WILD AND SCENID ELIGIBILITY ANSLYSIS FOR GEOLOGY
San Juan Forest and BLM

DRAFT 5/3/06

I. Region of comparison:

"*The interdisciplinary team must identify the area of consideration that will serve as the basis for meaningful comparative analysis. This area of consideration is not fixed; it may be a national forest, grassland, prairie, or comparable administrative unit, a portion of a state, or an appropriately scaled physiographic or hydrologic unit. Once the area of consideration is identified, a river's values can then be analyzed in comparison with other rivers*." (FSH 1909.12-80)

For this resource, we used the following area of consideration.

__X__SW Colorado
____Southern Rocky Mountains Province
____Colorado Plateau Province
____ other (explain)

II. Analysis procedure

"*There are a variety of methods to determine that certain river-related values are so unique, rare, or exemplary as to make them outstandingly remarkable. The determination that a river area contains outstanding values is a professional judgment on the part of an interdisciplinary team, based on objective, scientific analysis*." (FSH 1909.12-80)

In order to be assessed as outstandingly remarkable, a river-related value must be a unique, rare, or exemplary feature that is significant at a comparative regional or national scale. A river-related value would be a conspicuous example of that value from among a number of similar examples that are themselves uncommon or extraordinary. (FSH 1909.12-80)

"*The following eligibility criteria are offered to foster greater consistency within the agency and with other federal river-administering agencies. They are intended to set minimum thresholds to establish outstandingly remarkable values and are illustrative and not all-inclusive. These criteria may be modified to make them more meaningful in the area of comparison, and additional criteria may be included"* (FSH 1909.12-80)

"Geology. The river, or the area within the river corridor, contains one or more examples of a geologic feature, process, or phenomenon that is unique or rare within the region of comparison. The feature(s) may be in an unusually active stage of development, represent a "textbook" example, and/or represent a unique or rare combination of geologic features (erosional, volcanic, glacial, or other geologic structures)." (FSH 1909.12-80)

A scientific analysis of the outstanding geological and mining-related features was done by groupings of streams for each watershed. That list is attached as an appendix to this document.

During the ID Team process, these values were reviewed, and an exemplary example was selected. The goal was to assure the protection of the best representative example of the ORV, rather than of all possible examples of it. In situations where an outstanding value was noted in several places, we chose a conspicuous example of that value from among a number of similar examples that are themselves uncommon or extraordinary. Where possible, the conspicuous example was chosen on a river that had ORVs from other resources, also.

III. Justification for each ORV

Dolores River McPhee to Bedrock
There are dramatic Cretaceous (dinosaur age) sandstone cliffs throughout the canyon, and in some areas the geology has confined the canyon to a uniquely persistent linear and angular form; the northerly flow of this river is rare within the region of comparison, documenting the uplift of the Colorado Plateau and the subsidence of the adjacent Paradox Basin, determining the unusual gradient of the river. Rivers and their flow patterns are the active memories of geologic history; analysis of their movement presently and across geologic time was one of the fundamental bases for the origin of the geological sciences, and remains the foundation of geology and geomorphology today. The action of the Dolores River by penetrating the hard caprock of the present-day cliffs and the linear flow pattern of its canyon demonstrate the unusual rapidity of the area's tectonic processes and the speed of the corresponding downward cutting of the river, which in turn documents the geologic-timescale history of water supply in Southwest Colorado. As an example of the beauty and immensity of Earth's geologic processes, it is truly significant to contemplate.

Bull Canyon .
The canyon walls are outstanding geology

Coyote Wash
The canyon side walls offer spectacular views of the geology

Wild Steer Canyon
Montrose BLM will analyze this. No longer on San Juan list to analyze

Animas River Deer Park Creek (E.g., Silverton) to Animas Forks
The Geology ORV is the stream canyons cutting through a complex of Tertiary Oligocene igneous intrusives (Tiy) and pyroclastics (ash flows, tuffs and lava flows) emplaced during the creation of the San Juan Volcanic field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years. Overlain on this "headwaters complex" is the more recent Silverton Caldera, with the dramatic and colorful Red Mountains. The massive mineralization in these volcanic mountains has generated world-class mineral deposits and spectacular color displays in the mountain peaks unique in Colorado. Volcanic geology has combined with the river to control its flow; the Animas River follows one of the "ring fractures" from the Silverton Caldera. Volcanic terrains are inherently geologically unstable and ephemeral- they are destroyed by nature within short geologic timespans of their creation. The San Juan Volcanic Field, and the river systems that dissect it and expose its history, are rarities in the geologic record across the world. In addition, the volcanoes of the San Juan Volcanic Field created perhaps the largest, and certainly some of the most violent naturally occurring explosions experienced by this planet since the asteroidal bombardment of the early Precambrian ended some 4 billion years ago. The uniquely complete and spectacularly beautiful exposures of this unparalleled geologic event are treasures of geology, essential to our understanding of what this world is capable of. Their value is enhanced by their completeness, because of their geologic youth and the rapid tectonic activity that has exposed them, through the agency of the river systems. These exposures represent a knowledge bank of outstanding importance, significantly because of their accessibility to study. The accessibility of these exposures to the recreationist enhances the public appreciation for Earth history and the human scale and place in it, reinforces the understanding of the interrelationship between human and geologic time, and provides a target destination for surrounding communities that rely on tourism.

Cement Creek
This is also important geologically because of its historical association with precious-metal lode and placer mining and milling (which used stream water), and the development of railroad, mining and milling technology. Although laws protecting archaeological and historical resources are adequate to protect the artifacts and structures, the essence of the ORV is the relationship of this activity to the river. Without the river, of course, there would have been nothing associated with it. Mining and settlement follow rivers across the country, and this area saw the some of the earliest settlement and mineral exploitation since initial European intrusion into the West, including possibly the French mining expeditions of the 1790's just prior to the Louisiana Purchase. If the river is not protected, much of the context of the associated historical value is permanently lost.

Piedra River Highway 160 to the forks.

The geologic ORV here is the Headwaters Complex, a timespan revealed in the canyon and valley side walls from a sequence that rivals the Grand Canyon in its exposure of geologic history

Williams Creek
The geologic ORV here is the Headwaters Complex, a timespan revealed in the canyon and valley side walls from a sequence that rivals the Grand Canyon in its exposure of geologic history

West Fork San Juan
The River has carved through a complex of Terriary Oligocene pyroclastics (ash flows, tuffs and lava flows) emplaced during the creation of the San Juan Volcanic field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years; exposures of massive layers of pyroclastics and volcaniclastics are “textbook” cross sections of the distal zones of the San Juan Volcanic field in Colorado, and the post-glacial failure of support in the volcanic cliff walls has generated massive on ongoing landslides, classic examples of slope failure, gravity slumping and colluvial movement, hosting outstanding groves of aspen which thrive on such disturbed ground. Recreational driving and hiking benefit from the colorful exposures of volcanic ash which rival those of Yellowstone National Park’s Little Grand Canyon.

East Fork San Juan River
This stream is a “textbook” example in the San Juan Mountains of a multiple advance-and-retreat alpine glacial-fluvial system in a setting of recent volcanic geology, ranging from sculpted headwaters through glaciated valley to narrow outwash canyons. There are abundant post-glacial features, including braided stream system, terminal and lateral moraines, the dramatic “gateway” entrance to the glacial valley, hanging valleys, and waterfalls. The entire reach of the river is a document of the most recent planetary glacial age, which may not yet be over, through geologic terrain that was fresh when the glaciation began and has been little altered since it ended, a valuable “classroom” for study of a phenomenon of planetary importance that is poorly understood today. The valley’s dramatic glaciated and floodwater-carved landscapes have attracted recreational use and development proposals since the settlement of this part of the state.

LIST OF OUTSTANDING GEOLOGIC AND MINING FEATURES

ANIMAS RIVER SYSTEM: ORV - <u>Geology</u>

Each river segment in the following categories may show the features or associations noted for that category but must be evaluated segment by segment.

1 No Outstanding Remarkable Value identified.
All segments not otherwise noted below.

2 Upper Animas River & Tributaries
Animas River, Deer Park to Animas Forks
Cinnamon Creek
Cunningham Creek
Deer Park Creek
Euraka Gulch
Ice Lake Creek
Maggie Gulch
Middle Fork Mineral Creek
Mineral Creek
Minnie Gulch
Molas Creek
South Fork Animas River
South Fork Mineral Creek
West Fork Animas River California Gulch

Outstanding Remarkable Value identified: Canyons cutting through a complex of Tertiary Oligocene igneous intrusives (Tiy) and pyroclastics (ash flows, tuffs and lava flows) (Theb) emplaced during creation of the San Juan Volcanic Field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years; some recent glacial and post-glacial erosional features may be present; rivers also show the result of a century of extensive precious-metal lode and placer mining and milling (1870-1970). Historical association with Silverton and Durango-Animas City settlement, railroad development, mining and milling technology development; possible connection to French exploration of area prior to 1850.

3 Middle Animas River & Tributaries
Animas River, Deer Park to Bakers Bridge
Bear Creek (Animas tributary)
Canyon Creek
Cascade Creek
Coon Creek
Elbert Creek
Elk Creek (Animas tributary)
Engine Creek

Falls Creek
Florida River through LemonResv.
Freed Canyon
Goulding Creek
Lime Creek
Mill Creek
Missouri Gulch
Needle Creek
Noname Creek
Stevens Creek
Tank Creek
Tenmile Creek
Virginia Gulch
West Virginia Gulch

Outstanding Remarkable Value identified: Deep and dramatic canyons cutting through a series of Paleozoic & Precambrian sedimentary, metasedimentary, metavolcanic rocks and igneous intrusives (Pc, PPrm, Ml, Doe, Ci, pCe, pCus, pCi) emplaced between 200 million and 2 billion years ago, representing nearly half of the geologic history of the planet, and covering the period when life evolved from the simplest sea life to the first colonization of land by complex plant and animal forms; rivers also include some mining and railroad history (see 1 above).

4 Hermosa Creek & Tributaries
Bear Creek (Hermosa tributary)
Big Bend Creek
Big Lick Creek
Buck Creek
Clear Creek
Corral Creek
Corral Draw
Deer Creek
Dutch Creek
East Fork Hermosa Creek
Elk Creek (Hermosa tributary)
Hermosa Creek
No Buck Creek
South Fork Hermosa Creek
West Cross Creek

Outstanding Remarkable Value identified: Rugged canyons cutting through a series of Paleozoic sedimentary rocks (Pc, PPrm) laid down during the early Permian and Pennsylvanian Periods; representing a time of shallow seas and shoreline terrestrial environments; shales and fossil-bearing limestones; possibly associated with mining and settlement history (see 1 and 2 above) as a very minor component.

5 Lightner & Junction Creeks & Tributaries
Castle Creek
Flagler Fork
Junction Creek
Lightner Creek

Outstanding Remarkable Value identified: Canyons cutting through a complex of Tertiary Oligocene igneous intrusives (Tiy) and Paleozoic sedimentary rocks (Pc) of the La Plata Mountains; rivers also show the result of a century of extensive precious-metal lode mining and milling (1870-1970). Historical association with La Plata, Parrot City and May Day settlement, mining and milling technology development; possible connection to French exploration of area prior to 1850.

MANCOS, MIDDLE SAN JUAN & MONTEZUMA RIVER SYSTEM: ORV - Geology

Each river segment in the following categories may show the features or associations noted for that category but must be evaluated segment by segment.

1 No Outstanding Remarkable Value identified.
All segments not otherwise noted below.

2 Upper East Mancos & Upper Middle San Juan River
East Mancos River
La Plata River, above Mayday

Outstanding Remarkable Value identified: Canyons at the headwaters of each segment cutting through a complex of Tertiary Oligocene igneous intrusives (Tiy), Paleozoic (Pc) and potentially vertebrate fossil-bearing Jurassic (Jm) sedimentary rocks of the La Plata Mountains; headwaters and upper reaches of each segment also show the result of a century of extensive precious-metal lode mining and milling (1870-1970). Historical association with La Plata, Parrot City and May Day settlement, mining and milling technology development; possible connection to French exploration of area prior to 1850.

PIEDRA RIVER SYSTEM: ORV - Geology

Each river segment in the following categories may show the features or associations noted for that category but must be evaluated segment by segment.

1 No Outstanding Remarkable Value identified.
All segments not otherwise noted below.

2 Sand Creek, Little Sand Creek & Williams Creek
Little Sand Creek
Sand Creek
Weminuche Creek (lower reach)
Williams Creek (lower reach)

Outstanding Remarkable Value identified: Lower reaches of each segment run in canyons cutting through a capstone of Cretaceous (Kd) and underlying Jurassic (Jm) sedimentary rock; canyon walls are steep and demonstrate numerous detached erosional pinnacles with islands of forest on the detached capstone; tension fractures in the capstone bordering the canyons collect snow and ice (Ice Caves) that persists yearround. Historical association with Pagosa Springs settlement (Ice Caves).

3 Piedra River & Headwaters
Cimarrona Creek
East Fork Piedra River
Middle Fork Piedra River
Piedra River
Weminuche Creek (upper reach)
Williams Creek (upper reach)

Outstanding Remarkable Value identified: In the upper reaches, deep and dramatic canyons cutting through a complex of Tertiary Oligocene pyroclastics (ash flows, tuffs and lava flows) (Tev) emplaced during creation of the San Juan Volcanic Field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years, with abundant recent glacial and post-glacial erosional features; in the lower reach of the Piedra River, canyons cutting through a series of Paleozoic & Precambrian sedimentary, metasedimentary, metavolcanic rocks and igneous intrusives (Pc, PPrm, Ml, Doe, Ci, pCe, pCus, pCi) emplaced between 200 million and 2 billion years ago, representing nearly half of the geologic history of the planet, and covering the period when life evolved from the simplest sea life to the first colonization of land by complex plant and animal forms. In a relatively short distance, the river system flows through rock from the most recent to among the most ancient exposures in western North America.

UPPER DOLORES RIVER SYSTEM: ORV - <u>Geology</u>

Each river segment in the following categories may show the features or associations noted for that category but must be evaluated segment by segment.

1 No Outstanding Remarkable Value identified.
All segments not otherwise noted below.

2 Dolores River, McPhee to Disappointment
Dolores River, McPhee Res to Dissapointment

Outstanding Remarkable Value identified: Dramatic canyon cutting through caprock of Cretaceous (Kd) sedimentary rock, creating steep cliffs and an incised channel similar to the Goosenecks of eastern Utah, but dominated by a linear pattern rather than meanders. Canyon walls composed of Jurassic sedimentary rock with potential for vertebrate fossils. Only major north-flowing river segment in the Forest.

3 Dolores River, above Taylor & upper West Dolores River
Dolores River, above Taylor
Horse Creek
Horse Creek
West Dolores River

Outstanding Remarkable Value identified: Flows through Paleozoic sedimentary rocks (Pc) laid down during the early Permian Period, representing a time of shallow seas and shoreline terrestrial environments; shales and fossil-bearing limestones; and Cretaceous to Tertiary igneous intrusives (TKi) hosting the rich ore deposits of the Rico-Dunton area; shows the result of a century of extensive precious-metal lode and placer mining and milling (1870-1970) and current minor placer mining. Historical association with mining and milling technology development; possible connection to French exploration of area prior to 1850. Area of hot springs and high geothermal gradient; Rico Dome hosts huge carbon dioxide reserves.

UPPER SAN JUAN RIVER SYSTEM: ORV - <u>Geology</u>

Each river segment in the following categories may show the features or associations noted for that category but must be evaluated segment by segment.

1 No Outstanding Remarkable Value identified.
All segments not otherwise noted below.

2 East Fork San Juan & Tributaries
Crater Creek
East Fork San Juan River
Elwood Creek
Quartz Creek
Silver Creek

Outstanding Remarkable Value identified: Excellent example of an alpine glaciated fluvial system, ranging from sculpted headwaters through glaciated valley to narrow outwash canyon; abundant post-glacial features, including braided-stream system, terminal and lateral moraines, dramatic "gateway" entrance to glacial valley, hanging valleys and waterfalls. Canyon cuts through a colorful complex of Tertiary Oligocene pyroclastics (ash flows, tuffs and lava flows) (Tev) emplaced during creation of the San Juan Volcanic Field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years; mineral specimen collecting area, including a full suite of igneous rock compositions from basalt through rhyolite, with clear to amethyst quartz crystal geodes, agate nodules and zeolites.

3 San Juan Headwaters & Wolf Creek
Beaver Creek (San Juan tributary)
Cimarron Creek
Rainbow Creek
West Fork San Juan River
Wolf Creek

Outstanding Remarkable Value identified: River flows through a complex of Tertiary Oligocene pyroclastics (ash flows, tuffs and lava flows) (Tev) emplaced during creation of the San Juan Volcanic Field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years; exposures of massive layers of pyroclastics and volcaniclastics; outstanding scenic overview of glaciated valley; mineral specimen collecting area, including a full suite of igneous rock compositions from basalt through rhyolite and rare obsidian, with clear to amethyst quartz crystal geodes, agate nodules and zeolites; Rainbow Hot Springs.

4 Navajo River
Navajo River

Outstanding Remarkable Value identified: River flows through the Chalk Mountains beneath near-vertical cliffs of Tertiary Oligocene pyroclastics (ash flows, tuffs and lava flows) (Tev) emplaced during creation of the San Juan Volcanic Field, a time of possibly the most violent volcanic explosions (caldera eruptions) of the last 4 billion years.