50 tons of ore have been extracted.* If the value of U_3O_8 were to increase to $42/lb, 3,000 lb (worth ($126,000) could be economically extracted under either the NO Action Option, National Economic Development Option, or Environmental Quality Option 3. *Environmental Quality Options 1 and 2 would increase the cost of or preclude mining* in the visual corridor, small amounts of very fine gold also exist in the visual corridor.									
ENVIRONMENTAL QUALITY	PRESERVATION OF FREE-FLOWING STREAM	None guaranteed		None		13 miles – Wild River *38.2 miles – Scenic River* 4 miles – Recreational River 55.7 miles – Preserved		13 miles – Wild River 27.7 Miles – Scenic River 15 miles – Recreational River 55.7 miles – Preserved		13 miles – Wild River 27.7 miles – Scenic River No Recreational River Designation 40.2 miles – Preserved	
	PRESERVATION OF AREAS OF NATURAL BEAUTY	*None guaranteed. Management* priorities may dictate other *uses.*		*Less protected* than under the No Action Option. Economic *matters* to take first priority under this plan. Some values may be lost.		Areas of natural beauty preserved along 55.7 miles of river. Protection extended to 25,000 acres (10,000 ha).		Although areas of natural beauty are preserved along 55.7 miles of river, 11 of these miles which qualify as scenic river will only be preserved at the recreational river level of classification. Some protection extended to 25,000 acres (10,000 ha).		Areas of natural beauty preserved along 40.7 miles of river. Loss of areas of natural beauty likely along 15 miles of river. Protection extended to 18,300 acres (7410 ha).	
	PRESERVATION OF CULTURAL RESOURCES	Federal and state laws protect sites. Some damage could occur to sites on private lands.		Higher levels of recreation use without additional money extended for protection could result in damage to sites.		Higher level of recreation use is offset by additional efforts for protection.		Higher level of recreation use is offset by additional efforts for protection.		Some resources of cultural value may be damaged in non-designated segments.	
	PRESERVATION OF FREEDOM OF CHOICE	Many options preserved.		Economically important options increase. Preservation options decrease.		Preservation options increase. Potential for economic development decreases somewhat.		*Preservation options increase* in two segments. Potential mineral extraction could result in loss of freedom of choice for preservation *in the other two* segments.		*Preservation options increase* in two segments. Economic *options increase in the other* two segments.	
	AVOID IRREVERSIBLE OR IRRETRIEVABLE EFFECTS	Loss of scenic and recreational values possible. Economic values retained.		Greater loss of scenic and recreational alues probable. Economic values retained.		Scenic and recreational values preserved. *Some potential* economic values lost.		Most scenic and recreational values *preserved. Lesser* loss of potential economic values the EQ Option 1		Some scenic and recreational values preserved. Most potential economic values retained.	
REGIONAL DEVELOPMENT	REGIONAL INCOME GENERATED[7]	Net $		Total $[9]	Net $	Total $	Net $	Total $	Net $	Total $	Net $
	Service Stations	27,000		54,000	27,000	30,000	3,000	32,000	5,000	29,000	*2,000*
	Other Retail	37,000		79,000	42,000	42,000	5,000	44,000	7,000	40,000	3,000
	Eating and Drinking Places	54,000		119,000	65,000	62,000	8,000	65,000	11,000	49,000	5,000
	Lodging	61,000		135,000	74,000	70,000	9,000	74,000	13,000	67,000	6,000
	Other Services	7,000		14,000	7,000	8,000	1,000	8,000	1,000	7,400	400
	Transportation	5,000		12,000	7,000	6,000	1,000	6,000	1,000	5,300	300
	Contract Construction	55,000		148,000	93,000	62,000	7,000	65,000	10,000	55,300	300
	Total	**246,000**		**561,000**	**315,000**	**280,000**	**34,000**	**294,000**	**48,000**	**263,000**	**17,000**
	VALUE ADDED[8]										
	Service Stations	32,000		65,000	*33,000*	*36,000*	4,000	37,000	5,000	34,000	2,000
	Other Retail	51,000		109,000	58,000	58,000	7,000	61,000	10,000	55,000	4,000
	Eating and Drinking Places	67,000		148,000	*81,000*	*76,000*	*9,000*	81,000	14,000	73,000	6,000
	Lodging	86,000		191,000	105,000	98,000	12,000	104,000	18,000	94,000	8,000
	Other Services	11,000		21,000	*10,000*	*12,000*	1,000	13,000	2,000	11,600	600
	Transportation	8,000		18,000	10,000	9,000	1,000	9,000	1,000	8,500	500
	Contract Construction	68,000		182,000	*114,000*	*77,000*	9,000	81,000	13,000	68,300	300
	Total	**323,000**		**696,000**	**411,000**	**366,000**	**43,000**	**386,000**	**63,000**	**344,400**	**21,400**
	EMPLOYMENT– (MAN-YEARS)	Net		Total	Net	Total	Net	Total	Net	Total	Net
	Service Stations	*3.3*		6.7	3.4	3.7	.4	3.9	6	3.6	3
	Other Retail	4.8		10.2	5.4	5.4	.6	5.7	.9	5.2	.4
	Eating and Drinking Places	12.0		26.6	14.6	13.7	1.7	14.5	2.5	13.1	1.1
	Lodging	9.1		20.1	11.0	10.4	1.3	11.0	1.9	10.0	.9
	Other Services	1.8		3.5	1.7	2.0	.2	2.1	.3	1.9	.1
	Transportation	.3		.7	.4	.3	<.1	.4	.1	.3	<.1
	Contract Construction	7.4		19.8	12.4	8.3	.9	8.8	1.4	7.4	<.1
	Total	**38.7**		**87.6**	**48.9**	**43.8**	**5.1**	**46.4**	**7.7**	**41.5**	**2.8**
SOCIAL WELL BEING	EDUCATIONAL, CULTURAL *AND RECREATIONAL* OPPORTUNITIES	Opportunities remain similar *to those now.* Protection assured only by management *agency* policy now.		If deemed economically valuable opportunities increase. Otherwise, opportunities and/or quality decrease. Probable increase in gross number of opportunities and decrease in quality.		Availability of opportunities increases. Quality of opportunities preserved.		Availability of opportunities increases. Quality of opportunities preserved on segments A & B and lost on the other segments C & D		Availability of opportunities increases. Quality of opportunities preserved on segments *A & B* and lost on the other segments *C & D.*	
	LIFE, HEALTH AND SAFETY	Adverse health effects from potential uranium extraction may occur.		Adverse health effects from potential uranium extraction may occur.		This plan is neutral for *this component.*		Plan neutral for this this component in segments A & B. Adverse health effects from potential uranium extraction may occur in segments C & D.		Plan neutral for this component in segments A & B. Adverse health effects from uranium extraction may occur in segments C & D	
	INCOME DISTRIBUTION	Income to service, recreational supply, and construction industries increases.		*This plan provides the* greatest increase to service, *recreational supply, and* construction industries.		*Income to* service, recreational supply, and *construction* industries increases.		Income to service, recreational supply, and construction industries increases.		Income to service and recreational supply industries increases. No increase to construction industry.	

[1] All recreational use and values are given in recreation days.

[2] The total column under each option represents total expected recreation use or expenditures which will occur in the study area under that option by 1990.

[3] The net column under each option is the expected net effect of implementing that option. Under the No Action Option, recreation is expected to increase by the year 1990 by the net amounts shown. *The net increases represented under* option 1-4 are all additional to the net increases shown under the No Action Option.

[4] The values used in estimating on-site recreationist expenditures per recreation day (RD) were: boating – $14.04/RD, fishing – $7.00/RD, and hunting – $15.00/RD. Sources used for these values are: Milliken and Mew, *Economic and Social Impact of Recreation at Reclamation Reservoirs,* University of Denver, March 1969; Doll, G. Fred and Clynn Phillips, *Wyoming's Hunting and Fishing Resources, 1970,* Division of Business and Economic Research, University of Wyoming, Laramie, August 1972; *1974 Colorado Big Game Harvest, Colorado* Division of *Wildlife, Denver, 1975; John Devine,* "White-water Boating on the Dolores River – Final Estimate of Effects of Dolores Project on Boating," January 18, 1977 – Memorandum to File, Bureau of Reclamation.

[5] Annual government expenses for each option include capital costs annualized over a 50-year period, a *25-year sinking fund, annual administration,* operation, and management costs, and administrative costs for easement acquisition.

[6] Household income is direct income generated to U.S. citizens from output of alternative actions.

[7] Regional income *generated is the portion of National Economic* Development account expenditures which remain in the region.

[8] Value added is the gross regional product.

[9] Total $ under each option is the sum of the total $ for the No Action Option and Net $ for each option.

and scenic river designation, degradation of the recreational environment might occur.

Economic and Regional Development Impact--The additional 3,000 recreation days under this option would produce $42,000 in recreationist expenditures. Recreation facilities associated with this use would cost $18,000 and would necessitate additional AO&M of $500. An increase of $17,000 in regional income would be registered.

Social Impact--Recreational opportunities will increase, diminishing solitude slightly. Possible degradation of the lower two segments may increase crowding in segment A, where similar recreational opportunities exist, very slightly. The increase in regional income would support an additional three man-years of employment, primarily in service industries.

Other Impacts--The additional 3,000 recreation days of use in segments A and B attributable to this alternative would result in a proportionate increase in the impacts on soils, vegetation, fish and wildlife, and cultural features. Most impacts on soils, vegetation and wildlife would be near the developed boat ramps and campgrounds.

Threatened or endangered fish and wildlife species within the entire study segment would continue to be protected according to the Endangered Species Act.

Cultural features along the total river area would be identified and protected according to the National Historic Preservation Act of 1966. Mining activity in segments C and D could have some adverse impacts on soils, vegetation, and wildlife, and perhaps on cultural and paleontological resources. The degree of these impacts would depend on the amount of exploration and extraction that takes place.

Routine maintenance of the Denver and Rio Grande Western trackage in segment A would not be affected by this plan; improvements to the line would be permitted if they did not diminish the values for which the river were designated.

No Action Option - Dolores River

Under this alternative the 31-mile (49.9 km) portion of the Dolores River and the 11,900 acres (4,820 ha) in its corridor would not be included in the National Wild and Scenic River System; this alternative is thus a projection of what will happen in the Dolores corridor if no action is taken as a result of this study. The team assumed that current management authority and policy will continue without substantial alteration.

Existing uses of the land will continue--private lands will remain in crop production, and public lands will continue to be used for recreation, grazing, and mining, in the lower corridor.

The Paradox Valley Salinity Control Unit will be completed upstream from the study area, improving its water quality. The Dolores Project will be completed, depleting the annual flows in the study area by about 20 percent. Approximately 1,000 recreation days occurred in the 31-miles (49 km) visual corridor of the Dolores River study area in 1976. Recreation use is expected to increase to about 5,000 recreation days by 1990. Boating, with associated camping and picnicking, is the sole projected increase.

The Bureau of Land Management proposes to serve this increased use by acquiring access to Utah Bottoms.

Energy and Mineral Impact. As much as 15,000 lb. (6,800 kg) of U_3O_8 worth $630,000 at $42 per pound and 42,000 lb. (19,000

TABLE XI-3. Impacts of Alternatives for the Dolores River.

Alternative and Description	No Action Option: No river designation; present management continues. Study area used for recreation, grazing, agriculture and mining. Dolores Project and Paradox Valley Salinity Control Unit completed upstream. Cultural features eligible for National Register receive protection. Recreation use quintuples.	Proposal: River designation: Segment A – Scenic Segment B – Wild Segment C – No designation Alternative designed to protect upper, more scenic segments while allowing access to minerals in Segment C. Though undesignated, Segment C is covered by river management plan for other segments and managed to assure continuation of desirable boating experience.	**National Economic Development Option** Similar to present management, but BLM encourages economic development by construction of recreation facilities and relaxing user limits if necessary. If trade-offs between economic and environmental values arise, economic concerns supercede. Greatest levels of recreation use.	**Environmental Quality Option 1:** River designation: Segment A – Scenic Segment B – Wild Segment C – Scenic Designation is at the level for which the river now qualifies. Issuance of mining regulations to protect Segment C in particular makes mining in that area less competitive and therefore less probable.	**Environmental Quality Option 2:** River designation: Segment A – Recreation Segment B – Wild Segment C – Recreation Discretionary lowering of classification still protects river legally, but with less restriction on mining and private lands.
Energy and Mineral Impacts	No interference with extraction. Possible mining of 15,000 pounds (6800 kg) of U_3O_8 and 42,000 pounds (19,000 kg) of V_2O_5 if economic climate improves substantially. Minerals almost wholly located in Segment C of corridor.	Cost of mining in scenic segment will be increased and thus become less probable. Designation of "wild" segment will result in the withdrawal of Federal lands within corridor from all forms of appropriation under mining laws and operation under mineral leasing laws. Designated segments lack minerals so impacts insignificant.	Same as no action option; no interference with extraction.	Same as proposal, but mining regulations to protect river values in Segment C raise costs of mining in that area, making it less likely to occur.	Same as proposal, but designation at less restrictive classification level of Segment C still renders mining less competitive nationally. Effects about midway between EQ1 and proposal in that area.
Environmental and Land Use Impacts	Existing land use and ownership continues, but BLM acquires about 5 acres (2 ha) at Utah Bottoms. If mining occurs in Segment C, locally severe scenic impacts will attend it. Recreation impacts at camping areas, stopping points, and side canyon trails are mostly insignificant, since areas are periodically flooded. No scenic easement acquisition.	Designation should have no effect on grazing practices. Mining unaffected in Segment C. Land use pattern largely unchanged except for BLM acquisition of about 5 acres (2 ha) at Gateway. Scenic easements may be necessary on about 920 acres (370 ha) if developments threatening river values arise.	Same as no action, but provision of more facilities impacts about twice as many acres (about 10 acres or 4 ha) and large increase in recreation impacts stopping areas more. No scenic easement acquisition.	Same as proposal in Segments A and B. Mining becomes less likely in Segment C, and recreation facilities concentrate impacts in all areas. Acquisition of Lake Bottom site impacts about 2 acres (1 ha). Scenic easements may be necessary on 1,640 acres (690 ha).	Lowered classification in Segment A lessens restrictions on private development, which are not probable in any case. Landownership patterns remain about the same. Compared to the proposal, mining impacts on environment lessened. Scenic easements on 1,640 acres (690 ha) possibly necessary.
Water Resource Impacts	None.	Federally licensed or assisted water development projects that would diminish river values would be precluded. Possible secretarial finding required on upstream projects not under construction. No interference with existing water rights.	None.	Same as proposal but corridor protection extended to Segment C.	Same as proposal, but corridor protection extended to Segment C.
Recreation Impacts	Increase from 1976 use of 1,000 recreation days to about 5,000 in 1990.	Increase to 6,950 recreation days in 1990.	Increase to 12,740 recreation days in 1990.	Increase to 8,060 recreation days in 1990.	Increase to 11,120 recreation days in 1990.
Facilities Planned	Acquire access to Utah Bottoms.	Same as no action option but add: Gateway – boat ramp and sanitation.	Same as no action option but add: Gateway – boat ramp, 10-unit camp, and sanitation Segment B – 6-mile (9.6 km) trail Lake Bottom – 10-unit camp.	Same as no action but add: Gateway – boat ramp and sanitation Lake Bottom – 5-unit camp	Same as proposal.
Economic and Regional Development/Recreationist expenditures 1990	$68,300	$ 96,300	$177,000	$111,200	$154,200
Possible Easement Cost	0	$368,000	0	$656 000	$656,000
Total Annual Costs, 1990	$ 4,400	$ 8,400	$ 24,400	$ 11,500	$ 13,800
AO&M, 1990	$ 4,000	$ 6,000	$ 14,100	$ 7,000	$ 8,000
Total Non-Annual Costs	$ 4,000	$ 28,600	$123,000	$ 53,600	$ 68,600
Regional Income Generated, 1990	$30,700	$ 44,700	$113,700	$ 52,700	$ 75,700
Social Impacts	Increased recreation and possible mining in Segment C degrade recreation environment somewhat, attracting socially oriented boaters and repelling wilderness oriented recreationists. Social environment otherwise unchanged.	Increased recreation and possible mining in Segment C may degrade recreation environment especially in lower corridor. Altered recreation environment may attract more crowd-tolerant recreationists. Social environment otherwise unchanged.	Some type of impacts as no action option but about 2.5 times greater due to much larger recreation use.	Same as proposal, but designation of Segment C ameliorates recreation and mining impacts in that area	Same as proposal, but designation of Segment C somewhat ameliorates recreation and mining impacts in that area Lowered classification in Segment A allows more degradation than proposal in that area.
Man-Years of Labor in 1990	5	7.4	16.1	8.6	12.1
Other Impacts	Increased recreation and possible increased mining result in soil disturbance and erosion, loss of vegetation and (at mines) locally degraded scenery. Increased impacts on cultural sites as recreation and mining increase. Possible degradation of water quality from mining, although enforcement of water quality laws limit impact. Endangered species not significantly affected.	Increased recreation use will result in a concomitant increase in impacts on soils, vegetation, wildlife, and cultural resources. Soil compaction and erosion, loss of vegetation, and disturbance of wildlife will occur near boat ramps. Increased use may also result in increased vandalism of historic and archeologic sites. Endangered species should not be significantly impacted.	Same type of impacts as no action, but those from recreation increased by a factor of about 2.5.	Same as proposal except in Segment C, where designation and consequent management tend to concentrate and abate recreation impacts, and by regulating mining, moderate its impacts as well.	Increased recreation use and impacts on soils erosion, vegetation, and wildlife in Segment A as compared with the proposal. Somewhat diminished recreation and mining impacts in Segment C as compared with the porposal.

kg) of V_2O_5 worth $42,000 at $1 per pound could be produced from the lower portion of this river area (segment C) if the economic climate becomes more favorable. The total value of U_3O_8 is $672,000 at these prices.

Environmental and Land Use Impact. Existing land use and ownership patterns will continue. Acquisition of access to Utah Bottoms will affect a small area of private land along the road and approximately 5 acres (2 ha) at the river shore. Increased mining in the lower corridor, if it takes place, will adversely affect scenery. Increased recreation use is expected to have some adverse effects, localized at camping areas, side canyon trails, and other stopping points.

Water Resources Impact. This option will have no effect on water resource development projects.

Recreation Impact. The increase in recreation will alter the type of river trip available; crowding will increase, resulting in a more social experience. This may produce an alteration in the type of recreationists using the river. Solitude during the boating season will diminish. Possible degradation of the lower corridor by mining could also alter the type of recreationist now using the corridor, to a type of person more tolerant of human intrusions.

Economic and Regional Development Impact. The anticipated increase in recreation use discussed under Recreation Impact will result in increased recreationist expenditures of approximately $56,000 or about 82 percent of the expected total 1990 on-site recreationist expenditures of about $68,000.

The recreation developments described under Recreation Impacts are expected to cost $15,000. Total annual administration, operation,

and management costs (AO&M), including a 25-year sinking fund, are expected to increase by about $4,300 as a result of increased recreation use. Regional income generated from recreationist expenditures and federal recreation development is expected to increase $37,000 by 1990.

Social Impact. The increased regional income discussed under Economic and Regional Development Impacts will support an additional 5.5 man-years labor in the region. Other social impacts, as with the No Action Option for the Colorado, will be minimal.

Other Impact. Increased recreational use and mineral extraction will result in an increase in soil disturbance and erosion, loss of vegetation, disturbance of wildlife, and locally degraded scenery. Recreation impacts, which would be concentrated at access points and stopping points that are mostly on gravel bars and subject to periodic flooding, would be minor. Impacts from mining would be locally severe, but the extent of each mine would probably be limited to 20 acres (8 ha) or less.

Endangered and threatened fish and wildlife species will continue to be protected according to provisions of the Endangered Species Act.

Increased recreational use and mining will increase the likelihood of vandalism of historic and cultural sites. Although features eligible for the National Register on public lands are expected to be identified and protected according to the National Historic Preservation Act, some adverse impacts are still likely to occur.

Mining activities, particularly for uranium and vanadium near the confluence and on Beaver Mesa, are likely to cause some degradation of water quality. BLM management and existing water quality laws should prevent this from being a significant impact.

National Economic Development Option - Dolores River

As with the Colorado River, there is little that can be done by the federal government to expand economic production or efficiency in the area. Since recreation is the most important economic resource in the study area, this plan provides for the greatest increase in recreation use by encouraging it with facilities and relaxed or non-existent user limits. To support a total of 12,740 recreation days in 1990, the following facilities would be installed;

Gateway launch	--	acquire access provide parking sanitation facilities 10-unit campground
Segment B	--	construct 6-mile (9.6 km) hiking trail
Segment C	--	10-unit campground at Lake Bottom

No portion of the Dolores study area would be designated to the National Wild and Scenic River System under this option, and environmental considerations would, within the limits of applicable existing and future regulations, be sacrificed in favor of increased economic production if conflicts between the two arose.

Energy and Mineral Impact. The impacts are the same as for the No Action Option: no interference with extraction.

Environmental and Land Use Impact. As with the National Economic Development Option for the Colorado, most of the environment, especially in the upper segments, would be preserved. Except for acquisition of limited areas (about 2 acres or 1 ha each at Gateway and Lake Bottom), landownership would be unchanged. Increased recreational use would degrade limited areas, solitude would be lost, and locally severe environmental degradation in the lower segment would result around individual mines if mining increased.

Water Resources Impact. This plan would have no effect on development of water resources, in the study area or upstream.

Recreation Impact. The expansion of recreation facilities in this option will provide for an increase of 7,740 recreation days (a 155 percent increase) over that expected under the No Action Option. Total recreation days would be 12,740. Under such conditions, effects would vary with the length of the boating season. Severe crowding at launch, attraction, rapid-scouting, and campsites would occur during low water years; years with longer seasons would produce somewhat fewer encounters between recreationists, but they would still be more frequent than at present. Solitude and wilderness values now available from floating the stretch would be in large measure lost. More crowd-tolerant recreationists would probably replace the present users. The recreation environment would be degraded, both by recreational pressures and by mining in the lower corridor, if it occurred.

Economic and Regional Development Impact. An increase of $108,000 (159 percent) in on-site recreationist expenditures is anticipated to result from this option. Recreation developments will cost $119,000. Increased annual costs are $20,000. Regional income will increase by $98,000.

Other than the above, the expected economic and regional development impacts are those described under the No Action Option.

Social Impact. The increased regional income discussed under Economic and Regional Development Impact will support an additional 13 man-years of labor in the region. The other social impacts are very similar to those described for the National Economic Development Option for the Colorado River.

Other Impacts. The other impacts under this plan that are caused by mining would be the same as those described under the No Action Option. Those caused by recreation would be the same in type, but more severe, since this plan envisions a level of use in 1990 that is 2.55 times as high as is expected to occur under the No Action Option, and about 12 times as high as present use. In spite of preservation, vandalism of historic and archaeological sites would increase proportionately. Increased impacts on stopping points, even those subject to periodic flooding, would occur.

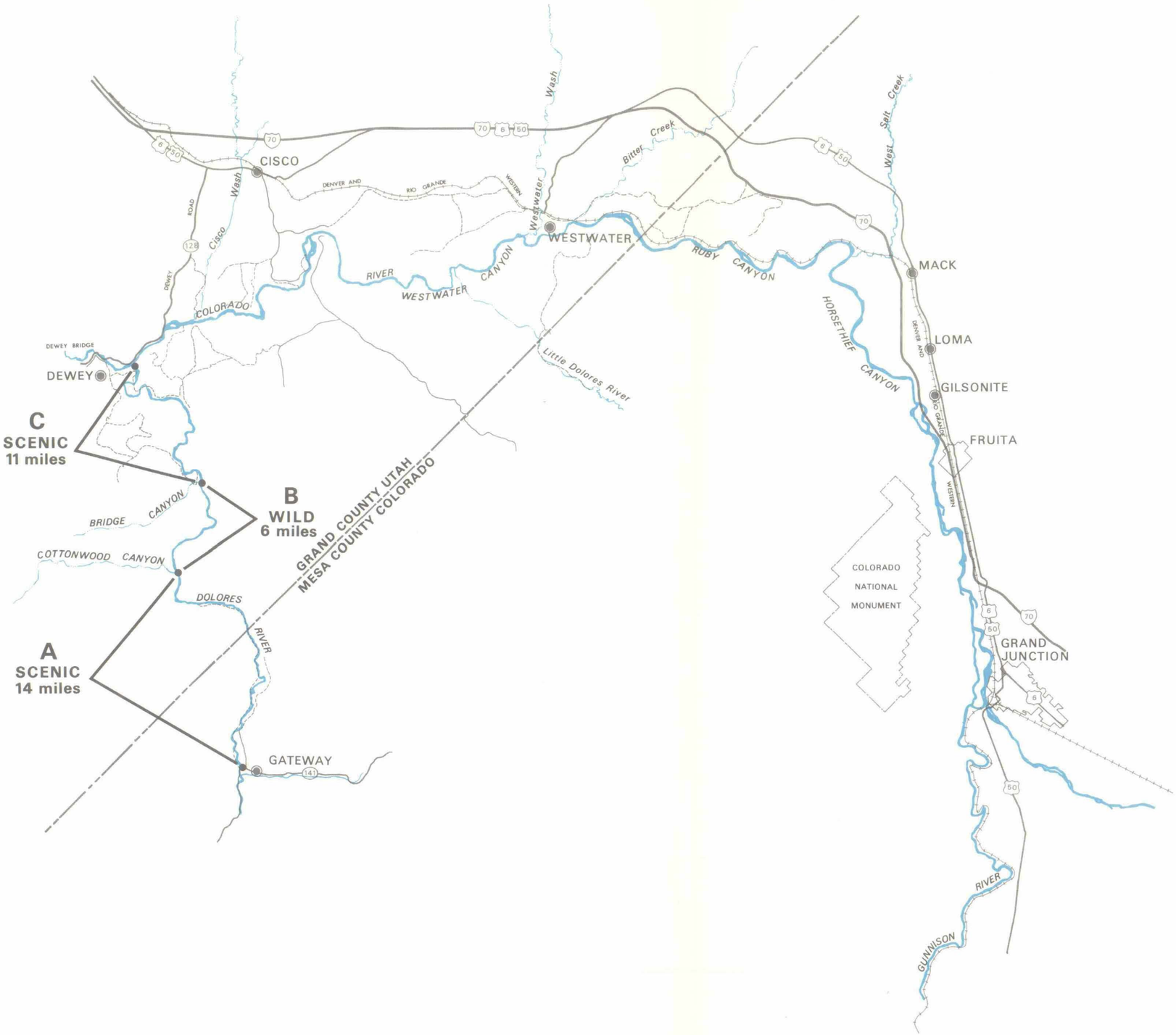
Environmental Quality Options

Option 1 - Dolores River. Option 1 will designate the Dolores River study area and its 11,900 acres (4,820 ha) at the classification level for which it qualifies. This alternative would allow the least degradation of the river. The segments would receive the following classifications:

Segment		Classification
Segment A	14 miles (22.5 km)	Scenic
Segment B	6 miles (9 km)	Wild
Segment C	11 miles (17.7 km)	Scenic

The only recreation facilities needed beyond that provided under the No Action Option are acquisition of the Gateway launch area and a five-unit campground at Lake Bottom. Although option I will increase recreation use in the study area, it will provide maximum protection for the outstandingly remarkable qualities of the corridor.

Energy and Mineral Impacts--Since the deposits in the lower 11 miles (17.7 km) of the corridor cannot be economically mined at present cost and price levels, mining will probably be more affected by economic developments outside the region than by designation. The relationship between all these factors cannot be quantified at



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

OPTION 1 - DOLORES RIVER

GRAVEL ROAD

JEEP ROAD

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,027
DSC | FEB 79

this time, so the affect of designation on mining in the lower corridor can only be estimated.

Under this option, the Secretary of the Interior would issue regulations on mining in the lower 11 miles (17.7 km) to safeguard the values which caused the river to be included in the system. These regulations would raise the cost of mining, rendering mines in the corridor less economically competitive and thus lowering the probability that mining would take place.

There are no known deposits of economically mineable minerals in segments B and C, so no effects on mining are predicted in these areas.

Environmental and Land Use Impact--Applying the highest level of protection for which the 31-mile (49 km) corridor now qualifies would not change private land uses, but would preclude future uses that would harm the values for which the river was designated. This could eventually require scenic easements on 1,640 acres (690 ha) of private land. Grazing and recreational use of public land would continue. Mining on public land would be rendered more expensive in the lower corridor than at present because of regulations designed to protect the river's outstanding values; this could make its continuance less probable. Mineral entry in the "wild" segment would be precluded. Public lands in the corridor could not be disposed of.

Acquisition of about 1 to 2 acres (0.4-1 ha) each at the Gateway and Lake Bottom sites would slightly alter land use patterns in the area.

Water Resources Impact--Water resource development projects in the corridor which required federal licensing or assistance would be precluded. No such projects are planned, so this impact will be

insignificant. This plan would not interfere with existing water rights in the study area. If appropriate, the Secretary of the Interior will determine whether any of the projects planned upstream from the study area, or a combination of these projects, would unreasonably diminish the values for which the rivers were designated.

Recreation Impact--Recreation use is expected to increase from 1,000 recreation days in 1976 to about 8,000 recreation days in 1990. This is about 3,500 more than would occur with no action and about 1000 more than with the proposed action. As with the other alternatives, boating and the associated picnicking and camping would constitute the total projected increase. To accommodate this use, five additional campground units would be developed at Lake Bottom, and improvements to the Gateway launch area would be made.

These increases in recreational use would diminish solitude and perhaps favor use of the river by more socially-oriented recreationists than at present. The recreation environment would be least degraded under this plan.

Economic and Regional Development Impact--Recreationist expenditures will increase $43,000 annually (63 percent) by 1990. This option will cost $26,000 for recreational developments and $7,100 annually.

Regional income generated from recreationist expenditures and Federal recreational development is expected to increase $28,000 by 1990.

Social Impact--The increase in regional income will support an additional four man-years of labor in the region, primarily in the service industries. The availability of recreational opportunities will

increase, and as noted above, the quality and diversity of the recreational experience will be preserved. The social environment will otherwise remain as it is now.

Other Impacts--Increased use will result in an increase in impacts on soils, vegetation, wildlife, and cultural resources.

Impacts on soils and vegetation will be concentrated around the campground boat ramps, and other stopping points along the river. Since most stopping points are located on gravel bars, they should not be significantly affected. Some soil compaction and erosion, loss of vegetation, and disturbance of wildlife will occur near the boat ramps and campgrounds, but due to the small area involved (1-2 acres or 0.4-1 ha) at both Gateway and Lake Bottom, these impacts should not be significant.

Increased use will also result in increased vandalism of historic and archeologic sites near the river if these sites are not adequately protected. However, it is expected that features eligible for the National Register will be identified and protected according to provisions of the National Historic Preservation Act of 1966. Even with protection, some impacts to these sites may occur.

The endangered bald eagle is generally present along the river during the winter months. Recent sightings in the spring and early summer indicate that there may be an active bald eagle nest in the area of the Colorado and Dolores Rivers. However, this has not been confirmed. Since little recreation occurs in the winter, the bald eagle would not be affected unless an active nest does exist, and then only if hikers were to get too close to the nest.

Option 2 - Dolores River. Under Option 2, the Dolores River would receive the following classification:

Segment		Classification
Segment A	14 miles (22.5 km)	Recreational
Segment B	6 miles (9.7 km)	Wild
Segment C	11 miles (17.7 km)	Recreational

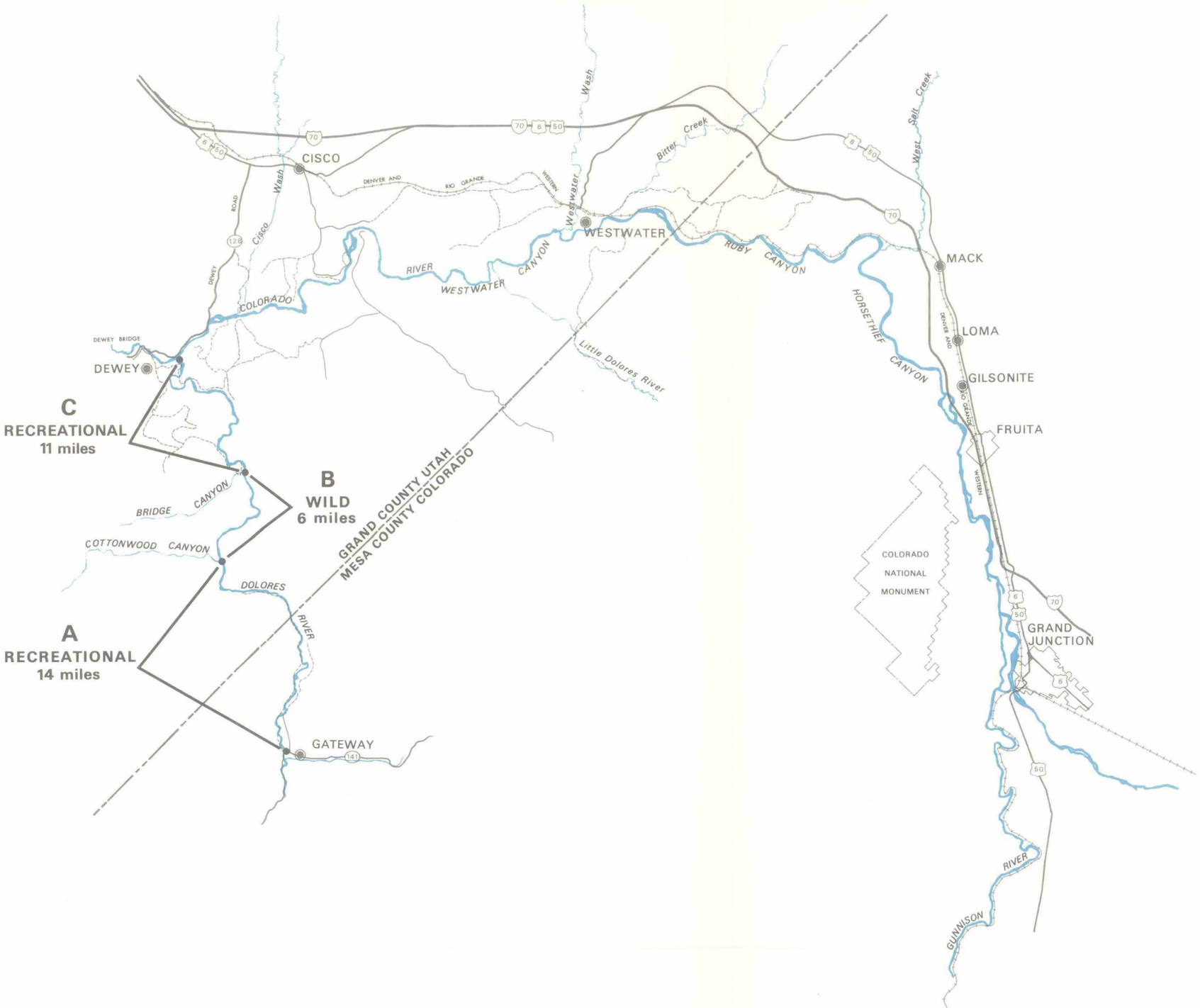
The discretionary change in classification from "scenic" to "recreational" in the upper and lower corridor would place less restriction on mineral exploration and development within these two segments. There would be fewer restrictions on the amount and type of development that could take place on private lands.

The recreation facilities needed to serve this level of use are:

Gateway launch area	--	acquire access
	--	parking
	--	sanitation facilities
Utah Bottoms	--	acquire access
Lake Bottom	--	10-unit campground

Energy and Mineral Impact--With the changed classification levels in segments A and C, the regulations issued by the Secretary of the Interior would place less restriction on mining. This would allow less costly access to the $672,000 worth of uranium and vanadium in the lower corridor, making mines in that segment somewhat more competitive with mines in areas where no such regulations exist, and thus rendering it more probable that mining would take place. The probability that mining would take place would be higher under this option than under option 1, but not so high as in the recommended plan, the no-action option, or the NED plan.

Environmental and Land Use Impact--Under this alternative, land use would remain essentially as it is now. Changing the classification levels of the upper and lower segments from "scenic" to "recreational" would permit more alteration of the corridor by



COLORADO / LOWER DOLORES
WILD AND SCENIC RIVER STUDY

OPTION 2 - DOLORES RIVER

GRAVEL ROAD
JEEP ROAD

N

1 5 0 1 2 3 4 miles

1 5 0 1 2 3 4 5 kilometers

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

WSRS | 20,025
DSC | FEB 79

private landowners, but there is apparently no pressure now for the types of developments (second homes and dispersed subdivisions) that would presumably be permitted under this less restrictive classification. Such developments would be most likely in segment A. This impact is not expected to be significant.

Patterns of landownership would remain approximately the same, except for the acquisition by BLM of about 2 acres (1 ha) at Lake Bottom.

Land use on public lands would continue as at present, but with a slight alteration. A recreational classification in segment C would, by the institution of regulations designed to safeguard the values for which the river was designated, somewhat inhibit mining as compared to the present situation.

Water Resources Impact--This plan would have the same impacts as option I and the recommended plan, described in chapter VIII: corridor developments requiring federal licensing or assistance precluded, no impact on existing water rights, and the possibility that a finding by the Secretary of the Interior would needed that upstream water projects not already under construction would not unreasonably diminish the values for which the river was designated.

Recreation Impact--Recreational use under this alternative is expected to increase to 11,100 recreation days by 1990, about 6,600 more than would occur under the no action alternative. Boating, with associated picnicking and camping, would again constitute the total projected increase. To accommodate this use, five additional campground units will be developed at Lake Bottom. Less restriction on mining activities near the confluence is likely to cause some degradation of the recreation atmosphere. With increased use, encounters between boaters will increase and solitude will lessen.

Boaters oriented toward more wilderness-type trips may be replaced by socially-oriented recreationists.

Economic and Regional Development Impact--Recreationist expenditures will increase $86,000 annually (126 percent) by 1990. This option will cost $30,000 for recreation developments and require $4,500 annually for a sinking fund and additional AO&M. It will contribute an additional $55,000 annually to the regional economy.

Social Impact--The quantity of recreational opportunities will increase, with a consequent decrease in the quality of the recreational environment and degree of solitude available. The increased regional income discussed under Economic and Regional Development Impacts will support an additional eight man-years of labor in the region.

Other Impacts--Increased recreation use and mineral exploration would result in proportionately greater impacts on soils, vegetation, fish, wildlife and cultural features. Those from recreation use would be concentrated near the development sites. About 2 acres (1 ha) will be disturbed at Lake Bottom in constructing the five additional camping units. Although construction would result in short-term disturbance, these facilities should reduce potential future disturbance by controlling use. Endangered and threatened species of wildlife will continue to be protected. An increase in mining activity near the confluence will also disturb soils, vegetation, wildlife and cultural features. The BLM management should regulate this use and prevent significant degradation of the river values, although, under the less restrictive classification, more degradation could take place than is permitted in option I. Increases in recreation use and mining will increase the likelihood of vandalism of unprotected historical and archeological features. Although those sites eligible for the National Register on public

TABLE XI-4. Effects of Options for the Dolores River in 1990

Account	Components	No Action Option		National Economic Development Option		ENVIRONMENTAL QUALITY OPTIONS OPTION 1 Segment A – Scenic Segment B – Wild Segment C – Scenic		OPTION 2 Segment A – Recreational Segment B – Wild Segment C – Recreational		OPTION 3 Segment A – Scenic Segment B – Wild Segment C – Not Designated	
		Total[2]	Net[3]	Total	Net	Total	Net	Total	Net	Total	Net
NATIONAL ECONOMIC DEVELOPMENT	RECREATION USE[1]										
	Boating	4,500	4,000	12,240	7,740	7,560	3,060	10,620	6,120	6,450	1,950
	Fishing	300	0	300	0	300	0	300	0	300	0
	Hunting	200	0	200	0	200	0	200	0	200	0
	Total Annual Recreation Days	5,000	4,000	12,740	7,740	8,060	3,060	11,120	6,120	6,950	1,950
	Annual Recreationist[4] Expenditures	$68,000	$56,000	$177,000	$109,000	$111,000	$43,000	$154,000	$86,000	$96,000	$28,000
	Annual Government[5] Expenditures		$ 5,276	$ 28,276	$ 23,000	$11,076	$ 5,800	$ 13,376	$ 8,100	$ 8,126	$ 2,850
	Household Income[6]		$43,000	$159,500	$116,500	$75,400	$32,400	$118,700	$75,700	$63,500	$20,500
	MINERALS AND ENERGY	Ore containing .15% U_3O_8 and .42% V_2O_5 occurs in the lower visual corridor. Since 1948 a total of only 50 tons of ore has been extracted. If the value of U_3O_8 were to increase to $42/lb, 15,000 lb (worth $630,000) might be economically extracted under either the No Action Option, National Economic Development Option, or Environmental Quality Option 3. Environmental Quality Options 1 and 2 would probably increase the cost of mineral extraction in the visual corridor. Small amounts of very fine gold also exist in the visual corridor, but significant extraction is unlikely under all options.								
ENVIRONMENTAL QUALITY	PRESERVATION OF FREE-FLOWING STREAM	None Guaranteed		None		6 miles – Wild River 25 miles – Scenic River 0 miles – Recreational River 31 miles – Preserved		6 miles – Wild River 0 miles – Scenic River 25 miles – Recreational River 31 miles – Preserved		6 miles – Wild River 14 miles – Scenic River 11 miles – Not Recommended for Desg. 20 miles – Preserved	
	PRESERVATION OF AREAS OF NATURAL BEAUTY	None guaranteed. Management priorities may dictate other uses.		Less protected than under No Action Option. Economic values to take top priority under this plan. Some values may be lost.		Areas of natural beauty preserved along 31 miles of river.		Although areas of natural beauty preserved along 31 river miles, 14 of these miles which qualify as scenic river will only be protected at the recreational river classification level.		Areas of natural beauty preserved along 20 river miles. Areas of natural beauty along 11 miles of river qualifying for scenic river designation not preserved by designation.	
	PRESERVATION OF CULTURAL RESOURCES	Federal and state laws protect sites, some damage could occur to sites on private lands.		Higher level of recreation use without additional money expended for protection results in increased damage to sites.		Higher level of recreation use is off-set by additional efforts for protection.		Higher level of recreation use is off-set by additional efforts for protection.		Higher level of recreational use without additional level of protection results in increased damage to sites.	
	PRESERVATION OF FREEDOM OF CHOICE	Many options preserved.		Economically important options increase. Preservation options decrease.		Preservation options increase. Potential for mineral development decreases.		Preservation options increase. Potential for mineral development decreases somewhat.		Economic development options increase. Preservation options also increase somewhat.	
	AVOID IRREVERSIBLE OR IRRETRIEVABLE EFFECTS	Possible loss of scenic and recreational values. Irreversible loss of any minerals extracted.		Greatest possibility of loss in scenic and recreational values. Irreversible loss of any minerals extracted.		None. Economic values from mining probably unrealized unless designation is lifted.		None. Slightly greater possibility of mining than in EQ1, but economic values from mining probably unrealized unless designation is lifted.		None in Segments A and B. Possible loss of scenic and recreational values in Segment C. Irreversible loss of any minerals extracted in Segment C.	
REGIONAL DEVELOPMENT		Net $		Total $[9]	Net $	Total $	Net $	Total $	Net $	Total $	Net $
	REGIONAL INCOME GENERATED[7]										
	Service Stations		4,000	10,000	6,000	6,000	2,000	8,000	4,000	5,300	1,300
	Other Retail		6,000	15,000	9,000	9,000	3,000	13,000	7,000	7,900	1,900
	Eating and Drinking Places		8,000	21,000	13,000	13,000	5,000	18,000	10,000	11,200	3,200
	Lodging		9,000	24,000	15,000	15,000	6,000	21,000	12,000	12,800	3,800
	Other Services		1,000	3,000	2,000	1,500	500	2,000	1,000	1,300	300
	Transportation		700	2,700	2,000	1,200	500	1,700	1,000	1,000	300
	Contract Construction		2,000	38,000	36,000	7,000	5,000	12,000	10,000	5,200	3,200
	Total		30,700	113,700	83,000	52,700	22,000	75,700	45,000	44,700	14,000
	VALUE ADDED[8]										
	Service Stations		5,000	12,000	7,000	6,000	3,000	10,000	5,000	6,900	1,900
	Other Retail		8,000	20,000	12,000	13,000	5,000	17,000	9,000	11,200	3,200
	Eating and Drinking Places		10,000	26,000	16,000	16,000	6,000	23,000	13,000	13,800	3,800
	Lodging		12,000	33,000	21,000	20,000	8,000	29,000	17,000	17,000	5,000
	Other Services		2,000	4,000	2,000	2,000	800	4,000	2,000	2,500	300
	Transportation		1,000	4,000	3,000	1,700	700	2,000	1,000	1,450	450
	Contract Construction		3,000	47,000	44,000	8,000	5,000	16,000	13,000	6,200	3,200
	Total		41,000	146,000	105,000	69,500	28,500	101,000	60,000	59,050	13,050
		Net		Total	Net	Total	Net	Total	Net	Total	Net
	EMPLOYMENT (MAN-YEARS)										
	Service Stations		.6	1.3	.7	.9	.3	1.1	.5	.8	.2
	Other Retail		.7	1.8	1.1	1.1	.4	1.6	.9	.9	.2
	Eating and Drinking Places		1.7	4.6	2.9	2.9	1.2	4.0	2.3	2.5	.8
	Lodging		1.3	3.5	2.2	2.2	.9	3.1	1.8	2.0	.7
	Other Services		.3	.7	.4	.4	.1	.5	.2	.4	<.1
	Transportation		<.1	.1	0.0	<.1	<.1	.1	.1	<.1	<.1
	Contract Construction		.3	5.1	4.8	1.0	.7	1.7	1.4	.7	.4
	Total		5.0	16.1	12.1	8.6	3.7	12.1	7.2	7.4	2.5
SOCIAL WELL BEING	EDUCATIONAL, CULTURAL AND RECREATIONAL OPPORTUNITIES	Opportunities remain similar to those now. Protection assured only by management agency policy now.		If deemed economically valuable, opportunities increase. Otherwise, opportunities and/or quality decrease. Probable increase in gross number of recreationists combined with decrease in quality of experience.		Availability of opportunities increases. Quality of experience is preserved.		Availability of opportunities increases. Quality of experience preserved in segment B.		Availability of opportunities increases somewhat. Quality of experience in Segment C is degraded.	
	LIFE, HEALTH AND SAFETY	Adverse health effects from potential uranium extraction may occur.		Adverse health effects from potential uranium extraction may occur.		This plan would decrease potential for adverse health effects from uranium extraction.		Adverse health effects from potential uranium extraction could occur.		Adverse health effects from potential uranium extraction could occur.	
	INCOME DISTRIBUTION	Income to service, recreational supply, and construction industry increases.		This plan provides the greatest increase to service, recreational supply, and construction industries.		Income to service recreational supply, and construction industries increases.		Income to service, recreational supply, and construction industries increases.		Income to service, recreational supply, and construction industries increases.	

[1] All recreational use and values are given in recreation days.

[2] The total column under each option represents total expected recreation use or expenditures which will occur in the study area under that option by 1990.

[3] The net column under each option is the expected net effect of implementing that option. Under the No Action Option, recreation is expected to increase by the year 1990 by the net amounts shown. The net increases represented under option 1-4 are all additional to the net increases shown under the No Action Option.

[4] The values used in estimating on-site recreationist expenditures per recreation day (RD) were: boating – $14.04/RD, fishing – $7.00/RD, and hunting – $15.00/RD. Sources used for these values are: Milliken and Mave, *Economic and Social Impact of Recreation at Reclamation Reservoirs*, University of Denver, March 1969; Doll, G. Fred and Clynn Phillips, *Wyoming's Hunting and Fishing Resources, 1970*, Division of Business and Economic Research, University of Wyoming, Laramie, August 1972; *1974 Colorado Big Game Harvest, Colorado* Division of Wildlife, Denver, 1975, John Devine, "White-water Boating on the Dolores River – Final Estimate of Effects of Dolores Project on Boating," January 18, 1977 – Memorandum to File, Bureau of Reclamation.

[5] Annual government expenses for each option include capital costs annualized over a 50-year period, a 25-year sinking fund, annual administration, operation, and management costs, and administrative costs for easement acquisition.

[6] Household income is direct income generated to U.S. citizens from output of alternative actions.

[7] Regional income generated is the portion of National Economic Development account expenditures which remain in the region.

[8] Value added is the gross regional product.

[9] Total $ under each option is the sum of the total $ for the No Action Option and Net $ for each option.

lands will be identified and protected according to the National Historic Preservation Act, some adverse impacts to these sites are likely.

Option 3 - Dolores River. Option 3 is the recommended plan; it was described in chapter VI and its impacts specified in chapter VIII.

SUMMARY AND COMPARISON OF EFFECTS OF ALTERNATIVE PLANS

Colorado River

Projected annual recreationist expenditures for the five alternatives range from $501,000 to $999,000. The difference in recreationist expenditures between the three EQ options is small ($501,000 to $550,000) when compared to the NED option ($999,000).

EQ options 1 and 2 would preserve the entire 55.7 miles (89.7 km) portion of the river while EQ option 3 would preserve 40.7 miles (65.5 km). The NED option would not guarantee preservation of any portion of the river.

The NED plan would provide for the greatest amount of use, but it would not guarantee protection and could cause degradation of the existing river values as a result of overuse.

EQ option 3 would not provide protection for 15 miles (24 km) of the Colorado River which was found eligible for inclusion in the national system. It would permit potential mineral extraction without the possibly expensive environmental regulations attendant on designation to the system, but the total dollar value of uranium and vanadium that could be extracted from the corridor is very

small--about one-fourth of annual recreation expenditures under EQ option 1.

EQ option 2 would preserve 11 miles (17.7 km) of the river at a less restrictive classification than it is eligible for, without substantial monetary benefits.

EQ option 1 would guarantee preservation of the outstanding values of the Colorado River at the most restrictive classifications for which each segment is eligible, without having significant effects on mineral extraction, the regional economy, or government expenditures.

Dolores River

As with the Colorado River, recreationist expenditures are the most important economic factors in the study area. Under the various plans, these are projected to vary between $96,000 and $177,000 annually by 1990.

The NED option, which is predicated on maximum recreation use, attains the greatest recreationist expenditure and requires annual government expenditures more than twice as large as any other option. Since this option does not guarantee preservation of the river values, it could result in degradation by overuse and mining, imperiling the qualities which attract the recreationists whose expenditures create its benefits.

Each of the three EQ options involves some designation under the Wild and Scenic Rivers Act. EQ option 2, though resulting in the highest recreationist expenditures of the three, would protect 25 miles (40.3 km) of river at a level less than they qualify for. EQ option 1 protects all 31 miles (49.9 km) of river at the highest

levels of classification for which each segment qualifies, and results in the second-highest level of recreationist expenditures.

None of the three EQ options precludes mineral development, but options 1 and 2 may increase the costs of any development that may take place. EQ option 3 will not increase the costs of mineral extraction because it does not protect the 11 miles of river in which minerals occur. Of the EQ plans, it generates the smallest recreationist expenditures, the smallest contribution to household income, the smallest contribution to regional income, and the smallest amount of added employment. It does provide the most encouragement for the mineral extraction field, while protecting 20 miles (32.2 km) of river values.

Selected Options

EQ option 1 for the Colorado River offered a chance to preserve the outstanding values of the area for future generations, with very little impact on mineral extraction, and substantial benefits to the region from recreationist expenditures. For those reasons it was selected as the recommended alternative.

EQ option 3 for the Dolores River was chosen because it protected the upper 20 miles (32.2 km) of the study area, in which the outstanding values and scenery are concentrated, while allowing unhampered mineral extraction in the less scenic lower 11 miles (17.7 km). Local opinion expressed to the study team was that access to the minerals of the area was too important to the local economy to be impeded. This position was supported by the Bureau of Land Management and the State of Utah, who also noted that the scenic values of this lower reach are marginal.

CHAPTER XII
CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND ENVIRONMENTAL STATEMENT

An interagency study team was formed in June 1976 to conduct the study and prepare a report and environmental statement. Study team agencies consisted of the Heritage Conservation and Recreation Service (formerly the Bureau of Outdoor Recreation), Colorado Department of Natural Resources (represented by the Colorado Water Conservation Board), Utah Department of Natural Resources (represented by the Utah Outdoor Recreation Agency) and the Bureau of Land Management (Colorado and Utah).

Numerous other Federal and State agencies with special expertise in various subjects also participated in the study. These study participants included:

Federal Agencies

Energy Research and Development Administration (now the Department of Energy)
Bureau of Reclamation
National Park Service
U.S. Fish and Wildlife Service
Soil Conservation Service

State Agencies

Colorado State Historical Society
Colorado Division of Wildlife
Colorado Division of Planning
Utah State Historical Society
Utah Division of Wildlife Resources

A number of individuals also participated in the study process.

These were:

John Williams
Doug Treadway
Richard Smith
Verne Huser
Ginger Gheen
Al Gunter
George Morehouse
Chris Jouflas

Two series of public meetings were conducted to obtain citizen input to the study. The Colorado meetings were held in Denver and Grand Junction; the Utah meetings, in Salt Lake City and Moab. The oral and written comments solicited at these meetings were used to aid the study team in making its decisions and recommendations.

The first series of public meetings were held July 6-13, 1976, their purpose being to inform the public about the study including its purpose, scope, and organization. Those attending selected the individuals above to represent the public throughout the study process. A second series of public meetings was held May 2-9, 1977, to present various management alternatives for the rivers, including national designation of the rivers.

Field reconnaissance of the Colorado River was conducted in August 1976, and in June 1977 for the Dolores River. In addition to the study team, participating agencies and individuals were invited to join in these field inspections so that they would also be familiar with the values of the area.

On July 5, 1978, responsibility for the study of the Colorado and lower Dolores Rivers was transferred to the National Park Service by the Heritage Conservation and Recreation Service. After the transfer, a draft of the report and environmental statement was edited and revised, and discussions were held to select recommended alternatives for the rivers. The National Park Service then prepared the graphics, printed, and distributed this document.

A P P E N D I X A

Rock Formations of The Colorado and Dolores River Study Area

Quaternary

Light red, wind and stream deposited alluvium, stream deposits, terrace gravels, landslide deposits, and talus. Can reach a thickness of up to 300 feet.

Unconformity

Upper Cretaceous

Mancos Shale--dark gray to black, soft, fossilferous, fis marine shale with thin beds of sandstone nea ba Thickness is approximately 4,000 feet. Only ba feet exposed in area. Forms low, rounded hills.

Upper and Lower Cretaceous

Dakota Sandstone--yellowish-brown to gray, quartzitic, fi sandstone and conglomeratic sandstone in thick beds w thin, lenticular beds of gray claystone, impure coal, anc carbonaceous shale. Thickness of formation varies from 20 to 150 feet. Sandstone forms ledges and cliffs.

Unconformity

Lower Cretaceous

Burro Canyon Formation--lenticular, light-brown, fluvial quartzose sandstone and conglomerate, with brown to green siltstone, shale, and mudstone. Formation varies in thickness from 50 to 120 feet. Forms cliffs where largely sandstone.

Upper Jurassic

Morrison Formation--Brushy Basin Member--Red, green, brown, purple, and gray-white fluvial and lacustrine siltstone and mudstone with lenticular beds of white to brown sandstone and gray limestone. Contains dinosaur remains. Thickness of member varies from 260 to 350 feet. Forms slopes.

Morrison Formation--Salt Wash Member--yellowish-brown to gray fluvial sandstone beds with interbedded grayish-green and reddish-brown mudstone, some thin beds of gray limestone. Member varies in thickness from 190 to 350 feet. Forms ledges and cliffs where largely sandstone. Sandstones contain small deposits of uranium and vanadium in the area of the confluence of the Dolores and Colorado Rivers.

Summerville Formation--thin-bedded, red, green, gray, purple, and brown mudstone and siltstone, 40 to 60 feet thick. Deposited in shallow water of possible marine origin. Forms steep slopes.

Entrada Sandstone-Moab Member--White to gray, evenly bedded, fine-grained sandstone that varies in thickness from 45 to 90 feet. Deposited in shallow water. Forms steps.

Entrada Sandstone--Slick Rock Member--Orange, buff, and white, fine-grained, cross-bedded, eolian sandstone, containing scattered grains of medium- to coarse- grained sandstone. Member varies in thickness from 100 to 230 feet. Forms cliffs, locally called the "Slick Rim."

Entrada Sandstone--Dewey Bridge Member--reddish-brown to buff siltstone, sandy siltstone and silty sandstone that vary in thickness from 0 to 50 feet. Member becomes increasingly sandy eastward and is not not recognized near Fruita, Colorado. Deposited in a littoral environment. Forms rounded ledges and "hoodoos."

Unconformity

Jurassic and Triassic (?)

Navajo Sandstone--Buff and gray, fine-grained, massive cross-bedded eolian sandstone. Thickness varies from 0 to 200 feet. Thins to a featheredge northeast of Colorado River's confluence with Coates Creek and east of Gateway. Not generally visible on Colorado. Forms cliffs.

Triassic (?)

Kayenta Formation--gray, purplish-gray, red and maroon, irregularly bedded, fluvial, fine- to coarse-grained, sandstone and siltstone with some mudstone, conglomerate, and limestone. Formation thins eastward and thickness varies from 80 to 320 feet. Forms benches and ledges.

Triassic

Wingate Sandstone--reddish-brown to buff, fine-grained, massive, thick-bedded, cross-bedded, eolian sandstone. Formation averages 300 feet thick, but varies from 275 to 400 feet. Forms cliffs; many cliff faces are coated with desert varnish.

Chinle Formation--red to orange-red siltstone with interbedded lenses of red sandstone, mudstone, and limestone-pebble and clay-pellet conglomerate. Lenses of quartz-pebble conglomerate and grit at base of formation. It is terrestrial in origin. Thickness of the formation varies from 100 to 300 feet on the Dolores, 80-120 along the Colorado. Forms a steep slope below the Wingate Sandstone.

Moenkopi Formation--chocolate-brown, ripple-bedded shale, brick-red sandy mudstone, reddish-brown and chocolate-brown sandstone, and purple and reddish-brown arkosic conglomerate. Local gypsum beds. The formation is of terrestrial origin and varies in thickness from zero to 400 feet, thinning to the east. Not present on the Colorado. Forms steep slopes.

Permian

Cutler Formation--maroon, red, mottled light red, and purple conglomerate, arkose, arkosic sandstone. Thin beds of sandy mudstone. Formation varies in thickness from zero to 7,800 feet in the Gateway area, thinning abruptly to the northeast. Rocks were deposited as an fanglomerate on the southwest flank of the Uncompahgre uplift. Not present on Colorado. Forms slopes and ledges.

GREAT UNCONFORMITY

Precambrian

Gneiss, schist, granite and pegmatite. Not visible in Dolores corridor but exposed in the Uncompahgre uplift northeast of the Gateway and along the Colorado.

APPENDIX B

TABLE B-1
Colorado River near Colorado - Utah State Line
WATER FLOW DATA - YEARLY SUMMARY

Drainage: 17,900 square miles. Average Discharge 5,815 cfs/4,200,000 acre-feet per year.

Maximum: 56,800 cfs (9 June 1957)
Minimum: 960 cfs (7 September 1956)

Water Year AC-FT/YR.	MEAN	YEAR MAX.	YEAR MIN.	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YR.
		30,200						12,340	19,960	8,661	3,616	2,278	2,726	2,967	2,832	51
6,851,000	9,437	52,000	2,000	2,830	2,431	2,810	11,290	30,500	36,080	9,887	5,451	3,427	2,683	2,999	2,910	52
3,747,000	5,175	37,300	1,880	2,799	2,514	2,802	3,557	8,905	22,051	5,341	3,888	2,142	2,548	3,179	2,452	53
2,083,000	2,877	11,600	1,000	2,477	2,321	2,464	3,013	6,256	3,481	2,341	1,514	2,496	3,213	2,685	2,214	54
2,853,000	3,941	17,100	1,400	2,057	2,060	2,907	4,265	10,130	10,760	3,233	2,703	1,814	1,932	2,726	2,650	55
3,298,000	4,542	28,900	960	2,353	2,293	2,792	5,056	15,640	14,270	2,553	1,672	1,361	1,916	2,549	2,071	56
7,868,000	10,870	56,800	1,700	2,248	2,587	2,494	4,878	18,710	43,830	29,590	9,183	4,379	4,206	4,411	3,543	57
5,183,000	7,159	45,000	1,200	2,881	3,486	3,625	7,379	28,820	23,960	3,349	1,692	2,437	2,404	3,074	2,715	58
3,056,000	4,222	23,200	1,310	2,544	2,616	2,312	2,425	8,337	15,300	3,219	2,364	2,078	3,951	3,129	2,430	59
3,651,000	5,029	24,700	1,190	2,490	2,358	3,898	8,628	11,170	16,790	3,745	1,635	1,877	2,480	2,866	2,559	60
3,022,000	4,174	19,300	1,340	2,328	2,383	2,506	2,559	9,300	10,160	1,962	1,968	4,694	5,116	3,978	3,109	61
6,123,000	8,458	40,500	1,700	2,825	4,140	3,649	15,010	23,650	22,900	12,000	3,278	2,867	4,185	3,953	2,886	62
2,350,000	3,246	11,300	1,020	2,639	3,151	3,012	3,259	7,579	5,226	1,731	2,453	2,773	2,186	2,924	2,048	63
3,167,000	4,363	27,300	1,470	1,871	1,815	1,984	2,981	12,520	12,600	4,353	3,575	2,556	2,418	2,888	2,749	64
5,977,000	8,256	36,400	1,870	2,581	2,377	2,406	6,677	16,890	26,140	17,090	6,627	5,652	5,014	3,786	3,567	65
2,695,000	3,723	14,400	1,620	2,770	2,763	3,624	4,982	8,995	6,215	2,828	1,929	2,475	2,845	2,568	2,629	66
3,021,000	4,173	19,400	1,570	2,254	2,368	2,815	3,146	6,899	11,460	4,941	2,550	2,925	2,840	3,662	4,174	67
3,808,000	5,246	26,600	2,300	3,314	3,442	2,835	3,258	8,895	16,730	4,572	5,248	2,643	3,532	4,373	4,188	68
4,473,000	6,179	20,400	2,200	4,369	3,326	4,087	8,796	13,490	11,440	6,860	3,167	4,007	5,454	3,832	4,189	69
5,584,000	7,173	33,000	3,020	3,820	3,940	4,462	4,804	19,720	21,430	8,399	3,887	5,889	5,602	5,446	5,002	70
5,208,000	7,194	22,200	2,630	5,271	5,773	6,465	9,013	11,570	18,010	8,456	3,879	4,681	4,354	4,620	4,343	71
3,505,000	4,828	18,400	1,700	3,884	3,904	4,209	3,325	7,386	12,310	3,135	2,132	3,618	4,624	4,872	4,629	72
5,308,000	7,346	35,000	2,880	4,496	3,593	3,603	3,731	17,710	21,540	11,570	5,183	3,614	3,987	4,090	4,784	73
4,243,000	5,861	22,800	1,850	5,073	5,333	5,920	5,452	15,230	12,120	4,781	2,544	2,683	3,320	4,209	3,656	74
5,220,000	7,210	26,300		3,849	3,823	3,909	5,155	13,150	18,710	11,750	3,713	3,269				75
MEAN				3,084	3,071	3,237	5,527	13,752	17,339	6,880	3,434	3,145	3,481	3,616	3,264	

WATER FLOW DATA - YEARLY SUMMARY

Dolores River near Cisco, 9 miles above mouth
Drainage: 4,580 square miles. Average Discharge 683 cfs/494,500 acre-feet per year.

Maximum: 17,400 cfs (21 April 1958)
Minimum: 3.4 cfs (23 September 1956)

Water Year AC-FT/YR	MEAN	YEAR MAX	YEAR MIN	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YR
													80	90	122	50
162,700	225	2,140	31	148	160	127	123	620	806	192	186	64.3	67	95.2	108	51
1,095,000	1,509	11,100	34	234	164	251	5,450	5,930	4,076	1,093	343	176	136	122	162	52
300,900	416	3,060	38	184	166	196	660	1,035	1,481	297	315	66.4	265	189	133	53
208,500	288	3,220	38	143	170	165	724	866	309	158	107	226	327	150	109	54
342,600	473	3,690	36	92.1	129	515	1,094	1,884	1,108	205	276	57.5	58	101	143	55
264,800	365	2,470	4.2	128	150	265	946	1,372	1,052	131	105	13.8	30	106	87.3	56
1,150,000	1,589	9,500	14	95	230	207	1,912	4,818	5,916	2,562	1,280	720	511	451	320	57
1,016,000	1,404	17,400	64	208	578	573	5,726	5,981	2,757	322	136	146	126	157	157	58
169,300	234	3,300	30	159	176	175	420	536	534	133	210	55.8	171	150	107	59
480,400	662	5,180	28	138	160	712	2,631	1,808	1,743	330	79.7	60.6	81.4	117	111	60
366,600	506	3,510	45	97.2	126	199	967	2,134	1,180	180	221	310	292	200	154	61
530,000	732	6,760	36	131	449	273	3,195	2,186	1,351	533	126	107	191	144	132	62
236,600	327	3,080	41	102	311	581	858	917	309	136	237	163	80.8	136	93.9	63
300,500	414	5,310	32	72.9	103	114	625	1,905	940	228	455	135	111	108	154	64
848,900	1,172	11,000	45	179	158	149	2,926	3,959	2,776	1,564	679	450	492	346	351	65
463,500	640	4,040	10	366	244	1,089	2,185	2,165	744	223	85.2	72.2	103	115	272	66
228,100	314	2,650	30	138	174	317	313	943	761	274	381	158	101	101	109	67
500,800	690	4,870	32	123	191	165	904	2,736	2,660	433	655	82.2	99.9	130	99.7	68
599,300	828	6,480	36	182	189	211	3,584	2,735	1,254	626	204	239	240	242	229	69
560,000	774	7,000	69	205	201	187	859	3,723	1,488	464	291	1,069	267	247	245	70
457,000	631	4,140	25	266	273	687	1,363	1,769	1,739	405	281	139	263	165	220	71
269,000	371	2,410	13	219	208	547	464	631	790	122	33.8	98.8	645	386	300	72
1,289,000	1,780	14,600	77	300	315	539	3,265	8,877	5,393	1,771	213	130	136	131	206	73
329,000	455	4,500	13	166	184	388	1,294	2,112	622	243	66.4	18.1	79.8	137	117	74
887,500	1,226	11,900	83	120	164	223	2,528	5,121	3,660	2,107	256	145				75
MEAN				167.9	40.9	354.2	1,800.6	2,670.5	1,818	588.5	288.9	196.1	222.6	172.7	169.7	

WATER FLOW DATA - YEARLY SUMMARY

Colorado River, near Cisco, Utah: 1 mile below Dolores River
Drainage: 24,100 square miles. Average Discharge 7,883 cfs/5,707,000 acre-feet per year

Maximum: About 125,000 cfs (4 July 1884)
Minimum: 558 cfs (21 July 1934)
(Maximum Gage: 76,800 cfs. 19 June 1917)

Water Year AC-FT/YR.	MEAN	YEAR MAX.	YEAR MIN.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YR.
4,074,000	5,627												2,037	2,712	2,723	50
3,986,000	5,507	29,800	1,400	2,484	2,721	2,625	2,904	12,330	19,720	8,610	3,875	2,193	2,749	2,995	2,797	51
7,718,000	10,630	57,200	2,000	3,103	2,706	3,150	16,290	35,000	38,890	10,430	5,817	3,585	2,696	2,971	3,051	52
4,062,000	5,610	38,900	1,820	3,015	2,563	3,036	4,207	9,857	23,510	5,741	4,161	2,148	2,886	3,475	2,782	53
2,293,000	3,167	12,900	1,060	2,870	2,574	2,612	3,714	7,089	3,644	2,439	1,602	2,879	3,502	2,760	2,275	54
3,185,000	4,399	18,100	1,370	2,171	2,185	3,219	5,384	12,226	11,580	3,486	3,008	1,811	1,941	2,833	2,862	55
3,568,000	4,916	30,900	1,000	2,521	2,458	3,043	5,976	16,350	15,520	2,800	1,931	1,369	1,964	2,782	2,305	56
8,888,000	12,280	64,200	1,740	2,671	3,018	2,724	6,685	22,360	48,040	31,750	10,750	5,273	4,750	5,034	3,882	57
6,354,000	8,349	49,700	1,200	3,255	4,052	4,134	12,700	33,050	26,220	3,805	1,779	2,573	2,522	3,188	2,860	58
3,214,000	4,439	22,300	1,240	2,725	2,752	2,432	2,735	8,710	15,520	3,482	2,595	2,087	4,075	3,533	2,652	59
4,003,000	5,514	26,100	1,220	2,666	2,490	4,442	10,580	12,330	17,950	4,075	1,716	1,959	2,485	2,972	2,677	60
3,395,000	4,690	21,100	1,450	2,545	2,514	2,634	3,469	11,010	11,170	2,122	2,241	5,305	5,805	4,232	3,203	61
6,575,000	9,082	44,400	1,450	2,964	4,705	4,002	17,710	26,070	23,520	12,440	3,351	2,908	4,268	4,082	2,930	62
2,585,000	3,571	12,500	1,020	2,658	3,480	3,568	4,110	8,402	5,578	1,863	2,727	3,069	2,183	3,004	2,250	63
3,433,000	4,728	29,200	1,230	2,146	2,102	2,090	3,603	14,000	13,100	4,489	3,919	2,564	2,659	3,057	2,948	64
6,723,000	9,286	38,200	1,770	2,631	2,531	2,509	9,450	20,680	27,800	18,160	7,264	6,203	5,854	4,190	3,849	65
3,163,000	4,369	17,800	1,560	3,246	3,040	4,524	7,368	11,330	7,207	3,014	1,949	2,432	2,834	2,577	2,842	66
3,146,000	4,346	21,600	1,390	2,376	2,443	3,017	3,333	7,506	11,990	5,319	2,844	2,984	2,838	3,543	3,919	67
4,185,000	5,765	31,900	2,020	3,339	3,357	2,782	3,869	10,850	19,670	4,969	5,935	2,667	3,470	4,309	4,039	68
4,906,000	6,777	24,000	2,120	4,219	3,396	4,063	12,000	16,060	12,060	7,673	3,236	4,032	5,272	4,855	4,100	69
4,005,000	5,532	36,100	2,650	3,834	3,957	4,499	5,501	22,520	22,520	8,745	3,985	6,836	5,852	5,685	5,155	70
5,458,000	7,538	23,500	2,450	5,399	5,773	6,712	9,738	12,490	19,180	8,708	4,000	4,746	4,548	4,640	4,621	71
3,549,000	4,888	19,600	1,600	4,346	3,941	4,537	3,389	7,366	12,750	3,115	1,943	3,373	4,916	4,727	4,345	72
6,374,000	8,804	42,800	2,500	4,595	3,793	3,908	6,520	25,320	26,170	12,990	5,377	3,705	4,080	4,159	4,717	73
4,416,000	6,100	25,100	1,730	5,067	5,295	5,909	6,072	16,530	12,550	5,097	2,614	2,653	3,348	4,351	3,674	74
5,290,800	7,308	30,000	2,140	3,835	3,731	3,910	6,337	16,380	20,890	13,120	3,682	3,112	3,463	4,770	4,370	75
3,458,700	4,766	15,600	1,910	3,880	3,715	3,520	4,537	12,082	9,601	3,659	2,418	2,931	3,430	3,830	3,570	76
				3,467	2,627	1,943										77
MEAN				3,297	3,256	3,539	6,853	15,688	18,330	7,389	3,643	3,284	3,571	3,750	3,385	

APPENDIX C

TABLE C-1
FISHES OF THE COLORADO AND DOLORES RIVER

Species	Native or Exotic	Colorado River Moab to Westwater	Colorado River Westwater to Grand Junction	Dolores River Utah	Population Trends
Roundtail chub					
Gila robusta	N	C	A	A	O
Bonytail chub					
Gila elegans	N	R	R	X	O-
Humpback chub					
Gila cypha	N	R	R	X	O-
Colorado squawfish					
Ptychocheilus lusius	N	R	R	X	O-
Speckled dace					
Rhinichthys osculus	N	C	A	A	O
Fathead minnow					
Pimepales promelas	E	C	A	C	O
Carp					
Cyprinus carpio	E	C	A	C	O+
Red shiner					
Notropis lutrensis	E	A	A	A	+
Sand shiner					
Notropis stramineus	E	A	A	A	+
Flannelmouth sucker					
Catostomus latipinnis	N	A	A	A	O
Bluehead sucker					
Pantosteus discobolus	N	C	A	C	O
Humpback sucker					
Xyrauchen texanus	N	C	R	X	O-
White sucker					
Catostomus commersoni	E	X	A	X	O
Channel catfish					
Ictalurus punctatus	E	A	A	A	O+
Black bullhead					
Ictalurus melas	E	R	A	X	O
Southwest plains killifish					
Fundulus kansae	E	R	R-C	R	O
Largemouth bass					
Micropterus salmoides	E	R	C	R	O+
Green sunfish					
Lepomis cyanellus	E	C	C-A	A	O+
Bluegill sunfish					
Lepomis macrochirus	E	R	R	X	O+

E-exotic, or introduced
N-native

X-not taken
R-rare

C-common
A-abundant

O-no change
--decrease
+ increase

Three sucker hybrids were also found; Flannelmouth x Humpback sucker, Bluehead x White sucker; and Flannelmouth x White sucker.

APPENDIX D

TABLE D-1
Wildlife of the Colorado and Dolores River Study Areas

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Riparian[3]	Vegetative Types: Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
MAMMALIAN SPECIES								
Permanent Residents								
Desert Cottontail	C		X	X	X	X	X	X
Least Chipmunk	C		X		X		X	
Colorado Chipmunk		2						
Whitetail Antelope Squirrel		1		X	X			
Rock Squirrel	U			X	X		X	
Thirteen-lined Ground Squirrel		1	X		X		X	
White-tailed Prairie Dog		1		X		X		
Valley Pocket Gopher		3						
Apache Pocket Mouse		1	X	X		X		
Ord Kangaroo Rat		2		X		X		
Beaver	U		X					X
Western Harvest Mouse		1	X	X	X	X		
Cañon Mouse	U				X		X	
Deer Mouse	C		X	X	X	X	X	X
Brush Mouse	C		X	X	X	X		
Pinon Mouse	C			X	X	X	X	
Northern Grasshopper Mouse		2						
Desert Woodrat	C		X	X	X		X	
Mexican Woodrat		2						
Bushytail Woodrat	U			X	X		X	
Muskrat		1	X					X
Porcupine	U		X		X			
Coyote	C		X	X	X	X		
Red Fox		4						
Kit Fox		4						
Gray Fox		1						
Ringtail		2						
Raccoon		1	X					
Long-tailed Weasel		1		X	X			
Black-footed Ferret		4				X		
Badger		1	X	X				
Striped Skunk		1	X					
Bobcat		1	X	X	X		X	
Mule Deer	C		X	X	X			

1 - C= Common U=Uncommon R=Rare
2 1=90% 2=50% 3=10% 4=Unknown
3 Cottonwood, tamarisk, and willow.

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Riparian[3]	Vegetative Types: Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
MAMMALIAN SPECIES								
Summer Residents								
Little Brown Myotis		1	X					X
Yuma Myotis		2	X					X
Long-eared Tyotis		1	X					X
Fringed Myotis		4	X					X
Long-legged Myotis		2	X					X
California Myotis		1	X					X
Small-footed Myotis		1	X					X
Silver-haired Bat		1	X					X
Western Pipistrel		1	X					X
Big Brown Bat		1	X					X
Hoary Bat		1	X					X
Western Big-eared Bat		1	X					X
Pallid Bat		1	X					X
Brazilian Free-tailed Bat		4	X					X
Big Free-tailed Bat		4	X					X
Domestic Cattle	C		X	X		X		
Domestic Horse	C					X		
Winter Residents								
Domestic Sheep		1		X	X	X		
Transients								
Black Bear		4						
Spotted Skunk		3						
Mountain Lion		2	X	X	X		X	
AVIAN SPECIES								
Permanent Residents								
Sharp-skinned Hawk		2		X		X		
Cooper's Hawk		1	X		X		X	
Golden Eagle	C		X	X	X	X	X	
Marsh Hawk	U			X		X		
Prairie Falcon	U		X	X	X	X	X	

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Vegetative Types: Riparian[3]	Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
AVIAN SPECIES								
Permanent Residents								
Ring-necked Pheasant		2	X			X		
Rock Dove	C						X	
Screech Owl		2	X		X			
Great Horned Owl	U		X		X		X	
Long-eared Owl		1	X					
Common Flicker (Red-shafted)	C		X	X	X			
Hairy Woodpecker	U		X					
Downy Woodpecker	U		X					
Horned Lark	C			X		X	X	
Scrub Jay	C		X		X			
Black-billed Magpie	C		X		X			
Common Raven	U							
Common Crow	U							
Pinon Jay	C		X	X	X			
Black-capped Chickadee	C		X					
Mountain Chickadee		2	X		X			
White-breasted Nuthatch		2	X					
Canon Wren	U						X	
Robin		1	X	X		X		X
Loggerhead Shrike		1	X	X	X	X		
Starling	U		X	X		X		X
Summer Residents								
Great Blue Heron	C		X					X
Canada Goose	C		X					X
Turkey Vulture	C		X	X		X	X	
Red-tailed Hawk	C		X	X	X	X	X	
Swainson's Hawk		2						
Peregrine Falcon		2	X	X		X	X	
Kestrel (Sparrow Hawk)	C		X	X	X	X	X	
Killdeer		1				X		X
Spotted Sandpiper	C		X					X
Mourning Dove	C		X	X	X			

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Vegetative Types: Riparian[3]	Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
AVIAN SPECIES								
Summer Residents								
Common Nighthawk	C		X	X	X	X	X	X
White-throated Swift	C		X				X	X
Black-Hummingbird		2	X					
Broad-tailed Hummingbird	U		X					
Belted Kingfisher		1						X
Eastern Kingbird		1	X					X
Western Kingbird	U		X				X	X
Ash-throated Flycatcher			X	X				
Say's Phoebe	C		X	X	X	X	X	X
Willow Flycatcher (Traill's)			X					
Western Wood Peewee		1	X					
Violet-green Swallow		1		X		X	X	X
Tree Swallow		3	X					
Rough-winged Swallow	C		X				X	X
Cliff Swallow	C		X				X	X
Bewick's Wren	C		X					
Rock Wren	C						X	
Hermit Thrush		1	X					
Swainson's Thrush		3	X					
Mountain Bluebird		1	X	X	X	X		
Blue-gray Gnatcatcher	C		X	X	X			
Solitary Vireo		2	X					
Warbling Vireo		1	X					
Orange-crowned Warbler		1	X					
Virginia's Warbler		2	X					
Yellow Warbler		1	X					
Yellow-rumped Warbler (Audubon's and Myrtle)		1	X	X				
Black-throated Gray Warbler	C		X	X	X			
MacGillivray's Warbler		1	X					
Common Yellowthroat		1	X					
Wilson's Warbler	C		X					
Western Meadowlark		1	X	X		X		
Red-winged Blackbird		1	X					

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Vegetative Types: Riparian[3]	Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
AVIAN SPECIES								
Summer Residents								
Scott's Oriole	U		X	X				
Northern Oriole (Bullock's)		1	X					
Brewer's Blackbird		1	X	X		X		
Brown-headed Cowbird		1	X	X				
Western Tanager	U		X					
Black-headed Grosbeak		1	X					
Blue Grosbeak		1	X					
Lazuli Bunting		1	X					
House Finch	C		X		X			
American Goldfinch		1	X			X		
Lesser Goldfinch		2						
Green-tailed Towhee		1	X	X				
Rufous-sided Towhee	C		X	X				
Lark Sparrow		1	X		X			
Black-throated Sparrow		1		X				
Sage Sparrow		1		X		X		
Chipping Sparrow		1			X			
Brewer's Sparrow	C		X	X				
Winter Residents								
Common Goldeneye		2	X					X
Common Merganser		1	X					X
Goshawk		2	X	X	X			
Rough-legged Hawk		2		X	X		X	
Bald-Eagle		1	X				X	X
Merlin (Pigeon Hawk)		2						
Yellow-bellied Sapsucker		1	X					
Bushtit	U		X	X				
Townsend's Solitare		2	X		X			
Gray-crowned Rosy Finch		2		X		X		
Black Rosy Finch		2		X		X		
Pine Siskin		2						

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Vegetative Types: Riparian[3]	Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
AVIAN SPECIES								
Winter Residents								
Dark-eyed Junco (Oregon and Slate-colored)		1	X	X	X	X		
Tree Sparrow		2	X	X				
White-crowned Sparrow		1	X					
Transients								
Mallard	C		X					X
Gadwall		1	X					X
Green-winged Teal	U							X
Blue-winged Teal	C							X
Cinnamon Teal		2						X
American Widgeon		2						X
Northern Shoveler		2						X
Osprey		3	X					X
Whooping Crane		4						
Greater Yellowlegs		2						
Lesser Yellowlegs	U							X
Barn Swallow		1						
House Wren		1	X					
Western Bluebird		2	X		X			
Ruby-crowned Kinglet		1	X					
Water Pipit	R							X
Cedar Waxwing		2	X					
American Redstart		2						
Song Sparrow		1	X					
AMPHIBIANS AND REPTILES								
Permanent Residents								
Amphibians								
Great Basin Spadefoot Toad		1	X					X
Woodhouse's Toad (Rocky Mountain)		1	X					X

Wildlife of the Colorado and Dolores Rivers
(Continued)

Wildlife	Relative Abundance[1]	Probability of Occurrence[2]	Vegetative Types: Riparian[3]	Greasewood	Juniper	Grassland	Cliffs, Boulders	Shorelines, Pools
AMPHIBIANS AND REPTILES								
Permanent Residents								
Amphibians								
Red-spotted Toad	C		X					X
Western Chorus Frog		2	X					X
Canon Treefrog		2	X			X		X
Bullfrog		3	X					X
Lizards and Snakes								
Collared Lizard	C			X	X		X	
Long-nosed Leopard Lizard		3						
Eastern Fence Lizard (Northern Plateau-Southern Plateau)	C		X	X	X		X	
Northern Sagebrush Lizard	U			X	X	X	X	
Desert Side-blotched Lizard	C			X	X	X	X	
Tree Lizard	C		X		X		X	
Desert Short-horned Lizard		3						
Plateau Whiptail		1	X					
Western Whiptail (Northern)	C			X	X			
Racer (Western Yellow-bellied)		1	X					
Striped Whipsnake		1		X			X	
Corn Snake		1	X		X		X	
Great Basin Gopher Snake	C		X	X	X	X	X	
Utah Milk Snake		2	X	X	X	X		
Western Terrestrial Garter Snake (Wandering)		1	X					X
Western Black-headed Snake (Utah)		3						
Mesa Verde Night Snake		2		X	X			
Western Rattlesnake (midget-faded)		2		X	X			

APPENDIX E
OUTLINE AND APPLICATION OF PRINCIPLES AND STANDARDS PROCEDURES TO ALTERNATIVE ACTIONS

APPLICATION

Planning for the use and development of the nation's water and related land resources serves two major objectives - national economic development and environmental quality. Sometimes contributions to one objective do not conflict with contributions to the other, and alternative plans need not be developed. Normally, there is conflict, and alternatives must be generated.

In such a case, at least two alternative plans must be developed, one optimizing contributions to the national economic development objective and the other optimizing contributions to environmental quality. Both objectives are equal in importance and are treated with equal weight in the analysis. A series of plans is generated to satisfy each objective. Each alternative plan is then evaluated to determine how well it satisfies the objective for which it was formulated, by displaying its measured beneficial and adverse effects in the four-account system mentioned in chapter XI. In this analysis, satisfaction of the national economic and environmental quality objectives cannot be wholly complementary, so alternative plans were developed to meet both objectives.

SPECIFICATION OF OBJECTIVES

The first step in the analysis is to identify or specify the components of the two major objectives. These components must be of concern to the nation, be present in the study area or relevant to the resources being studied, be measurable or capable of being qualitatively defined, and be substantially influence by management alternatives available to the planners.

The national economic development objective can be served in two basic ways; (1) by increasing output or production of goods and services, and (2) by increasing economic efficiency in the production of goods and services.

The Colorado River area's economy is largely resource oriented. Its major goods are agricultural products, timber, and minerals; its major service is outdoor recreation. So national economic development can be served by increasing production of any of these components, provided that the share of national demand allocated to this area exceeds the current or projected supply (production). Increased efficiency in producing these goods or services will also contribute to the national economic development objective.

The initial components of the national economic development objective identified in the Colorado and Dolores River study areas were:

(1) increased or more efficient output of outdoor recreation services and uses,
(2) increased or more efficient production of agricultural products,
(3) increased or more efficient production of mineral resources,
(4) increased or more efficient hunting and fishing opportunities, and
(5) increased or more efficient water resource development.

The environments of the Colorado and Dolores River study areas possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, and cultural values. To preserve or enhance these values for the benefit and enjoyment of present and future generations of the nation would serve the environmental quality objective of Principles and Standards.

The initial components of the environmental quality objective identified in the Colorado and Dolores River study areas were:

(1) to preserve or enhance areas of natural beauty and river segments with wild, scenic, or recreational river characteristics,
(2) to preserve or enhance areas with historic, archeologic, and cultural value,
(3) to preserve or enhance endangered or threatened wildlife, fish, or vegetation,
(4) to preserve or enhance air, auditory, and water quality,
(5) to preserve or enhance freedom of choice for future resources users by avoiding irreversible or irretrievable effects,
(6) to preserve or enhance outstandingly remakkable scenic, recreational, geologic, fish and wildlife, or other similar values, and
(7) to preserve or enhance other endemic vegetation, wildlife, and their habitat.

SECOND LEVEL SPECIFICATION OF COMPONENTS

A second level specification of components was made to determine which components are relevant to the Colorado and Dolores River study areas and to the powers and actions available to planners under the authority of this study.

Components of the national economic development objective which were identified in the second level specification were increased or more efficient provision of recreation services for floatboating and associated camping, picnicking, and hiking activities; and increased or more efficient water resource development.

Components of national economic development eliminated in the second level specification were:

(1) increased or more efficient production of agricultural products within the corridor. This was eliminated because the agricultural land in the corridor is fully utilized now and will continue to be utilized at its maximum economic potential without conflicting with wild and scenic river designation.
(2) increased or more efficient hunting and fishing. These were eliminated because increased opportunities are already part of the management programs of the area.
(3) increased or more efficient production of mineral resources. There is not a large enough quantity of mineral resources in the corridor to provide a basis for a national economic development alternative, and
(4) increased or more efficient water resource development. This component was eliminated because data to determine the feasibility and economic potential of the only contemplated project that could conflict with wild and scenic river designation were not made available to planners in this analysis.

Components of environmental quality identified in the second level specification were:

(1) preservation of 13 miles (20.9 km) of wild river values in and along the Colorado River in Westwater Canyon,

(2) preservation of 38.7 miles (62 km) of scenic river values in and along the Colorado River in Horsethief and Ruby Canyons and from Rose Ranch to Cisco Wash,
(3) preservation of 4 miles (6.4 km) of recreational river values in and along the Colorado River from Cisco Wash to the confluence of the Dolores River,
(4) preservation of 6 miles (9.6 km) of wild river values in and along the Dolores River between Fisher Creek and Bridge Canyon.
(5) preservation of 25 miles (40.2 km) of scenic river values in and along the Dolores River between Gateway, Colorado, and Fisher Creek; and between Bridge Canyon and the confluence with the Colorado River,
(6) preservation or enhancement of areas of natural beauty,
(7) preservation or enhancement of air quality, and
(8) preservation of freedom of choice for future resource users by avoiding irreversible or irretrievable effects.

The following components of the environmental quality objective were eliminated in the second level specification:

(1) Protection of endangered species was eliminated because they are already fully protected by the Endangered Species Act of 1973, and
(2) Preservation of water quality was eliminated since adequate protection currently exists. Statutes, regulations, and policies will be recognized in the management plans for designated segments to provide for protection of water quality.

ASSUMPTIONS FOR COMPONENT NEED SPECIFICATION

To contribute to either objective, a plan must provide for a demand which is unmet by current or expected supply (need). The need

for increased recreational services within the Colorado and Dolores River corridors is evident from current trends. In recent years the use of rivers for floatboating has been increasing rapidly. From 521 recreation days in 1971, use of the Colorado River in Westwater Canyon has increased to over 10,000 in 1977. The same trend is evident on other whitewater rivers such as the Green or Yampa, which have already reached their maximum capacity. As these pressures increase, the Colorado and Dolores Rivers, which have not yet reached their capacity, will continue to experience rapidly increasing use. Such increases will require support facilities such as campgrounds, a picnic ground, and access. As Westwater Canyon approaches its capacity, use pressures will extend from the canyon to other portions of the study area.

Assumptions related to derivation of need for components of the environmental quality objective are:

(1) that there is a national need for the beneficial esthetic, environmental, and spiritual effects associated with the preservation of free-flowing streams that have outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historical, cultural, and other similar values.
(2) that the greatest contribution to the environmental quality objective is made by including wild river areas in the National Wild and Scenic River System; the next greatest, by scenic river areas; and the least by designating recreational river areas.

The following tables display additional information resulting from the Principles and Standards analysis. Table 1 displays differences in effects between the recommended plans and the other alternatives, plans. The difference in effects between the no action option and each alternative plan are displayed in table XI-2 and XI-4 in chapter XI.

Table 2 displays anticipated government expenses for each option and segment. All expenses listed are in addition to existing government expenses in the area. Government cost data shown in table 2 are summarized in table 3 in both discounted and non-discounted forms. Also shown in table 3 are on-site recreationist expenditure data.

TABLE E-1. Differences In Effects Between The Recommended Option and Other Options in 1990 – Colorado River

Account	Components	Recommended Option (Option 1) Segment A – Scenic Segment B – Wild Segment C – Scenic Segment D – Recreational		National Economic Development Option No Designation Increased Recreation		Option 2 Segment A – Scenic Segment B – Wild Segment C – Recreational Segment D – Recreational		Option 3 Segment A – Scenic Segment B – Wild Segment C – No Designation Segment D – No Designation	
		Total	Net*	Total	Difference**	Total	Difference**	Total	Difference**
NATIONAL ECONOMIC DEVELOPMENT	RECREATION USE								
	Boating	36,000	4,500	70,000	+ 34,000	38,000	+ 2,000	34,500	– 1,500
	Fishing	1,164	0	1,164	0	1,164	0	1,164	0
	Hunting	585	0	585	0	585	0	585	0
	Total Annual Recreation Days	37,749	4,500	71,749	+ 34,000	39,749	+ 2,000	36,249	– 1,500
	Annual Recreationist Expenditures	$522,000	63,000	999,000	+ 477,000	550,000	+ 28,000	501,000	– 21,000
	Annual Government Expenditures		$ 4,400		+ 87,600		+ 19,000		– 3,100
	Household Income	$395,000	46,500	798,000	+ 403,000	416,300	+ 21,300	362,600	– 32,400
	MINERALS AND ENERGY	Ore containing .15% U_3O_8 and .42% V_2O_5 occurs in the lower visual corridor. Since 1948 a total of only 50 tons of ore have been extracted. If the value of U_3O_8 were to increase to $42 per pound, 3000 pounds (worth $126,000) could be economically extracted. This option would increase the cost of or preclude mining in the visual corridor.		No interference with potential mineral extraction.		Less interference with mineral extraction exported than with recommended option.		No interference with potential mineral extraction.	
ENVIRONMENTAL QUALITY	PRESERVATION OF FREE-FLOWING STREAM	13 miles – Wild River 38.7 miles – Scenic River 4 miles – Recreational River 55.7 miles – Preserved		–13 Miles – Wild River –38.7 miles – Scenic River – 4 miles – Recreational River –55.7 miles – Preserved		No change – Wild River –11 miles – Scenic River +11 miles – Recreational River No change – Preserved		No change – Wild River –11 miles – Scenic River – 4 miles – Recreational River –15 miles – Preserved	
	PRESERVATION OF AREAS OF NATURAL BEAUTY	Areas of natural beauty preserved along 55.7 miles of river at the most protective level of classification they quality for. Scenic easements may be acquired 5350 acres of private land.		Areas of natural beauty not protected by inclusion in the National Wild and Scenic River System along 55.7 miles of river. No scenic easements acquired on private lands.		11 miles of river qualifying for scenic river classification will only be protected at the recreational river level. Scenic easements may be acquired on on the same number of acres.		Areas of natural beauty not protected by inclusion in the National Wild and Scenic River System along 15 miles of river. Scenic easements not acquired on 1160 acres.	
	PRESERVATION OF CULTURAL RESOURCES	Sites protected by federal and state laws. Higher level of recreation use is offset by additional efforts for protection.		Higher level of recreational use without additional protection could result in damage to sites.		No change.		Some resources of cultural value may be damaged in non-designated segments.	
	PRESERVATION OF FREEDOM OF CHOICE	Preservation options increase. Potential for economic development decreases somewhat.		Economically important options increase. Preservation options decrease.		No change except potential mineral extraction could result in loss of preservation options in segments C & D.		No change – Segments A & B. Potential economic options retained in Segments C & D.	
	AVOID IRREVERSIBLE OR IRRETRIEVABLE EFFECTS	Scenic and recreational values preserved. Some potential economic values lost.		Probable loss of many scenic and recreational values. Economic values not affected.		Potential for some loss of scenic and recreational values in Segments C & D. Lesser loss of potential economic values.		Segments A & B – no change. Potential economic values retained in segments C & D.	

* Figures in the "net" column are the difference between effects of the recommended option and the no action plan (see Table V-1).

** These differences are between the effects of the recommended option and the effects of other plans.

Table E-1. Differences in Effects Between the Recommended Option and Other Options in 1990 – Dolores River

Account	Components	Option 3 (Recommended) Segment A – Scenic Segment B – Wild Segment C – Not Designated		National Economic Development Option No Designation Increased Recreation		Option 1 Segment A – Scenic Segment B – Wild Segment C – Scenic		Option 2 Segment A – Recreational Segment B – Wild Segment C – Recreational	
		Total	Net*	Total	Difference**	Total	Difference**	Total	Difference**
NATIONAL ECONOMIC DEVELOPMENT	RECREATION USE								
	Boating	6,450	+ 1,950	12,240	+ 5,970	7,560	+ 1,110	10,620	+ 4,170
	Fishing	300	0	300	0	300	0	300	0
	Hunting	200	0	200	0	200	0	200	0
	Total Annual Recreation Days	6,950	+ 1,950	12,740	+ 5,970	8,060	+ 1,110	11,120	+ 4,170
	Annual Recreationist Expenditures	$96,000	$28,000	$177,000	$81,000	$111,000	$15,000	$154,000	$58,000
	Annual Government Expenditures	$ 8,126	$ 2,850	$ 28,276	$20,150	$ 11,076	$ 2,950	$ 13,376	$ 5,250
	Household Income	$63,500	$20,500	$159,500	$96,000	$ 75,400	$11,900	$118,700	$55,200
	MINERALS AND ENERGY	No interference with potential mineral extraction.		No interference with potential mineral extraction.		Ore containing .15% U_3O_8 and .42% V_2O_5 occurs in the lower visual corridor. Since 1948 a total of only 50 tons of ore have been extracted. If the value of U_3O_8 were to increase to $42 per pound, 15,000 lb (worth $630,000) could be economically extracted. This option would increase the cost of or preclude mining in the visual corridor.		Some interference with mineral extraction, but less than in option 1.	
ENVIRONMENTAL QUALITY	PRESERVATION OF FREE-FLOWING STREAM	6 miles – Wild River 14 miles – Scenic River 0 miles – Recreational River 20 miles – Preserved		6 miles – Wild River 14 miles – Scenic River No change – Recreational River 20 miles – Preserved		No change – Wild River +11 miles – Scenic River No change – Recreational River +11 miles – Preserved		No change – Wild River –14 miles – Scenic River +25 miles – Recreational River +11 miles – Preserved	
	PRESERVATION OF AREAS OF NATURAL BEAUTY	Areas of natural beauty preserved along 20 miles of river at most restrictive classification. Scenic easements may be acquired on 920 acres. Areas of natural beauty not legally protected on 11 miles of river qualifying for scenic designation.		Areas of natural beauty not protected by inclusion in the National Wild and Scenic River System along 20 miles of river. No scenic easements acquired on private lands.		Areas of natural beauty preserved along 31 miles of river at the most protective level of classification. Scenic easements may be acquired on 1640 acres of private land.		14 miles of river qualifying for scenic river designation will only be protected at recreational river level. Scenic easements may be acquired on 1640 acres.	
	PRESERVATION OF CULTURAL RESOURCES	Sites protected by state and federal law. Increased recreation use offset by designation in Segments A & B. Possible increased damage in Segment C not offset by legal protection.		Higher level of recreation use without additional protection results in increased damage to sites.		Sites protected by federal and state laws. Higher level of recreation use is offset by additional efforts for protection.		Sites protected by federal and state laws. Higher level of recreation use partially offset by management of recreation river area in Segment C.	
	PRESERVATION OF FREEDOM OF CHOICE	Freedom of choice for potential mineral extraction preserved in Segment C. Option for preservation of natural values in Segment C may be lost.		Economically important options increase. Preservation options decrease.		Preservation options increase. Potential for economic development decreases somewhat.		No change except potential mineral extraction would result in loss of preservation options in Segment C.	
	AVOID IRREVERSIBLE OR IRRETRIEVABLE EFFECTS	Scenic and recreational values in Segment C may be degraded, others preserved.		Probable loss of many scenic and recreational values. Economic values not affected.		Scenic and recreational values preserved. Some potential economic values lost.		Potential for some loss of recreational and scenic values in Segment C. Lesser loss of potential economic values.	

* Figures in the "net" column are the difference between effects of the recommended option and the no action plan (see Table V-1).

** These differences are between the effects of the recommended option and the effects of other plans.

TABLE E-2
GOVERNMENT COST ASSUMPTIONS
COLORADO WILD AND SCENIC RIVER STUDY

Item	Cost	No Action Option	National Economic Development Option	Environmental Quality Options		
				Option 1	Option 2	Option 3
				Segment A - Scenic Segment B - Wild Segment C - Scenic Segment D - Recreational	Segment A - Scenic Segment B - Wild Segment C - Recreational Segment D - Recreatonal	Segment A - Scenic Segment B - Wild Segment C - No Designation Segment D - No Designation
Colorado River						
Segment A:						
Boatramp at Loma	$ 3,000	$ 0	0	3,000	3,000	3,000
1. Parking	5,000	0	0	5,000	5,000	5,000
2. Sanitation	10,000	0	14,000	10,000	10,000	10,000
3. Upgrade road	300	0	14,300	300	300	300
20-unit campground at Loma	28,000	0	28,000	0	0	0
10-unit campground at Blackrock	10,000	0	10,000	0	0	0
2-3 mi. trail at Rattlesnake	10,000	0	10,000	0	0	0
2-3 mi. trail at Mee	10,000	0	10,000	0	0	0
2-3 mi. trail at Knolls	10,000	0	10,000	0	0	0
Westwater Ranger Station						
Access road	10,000	10,000	0	0	0	0
20-unit campground	30,000	30,000	0	0	0	0
Improve boatramp	5,000	5,000	0	0	0	0
Build ranger station	75,000	75,000	0	0	0	0
Subtotal Nonannual Cost		$120,000	96,300	18,300	18,300	18,300
Additional AO&M		$48,595	36,582	500	500	500

TABLE E-2 (Continued)

Item	Cost	No Action Option	National Economic Development Option	Environmental Quality Options		
				Option 1	Option 2	Option 3
Segment B:						
Hiking Trails (3 miles)	$ 30,000	0	30,000	0	0	0
10-unit campground at Little Dolores	30,000		30,000	0	0	0
Canyon overlook at Skull						
20-unit campground	30,000		30,000	0	0	0
Road access	180,000	0	180,000	0	0	0
Subtotal Nonannual Cost		0	$270,000	0	0	0
Additional AO&M			$ 14,000			
Segment C:						
Rose Ranch boat ramp						
Acquire 6 acres	$ 5,000	5,000	0	0	0	0
Improve boat ramp	5,000	5,000	0	0	0	0
Provide parking	5,000	5,000	0	0	0	0
Sanitation at Fish Ford	10,000	0	0	0	10,000	0
10-unit campground at Fish Ford	30,000	0	30,000	0	0	0
Gravel access road to Fish Ford	15,000	0	15,000	0	0	0
Subtotal Nonannual Cost		$15,000	45,000	0	10,000	0
Additional AO&M		$ 3,000	2,000	0	1,000	0

TABLE E-2 (Continued)

Item	Cost	No Action Option	National Economic Development Option	Environmental Quality Options		
				Option 1	Option 2	Option 3
Segment D:						
Dewey boat ramp						
Parking	$ 6,000	6,000	0	0	0	0
Boat ramp	8,000	8,000	0	0	0	0
5-unit campground	20,000	0	20,000	20,000	20,000	0
2-unit sanitation	10,000	10,000	0	0	0	0
Subtotal Nonannual Cost		$24,000	20,000	20,000	20,000	0
Additional AO&M		$ 4,000	1,000	1,000	1,000	0

Item	Cost	No Action Option	National Economic Development Option	Environmental Quality Options		
				Option 1	Option 2	Option 3
				Segment A - Scenic Segment B - Wild Segment C - Scenic	Segment A - Recreational Segment B - Wild Segment C - Recreational	Segment A - Scenic Segment B - Wild Segment C - Not Designated
DOLORES RIVER						
Segment A:						
Gateway boat ramp	$ 1,000	1,000	0	0	0	0
Acquire access	3,000	3,000	17,000	0	0	0
Sanitation	7,000	7,000	0	0	0	0
10-unit campground	35,000		35,000	0	0	0
Subtotal Nonannual Cost		$11,000	52,000	0	0	0
Additional AO&M		$ 3,015	6,037	0	0	0
Segment B:						
Trail through canyon	$37,000	0	37,000	0	0	0
Subtotal Nonannual Cost		0	$37,000	0	0	0
Segment C:						
Easement to Utah Bottom	$ 4,000	4,000	0	0	0	0
5-unit campground at Lake Bottom	15,000	0	30,000	15,000	30,000	0
Subtotal Nonannual Cost		$ 4,000	30,000	15,000	30,000	0
Additional AO&M		$ 1,000	4,000	3,000	3,000	2,000

TABLE E-3 - COST ASSUMPTIONS - COLORADO AND DOLORES WILD AND SCENIC RIVERS STUDY

ITEM	NO ACTION OPTION	NATIONAL ECONOMIC DEVELOPMENT OPTION	ENVIRONMENTAL QUALITY OPTION 1	ENVIRONMENTAL QUALITY OPTION 2	ENVIRONMENTAL QUALITY OPTION 3
Total Nonannual Cost-Colorado River	$159,000	$431,300	$64,300	$74,300	$37,300
Annual Additional A, O & M	55,595	53,382	1,500	2,000	500
Partial Payment (50-yr. Analysis)	10,620	28,810	4,295	4,962	2,491
Sinking Fund (25-yr. Analysis)	2,840	7,704	1,149	1,327	666
Total Annual Costs	69,055	89,896	6,944	8,789	3,657
On-site Recreationist Expenditures in 1990	459,183	540,540	63,180	91,260	42,120
Discounted Total Annual Costs- 1990	30,922	40,255	3,109	3,936	1,638
Discounted On-site Recreationist Expenditures - 1990	206,623	242,054	28,292	40,866	18,861
Easement or Acquisition Portion of Total Nonannual Cost	5,000	0	0	0	0
Total Nonannual Cost - Dolores River	$15,000	119,000	38,600	53,600	13,600
Annual Additional A, O & M	4,015	13,037	3,000	4,000	1,935
Partial Payment (50-yr. Analysis)	1,002	7,948	2,578	3,580	908
Sinking Fund (25-yr. Analysis)	259	2,057	259	518	0
Total Annual Costs	5,276	23,042	5,837	8,098	2,843
On-Site Recreationist Expenditures in 1990	68,280	108,670	42,962	85,925	28,000
Discounted Total Annual Costs - 1990	2,363	10,318	2,614	3,626	1,273
Discounted On-Site Recreationist Expenditure - 1990	30,576	48,663	19,238	38,477	12,538
Easement or Acquisition Portion of Total Nonannual Cost	7,000	17,000	0	0	0

B I B L I O G R A P H Y
COLORADO AND DOLORES RIVER STUDY

Bosworth, William C. Letter of March 24, 1978, on water rights in the Colorado River study corridor, from Sheridan Enterprises, Inc.

Bureau of Economic and Business Research, University of Utah. Utah Facts. University of Utah, Salt Lake City (1977).

Bureau of Land Management. Final Environmental Statement, Northwest Colorado Coal. Department of Interior, Washington, D.C. (1977).

Bureau of Outdoor Recreation, Colorado Department of Natural Resources, Forest Service. Dolores River Wild and Scenic River Study Report. (March, 1976).

Bureau of Reclamation. Letter of May 18, 1977, transmitting information on projects on the two rivers under study or their tributaries, from the Upper Colorado Regional Office, Salt Lake City.

Bureau of Reclamation. Paradox Valley Unit Draft Environmental Statement. Salt Lake City (1978).

Business Research Division, Graduate School of Business Administration, University of Colorado. The Plateau Region: Colorado Planning and Management Region Number 11, Colorado Regional Development Profile. Colorado Department of Local Affairs (1975).

Chenoweth, William L. Letter of August 9, 1976. Energy Research and Development Administration (now Department of Energy), Grand Junction, Colorado.

Colorado Division of Wildlife. 1975 Big Game Harvest. Denver (1976).

Colorado Division of Wildlife. "Wildlife in Danger," a supplement in Colorado Outdoors Magazine, 27:4. Denver (1978).

Colorado River Fishes Recovery Team. Colorado Squawfish Recovery Plan. U.S. Fish and Wildlife Service. (1978).

Colorado State University. "Mesa County," in County Information Service, Colorado State University (Revised annually; 1976 edition used).

Crampton, C. Gregory and Madsen, Steven K., Boating on the Upper Colorado - A History of the Navigational Use of the Green, Colorado, and San Juan Rivers and Their Major Tributaries. U.S. Army Corps of Engineers, Sacramento (1975).

Daber, James C. Letter of October 18, 1978, on Water Quality Standards, from the Colorado Water Conservation Board.

Dellenbaugh, F.S. The Romance of the Colorado River. G.P. Putnam and Sons, New York (1902).

Department of Agriculture and Colorado Water Conservation Board. Water and Related Land Resources, Colorado River Basin in Colorado. Denver (1965).

Department of Agriculture and Colorado Water Conservation Board. Water and Related Land Resources, Dolores River Basin, Colorado and Utah. Denver (1972).

Dominguez, Silvestre, and Escalante, Velez de. Diario, in Pageant in the Wilderness. Introduced, translated, and edited by Herbert E. Bolton. Utah State Historical Quarterly XVIII, Salt Lake City (1950).

Federal Power Commission. Hydroelectric Power Resources of the United States - Developed and Undeveloped, January 1, 1976. Washington, D.C. (1976).

Geological Survey. Water Supply Papers, Colorado and Utah. For the Dolores, 1937-1975; for the Colorado, 1930-1976. Washington, D.C. (published yearly and gathered into volumes every five years).

Gunnerson, James H. The Fremont Culture; A Study in Culture Dynamics on the Northern Anasazi Frontier. Peabody Museum 59:2, Cambridge, Mass. (1969).

Harmon, O'Donnell, & Henninger Associates. Visual Resource Inventory and Evaluation of the Horsethief, Ruby, and Westwater Canyons Portion of the Colorado River. Department of the Interior, Denver (1976).

Heil, R.D., and others. General Soil Map - Colorado. Colorado State University Experiment Station and United States Soil Conservation Service Denver (1977).

Historical Museum and Institute of Western Colorado. Antiquities Inventory for the Wild and Scenic River Designation of the Colorado River. Report, Bureau of Land Management contract, Grand Junction, Colorado (1976).

Hunt, Charles B. "The Geologic History of the Colorado River," in The Colorado River and John Wesley Powell. Professional Paper 669. U.S. Geological Survey, Washington, D.C. (1969).

Lohman, S.W. Geology and Artesian Water Supply of the Grand Junction Area, Colorado. Professional Paper 451. U.S. Geological Survey, Washington (1965).

Perry, Earl. Rivers of Colorado; Ten Easy River Trips in the Mountains, Canyons, and Plains of Colorado. American Canoe Association, Denver (1978).

Quinn, Michael C., Letter of August 9, 1977. State Historical Society of Colorado.

Rippeteau, Bruce E. Letter of May 10, 1977. Office of the State Archaeologist of Colorado.

Rippeteau, Bruce E. Memorandum of June 17, 1977. Office of the State Archaeologist of Colorado.

Rosar, Edward C. Letter of August 18, 1977, on water rights in the Colorado River study corridor, from Industrial Resources, Inc.

Shinn, Randall S., and Smith, Frank J. "Vegetation Inventory for the Colorado Wild and Scenic River Study." Bureau of Land Management Contract. Report, BIO/ WEST, Inc., Logan, Utah (1976).

Stanton, Robert Brewster. Down the Colorado. Edited by Dwight L. Smith. University Oklahoma Press (1965).

Stiles, Helen J. "Down the Colorado in 1889," in Colorado Magazine, 41:3 (1964).

Tanner, Faun M. The Far Country; A Regional History of Moab and La Sal, Utah. Olympus Publications, Salt Lake City (1976).

Terry, Claude E. "A filter system for determining river suitability for National Wild and Scenic River status," in Proceedings: River Recreation Management and Research Symposium. General Technical Report NC-28. North Central Forest Experiment Station, Forest Service, St. Paul (1977).

Toll III, Henry Wolcott. Dolores River Archaeology: Canyon Adaptations as Seen Through Survey. Cultural Resources Series No. 4. Bureau of Land Management, Denver (1977).

Ubbelohde, Carl; Benson, Maxine, and Smith, Duane A. A Colorado History. Pruett Publishing Co., Boulder (1972).

United States Department of the Interior. Westwide Study Report on Critical Water Problems Facing the Eleven Western States. Washington D.C. (1975).

University of Colorado Wilderness Study Group. "Recommendations for Classification of the Dolores River under the Wild and Scenic Rivers Act." Report, Boulder (1975).

Utah Division of Water Rights, Department of Natural Resources. Inventory of Water Rights, Upper Colorado River Basin, Utah. Salt Lake City (1974).

Waters, Frank. The Colorado. In the Rivers of America series. Rinehart and Co., New York (1946).

Wilson, L., and others. Soils of Utah. Utah Agricultural Experiment Station and Soil Conservation Service, USDA. Salt Lake City (1974).

As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the graphics staff of the Denver Service Center. NPS 1391

* U.S. GOVERNMENT PRINTING OFFICE: 1979—677-018/68