# Available Coal Resources of the Williams Fork Formation in the Yampa Coal Field

## Routt and Moffat Counties, Colorado

*Resource Series 41*


By

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Colorado Geological Survey



and

Alexander R. Papp
Dwight M. Kinnes
Marston & Marston, Inc.



Colorado Geological Survey
Division of Minerals and Geology
Department of Natural Resources
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Coal Availability/Recoverability Studies project
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# FOREWORD

The purpose of Colorado Geological Survey Resource Series 41 is to calculate the volume of coal that is realistically available for mining in the Yampa Coal Field of Routt and Moffat counties, Colorado. The staff of the Mineral Resources Section of the Colorado Geological Survey and Marston & Marston Inc., a geologic and mining consulting firm, performed the work from June 1999 to June 2000. The objective of this publication is to provide geological information to resource developers, government planners, and interested citizens.

Funding for this report was provided through a grant from the U.S. Geological Survey, Energy Resources Team, Coal Availability/Recoverability Studies Project under Cooperative Agreement No. 00HQAG0199.

Partial funding for this project came from the Colorado Department of Natural Resources Severance Tax Operational Fund. Severance taxes are derived from the production of gas, oil, coal, and metals.

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# ACKNOWLEDGEMENTS

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### Agencies

- U.S. Bureau of Land Management (BLM), Craig District— Janet Hook and Robert Ernst, geologists, and Jerry Strahan, mining engineer, who provided stratigraphical and GIS data. Colorado State Office- Matt McColm, for permission to access and display the data.
- Colorado Division of Minerals and Geology (CDMG)— David Berry-Coal Program Manager; Dan Hernandez-Coal Program Supervisor; Mike Boulay, Tom Kaldenbach, and Sandra Brown-Coal Program Leads; all provided general support and guidance.
- USGS— Mark Kirschbaum, Carol Molnia and Lee Osmonson, who provided guidance on the report format and advice on mining restrictions.
- Colorado Division of Wildlife— Don Schrump, Habitat Section, for providing information on habitat and potential endangered species locations in northwestern Colorado.

### Mines

- Trapper Mine— Forrest Luke and Jim Mattern supplied information on current mining and reclamation parameters, and guidance about endangered species habitats in northwestern Colorado.
- Seneca IIW and Yoast Mines (Peabody)— Mike Altavilla and Chuck McCulloh provided information on mining constraints and a mine tour.
- Empire and Foidel Creek Mines (RAG American Coal)— Rocky Thompson, geologist for Twentymile Mine, and Rick Mills, Mining Engineer, provided geological insight and information on mining constraints.

**The format of these Coal Availability reports were used as guidance:**

- Kentucky Geological Survey Information Circular 47, Salyersville South Study area, 1994.
- Indiana Geological Survey Open-File Report 95-2, Center Point Study area, 1995
- Illinois State Geological Survey Minerals 114, Mt. Carmel Study area, 1996.
- U.S. Geological Survey Open-File Report 97-469, Hilite Study area, Wyoming, 1997.
- Colorado Geological Survey Resource Series 36 and 38, Somerset quadrangle and Somerset coal field, 1998 and 1999, respectively.
- Utah Geological Survey Circular 100 (Wasatch Plateau), 1999.
- New Mexico Bureau of Mines and Mineral Resources Open-File Report 438 (NW New Mexico), 2000.
- Illinois State Geological Survey, IM 120 (Heron Coal), 2000.

Aside from land-use restrictions, technological constraints that affect the availability of coal were also considered in the coal resource estimate. Overburden depth, minimum interburden thickness, seam thickness, structural geology, and areas of previous mining were addressed in this resource assessment. Overburden depth limits ranged from 20 to 200 ft for surface resources and a 2,000 ft depth was applied as a limit for underground resources. The minimum interburden thickness deemed safe and efficient for underground mining was 40 ft. The available resource estimate is subdivided into categories of seam thickness and depth. The coal resources that were previously extracted or sterilized as a result of mining were deducted during the resource estimate. Historically, approximately 426 million tons of coal were depleted (mined or lost to mining) in the Yampa Coal Field between 1885 and 2000. More than 80 percent of the total coal production has occurred within the last 30 years, making this area the most active mining region in Colorado.

The available coal resource within the Yampa Coal Field is estimated at 16.1 billion short tons to a depth of 2,000 ft. Of this total, 1.8 billion tons is considered available as a surface minable resource (20 to 200 ft depth). The remaining 14.3 billion tons is considered an available underground resource (200 to 2,000 ft depth). Of this available underground resource, a total of 12.0 billion tons occurs in coal seams greater than 5 ft thick. Extensive coal reserves deeper than 2,000 ft exist in this area but were not considered here as economically viable in today's market. Extensive technical and financial analysis is required to determine the economical viability of these resources. However, this assessment demonstrates that the area holds an extensive resource and that the Yampa Coal Field can be considered one of the country's important future sources of high-energy, low-sulfur coal.

# ABSTRACT

The Colorado Geological Survey has completed an assessment of the available coal resources contained within the Williams Fork Formation for a 520 square mile area in northwest Colorado referred to as the Yampa Coal Field. This area contains a significant quantity of high-quality coal that is economically suitable for mining and also has coalbed methane potential. The coal seams of the Williams Fork Formation are often thick, laterally continuous and low in sulfur. Surface dragline and underground longwall operations are currently mining in this formation. Due to resource size, quality, and mining conditions, the Yampa Coal Field is perceived to be an attractive future fuel supply region for low-cost power generation. Because of this future potential, the Yampa Coal Field was selected for this resource assessment.

The Cretaceous Mesaverde Group is divided into two formations, the Williams Fork Formation and the underlying Iles Formation. Although the Iles Formation is a coal-bearing part of the Mesaverde Group and was mined in the past, the most economically attractive resource for future leasing and mining is contained with the Williams Fork Formation. Several distinct coal horizons, each containing up to five individual coal beds were identified in the resource study area. The Williams Fork coal horizons were grouped into two distinct coal groups, the upper coal group and the middle coal group (Iles Formation contains the lower coal group). Coal seams of the middle coal group are classified as high-volatile C bituminous and comprise the best quality coal in the region. Typically the coal is moderately low in ash (<10 percent), low in sulfur (< 1 percent) and has an average heating value of 11,500 Btu/lb. As a fuel source, the quality of coal from the Yampa Coal Field is attractive on an environmental standpoint due mainly to its low sulfur content. As a result, future demand for this coal is perceived to remain strong.

The resource estimate of the Yampa Coal Field was based on extensive exploration data, research into mining methods, technological constraints, and land-use restrictions. A total of 674 drill holes were compiled into a database and coalbed correlations were established. Seam limits, previous mined out areas, and other aerial restrictions were acquired digitally and used in this assessment. Coal quality was considered for seam selection but not incorporated into the model. Coal seams were modeled in Minescape™ and resource estimates were compiled for an area comprising 27 7.5-minute quadrangles.

Assuming no mining depletion, no land-use restrictions, and no technological constraints, a gross or original coal resource of 25.7 billion short tons (deposit constraint include coal beds >1.2 ft thick and depths between 20 to 2,000 ft) was calculated for the Yampa Coal Field. Significant coal resources below 2,000 ft depth are not considered economically viable. Once the gross or original resource base was established, the available coal resource was then determined. Available coal is defined as that quantity of the gross or original coal resource that is accessible for mine development under current regulatory, land-use, and technological constraints. In this assessment, these constraints accounted for a total of 9.6 billion tons. The Colorado Geological Survey estimates that the available resource within the Yampa Coal Field is 16.1 billion short tons or 62 percent of the gross or original coal resource.

While deriving the available coal resource, a significant amount of coal was excluded due to surface land-use restrictions. Resources overlain by railroads, highways, airports, electrical generation plants, power lines, petroleum wells, pipelines, rivers, lakes, cemeteries, towns, critical habitat for threatened and endangered species, and alluvial valley floors were excluded when deriving the available coal resource estimate. Certain mining operations have successfully extracted coal under some of these restrictive areas in a safe and environmentally acceptable manner. Mining under these restrictive areas require detailed site-specific evaluations. Consequently, a conservative approach was adopted in the resource assessment and all coal resources beneath restrictive areas were excluded.

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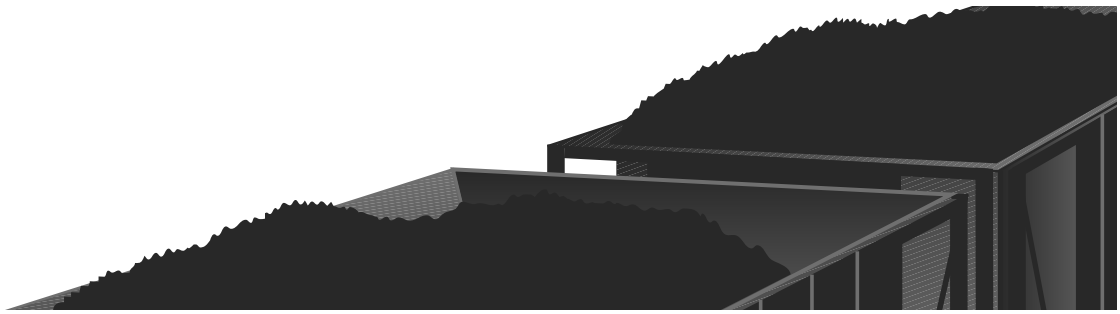


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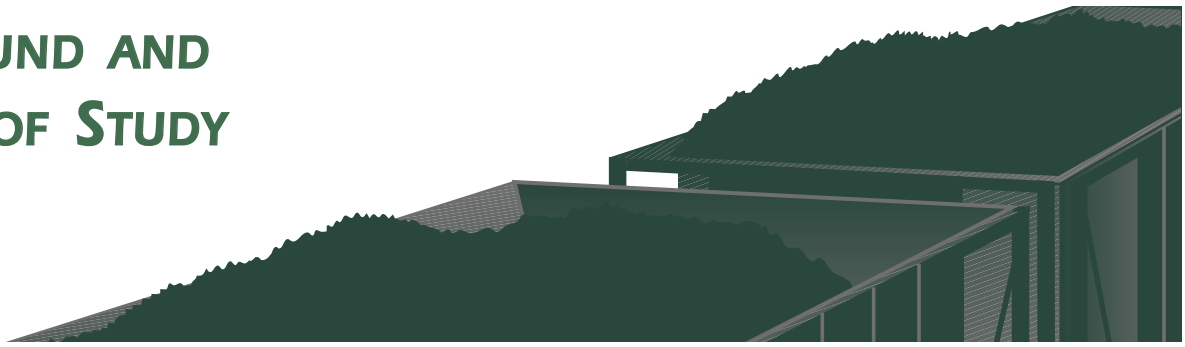
L = Linked

# Background and Purpose of Study



United States coal resource tonnage is coal that is in-place, or the "original" resource of a deposit. Original coal resources are defined as the amount of coal, containing 33 percent or less ash, in the ground prior to production and under less than 6,000 ft of overburden. The coal beds are 14 in. or thicker for anthracite and bituminous coal, or 30 in. or thicker for subbituminous coal and lignite (Wood and others, 1983). Land use, regulatory, technological, and economical restrictions on coal mining and resource recoverability were not originally part of their assessment. Consequently government and industry planners who use that resource tonnage overestimate their supply of minable coal.

In 1986, the Kentucky Geological Survey and the U.S. Geological Survey (USGS) addressed this issue in a pilot study. They developed a methodology for determining the quantity of coal resources available using current "technological" mining methods and "land use" surface restrictions (Carter and Gardner, 1989; Eggleston and others, 1990). The methods and procedures they developed resulted in collaborative programs between the USGS and several state geological surveys. The resource data generated by these "Coal Availability" studies is used by the USGS to further their coal recoverability and coal assessment activities. In their recoverability studies, recovery and economical factors are applied to the estimated coal resources, resulting in economically recoverable coal calculations. The resultant resource tonnage is less than the amount of available coal resource calculated by the State geological surveys (Rohrbacher and others, 1994).

Coal availability studies began in the Appalachian coal fields of the eastern U.S. The studies expanded into the Illinois Basin and more recently into the western United States with studies completed in the Powder River Basin of Wyoming and Montana, the San Juan Basin of New Mexico, and the Wasatch Plateau and Book Cliffs of Utah. The Colorado Geological Survey (CGS) recently completed two studies on coal availability in the Somerset coal field, Uinta Coal Region. This study of coal availability in the Yampa coal field is the second region in Colorado to be studied by the CGS. Each project has become increasingly more complex as newer computer work stations handle larger resource data sets. The Yampa coal field of the Green River Coal Region was selected because it is the most productive coal field in Colorado.

The effect of land use and technological factors on the availability of coal remaining in Colorado's coal fields is not well documented. It is important to calculate the amount of remaining coal resources available for mining so planners can make better decisions regarding future coal development. Construction of a digital database for future use is key to this process. Coal is vital to Colorado as 93 percent of the electricity generated in Colorado originates from coal. The purpose of this project is to calculate the resource of available coal from the most productive coal field in the state, the Yampa Coal Field. The available coal calculated was modified to current mining methods, and the maximum depth calculated was 2,000 ft overburden to coal because current mining in this area is less than that depth.

# Location and Physiographic Setting

The Yampa Coal Field is located in northwest Colorado, at the southeastern tip of the Green River Coal Region (**Figure 1**).

The Yampa Coal Field comprises 520 sq mi in Moffat and Routt counties, Colorado. The study area for this report is slightly smaller than that because it only consists of the shallowest, minable part of the Yampa Coal Field to a maximum depth of 2,000 ft. The towns of Craig, located in the west-central part of the study area, and Hayden, in the east-central part of the study area, are the only significant population centers. Several large ranches are scattered across the region. A section of U.S. Highway 40 links these towns and crosses the study area east to west. State Highway 13 runs north and south through Craig. The study area encompasses twelve main quadrangles, in order from west to east: Horse Gulch, Round Bottom, Castor Gulch, Hamilton, Breeze Mountain, Pagoda, Hayden, Hayden Gulch, Mount Harris, Milner, Hooker Mountain, and Rattlesnake Butte (**Figure 2**). Parts of 15 other quadrangles were also evaluated: Lay, Lay Southeast, Pine Ridge, Craig, Ralph White Lake, Rock Spring Gulch, Quaker Mountain, Pilot Knob, Wolf Mountain, Cow Creek, Oak Creek, Dunckley, Monument Butte, Axial, and Juniper Hot Springs. The townships accompanying this area are T. 4 N., R. 85–92 W., T. 5 N., R 85–94 W., T. 6 N., R. 85–94 W., and T. 7 N., R. 86–94 W.

Physiographically, the Williams Fork Formation rocks exposed in the Williams Fork Mountains mark the southern boundary of the study area. Most of the coal-bearing strata crop out along the 47 mi southern exposure of the Williams Fork Mountains. The western boundary consists of the outcrop of the

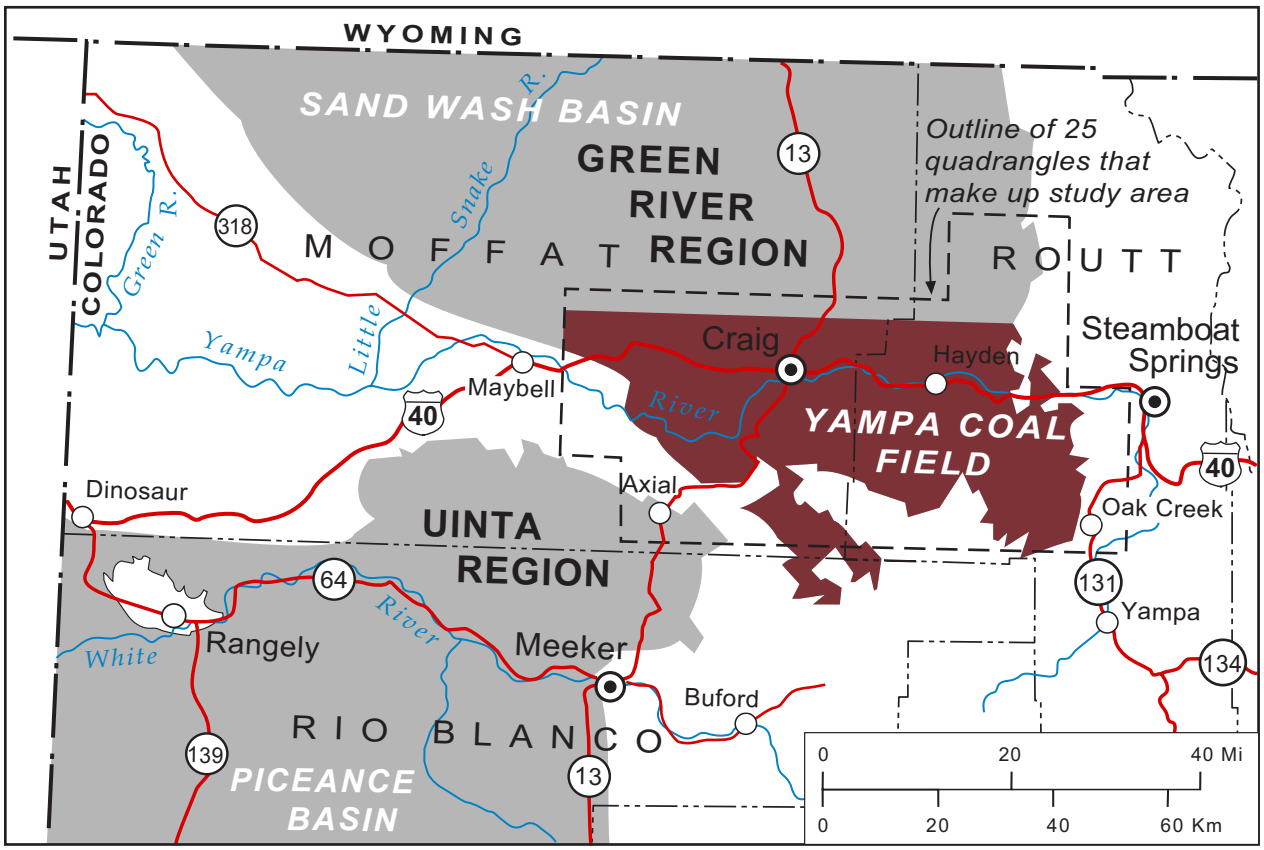



***Figure 1. Regional map of northwest Colorado showing location of the Yampa coal field.***

Williams Fork Formation and the unconformity line where the formation is covered or truncated by the Tertiary Browns Park Formation. A 2,000-ft minable depth-to-coal limit was selected as the northern boundary as Cretaceous strata deepen northwestward into the Green River Basin. The 2,000 ft overburden line varies in areal extent for different coal beds, and the map reflects a 2,500-ft deep line to the top of the underlying Trout Creek Sandstone Member of the Iles Formation to encompass all coal. Along the northeastern study area boundary the Williams Fork Formation coal resources are limited due to steeply dipping strata and Tertiary dikes and sills that may also hinder coal development.

The Yampa River flows westward through the study area (**Figure 3**). Tributaries of the Yampa River have dissected the highlands. Elevations within the area range from about 6,000 to 9,800 ft above sea level. The lowest elevation is along the Yampa River at the western boundary of the study area, while the highest elevation is in the northeastern part (Pilot Knob, 9,858 ft).

From a surface land use perspective, most of the study area is considered good grazing for livestock. One underground mine, two large coal burning power plants, and three surface coal operations comprise the main industry for the region. Surface land ownership is mostly private. According to the USGS, for the broader Colorado part of the Green River Coal Region, only seven percent is owned and administered by the Bureau of Land Management (BLM). No U.S. Forest Service land exists in the Yampa coal field. More than 69 percent of the subsurface coal ownership is federally owned (Johnson and others, 2000).

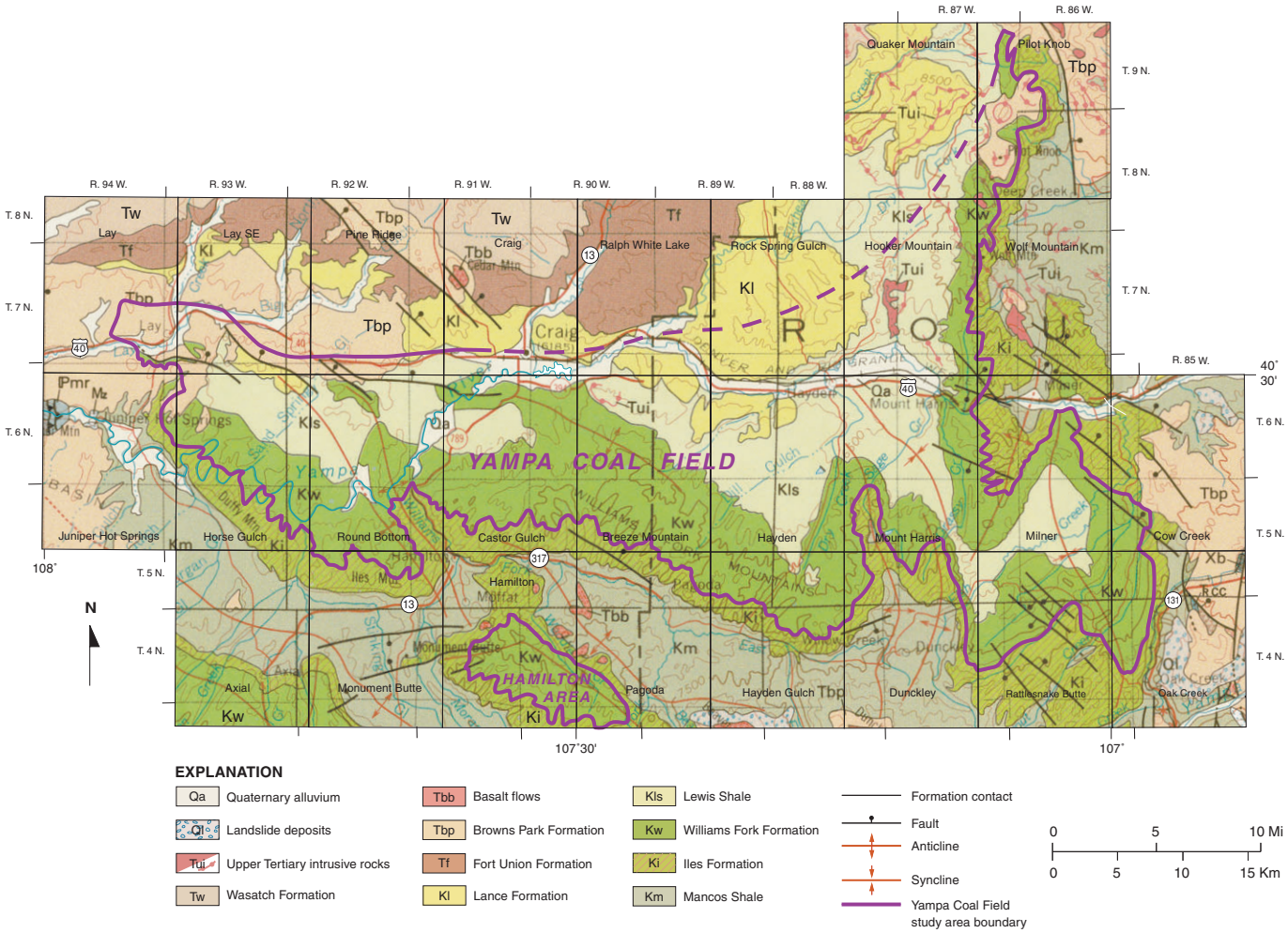
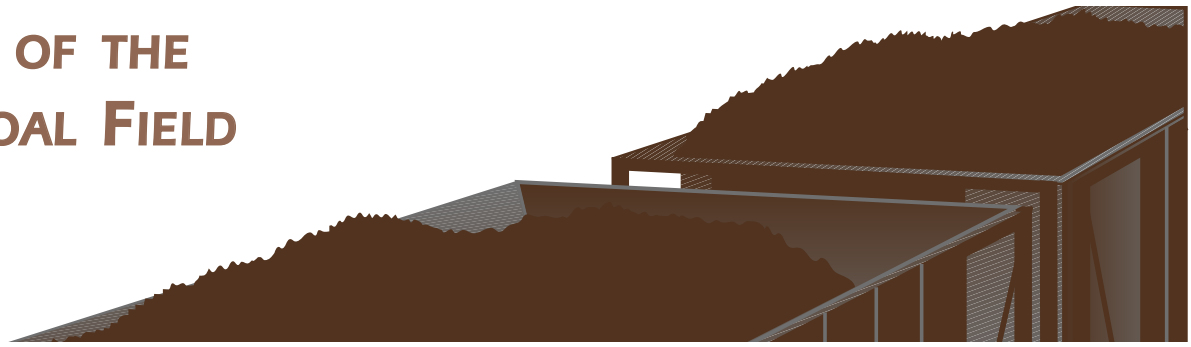



***Figure 3. Map showing general location of the Yampa Coal Field and geologic setting.***

# GEOLOGY OF THE YAMPA COAL FIELD



The Yampa Coal Field is the only designated coal field in the Colorado part of the Green River Coal Region. Most of the region lies in southwestern Wyoming. The outcrop of the Tow Creek Sandstone Member of the Iles Formation (base of the Mesaverde Group) defines the perimeter of the coal region. The Colorado part of the Green River Coal Region coincides with the Sand Wash Basin of Laramide age and is located in the northeastern part of the Colorado Plateau physiographical province. The Yampa Coal Field is bounded by the uplift of the Park Range near Steamboat Springs, the northeastern flank of the Axial Basin uplift to the south and west, and the Wyoming state line to the north.

The Sand Wash Basin is a small structural basin in northwestern Colorado, covering an area greater than 3,000 sq mi as defined by the base of the Mesaverde Group. The basin is asymmetric in shape, with the steep flank on the west side and its long axis trending northwest. The basin is comprised of over 13,000 ft of Tertiary and Upper Cretaceous strata (Tremain and others, 1996).

The northeastern part of the study area in Routt County is marked by igneous intrusions in the Elkhead Mountains northwest of Steamboat Springs. These Tertiary igneous intrusives consist of sills, dikes, and some plugs. Associated northwest-trending folds and faults also occur in the area. The high geothermal heat flow characteristic of this part of the region has locally increased the rank of the coal, producing a small resource of anthracite (Bass and others, 1955). The coal-bearing formations in the Green River Coal Region are a potential source for coalbed methane because the coal beds are numerous and thick. Two gas operators are currently (2002) exploring for coalbed methane in the Breeze Mountain and Hooker Mountain quadrangles. However, no coalbed methane production has resulted to date. Development may be hindered by groundwater-flow direction, permeability, lateral continuity, cleat development and gas content in the coals in this area (Kaiser and others, 1993). Coal beds in northwest Colorado have an average gas content of less than 200 cubic ft per short ton. Kaiser and others (1993) estimate that the coalbed methane resources of the Sand Wash Basin are at least 101 trillion cubic feet (tcf).

## CRETACEOUS AND TERTIARY GEOLOGICAL SETTING

During the Cretaceous, northwest Colorado was at 42 degrees north latitude with a humid subtropical climate (Robinson Roberts and Kirschbaum, 1995). A large epicontinental seaway known as the Western Interior Seaway (Robinson Roberts and Kirschbaum, 1995; Weimer, 1960; Zapp and Cobban, 1960) existed in what is now central North America. Shoreline sediments were deposited in this shallow seaway eastward from a tectonically active highland called the Sevier orogenic belt west of present-day Colorado. The resulting sediment supply and fluctuating sea levels created a complex depositional environment of shoreline and near-shore deposits. Up to 11,000 ft of sediment were deposited within the seaway during this time (Haun and Weimer, 1960).

Cretaceous coal-bearing rocks in the area include the Lance Formation and the Mesaverde Group (Iles and Williams Fork Formations) (**see Figure 4**). In response to tectonic activity in the Sevier orogenic belt, the Cretaceous shoreline fluctuated across northwest Colorado. In general terms, the Iles Formation strata represent general net shoreline regression while the overlying Williams Fork Formation strata represent an overall net shoreline transgression. Each thick stratigraphic unit is designated as a sequence bounded by an unconformity. Within each sequence, the top of the coal-bearing package and the base of the overlying marine shale are separated by a transgressive disconformity (Johnson and others, 2000). Coal beds stratigraphically positioned just above the thick near-shore sandstones were probably deposited as peat in lagoonal environments. Peat beds located higher in the section were deposited in swamps preserved between distributary channel systems.

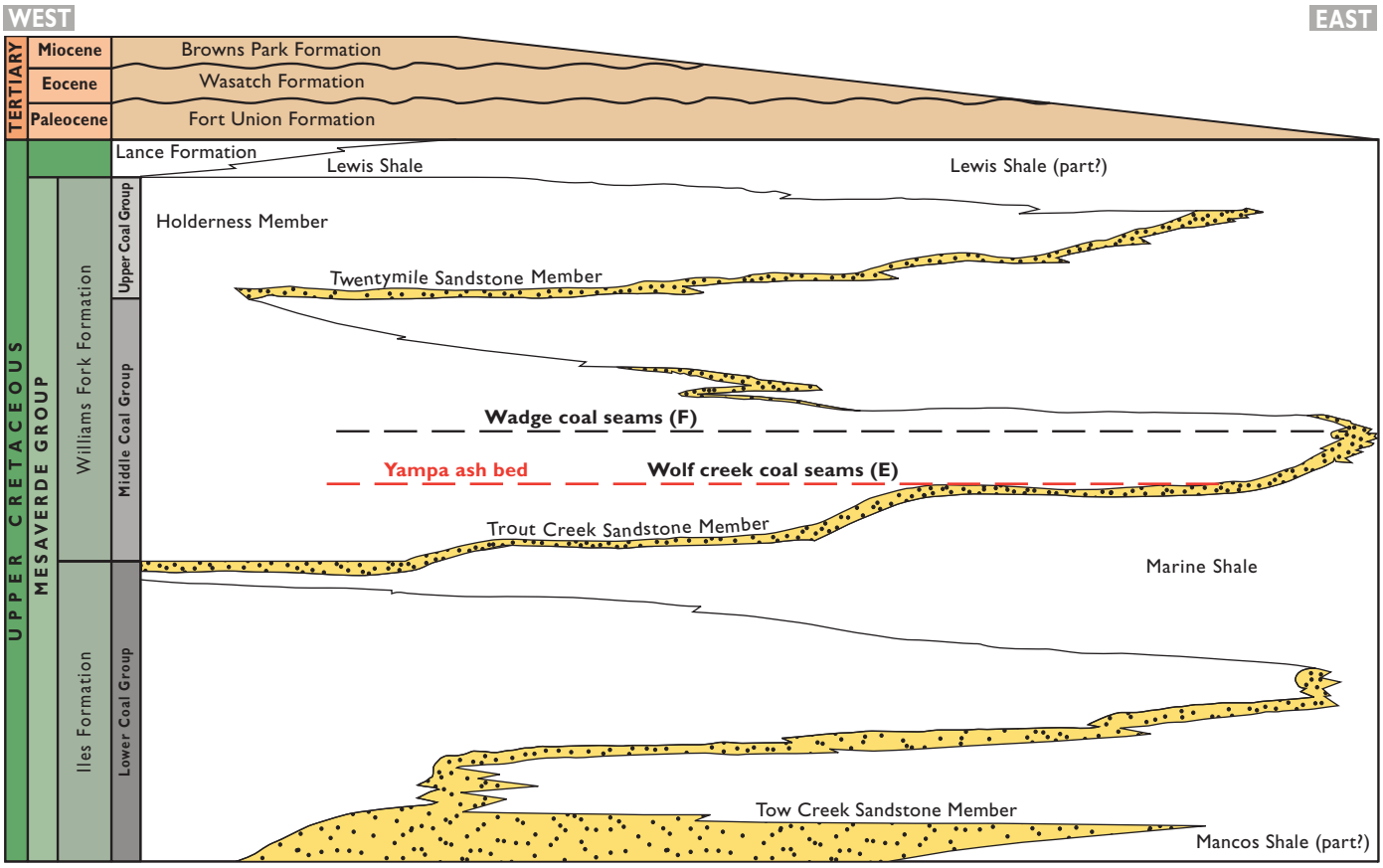



***Figure 4. Stratigraphic relationship of the Mesaverde Group showing facies development of key formations in the Yampa Coal Field.***

At the end of the Cretaceous, the Western Interior Seaway withdrew from northwest Colorado. Compressional tectonic forces associated with the Laramide orogeny folded all Cretaceous and older rocks (Johnson and others, 2000). A major unconformity separates Cretaceous units from the overlying Paleocene Fort Union and Wasatch Formations. Both formations include minor coal-bearing strata in the area. During the late Tertiary, the Axial Basin was uplifted and folded into the northwest-trending Axial Basin Anticline. Post-Mancos Shale rocks were eroded in that part of the Yampa Coal Field.

The most significant coal resources occur in the Williams Fork and Iles Formations and are ranked as high-volatile B and C bituminous coal in the lower (Iles) and middle (Williams Fork) coal groups, and mostly subbituminous rank in the upper (Williams Fork) coal group. Some of the bituminous coals are up to 30 ft thick. The overlying Lance and Fort Union coals are subbituminous B and C in rank (Murray, 1981).

The Elkhead Mountains and the Park Range are two groups of thrusted block mountains formed from intrusive and volcanic rocks that intrude into or cover sedimentary rocks of Cretaceous and Tertiary Period age in the northern Yampa Coal Field. Coal seams are either partially intruded or replaced by intrusives, and locally may be upgraded in rank. The Park Range was uplifted early in the Tertiary, coincident with the beginning of Sand Wash Basin development. During the middle and late Tertiary, extensional tectonics resulted in normal faulting and volcanism in the area. The Elkhead Mountains are the result of Miocene volcanism (Johnson and others, 2000). Faulting and folding were most active in the middle or late Tertiary.

## SURFICIAL GEOLOGY

Quaternary geology is depicted on geologic maps at a scale of 1:62,500 (Bass and others, 1955; Hancock, 1925) and from geologic hazards maps of Routt and Moffat counties at a scale of 1:126,720 (Miller, 1977 and 1975). The units described by Miller include Holocene alluvium along the Yampa River and its main tributaries, major colluvial deposits such as landslides and other Pleistocene deposits. The lateral extent of alluvial deposits along the Yampa River and its tributaries were digitized to represent the alluvial valley floor, a surface restriction for underlying coal resources. This area also includes several other restrictions to mining including the Yampa River, bald Eagle (Empire) nesting sites, endangered fish species, and low-lying parts of Craig.

## BEDROCK GEOLOGY

Rock units exposed within the Yampa Coal Field range from Tertiary intrusive rocks to the Cretaceous Mancos Shale. For the most part, the stratigraphic interval within the study area is a continuous section of lower Tertiary and Upper Cretaceous strata. Cedar Mountain is a volcanic intrusion located just north of Craig with associated scattered sills outcropping near Breeze Mountain southeast of Craig. Several other intrusive rocks lie in the northeastern part near Pilot Knob and Wolf Mountain. Upper Cretaceous lithostratigraphic units are briefly described below and are also diagrammed in Figure 4.

The **Mancos Shale** is the oldest Upper Cretaceous bedrock formation in the study area. As reported by numerous authors, the Mancos Shale is composed of thick, gray, calcareous shale with sandy intervals. The depositional environment is interpreted as offshore marine and the sandstone strata represent the prodelta facies of a deltaic system. The total thickness is about 4,900 ft (Bass and others, 1955). The Mancos Shale is exposed in the southern part of the study area along the valley incised by the Williams Fork River beneath the cliff-forming sandstone outcrops of the Iles Formation. It has a conformable but transitional contact with the overlying Iles Formation.

The **Mesaverde Group** was deposited in a deltaic system that prograded along the western edge of the Western Interior Seaway (Robinson Roberts and Kirschbaum, 1995; Weimer, 1960; Zapp and Cobban, 1960). In northwest Colorado, the Group is divided into the Iles and Williams Fork Formations, which are comprised of eastwardly-thinning wedges of shoreface strata and interbedded coal-bearing continental deposits. The wedges intertongue with and pinch out into the underlying Mancos Shale and the overlying Lewis Shale. Progradational units of shoreface strata comprise the Tow Creek Sandstone and the Trout Creek Sandstone Members of the Iles Formation. The Twentymile Sandstone Member of the Williams Fork Formation is also a progradational unit. The top of the Trout Creek Sandstone divides the Iles Formation from the overlying Williams Fork Formation. Significant deposits of coal are contained in the middle and upper coal groups of the Williams Fork Formation. The Twentymile Sandstone separates the middle and upper coal groups and the upper coal group is within the Holderness Member of the Williams Fork Formation. Less significant deposits of coal are found within the lower coal group of the Iles Formation (**Figure 4**).

The **Iles Formation** (Campanian) is a non-marine to marginal-marine deposit that measures approximately 1,300 ft thick. It consists of cliff-forming sandstone, sandy shale, shale, and coal (lower coal group). The lowest unit is the **Tow Creek Sandstone** Member that was deposited during a major regression as the shoreline shifted seaward over the nearshore or shallow muds of the Mancos Shale. The top member of the formation is the **Trout Creek Sandstone Member**, a cliff-forming, white to buff, massive sandstone that is present throughout the region. In the Yampa Coal Field it measures 50 to 130 ft thick. It is regionally extensive in northwest Colorado and is significant because it provides the basis for structure contour mapping for the Williams Fork coal beds. It has a conformable and gradational contact with the basal non-marine Williams Fork Formation. This regressive shoreface deposit is laterally equivalent to the Rollins Sandstone Member of the Iles Formation in the southern part of the Piceance Basin. Although the lower coal group of the Iles Formation has been mined extensively in the Oak Creek region east of the study area, Bass and others (1955) reported that these coal beds do not extend into the western Yampa Coal Field. However, more recent drill hole data provided by the USGS for this study indicates that between 25 and 30 ft of net coal occurs in the lower coal group of the Iles Formation in the Hayden Gulch quadrangle (see drill holes HAYG-2 and HAYG-8 in Dames and Moore, 1979a).

The **Williams Fork Formation** (Campanian) consists of siltstone, claystone, sandstone, shale, and coal. The formation ranges from 1,100 ft (Mount Harris quadrangle) to 1,880 ft (Round Bottom quadrangle) thick. Geophysical logs used in the project suggest the Williams Fork Formation is 1,900 ft thick in the center of the basin. The Williams Fork Formation can be divided into a middle coal group and the Holderness Member, which contains the Twentymile Sandstone Member, and the upper coal group.

The **Middle Coal Group** of the Williams Fork Formation contains multiple coal beds, sandstone, and shale stratigraphically positioned between the Trout Creek Sandstone and the Twentymile Sandstone. The middle coal group ranges from about 900 to 1,100 ft thick within the study area and consists of intervals of fine-grained sandstone, shale, carbonaceous shale, and coal representing cyclic deposition of marine and non-marine sediments (Weimer, 1960; Zapp and Cobban, 1960). These sediments were deposited in wave-dominated, strand plain, and barrier island facies systems, which contained brackish to fresh-water marshes and swamps, fresh-water lakes, occasional marine bays, and distributary channel systems (Siepman, 1986). The peat mires were deposited in interdistributary areas

where water table levels were close to sea level and where conditions favored thick vegetation and minimal sediment inflow. The lithofacies at the base of the unit is characteristic of lagoon, bay, salt marsh, freshwater swamp, and fluvial environments (Brownfield and Johnson, 1986). This coal group roughly correlates to the Bowie Shale Member of the Mesaverde Group in the Southern Uinta Coal Region. The Williams Fork Formation correlates to the Almond Formation in southwestern Wyoming.

Non-marine sediments accumulated low on the coastal plain as the basal Williams Fork Formation. Within the combined C and D coal beds (**Figure 5**) is a regionally extensive kaolinitic claystone or "tonstein" bed, varying 1 to 5 ft thick. This altered volcanic ash bed, called the "Yampa" bed by Brownfield and Johnson (1986), was used to correlate coal beds within the project area. This volcanic ash bed was observed in 80 drill holes, averaging 3.1 ft thick. This important marker displays high gamma (natural) and low resistance on coal geophysical logs. It is the only significant time-stratigraphic marker in the middle coal group and is used as a datum for most cross sections. From the west to the middle part of the Yampa Coal Field the Yampa ash bed lies between 259 and 113 ft (Johnson and others, 2000) above the top of the Trout Creek Sandstone Member, respectively. In the eastern part, the tonstein is less than 25 ft above the Trout Creek Sandstone Member.

Coal beds of the middle coal group are thin to thick, with many thin seams grading to carbonaceous shale. Most beds are lenticular in the middle coal group and commonly pinch out or split laterally along strike (Johnson and others, 2000). The thickest and most extensive coal beds in the middle coal group have been designated by the CGS and grouped as the B, C-D, E, F, and H coal zones shown on Figure 5. The lowermost coals, the A and A1 beds are discontinuous and not considered an important resource. The B beds are numerous and thick, but are not very laterally continuous. The C-D combined groups of coal beds are more laterally continuous, but usually contain the thick Yampa tonstein bed. East of Hayden a major split of a thick E bed has been identified. East of the split line the E beds consist of the E upper or Eu (upper Wolf Creek bed) and the E lower or El (lower Wolf Creek bed). The F bed has an upper and lower split as well throughout most of the study area. The F bed split is identified in this report as the F upper or Fu (Lennox bed), and the F lower or Fl (Wadge bed). The thickest F beds trend parallel to the paleo-shoreline, aligned in a northwest-southeast orientation. All current mining activity in the eastern part of the coal field produces from the F bed coals (Wadge and Lennox).

The H bed also splits at various localities and represents a much more laterally discontinuous coal zone than those beneath it. Two thick "barren" inter-

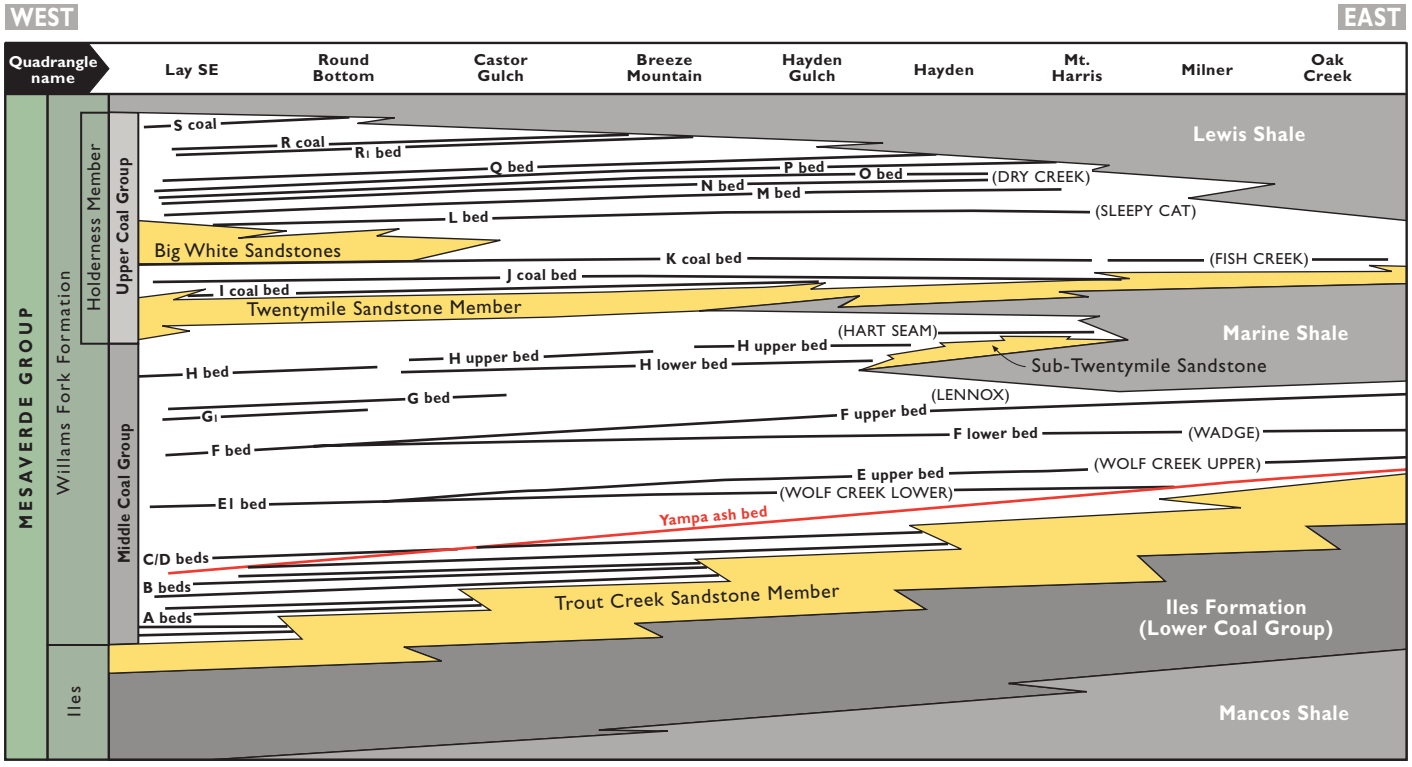



***Figure 5. Diagramatic correlation chart of coalbeds and lithofacies relationships in the Williams Fork Formation, Yampa Coal Field.***

vals of distributary channel sandstones bound the H coals in the upper part of the middle coal group. The uppermost part of the group comprises an interval of several stacked distributary channel sandstone units with a composite thickness of approximately 110 to 190 ft in the study area. The Lennox, Wadge, and Wolf Creek coal beds are the most productive coal zones mined in the study area and are correlative with the upper F, lower F, and E coal beds, respectively. The H or "Hart" seam achieves minable thickness and has been mined in the past as well. The sub-Twentymile Sandstone Member (Kiteley, 1983) is named for a prominent sandstone in the subsurface 150 ft below the Twentymile Sandstone Member on the Mount Harris quadrangle. It forms a platform for deposition of the H group of coals.

The **Holderness Member** of the Williams Fork Formation is designated for the sequence of sandstone, shale, and coal above the middle coal group (Masters, 1966). It consists of both the Twentymile Sandstone Member and the upper coal group.

The **Twentymile Sandstone Member** of the Williams Fork Formation occupies the stratigraphic interval from the last of the uppermost shale unit of the middle coal group to the base of the first "I" coal bed in the upper coal group. This regressive shoreface deposit consists of massive, white, ledge-forming sandstone with minor siltstone and shale. The unit ranges in thickness from approximately 30 to 200 ft within the study area. Approximately 205 drill holes in the study intercept the complete interval of the Twentymile Sandstone Member. The unit thins markedly east of Twentymile Park (see Figure 2 for location). On the west side of the study area the Twentymile Sandstone Member also thins and is difficult to distinguish from other similar sandstone units in its sequence as the entire section is reportedly much thicker than normal shoreface sequences. This thick sandstone contains many sedimentary structures and trace fossils that suggest deposition along a progradational shoreface. According to Benda (2000) the Twentymile Sandstone Member can be divided into a lower wave-dominated deltaic section (**Figure 6**) and an upper incised valley, wave-dominated and barrier island system interbedded with back barrier coastal plain deposits.

The **Upper Coal Group** originated in an upper delta plain environment similar to that of the middle coal group but influenced more by fluvial processes as indicated by an increase in channel and splay deposits (Bass and others, 1955). The upper coal group consists of coal, sandstone, shale, and siltstone and is about 200 ft thick on the Mount Harris Quadrangle. It is much thicker in the west where it attains 850 ft (Bass and others, 1955). The thickest coal beds in the upper coal group are comparably thinner to those in the middle coal group, and are generally not as laterally continuous. The I-J-K coal bed group, L-M-N-O-P-Q coal bed group, and R1-R-S beds are correlated within this unit (**Figure 5**).

A major marine sandstone unit 180 ft above the Twentymile Sandstone Member separates the I-K coal zone from the L-Q coal zone. This sandstone is informally referred to as the "Big white sandstone" on the western side or the Fish Creek sandstone on the eastern side. These beds have been mined in the past as the Fish Creek (I-K beds) and the Dry Creek (L-Q) coal beds. Active coal mining (Trapper Mine) in the west part of the Yampa Coal Field produces coal from the L-Q beds. In the uppermost part of the upper coal group are three thick sandstone units informally referred to as the "Three White

***Figure 6. Twentymile Sandstone Member at US 40 showing shallowing, coarsening upward deltaic shoreface sequence.***

Sandstones" of the western Yampa Coal Field. Three discontinuous, unminable coal beds were correlated as R and S coals in the western part of the coal field. The upper coal group coastal plain facies has an abrupt contact marking a major transgression with the overlying Lewis Shale (Benda, 2000). This group, in part, correlates to the Paonia Shale Member of the Uinta Coal Region (Eakins and others, 1998).

The **Lewis Shale** consists of dark gray, marine shale and is estimated to be 1,900 ft thick. It is eroded more readily than the overlying and underlying sandstone formations and conspicuously forms valleys. The lowermost beds of the Lewis Shale change progressively to the west from shale to sandstone and sandy shale as the contact with the underlying Williams Fork Formation rises stratigraphically westward. The Lewis Shale has a conformable and gradational contact with the overlying Lance Formation. The near shore marine Fox Hills Sandstone is reportedly 250 ft thick in the Yampa Coal Field (Johnson and others, 2000).

Formations overlying the Williams Fork are exposed in the Yampa Coal Field north of the study area. The uppermost Cretaceous **Lance Formation** locally has some thin coal seams. It consists of more than 1,000 ft of sandstone, siltstone, shale, and occasional coal. The productive coal beds are the Lorella and Kimberly seams (Carroll, 2000). The Paleocene **Fort Union Formation** overlies the Lance Formation and consists of interbedded sandstone, shale, and coal. It is estimated to be 1,400 ft thick (Johnson and others, 2000). The overlying Eocene **Wasatch Formation** is also greater than 1,000 ft thick. The resource potential for coal in these formations is unknown, but may be a significant subbituminous coal reserve. These formations contain thicker coals in the Wyoming part of the Green River Coal Region. The Miocene **Browns Park Formation** consists of semi-consolidated, white, tuffaceous sandstone. Drill hole Y-5 in the Lay Southeast quadrangle contains 211 ft of Browns Park Formation strata unconformably overlying the middle coal group of the Williams Fork Formation.

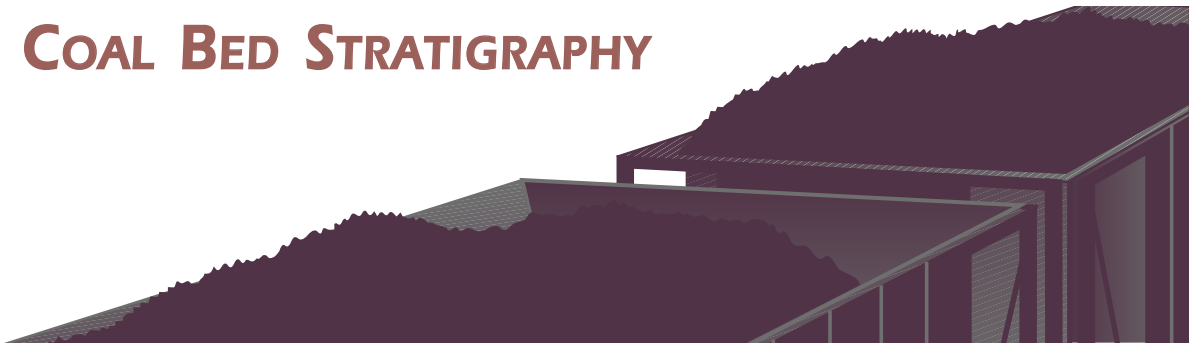
## MAIN STRUCTURAL FEATURES

The Axial Basin Uplift flanks the south and west side of the Yampa Coal Field (**Figure 3**). Based on structure contour maps derived from this evaluation, the deeper strata near the uplift typically dip less than 5 degrees north-northeast. Local faulting and steepening strata occur between Hayden and the Twentymile Park area (**Figure 3**). The strata in most of the Yampa Coal Field dip north-northeast at approximately 3 to 10 degrees, but may locally be steeper. Along the northeast part of the study area the strata dip steeply to the west. Faults are steeply dipping, primarily northwest trending, and exhibit several feet of vertical displacement. Most faults encountered during mining in the Yampa Coal Field have less than 25 ft of displacement and are typically less than five ft of displacement. Twentymile Mining Company reported a fifty-foot fault displacement east of their operations. Faults encountered at the Eagle (Empire) and Trapper Mines (**Figure 2**) in the west side of the study area may have up to 250 ft of displacement.

Several significant structural folds exist in this part of northwest Colorado. Folding occurred after deposition of the Lance Formation but before the Fort Union Formation was deposited (Tweto, 1976). In the eastern side of the Yampa Coal Field, fold and fault axes trend north-northwest. The Sage Creek and Fish Creek anticlines (**Figure 3**) are large north-plunging structures with steeply dipping limbs that form natural geologic barriers near the Seneca II-W and Yoast Mines. The Twentymile Syncline is a doubly plunging structure in the Twentymile Park area, and the Tow Creek anticline warps the edge of the Park.

In the Craig area, gently rolling hills topographically reflect northwest-trending synclines and anticlines. A prominent northwest-trending syncline, three miles south of Craig named the Big Bottom Syncline (Fenneman and Gale, 1906), is close enough to the mining region of the Williams Fork Mountains to effectively modify the structural model of coal less than 2,000 ft deep. Other significant folds there are the Round Bottom Syncline, the Williams Fork Anticline, and the Breeze Mountain-Buck Peak Anticline. In the Hamilton area, the Hart Syncline consists of a doubly plunging structure that contains a separate isolated section of Williams Fork Formation just south of the Yampa Coal Field. Coalbed methane wells drilled near Craig indicate several lower Williams Fork coalbeds less than 2,000 ft deep. This significantly modifies previous calculations for coal in this area since no coal was included in the 1950s resource calculation by Bass and others (1955) because of the lack of drill hole information.

# Principal Coal Bed Stratigraphy



Detailed coal bed stratigraphic nomenclature was derived by extensive coal bed correlations by the CGS. Coal beds were designated using alphanumeric values in stratigraphic order from bottom to top as the "A" through "S" beds respectively (**Figure 5**). These coal beds were grouped as coal zones and correlated continuous throughout the Yampa Coal Field. However, individual beds within the group may split or pinchout or be eroded by paleochannels. For example, coal bed F in the east part of the Yampa Coal Field may not necessarily be the same exact bed 40 mi to the west. The principle groups of interest contain beds that can potentially be mined or are currently being mined in the study area. A stratigraphic database was originally provided by the USGS. Additional data was then incorporated into a new database and the CGS assigned the coal bed nomenclature. The seams varied in thickness and, in some cases, thin unminable coal beds were designated codes that were correlative to their thick, minable counterparts.

## Middle Coal Group

The middle coal group nomenclature adopted by the CGS for this study was modified from USGS Map C-123 (Johnson and Brownfield, 1988). The principle coal beds modeled in the middle coal group include the B, combined C and D, E upper and E lower, F upper and F lower, and the H upper and H lower seams. Mapping and resource calculations were done for these five principle coal zones. Coal bed nomenclature used in this study is compared to other coal studies in the Yampa Coal Field in **Figure 7**.

USGS correlations for these same coal beds vary slightly across the Yampa Coal Field (Johnson and Brownfield, 1988). In the western part, coal beds in USGS zone A (Johnson and others, 2000) of the middle coal group (coal beds A through D of this report) have a net thickness up to 93 ft (from 23 coal beds). In the eastern part, the same beds have a net thickness of only 21 ft.

In this study, the basal Williams Fork coals are correlated as coals A and B. These coals consist of several thin and thick coal beds that are laterally discontinuous. Most of the coal between the Trout Creek Sandstone Member and the Yampa ash bed are of similar description. The A and B coals were not deposited in the east side of the coal field. In contrast, the C and D beds are thick, continuous seams in the west part of the coal field. They appear quite minable, but may have high ash content, due to its close approximation to the Yampa ash bed. Both of these seams also were not deposited in the east part of the Yampa Coal Field.

The main minable coals of the middle coal group are located in the middle of the group. The E coals are the lowest stratigraphically continuous coals across the entire coal field. The F coals are also very continuous throughout the study area. Both of these coal zones increase in thickness and number of beds from 4 coal beds in the east to about 13 coal beds in the west. The H coal beds are thick but contain laterally discontinuous coal beds that occur sporadically throughout the western and central parts of the study area.

## Upper Coal Group

The upper coal group, essentially a subbituminous surface minable resource, was modeled by grouping those coals within close proximity to each other. The I, J, and K beds were modeled together, while the L, M, N, O, P, and Q beds were modeled as a separate zone. It should be noted that the stratigraphic nomenclature used by personnel at the Trapper Mine for the upper coal group is in reverse alphabetic order from either CGS or USGS nomenclature (Figure 7). Geologists typically assign alphanumeric values beginning at the base of the geologic section. USGS and CGS nomenclature is similar to that established earlier by Utah International for the Eagle (Empire) Mine area with the A zone within the basal middle coal group of the Williams Fork Formation. **Table 1** provides commonly used mining bed names and the CGS nomenclature used in this report. It also includes the average and maximum thickness of the principal coal beds in the CGS database. Thin parting (less than three in.) is included in these thicknesses. Combined beds may include much more significant parting. Refer to "technological restrictions and computer techniques" sections for further information on parting.

***Table 1. Bed names and thickness ranges of principal coal beds, western part of Yampa Coal Field. Data based on 400 of the 674 drill holes in the study area. Criteria used for bed thickness may include parting.***

| Upper Coal Group Bed Names (Common name of bed) | Fish Creek | | | Carey | Dry Creek | | | | | Higher Coals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Letter Designation | I | J | K | L | M | N | O | P | Q | $R_1$ | R | S |
| Avg. Thickness (ft) (Individual beds) | 2.7 | 2.3 | 2.9 | 3.5 | 3.3 | 3.1 | 2.8 | 3.3 | 3.2 | 3.6 | 3.3 | 2.8 |
| Maximum thickness (ft) | 12.0 | 11.0 | 21.0 | 38.0 | 18.5 | 29.0 | 9.0 | 13.5 | 10.0 | 8.0 | 13.0 | 6.0 |

| Upper Coal Group Bed Names (Common name of bed) | Lower Coals | | | Yampa Bed Coals | | Upper/Lower Wolf Creek | | Wadge | Lennox | Hart Seam | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Letter Designation | $A_1$ | A | B | C | D | E lower | E upper | F lower | F upper | G ($G_1$) | H upper | H lower |
| Avg. Thickness (ft) (Individual beds) | 2.4 | 3.0 | 4.6 | 4.8 | 4.9 | 4.4 | 4.7 | 5.5 | 5.4 | 3.7 | 2.9 | 4.9 |
| Maximum thickness (ft) | 5.0 | 13.0 | 17.0 | 18.0 | 19.0 | 16.9 (combined) | | 37 (combined) | | 14.0 | 17.0 | 41.0 |

# METHODOLOGY–COMPUTER TECHNIQUES

## PREPARATION OF DATA

Stratifact™ was used to assemble and manipulate the stratigraphic database. Seam correlations were entered in Stratifact™, supplemented by several cross-sections in which geophysical logs were utilized. Correlations were established or modified in the database, and then data were transferred into Microsoft Access™, where coal zone files were established. Only those drill holes with complete stratigraphic thickness were used in the resource calculations for each seam. GIS coverages were digitized and then converted to CAD .dxf files to assimilate into Mincom's MineScape™ program. Drill hole locations, land use restrictions, and mine maps were assembled and digitized to produce a map of mined-out areas for each coal bed. Bed outcrops were constructed based on project data, geologic mapping and topographic mapping and then digitized. Split lines for the E, F, and H beds were defined, mapped, and digitized. Burn areas shown on the geologic map by Johnson (1987) for Round Bottom quadrangle were digitized. Geologic maps were digitized as well.

Williams Fork Formation coals in the Yampa Coal Field are generally bituminous in the middle coal group and subbituminous in the upper coal group. Using the calculation factors for these types of coal (Wood and others, 1983), resources were calculated for each coal zone. Assuming the beds to be lenticular and laterally continuous, resource calculations were based on total coal (>1.2 ft thick) within individual beds. This method eliminates thin rider beds and calculates resources on the thickest minable seams only. This criteria is typical for modeling the thinnest coal beds recovered at Trapper Mine. Resources were designated by thickness criteria but many underground mines will disregard the thinner categories. Coals less than 2.3 ft thick are only calculated if the parting criteria for thickness do not completely eliminate them.

Stratifact™ drill hole data was added to the modeling software and compiled with a 30-meter grid Digital Elevation Model (DEM). Structure contours and overburden thickness maps were obtained from this integration process and generated for each zone. The geologic line data was combined to delimit the zero depth and overburden thickness lines to complete "the model". Computer files for location, coal bed thickness, and point identification were created. The drill hole data are at such density within the borders of the study area that edge effects from outside coal resources are negligible. Reliability categories were assigned from these data files and used to produce grid polygons of the study area (Wood and others, 1983). The overburden isopach was overlain on the reliability layer and the total area for each part was determined.

Areas affected by land use restrictions were digitized from the 1:100,000 quadrangle Digital Line Grid (DLG). Historic and active mines outlines were digitized from the mine plan maps available. The mined-out areas were applied to the original resource layers to obtain remaining resources. Production data by coal zone was applied to each bed calculation. Technical restrictions were applied to the remaining resource layers for each coal bed. The land use restriction buffers were applied to the bed calculations.

## EXPLANATION OF COMPUTER CALCULATIONS

The geological reserve model was created using the StratModel™ application in the MineScape™ mine planning system developed by Mincom, Inc. StratModel™ is widely used in the coal mining industry to prepare detailed stratigraphic models of coal deposits for use in mine planning. StratModel™ builds stratigraphic models by combining a list of stratigraphic rules and parameters with a 3-dimensional graphical database of drill hole data.

A DEM model of the topography in the study area was created from ASCII DEM 7.5-minute quadrangle data collected from the USGS. The USGS DEM 30-meter resolution topographic data was converted from UTM to Colorado State Plane coordinates and compiled into MineScape™. A 100-foot resolution grid of topography was then created for use within the geologic reserve model.

Stratigraphic rules and modeling parameters were defined prior to modeling and stored in what is called a "schema". The StratModel™ schema is a named specification that stores modeling parameters and corresponding stratigraphic information for a geological model. A total of 28 coal beds and 2 sandstone units were included in the model and defined in stratigraphic order within the schema. The schema also contains the following modeling parameters:

| Modeling Parameter | Value |
|---|---|
| Thickness Interpolator | Planar (modified triangulation) |
| Surface Interpolator | FEM (Finite Element) |
| Search Radius | 26,400 ft (5 mi) |
| Extrapolation Distance | 26,400 ft (5 mi) |
| Minimum bed thickness | 1.16 ft (14 in.) |
| Minimum separable parting thickness | 0.25 ft (3 in.) |
| Resource Lithologies | Colorado |

The correlated drill hole data was imported into StratModel™ for modeling. The software program stores each drill hole as a three-dimensional graphical object within the three-dimensional Computer Aided Drafting (CAD) system associated with it.

During the modeling process, StratModel™ reviews the coal beds defined in each drill hole and compares them with the parameters defined in the schema. During modeling, the decimal fraction of parting material (non-coal) is determined for each seam being modeled in every drill hole. Parting material that exceeds the minimum separable parting thickness (3 in.) defined in the schema is accumulated as parting. Parting material less than the minimum separable parting thickness is accumulated as coal. StratModel™ models the full thickness of each coal bed based directly on the drill hole data. Parting is modeled as the decimal fraction of parting material. Therefore, net coal thickness is determined by factoring the full coal bed thickness by one, minus the decimal fraction of parting.

StratModel™ interpolates roof structure, floor structure, coal bed thicknesses and interburden thickness across the project area based upon the stratigraphic relationships of the coal beds defined in the schema and the coal beds existing in drill hole data. StratModel™ also determines whether or not a seam unit is depositionally "pinched out". During modeling StratModel™ determines if an interpolated roof and floor of a coal bed will intersect a drill hole without that bed defined. If the interpolated roof and floor values intersect a drill hole, then the coal bed is "pinched out"; otherwise the interpolated roof and floor values are used. The locations of "pinched out" or non-depositional coal beds are directly proportional to the distances between surrounding drill holes and the magnitudes of the coal bed thicknesses in surrounding drill holes. The final roof, floor, coal bed thickness and interburden thickness values were converted to a 500-foot resolution grid.

StratModel™ determines coal bed outcrops by intersecting roof and floor structures with topography. This data is compared to known coal seams mapped on the geologic base maps and modified where necessary in areas of steeply dipping strata. During modeling roof and floor structures are interpolated past the extent of topography. The extent of the coal beds is then determined by intersecting the topography by the roof and floor structures (**Figure 8**).

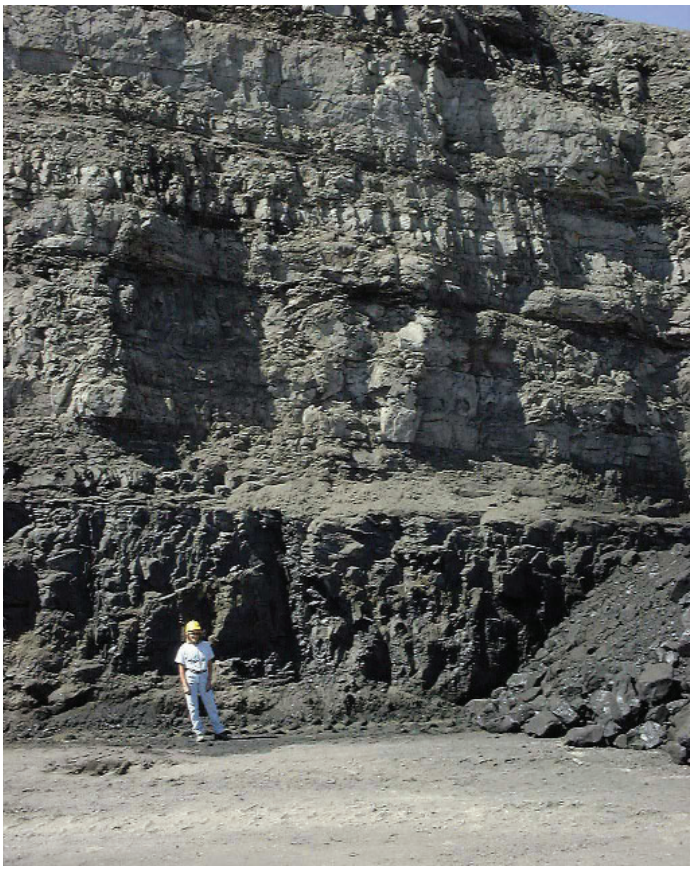
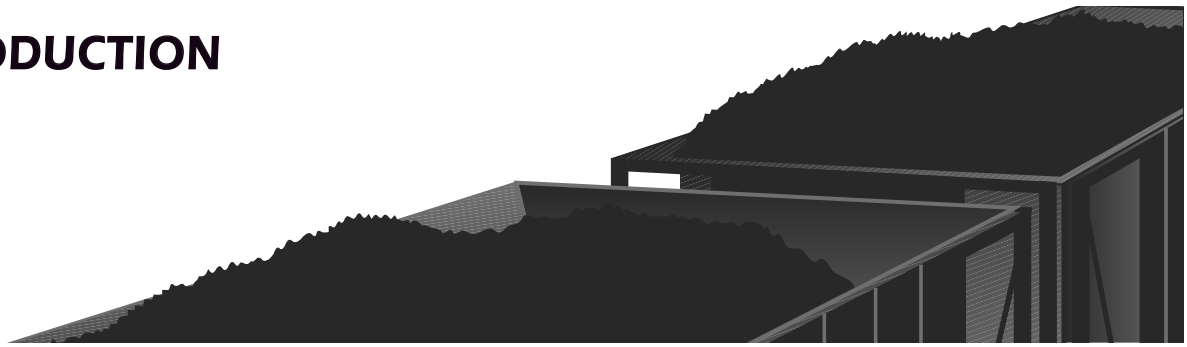


***Figure 8. 12 ft thick Wadge coalbed (F lower seam), Peabody Seneca II-W Mine.***

Volume and tonnage estimates were determined using the polygonal extents of coal. The maximum depth was determined where the depth to the top of the Trout Creek Sandstone Member is 2,500 ft below surface. Resource reliability and the extent of land use and technological restrictions are then subtracted from the volume. Approximately 197 drill holes intercept the Trout Creek Sandstone Member top. All coal bed tonnage estimates were restricted within this extent.

A series of resource reliability polygons were created for each coal bed in the geological model. Resource reliability polygons were created for "measured", "indicated", and "inferred" classes with radii of 1,320-ft (¼ mi), 3,960-ft (¾ mi), and 15,840-ft (3 mi), respectively (Wood and others, 1983). Hypothetical tonnage estimates were not compiled. The resource reliability polygons were created from drill hole locations plotted for each coal bed.

# COAL PRODUCTION



## HISTORICAL MINING AND PRODUCTION

After the railroad arrived in the region in 1909, northwest Colorado became a booming coal region. Early coal mining began in the Oak Creek area with underground operations in the Iles Formation. In the Mount Harris quadrangle, coal was mined largely from the Williams Fork Formation. Since then, nearly 302 million tons of coal have been produced from 194 mines in the Yampa Coal Field through 2000 (Carroll, in prep; Boreck and Murray, 1979). The cumulative Cretaceous coal production (Iles, Williams Fork, and Lance coals) constitutes 27 percent of the historic state coal production, making the Yampa Coal Field the greatest coal producing field in the state. Using an 80 to 90 percent depletion rate from surface mining and a 50 to 64 percent recovery rate for underground mining, it is estimated that 421 million tons of coal have been depleted from all formations in the Yampa Coal Field. More than 93 percent of this coal was mined from the Williams Fork Formation with total cumulative production of 280 million tons mined from 108 middle and upper coal group mines in the Yampa Coal Field.

Large historical mines (active before 1969) that produced more than 100,000 tons are listed on **Table 2**.

***Table 2. Historical coal mines with coal depletion exceeding 100,000 tons from the Williams Fork Formation.***

| Historic Mine Name (Alternate Name) | Dates of Operation | Production (Tons) | Depletion (Tons)[1] | Bed(s) Mined | Bed Thickness (Ft) | Kwf Coal Group[2] |
|---|---|---|---|---|---|---|
| **Black Dan Strip (Osage)** | 1947–1948 (1949–1961) | 2,310,656 | 2,888,320 | Wadge | 8 | Middle Coal |
| **Cardinal Mine** | 1958–1968 | 385,593 | 771,186 | Wolf Creek | 12 | Middle Coal |
| **Crow Bar Mine** | 1940–1958 | 386,402 | 772,804 | Dry Creek | 8–10 | Upper Coal |
| **Dry Creek Mine (Hayden Valley)** | 1919–1928 (1929–1939) | 226,770 | 453,540 | Dry Creek | 8–10.5 | Upper Coal |
| **Elk Creek** | 1917–1938 | 88,785 | 178,570 | Wolf Creek | | Middle Coal |
| **Harris Mine** | 1914–1958 | 8,742,236 | 17,484,472 | Wadge | 9.2 | Middle Coal |
| **Knez Mine** | 1924–1953 | 77,451 | 154,902 | Unknown | 10 | Upper Coal |
| **McGregor Mine (McNiel)** | 1915–1928 (1929–1940) | 981,583 | 1,963,166 | Wadge, Wolf Creek | 8 | Middle Coal |
| **Seneca Strip No.1** | 1964–1968 | 1,705,518 | 2,131,897 | Wadge | 8 | Middle Coal |
| **Sleepy Cat Mine** | 1925–1949 | 69,673 | 139,346 | Sleepy Cat | 5–10 | Middle Coal |
| **Wadge No.1 Mine** | 1917–1951 | 2,055,399 | 4,110,678 | Wadge | 8.5 | Middle Coal |
| **Wadge No.2 Mine** | 1917–1951 | 137,023 | 274,046 | Wolf Creek | 8 | Middle Coal |
| **Wise Hill No.3 & No.4** | 1962–1971 | 1,232,699 | 2,465,398 | F | 16 | Middle Coal |
| **Wise Hill No.5** | 1971–1979 | 1,207,960 | 2,415,920 | F | 10–14 | Middle Coal |
| **Wolf Creek Mine (Pinnacle-Kemmerer No.1)*** | 1915–1927 (1928–1934) | 247,553 | 495,106 | Wolf Creek | 10–18 | Middle Coal |
| **Yampa and Roman Mines** | 1920–1925 | 50,475 | 100,950 | Wadge | 8.3 | Middle Coal |
| **Total coal lost in mining** | | **19,905,776** | **36,800,301** | | | |

* Pinnacle-Kemmerer No.1 Mine also produced from the A zone of the lower coal group, Iles Formation, but these production numbers are only for the Williams Fork Formation production.

1 All production and depletion figures are in short tons of coal. Data from Boreck and Murray, 1979.
2 **Kwf** = Cretaceous Williams Fork Formation.

For each mine, the dates of operation, total production and estimated depletion, beds and thickness of beds mined, and coal group represented are provided. Both surface and underground mines have operated in the past. The Harris Mine was the largest mine, producing 8,742,236 tons of coal from 1914–1958 (**Figure 9**).

resource was depleted during that time frame. The Foidel Creek Mine began operations in 1983 accessing the Wadge coal bed from a high wall of an old surface mine operated as the Energy Mines.

***Figure 9. Manual mining methods, Yampa Coal Field, 1910.***

Although most of the coal is located in Moffat County, cumulative production records show that 220 million tons of coal, or 21 percent of the state cumulative production, has come from Routt County. Moffat County has produced 82 million tons. Iles Formation coal production slowed in the latter half of the 20th Century as environmental restrictions on coal favored production of the cleaner Williams Fork coal. Today all coal production in the Yampa Coal Field comes from the Williams Fork Formation because of its superior quality and combustion characteristics. Most of the coal extracted from the Williams Fork Formation is produced from either the Wadge (F-lower) or Fish Creek/Dry Creek (I-K and L-Q) seams.

The closure of the mines in Oak Creek by the early 1960s was the end of Iles Formation coal production. With the advent of large-scale surface mining equipment in the 1960s, surface mining began in the Williams Fork Formation at Twentymile Park. The Edna and Energy Mines were just two of more than 40 mines that operated during the 1960s and 1970s. Much of the Twentymile Park surface mining

## CURRENT PRODUCTION AND MINING

Today, the Yampa Coal Field produces more coal than any other single coal field in Colorado. In 2000, 10.84 million tons of coal were produced in the Yampa Coal Field (Colorado Division of Minerals and Geology [CDMG] data, 2001). This total comprises production from four operating mines including the Trapper Mine (operated by Trapper Mining Co.), Peabody Coal Company's Seneca II-W and Yoast surface mines (operated by Seneca Coal Company), and RAG American Coal Company's Foidel Creek Mine (operated by Twentymile Coal Company). These four mines account for 37 percent of the state's total output in 2000 (Wray and others, 2001) and employ over 500 miners. The Foidel Creek Mine is the most productive coal mine in the state and holds various U.S. production records. The mine produced 7,221,703 tons of coal in 2000. More coal was produced in Routt County in 2000 than any other Colorado county, accounting for approximately 30 percent of the state total output.

The Foidel Creek (Twentymile) Mine is the only active underground longwall operation in the Yampa Coal Field. Foidel Creek Mine produces compliance coal for many Front Range power plants and Midwest customers that use the coal for blending purposes (**Figure 10**). All of the coal produced at the Yoast and Seneca II-W Mines is consumed at the Hayden Power Plant in Hayden, Colorado. Xcel Energy (formerly Public Service Co.) operates the Hayden Station. It has a net capacity of 446 megawatts of power. Likewise, the Trapper Mine is mine-mouth to the Tri-State Generation and Transmission power plant in Craig, Colorado. These power plants have operated and provided electricity in the area since 1965 (Hayden) and 1979 (Craig). The 1,264 megawatt capacity Craig station is the largest power plant in Colorado (Carroll and Widmann, 2001).

On the west side of the Yampa Coal Field the Trapper Mine produces coal from the L-Q zone of the upper coal group. Twentymile (Foidel Creek) and Yoast mines operate in the eastern part of the Yampa Coal Field whereas Seneca II-W, Trapper, and Eagle (Empire) Mine (idle) operate in the western Yampa Coal Field. The Empire Mine (**Figure 11**) longwall

***Figure 10. Unit train leaving Foidel Creek mine for front range power plants.***

***Figure 11. Empire Mine surface facilities with Craig Power Plant in the background. (Photograph courtesy of RAG American Coal Co.)***

*Figure 12. Original longwall operation at Foidel Creek (Twentymile) Mine, Moffat County. (Photograph courtesy of RAG, American Coal Company)*

operation has been idle since 1995, awaiting market opportunities (**Figure 12**). It operated in the D and E seams of the middle coal group.

The recent demand for compliance coal has risen production substantially in the Yampa Coal Field. Since 1969, 33 mines have operated in the Yampa Coal Field. These mines have produced 237 million tons of coal since 1966. **Table 3** lists the most productive mines over the past 30 years. Today only four mining operations are active. Seneca Coal Co. has recently implemented auger mining in their highwall areas (**Figure 13**).

Foidel Creek Mine is the largest producing (active and historic) coal mine in the region. This mine has produced more than 63 million tons since 1983 from the Wadge seam. Of all the coal mined from 194 historic coal mines in the Yampa Coal Field, 27 percent of the historic total production has come from the Foidel Creek Mine. More than 80 percent of the coal produced in the Yampa Coal Field has been mined within the last 30 years.

***Table 3. Listing of the most productive coal mines in the Yampa Coal Field, 1969-2000.***

| Mine | Rank | County | Total[1] 1969–2000 | Years of Operation |
|---|---|---|---|---|
| **Foidel Creek (Twentymile)** | 1 | Routt | 63,478,834 | 1983–present |
| **Trapper Mine** | 2 | Moffat | 46,899,254 | 1977–present |
| **Energy Fuels No. 1 (strip)** | 3 | Routt | 31,468,534 | 1962–1989 |
| **Seneca Strip (combined)** | 4 | Routt | 31,135,843 | 1979–1999 |
| **Edna Mine (strip)** | 5 | Routt | 23,711,892 | 1945–1995 |
| **Seneca Strip No. 2** | 6 | Routt | 9,597,584 | <1969–1977 |
| **Colorado Yampa Strip** | 7 | Routt | 5,724,648 | 1984–1986 |
| **Energy Strip No. 2** | 8 | Routt | 4,348,246 | 1973–1978 |
| **Hayden Gulch Strip** | 9 | Routt | 3,956,447 | 1980–1986 |

1 Production totals are in short tons. Data from the CDMG coal production records.

***Figure 13. Auger mining methods in the Wadge coalbed, Yoast Mine. (Photograph courtesy of Seneca Mining Company)***

# COAL QUALITY CHARACTERIZATION

Coal quality parameters were only used in this resource study to evaluate potentially minable seams. Although publicly available coal quality data is plentiful, it is not well distributed within the Yampa Coal Field. USGS drilling investigations in the region concentrated on resource quantification and not coal quality. Most of the quality data available for this study originated from historical mines. Large distances between mines (nearly 20 mi) result in significant gaps in coal quality data that can only be modeled with less reliable outcrop channel sample data. Most of the study area that is void of data should be designated as hypothetical or "unable to classify". Hence, the statistical variance on coal quality for the Yampa Coal Field is high. In general, coal rank is unique in that the middle coal group of the Williams Fork Formation is mostly non-coking, high-volatile C bituminous coal, whereas, the upper coal group is mostly subbituminous A (Hornbaker and others, 1976). In the northeast part of the study area is a minor amount of anthracite associated with igneous intrusions (Bass and others, 1955). Both groups comprise low to moderate ash contents and low sulfur content.

Another problem stems from the ability to assign quality parameters collected from individual coal beds. In this study, the data must support an entire coal group, not just the bed. The coal quality for one bed does not necessarily reflect all of the coal beds in that group. Several large assumptions were used to assess which values truly reflect the quality for each data point. Although the quality of coal is an important factor in determining the market demand for specific coal deposits, it is only used in a precursory way in this study. Extensive assessment would be needed in order to map coal quality parameters within a reasonable level of certainty.

Several sources of coal quality data were compiled in this study. Speltz (1976) published coal quality data in a U.S. Bureau of Mines (USBM) report on coal reserves in Colorado. A summary of that data (**Table 4**) indicates that Cretaceous coal in the Yampa Coal Field is lower in moisture content with slightly higher heat values in the east, whereas in the west ash and sulfur content appears lower in comparison.

Coal quality data from the USGS was published recently in their Professional Paper 1625-B. The USGS used 349 samples from the Williams Fork and Lance Formations in their analyses (R. Affolter, 2000, Professional Paper 1625-B, Chapter G). Individual beds in the eastern part of the Yampa Coal Field were analyzed. The Wolf Creek beds (beds E upper and E lower in this report) have average values of 10.9 percent ash content, 0.72 percent sulfur content, and 10,769 Btu/lb heat value. The Wadge bed (bed F lower in this report) has average values of 7.97 percent ash content, 0.58 percent sulfur content, and 11,192 Btu/lb heat value. The Lennox bed (bed F upper in this report) averages 6.73 percent ash content, 2.64 percent sulfur content, and 11,422 Btu/lb heat value. Based on this data, the Lennox and Wolf Creek beds may display areas of high sulfur. Consequently, the Wadge bed is the most compliant coal and the only bed produced consistently in the area.

***Table 4. Mean coal quality data from the Yampa coal field. Data is from Johnson and others, 2000, and Speltz, 1976. *All values on an as-received basis.***

| Region | Moisture (%)* | Volatile Matter (%)* | Fixed (%)* | Ash Yield (%)* | Sulfur (%)* | Calorific (%)* |
|---|---|---|---|---|---|---|
| West Yampa | 11.6 | 42 | 53.8 | 4.3 | 0.3 | 11,500 Btu/lb |
| East Yampa | 9.4 | 41.1 | 51.8 | 6.9 | 0.9 | 11,580 Btu/lb |

Coal in the study area has low values for elements that are of current environmental concern (**Table 5**) when compared to other coal fields in the U.S. This is quite favorable in the national perspective, as Colorado Plateau coal is generally very low in trace element concentrations.

***Table 5. Mean content (in parts per million) for elements of environmental concern for the Yampa Coal field. This data is compared to mean values collected in three large national coal areas. Source: USGS Professional Paper 1625-B, Chapter G.***

| Coal Area | Elemental Content (ppm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | As | Be | Cd | Co | Cr | Hg | Mn | Ni | Pb | Sb | Se | Th | U |
| Yampa coal field | 1.8 | 1.2 | 0.06 | 1.3 | 4.3 | 0.06 | 23 | 3.8 | 5.2 | 0.3 | 1.0 | 2.6 | 1.0 |
| Colorado Plateau Cretaceous coal | 1.6 | 1.2 | 0.1 | 1.5 | 4.5 | 0.06 | 22 | 3.7 | 6.5 | 0.5 | 1.2 | — | 1.3 |
| Western US Tertiary coal | 7.4 | 1.1 | 0.1 | 3.5 | 10.0 | 0.12 | 60 | 4.6 | 4.2 | 0.6 | 0.7 | — | 1.7 |
| Appalachian Basin Pennsylvanian coal | 35.0 | 2.5 | 0.1 | 7.2 | 17.0 | 0.21 | 29 | 17.0 | 8.4 | 1.4 | 3.5 | — | 1.7 |

The National Coal Resource Data System (NCRDS) contains coal quality data for the Yampa Coal Field. A total of 441 individual analyses from more than 100 sample locations from historical mines in the Yampa Coal Field were reviewed in this assessment (Ambrose and others, 2001) (**Table 6**).

The non-proprietary part of the coal quality database contains: sample point identifying numbers, sample dates, mine or core hole names, bed and coal group designation, coal rank, ash, and sulfur data, location data, and source information. Five databases were reviewed from the USGS (USALYT), USBM and EIA (BMALYT), CGS coal core data (PETALYT), the USGS trace element database (CHEMALYT), and historical coal quality data in Colorado. All of the data was reported on an "as-received" basis for this study. The sulfur data in these databases are reported as percent sulfur by weight. **Table 7** lists variable coal quality data for coal beds surrounding and including the Williams Fork Formation. This data is from the 2000 Keystone Coal Directory (Carroll, 2000).

***Table 6. Coal Quality Characteristics. The range of analyses of Yampa Coal Field coals, as received basis Source: NCRDS database average values for Ash, Btu, and Sulfur.***

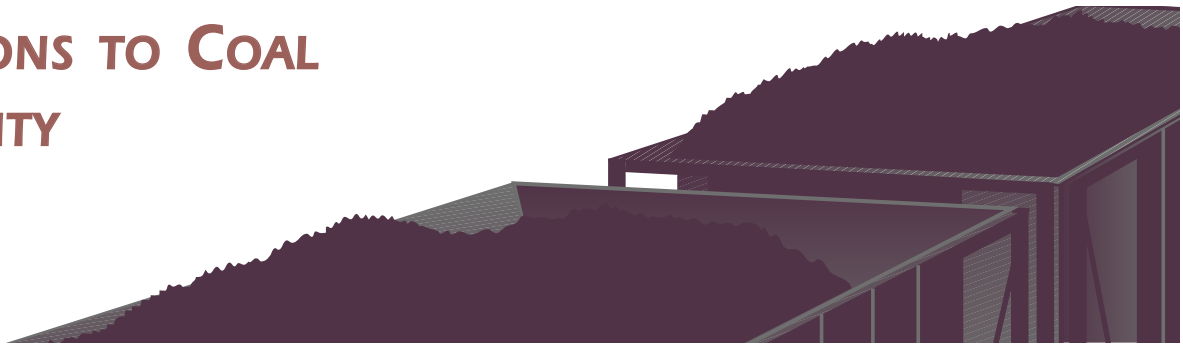
| Coal Field/Bed | Moisture (%) | Volatile Matter (%) | Ash (%) | Sulfur (%) | Heating Value (Btu/lb) |
|---|---|---|---|---|---|
| Upper Coal (Avg.) | 14.8 | 33.86 | 5.46 | 0.43 | 10,753 |
| Dry Creek (L-Q) 65 samples | 14.2–16.8 | 30.8–37.4 | 5.05 | 0.35 | 10,825 |
| Fish Creek (I-K) 27 samples | 10.5–15.6 | 33.3–37.1 | 6.55 | 0.63 | 10,558 |
| Middle Coal (Avg.) | 12.28 | 34.29 | 6.67 | 0.77 | 11,391 |
| Lennox | 12.3–16.2 | 31.8–36.2 | 4.39 | 1.59 | 11,747 |
| Wadge | 8.9–14.4 | 31.2–38.5 | 7.16 | 0.52 | 11,318 |
| Wolf Creek | 7.7–17.8 | 30.4–36.9 | 8.18 | 0.56 | 11,056 |

***Table 7. Coal quality characteristics. Data from the 2000 Keystone Coal Directory compares coal quality in coal bed formations of Tertiary and Cretaceous age in northwest Colorado. FSI = Free Swelling Index.***

| Formation (coal bed) | Moisture (%) | Volatile Matter (%) | Ash (%) | Sulfur (%) | Heating Value (Btu/lb) | Ash Fusion Temp. (°F) | FSI |
|---|---|---|---|---|---|---|---|
| **Ft. Union (Seymour)** | 20.7–23.0 | — | 3.9–7.8 | 0.2–0.4 | 8,250–8,710 | — | 0 |
| **Lance (Lorella, Kimberly)** | 19.6–21.8 | — | 4.1–6.5 | 0.5–0.7 | 9,660–9,720 | 2,010–2,260 | 0 |
| **Williams Fork, upper coal group (Dry Creek, Crawford, Fish Creek)** | 9.8–16.9 | 34.9–39.2 | 4.1–17.2 | 0.4–1.8 | 9,800–11,680 | 2,070–2,480 | 0 |
| **Williams Fork, middle coal group (Lennox, Wadge)** | 6.4–11.8 | 33.8–39.0 | 3.0–20.2 | 0.3–0.9 | 9,871–12,440 | 2,140–2,890 | 0–0.5 |
| **Williams Fork, middle coal group (Lennox, Wadge)** | 6.3–12.2 | — | 4.3–11.3 | 0.3–0.9 | 11,090–12,560 | 2,250–2,780 | 0 |

In 2000, the CGS calculated the Demonstrated Reserve Base (DRB) for the Yampa Coal Field using publicly available information from the USGS. The DRB comprises measured and indicated coal for the Williams Fork Formation to a depth of 2,000 ft. The data was combined from NCRDS (Ambrose and others, 2001) and COALQUAL (Bragg and others, 1998) databases. The Williams Fork Formation was evaluated, and out of a DRB of 10 billion tons, 98 per cent of the coal had less than 1.25 per cent sulfur (Carroll and Morgan, 2000). In terms of ash, 45 per cent of the DRB is less than 5 per cent. This data is skewed toward the middle coal group as 75 percent of the coal data is from that coal group.

# Restrictions to Coal Availability



The availability of future coal development in northwest Colorado is controlled by several factors. These factors were identified through interviews with mining engineers and geologists from the four operating coal companies within the study area. Discussions with staff members from the CDMG, the state agency responsible for permitting and inspecting mines, were conducted to establish the criteria of restrictions unique to the Yampa Coal Field. Members of the USGS Energy Resources team familiar with the study area also provided input. Information from these interviews was used to develop criteria for delineating available coal in the study area.

The availability of coal is evaluated by mining methods that will most likely be used in future recovery of the coal. In the Yampa Coal Field both surface and underground mining methods have been used in the past and present. In the western and central parts of the field, surface mining operations have prevailed recently, but much underground mining was also done in the past. The future of mining in the western Yampa Coal Field will probably continue with surface mining methods until the coal economics become more favorable for underground mining. The short-term availability then is for surface mining both in the middle and upper coal groups of the Williams Fork Formation. In the eastern part of the coal field, surface mining reserves have mostly been depleted. Therefore underground mining will continue to be prevalent.

## CONSIDERATION OF RESTRICTIONS

A computer model was established to calculate the coal resources. This "model" consists of geologic data and land-use and technologic information. Coal availability is affected by several factors that can be grouped into a hierarchy of restrictions. Three groups of factors were considered: 1) legal unsuitability for mining surface coal under Federal jurisdiction; 2) potential land use restrictions; and 3) mining coal based on significant technological restrictions. Legal unsuitability refers to mining regulation imposed by the Federal Office of Surface Mining and enforced by the CDMG. Potential land use issues refer to surface restrictions to mining and described below. Technological restrictions refer to the physical barriers to mining. **Table 8** provides a complete listing of all factors considered within these three groups. Many of the factors considered are either not applicable to the Yampa Coal Field or, after further analysis, were determined to be non-restrictive. Many factors that restrict mining are based on economic or social considerations and are not absolute restrictions to mining. For example, powerlines and railroad tracks were considered for land use restrictions. In reality, the Foidel Creek mine actually withdraws coal beneath these areas through a variance with CDMG. Certain stratigraphic features, such as the thick Twentymile Sandstone Member, actually provide some protection from extensive subsidence damage.

A hierarchy was established for land use and technological restrictions to prevent overlap of restrictions. Town boundaries, for instance, restrict all coal mining, and in most cases cover restrictions such as cemeteries, airports, and power plants. This hierarchy is important to the Geographic Information System (GIS) coverages. The hierarchy for resolving overlapping applicable land use restrictions was 1) streams, 2) highways, and 3) railroads. Technological restrictions were considered in this order: 1) mined-out areas, 2) coalbed thickness, 3) proximity to adjacent coalbeds, and 4) the limit of overburden.

***Table 8. General list of possible Federal restrictions to coal mining. Bold if applicable to Yampa Coal Field.***

| |
|---|
| **A. Coal-leasing unsuitability criteria from the Federal Coal Management Regulations (43 CFR 3461.5)** |
| **Federal land systems** |
| **Right of ways and easements [i.e., railroad]** |
| **Dwellings, roads, cemeteries, and public buildings** |
| Wilderness study areas |
| Lands with outstanding scenic quality |
| Lands used for scientific study |
| **Historic lands and sites** |
| Natural areas |
| **Critical habitat for threatened or endangered species** |
| **State listed threatened or endangered species** |
| **Bald or Golden Eagle (Empire) nests** |
| **Bald and Golden Eagle (Empire) roost and concentration Areas** |
| **Federal lands containing active falcon cliff nesting site** |
| **Habitat for migratory bird species** |
| **Fish and wildlife habitat for resident species** |
| **Floodplains** |
| Municipal watersheds |
| National resource waters |
| **Alluvial valley floors** |
| State or indian tribe criteria |
| **B. Land use restrictions** |
| **Towns** |
| **Pipelines** |
| **Power lines and power plants** |
| Archaeological areas |
| **Surface and coal ownership issues** |
| **Wetlands** |
| **Streams, lakes, and reservoirs** |
| **C. Technological restrictions** |
| **Coal quality** |
| **Coal depth (<200 ft overburden for underground mining)** |
| **Mined-out areas** |
| **Limit of coal (including areas of burned coal)** |
| **Subsidence over abandoned mines** |
| Subsidence is projected to cause material damage |
| **Active mines** |
| **Abandoned mines** |
| **Coal beds too close together (<40 ft)** |
| **Coal beds too thin** |
| **Coal bed discontinuities** |
| **Roof or floor problems** |
| Barrier pillars |
| **Oil and gas development** |
| Steep slopes |
| **Steeply dipping beds** |
| **Proximity to intrusive rocks or faults** |
| Block size |

The Colorado Surface Coal Mining Reclamation Act also includes a number of potential exclusions or restrictions to underground coal mining, within Colorado Revised Statute Title 34, Article 33 as listed in **Table 9**. Many of these restrictions overlap with Federal restrictions to mining. All were considered for inclusion in the factors affecting coal availability.

***Table 9. Exclusions/Restrictions to mining, Colorado Revised Statutes 34–33.***

| Restriction/Exclusion | Explanation of Restriction or Exclusion | Rule No. |
|---|---|---|
| Exclusion | Lands within the national park system, national wildlife refuges, national system of trails, national wilderness preservation system, wild and scenic rivers, and national recreation areas. | 2.07.6(2)(d)(iii)(A) |
| Exclusion | Within 300 ft of public buildings (school, church, hospital, courthouse, government building...), community or institutional building or any public park. | 2.07.6(2)(d)(iii)(B) |
| Exclusion | Within 100 ft of a cemetery. | 2.07.6(2)(d)(iii)(C) |
| Exclusion | Lands designated unsuitable for mining. CDMG *comment: None have been designated in Colorado.* | 2.07.6(2)(d)(i) |
| Exclusion | Operations which affect the continued existence of threatened and endangered species | 2.07.6(2)(n) |
| Restriction | Mining on steep slopes (has to meet specific performance standards) | 2.06.4 |
| Restriction | Lands within national forest | 2.07.6(2)(d)(iii)(D) |
| Restriction | Will not adversely affect publicly owned park or place eligible to be included in the National Register of Historic Places | 2.07.6(2)(e)(i) |
| Restriction | Within 100 ft of public road Right-of-way | 2.07.6(2)(d)(iv) |
| Restriction | Within 300 ft of an occupied dwelling (unless waived by owner). | 2.07.6(2)(d)(v) |
| Restriction | 500 ft, measured horizontally from active or abandoned underground mines | 4.19(1) |
| Restriction | Beneath or adjacent to any perennial stream, or impoundment or other body of water >20 acre-ft. | 4.20.4 |
| Restriction | Mining in alluvial valley floors and prime farm land. CDMG *comment: AVFs are identified during permitting process.* | 2.07.6(2)(K) |
| Restriction | Operations where subsidence is projected to cause material damage. CDMG *comment: Essentially must avoid or leave support pillars to protect aquifers, agricultural land and occupied residential dwellings and noncommercial buildings.* | 2.05.6(6)(b)(iii), 4.20 |
| Restriction | Blasting within 1,000 ft of schools, churches, hospitals and nursing facilities and within 500 ft of wells, pipelines and storage tanks for oil, gas, or water. *CGS uses 200 ft radius for actual restrictions accounting for typical variances* | 4.08.4(7) |
| Restriction | Surface disturbance within 100 ft of perennial streams that support biological communities. | 4.05.18 |

## EXCLUSIONS TO COAL MINING

Unsuitability criteria for coal mining are listed in the Federal Regulations, Title 43, Subpart 3461 (43 CFR 3461). These 20 specific legal criteria are used to determine if an area can be mined by surface methods. Underground mining on Federal lands can be exempted from these criteria, except where the mining will include surface operations and have surface impacts on Federal lands that cannot be otherwise exempted (43 CFR 3461.1).

Legal unsuitability criteria that were evaluated as restrictions to mining in the Yampa Coal Field are 1) property right-of-way and easements to railroads and roads; and 2) private property, town structures, airports, and cemeteries. Dwellings and public buildings within the towns of Hayden and Craig are also restrictions, and the land use coverage for both towns include these buildings as well as cemeteries, airports, road, power plants (**Figure 14**), and utilities.

The alluvial valley floor (AVF) for the Yampa River is the most significant exclusion to coal mining (**Figure 15**). The river valley is generally north of the study area near the 2,000 ft coal depth except where it joins with the Williams Fork River as it cuts through the Mesaverde Group in the Round Bottom quadrangle. Coal mining has occurred historically within the AVF and depletion coverages for several mines cross the AVF in this vicinity (Eagle (Empire) and Wise Hill Mines). Future planning and permitting may inevitably preclude this area from mining activity. Hence, the AVF in this area is treated as an exclusion for purposes of this study. The AVF is an absolute exclusion to surface mining, however coal is potentially minable at depths greater than 200 ft below the AVF.

Other unsuitable criteria that are potential restrictions in the study area include critical habitat for threatened or endangered species such as sites that contain Bald or Golden Eagle (Empire) nests, or endangered fish species in the Yampa River.

***Figure 14. Xcel Energy Hayden Power Station.***

It is conceivable that many land use restrictions could be relocated, or potentially given risk-based variances to allow mining to proceed. For the purposes of this study they are considered restrictions to mining. Land ownership was not considered in this study. However, conservation groups that may restrict future mining own several acres of land near Hayden. Federal coal in the Yampa Coal Field was not segregated from private coal for this study.

However, many of these restrictions are also inclusive within the AVF exclusion for the Yampa River. Federal lands with active falcon cliff-nesting may potentially exist in the Twentymile or Trout Creek Sandstone Members along the southern part of the study area. However, the effect of nesting areas along these sandstone outcrops is mitigated because of the sandstones form significant barriers to mining and they are non-inclusive for coal.

Digital habitat coverages from the Colorado Division of Wildlife identify some raptor nests within the study area. Sage grouse nesting sites indicated in the area are not currently restrictions to mining but should be included in mine planning. Surface mine reclamation in the Yampa Coal Field has significantly increased sage grouse lek sites. These criteria could cause areas to be declared unsuitable for coal mining. Detailed studies, to determine unsuitability or proposing mitigation measures, would be made if an expression of interest for coal development were submitted to the government.

## LAND USE RESTRICTIONS

Coal beneath the towns of Craig and Hayden are considered restrictions to mining. Streams, lakes and reservoirs are also restrictions to coal mining. The Yampa, Williams Fork, Elkhead, and Elk Rivers and several small reservoirs are considered land use restrictions; however, no restriction was applied to streams for coal deeper than 200 ft below the surface, although agencies may limit full extraction mining methods.

Other potential land use restrictions were considered; however none were evaluated as applicable to the Yampa Coal Field. The major power lines and pipelines that transect the study area (**Figure 15**) restrict coal mining somewhat and are considered exclusions to mining. The Colorado Historical Society has identified no significant archaeological sites. Small, isolated wetlands have been identified within areas permitted for coal mining; however, mining has not been restricted under these areas. Polygonal extents of land use restrictions were determined using the parameters outlined in **Table 9**. With the exception of old mine workings, land use restrictions were applied as a vertical slice through all of the coal beds.

## TECHNOLOGICAL RESTRICTIONS

Technological factors evaluated as restrictions to mining include coal depth, areas of no coal, insufficient interburden, thin coal beds, areas of burned coal, and the proximity to thick massive sandstone outcrops. As overburden increases, the depth to coal becomes a significant economic factor. Areas marked as "no coal" within the study area may be due to mined-out tracts, or are areas beyond the limits of coal deposition

Constraints at the surface include clinker and burned or oxidized coal to an estimated 20 ft depth in certain parts of the study area. A small clinker quarry exists in the Hayden Gulch quadrangle. The extent of this clinker is unknown and not formally mapped. Typical surface mining operations in the Yampa Coal Field today are at depths of less than 150 ft deep (**Figure 16**). For the purposes of this study, surface mining was considered for that volume of coal between 20 and 200 ft depth. Constraints to surface mining include stripping ratios and the extent of thick sandstone beds. According to the U.S. Bureau of Mines (1971) publication on strippable reserves of bituminous coal, resource calculations were derived using 50 ft overburden and a 10-to-1 stripping ratio, and a minimum coalbed thickness of 5 ft, and a minimum of 12,000 Btu per lb. Available coal for surface mining is limited to the area where the middle coal group has less than 200 ft of overburden, as shown on **Figure 23**.

The coal resource in the upper coal group has a greater extent in map view than the middle coal group (**Figure 23**). A 10-to-1 stripping ratio is suggested for the surface mining resource in the upper coal group. This will further limit the available coal calculated for the I-K and L-Q coal zones. For instance, when the upper coal group has L-Q coals are very close together with only thin sandstones between them, the strip ratio is low. This is analogous to the coal beds mined at Trapper Mine. Seneca II-W and Yoast Mines extract the Wadge seam with a steep dip (ranging from 10 to 26 degrees) but still retain high-wall heights less than 120 ft. The depth to coal for underground mining was also considered, and no coal is presently or economically produced below 2,000 ft. Therefore the underground resource was calculated from 200 to 2,000 ft deep.

Mining coal seams with an interburden of less than 40 ft was determined in the model and deducted from the resource. Other technological factors that apply to mining in the Yampa Coal Field include quality variances and partings over three inches thick. There is insufficient data to evaluate some of these factors. For some factors, the basis of what would constitute a restriction is difficult to establish.

Significant oil and gas development in northwest Colorado is a potential restriction to mining coal. More than 400 petroleum test wells have been drilled in the region. Most of these wells were drilled and abandoned and are not restrictions to mining. Only 92 of these wells are designated as producing oil and gas wells (**Figure 15**). Petroleum is produced from several formations beneath the Mesaverde section, mainly oil in the fractured Niobrara Formation of the Tow Creek oil field in the Mount Harris Quadrangle. Based on CDMG mining laws concerning blasting, a 500-ft barrier around active oil and gas development

***Figure 16. Surface mining Wadge Seam at the Peabody/Seneca Yoast Mine. The coal beds in the highwall are the Lennox (bed F, upper).***

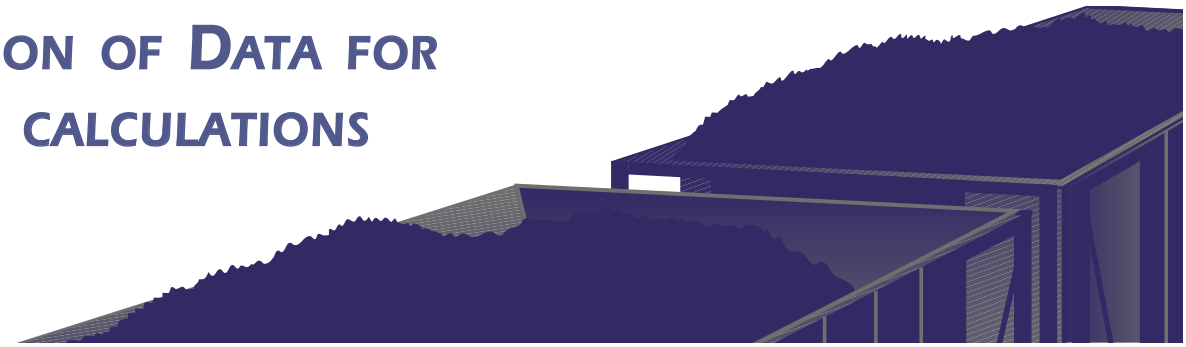
wells is required. CDMG has provided variances based on seismic studies that allow some operators to mine within 200 ft of these wells. Although this is the exception to the rule, CGS used a 200-ft buffer around the 92 producing petroleum wells in the study to more accurately reflect minable resources.

Other technological restrictions to mining include the proximity to old coal workings, geologic criteria such as faults and steep slopes, and coal quality variations. Coal quality is not used as a restriction in this study, although it would certainly influence specific areas of beds to be mined. It is likely that subsidence over abandoned mines may preclude mining in some areas. Data to identify areas affected by such subsidence is not readily available. Areas with roof or floor problems that would preclude mining, steep slopes, and intrusive rocks and faults have also not been identified. The largest faults located in the Eagle (Empire) and Trapper Mines may have up to 250 ft of throw. Block sizes will be evaluated in the ensuing coal recoverability study of the Yampa Coal Field.

The CGS established a digital database of the mined-out areas for the Yampa Coal Field. Information on the extent of mining was obtained from individual mine maps or previously-compiled 1:24,000 scale maps available at the CGS, from maps within mine permit documents at the CDMG, or from mine operators. Boundaries of active mines were updated to January 1, 2001, in part, based on mine plans through the end of 2000.

Depleted resources consist of the coal tonnage that was originally present in areas that have been mined and are considered constraints to mining. These resources have been extracted by mining or left as pillars within underground mines (**Figure 17**). In some examples, the resources from an entire coal zone were depleted due to the mining of an individual bed within the zone. Coal that has been left in place as barrier pillars has been excluded from resources. Colorado law requires that a barrier at least 500 ft wide be left around active mines; however, once a mine becomes inactive, mining may be permitted within 50 ft of abandoned workings. In contrast, the Mine Safety and Health Administration require only a 50-foot barrier between mines.

# Preparation of Data for Resource calculations



## STRATIGRAPHIC DATABASE

A Stratifact™ database was compiled of 674 drill holes within the study area. This database includes stratigraphic data from 245 publicly available USGS drill holes, and 100 proprietary drill holes provided by mining companies active in the Yampa Coal Field. The private data was used in the resource calculations but the drill holes were not shown on the maps. An additional 61 oil and gas petroleum wells are included in the database. Of these, 24 are coalbed methane (CBM) test wells. Geophysical logs from the CBM wells have very detailed coal bed information and were included as data points for reliability determinations. The other 37 petroleum wells were used for structural control in the model.

Drill hole data was obtained from published sources including USGS databases, BLM files, Trapper Mining Company and RAG American Twentymile proprietary data. Permit documents at the CDMG were used for digitizing mine boundaries and drill hole information for the active mines such as the Peabody Seneca II-W and Yoast mines. A total of 257 drill holes were included from the publicly available mine permits. Detailed locations are not provided due to mining company confidentiality agreements.

The CGS requested drill hole data from Trapper Mining Company to fill in areas where drill holes were spaced more than 1.5 mi apart to increase the amount of measured resources. Data, including geophysical logs and core logs, were released on 30 drill holes. Strip logs for five drill holes near the Eagle (Empire) Mine were obtained from cross sections within permit documents filed with the CDMG. Additional drill hole data was used from the CDMG permit filing for the Seneca II-W and Hayden Gulch Mines as well as selected historic coal mines. Historic data on measured coal thicknesses were used from several mines from the CGS subsidence lab, in particular, the Cardinal, Crow Bar and Dry Creek Mines. The BLM office in Craig provided 11 historic drill holes around the Harris Mine.

Measured coal sections by Bass and others (1955) were not used as the authors indicated that errors were prevalent due to unknowns such as exactly which stratigraphic interval was measured, and an inability to precisely measure height above the Trout Creek or Twentymile Sandstone Members.

## CORRELATION OF COAL BEDS

In general, Cretaceous coal beds of Colorado are highly lenticular and their minable thicknesses frequently extend laterally at relatively short distances. Because of this lenticularity, correlation of coal beds is difficult. Coal zone nomenclature was carried throughout the Yampa Coal Field for the resource assessment. Regional correlations of coal zones within the Williams Fork Formation can be accomplished with a good degree of confidence but is much more difficult at the individual seam level. Regional letter nomenclature used in this study correlates to those letter designations for the coal seams at both the Eagle (Empire) Mine and modified from the USGS (Johnson and Brownfield, 1988). Note that these letter designations differ considerably to those used at the Trapper Mine, which are in reverse order from those used in this study.

**Middle Coal Group—** A regional correlation established by the USGS, was used as a basis for correlation of the main coal zones. Coal Investigations Map C-123 (Johnson and Brownfield, 1988) was used to determine the regional extent of coal zones within the middle coal group of the Williams Fork Formation. For this study, the letter designations A through H, as documented in the western part of Map C-123 were adopted. In the east, these coal zones conflict with previous USGS correlation letter designations F through H (Bass and others, 1955), and were not adopted by the CGS for reasons of consistent computer nomenclature (See **Figure 7** for comparisons). For consistency, the CGS carried letter designations $A_1$, A, B, C, D, E lower, E upper, F lower, F upper, $G_1$, G, H lower, and H upper throughout the study area. The lowermost coal beds $A_1$, A, B, C, and D were not carried through to the Seneca II-W Mine on the eastern side of the study area because they stratigraphically pinchout against the Trout Creek Sandstone Member.

**Upper Coal Group—** Regional correlations for thinner coals of the upper coal group were adopted from USGS correlations set forth by Bass and others (1955). These thinner, more laterally discontinuous coal beds were subdivided into three main groups: 1) The uppermost uneconomic S, R, and $R_1$ coal bed zone; 2) the very productive L, M, N, O, P, and Q coal bed zone; and 3) the lowermost I, J, and K coal bed zone. The L-Q and I-K groups were modeled in this study. Lateral continuity of the coal zones is based on stratigraphic position above the Twentymile Sandstone Member as well as segregation of the coal groups by significant marine sandstones. This adopted nomenclature is similar to that of the detailed correlations provided by Janet Hook of the BLM within the Breeze Mountain quadrangle, where the "Carey" coal bed corresponds to the L coal bed of this study. The individual letter designations refer to a group of discontinuous coal beds that are only stratigraphically continuous as a zone of coal beds.

Proprietary data were available for use in this study. Coal bed correlations in the USGS databases were influenced by a relatively large amount of closely spaced proprietary data in some areas. Established USGS correlations were used to a large extent, however proprietary data used by USGS previously were not made available in this study. Several previous studies, particularly Brownfield and Johnson (1986) have covered a relatively large area of the Yampa Coal Field. Only in areas of coalbed methane drilling and around Trapper Mine have new deeper reserves been added to the database.

CGS coal bed correlations in the Yampa Coal Field are depicted in four coal correlation diagrams created with MINEX mining software. Diagram A–A' (**Figure 18**) depicts a regional cross section of middle coal group coals on Horse Gulch and Round Bottom quadrangles and runs east-west just north of the Yampa River. This diagram shows the complex nature of the multiple coal beds in the west part of the study area. The Wadge bed (Fl), for example, can be identified as far west as Trapper Mine, but splits into eight beds west of there. To the east, many of the coal beds are non-existent. East of Hayden Gulch (drill hole HAYG-15A), nearly all of the upper coal group coals, as well as the middle coal group A–D coals, are not present due to onlapping stratigraphic features or surface erosion. Perpendicular to A–A' is cross-section B–B', which extends north-south through Trapper Mine and the town of Craig, Colorado. Correlation along B–B' are shown in **Figure 19**. This cross-section shows a more lateral continuity of coal beds and the complexity of the middle coal group coals. These correlation diagrams illustrate the variability of bed thickness, splits, and bed positions that occur in relatively short distances, which makes correlation of beds difficult. Coal Correlation Diagram C–C' (**Figure 20**) depicts the middle coal group coals through the Twentymile Park area on the east side of the study area. It shows the very minable and laterally continuous Wolf Creek, Wadge, and Lennox Seams in that area.

A more detailed cross-section of the Wadge (F lower) and Lennox (F upper) seams is shown in **Figure 21**. This cross-section was constructed in Stratifact™ and it shows detailed coal correlations for the same beds from Hayden Gulch to Mount Harris Quadrangles. These cross-sections demonstrate the complex nature of the peat swamps and clastic sediments interspersed throughout the Williams Fork Formation.

## USE OF COALBED METHANE WELLS

About 24 coalbed methane wells were drilled between 1989 and 2001 to test the potential of methane from Mesaverde Group coal beds. The Gamma-Compensated Neutron-Density geophysical logs that were run for those holes provided detailed data for coal seams within the formation. Phillips Petroleum Company has recently drilled several coalbed methane wells in the Hooker Mountain quadrangle and four of those well logs are now publicly available. These wells intercept several thick coal seams; however, they are greater than 2,000 ft deep. Most of the coalbed methane wells were used to provide resource reliability data within the database. Several other oil and gas holes lacked geophysical log coverage of the Williams Fork Formation or contained poor details in the coal section and were only used in the structural model.

## DATA SOURCES FOR LAND USE RESTRICTIONS

**Streams—** Digital coverages were obtained from both Federal and State government agency sources for GIS data. Lakes and reservoirs, towns, railroads, and cemeteries were digitized by the CGS from topographic maps. Contour maps at a scale of 1:50,000 were used in the Yampa Coal Field. Only relatively major lakes and reservoirs, those having surface areas greater than 20 acres, were selected as a restriction.

**Highways—** Digital coverage of highways were obtained from the Colorado Department of Transportation.

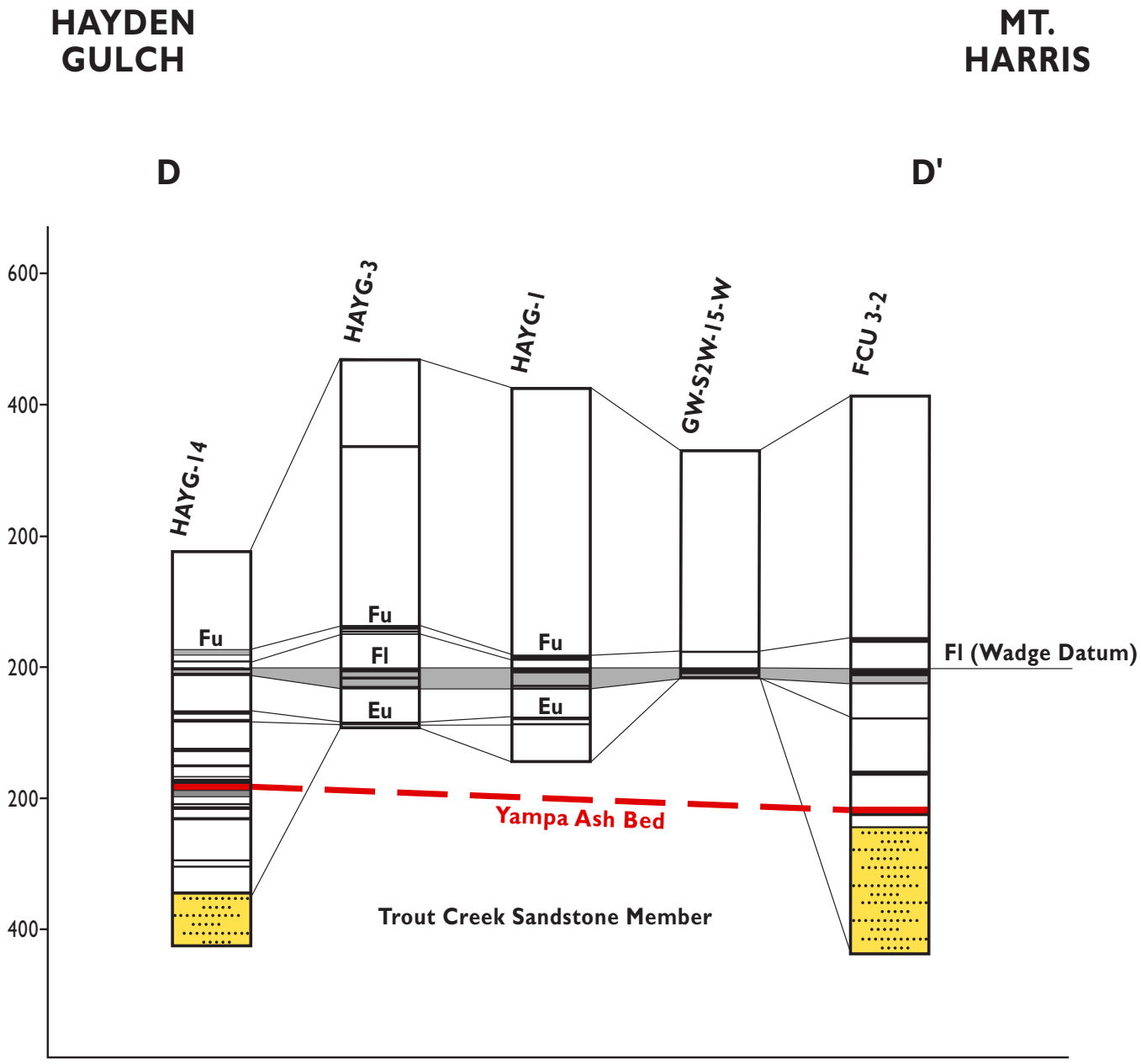



*Figure 21. Coal correlation diagram D–D' (Hayden Gulch–Mt. Harris quadrangles).*

**Power lines—** Guidance was obtained from Public Service Company (PSC) and Western Area Power Association (WAPA), and power lines were highlighted on 1:100,000 scale BLM maps for review by WAPA. The coverage was then modified based on WAPA input.

**Pipelines—** Individuals working for major natural gas pipeline companies were contacted and regional maps of major pipelines were obtained. A set of digital coverages of pipelines in Routt and Moffat counties was used; only the major natural gas pipelines for PSC and Northern Natural Gas were selected for restrictions.

**Alluvial Valley Floors—** The parts of alluvial valley floors in the vicinity of the Yampa Coal Field were digitized by the CGS. The information was procured from the Office of Surface Mining draft maps (U.S. Department of Interior, 1983 and 1985), and from USGS geologic maps by Hancock (1925) and Bass and others (1955), and from the CGS, Miller (1975, and 1977). Metadata information can be obtained from the CGS for these files.

Digital elevation models and digital line grid data used in the study were obtained from the USGS.

# Results: Coal Resources and Available Coal in the Yampa Coal Field

The Yampa Coal Field contains more than 25.7 billion tons of total gross or original coal resources to 2,000 ft deep. Approximately 421 million tons have been extracted or lost in the mining process (total depletion through 2000), leaving about 25.3 billion tons of coal remaining. Subtracting the 9.2 billion tons restricted by both land use (2.3 billion tons) and technological (6.9 billion tons) conditions leaves about 16.1 billion tons as available for mining. This is 62 percent of the gross or original resource and coal resource tables. Appendix A lists coal resources for the middle coal group. Appendix B lists coal resources for the upper coal group. The raw data for the coal calculations is shown in **Appendix A1** ("B" bed), **Appendix A2** ("C" and "D" bed), **Appendix A3** ("E" bed), **Appendices A4** ("F" bed), **Appendix A5** ("H" bed), **Appendix B1** ("I, J and K" bed), and **Appendix B2** ("L. M, N, O, P and Q" bed).

## ORIGINAL RESOURCES

More than 1.34 billion tons, or approximately 5.2 percent of the original resource of 25.7 billion tons in the study area, is calculated for the "B" coal bed zone (**Table 10**). The C and D beds combined contain about 4.04 billion tons, or 15.7 percent of the original resource. The E upper and E lower beds have more than 4.47 billion tons, which represents about 17.4 percent of the original resource; the F upper and F lower beds have 6.07 billion tons for 23.6 percent of the resource. This is the largest original resource. The H upper and H lower beds have 10.4 percent of the original resource.

The upper coal group has 1.98 billion tons in the I, J, and K beds, or 7.7 percent of the total resource, and the L-Q beds combined is 5.13 billion tons, or 20 percent of the original resource.

Nearly half (48 percent) of the original coal resources calculated are between 1,000 and 2,000 ft deep (12.4 billion tons). For the surface minable resource, original coal less than 200 ft deep is 2.152 billion short tons, or 8.4 percent of the total. More than 1 billion short tons of coal are available in the L-Q zone as surface minable. Almost all of the original resource is greater than 2.3 ft thick, as only 1.15 percent of the original resource for all beds represents coal between 1.2 and 2.3 ft thick.

Most of the coal within this thin coal thickness category is from the L-Q zone of coal beds. This indicates that although the greatest volume of coal is in this zone, they are mostly thin beds. The coal resources for the Yampa Coal Field are summarized

***Table 10. Summary of original, restricted, and available coal resources of the Yampa coal field by coal zone. All values are reported in thousands of short tons. Original resources are also segregated for surface minable and thin coal resources as well and are included in the total resource value.***

| Resource Category | | Middle Coal Group | | | | | Upper Coal Group | | |
|---|---|---|---|---|---|---|---|---|---|
| | | B beds | C/D beds | $E_U/E_l$ | $F_U/F_l$ | $H_U/H_l$ beds | I-K beds | L-Q beds | Total |
| Original resources | Surface | 70,090 | 214,396 | 287,132 | 454,138 | 201,109 | 147,369 | 841,932 | **2,216,166** |
| | <2.3 ft. | 1,271,351 | 3,828,459 | 4,183,001 | 5,618,910 | 2,492,751 | 1,828,893 | 4,290,715 | **23,514,080** |
| Total original resources | | 1,341,441 | 4,042,855 | 4,470,133 | 6,073,048 | 2,693,860 | 1,976,262 | 5,132,647 | **25,730,246** |
| Mined or lost in mining | | 20 | 126,396 | 2,375 | 205,683 | 3,076 | 1 | 83,844 | **421,395** |
| Remaining | | 1,341,421 | 3,916,459 | 4,467,758 | 5,867,365 | 2,690,784 | 1,976,261 | 5,048,803 | **25,308,851** |
| Land use restrictions | | 149,241 | 389,307 | 314,853 | 466,079 | 228,767 | 220,688 | 548,183 | **2,317,118** |
| Technological Restrictions | | 534,844 | 1,239,867 | 923,245 | 1,660,470 | 859,590 | 660,682 | 1,043,127 | **6,921,823** |
| Available | | 657,335 | 2,287,285 | 3,224,417 | 3,740,814 | 1,598,279 | 1,094,890 | 3,457,493 | **16,060,513** |

in Table 10 above. Detailed coal resources are tabulated in **Appendix A** for all of the coal resources, land use and technological restrictions by bed or zone for the middle coal group. **Appendix B** contains the resource, land use and technological restrictions for the upper coal group. The appendices also segregate resources by depth and thickness for each coal zone. **Table 11** is a listing of applicable land use and technological restrictions by coal zone.

## AVAILABLE COAL RESOURCE CATEGORIES

The term "remaining" coal resources refers to the amount of original coal remaining after the coal mining and depletion part has been subtracted (Carter and Gardner, 1989). Available resources are those resources that are available for development after coal restricted by land use or technological restrictions have been subtracted from those remaining resources (Carter and Gardner, 1989). Density criteria used in this study are 1,770 tons/acre-ft for subbituminous coal and 1,800 tons/acre-ft for bituminous coal. These were segregated by general coal grouping: the upper coal group is subbituminous and the middle coal group is bituminous.

Available resource estimates are subdivided into categories of reliability of estimate, overburden thickness (depth-to-coal), and coal thickness. Reliability categories used were: measured (coal within ¼ mi of a data point); indicated (coal ranging from ¼ to ¾ mi from a data point); inferred (coal ranging from ¾ to 3 mi from a data point). Hypothetical (coal more than 3 mi) coal was not calculated. The measured category contains 10.8 percent of the original resource, 36.4 percent of the original coal is within the indicated category, and 52.8 percent is in the inferred category (**Table 12**).

***Table 11. Summary of restricted coal categories of the Yampa Coal Field by beds. All values in thousands of short tons.***

**Land Use Restrictions**

| Resource Category | B | C/D | E | F | H | I-K | L-Q | Total |
|---|---|---|---|---|---|---|---|---|
| Airports | 0 | 0 | 0 | 672 | 2,703 | 4,030 | 17,578 | **24,983** |
| AVF | 105,872 | 257,404 | 186,954 | 229,531 | 134,511 | 124,282 | 255,970 | **1,294,524** |
| City | 3,423 | 14,147 | 12,787 | 26,419 | 18,011 | 17,991 | 29,219 | **121,997** |
| Pipelines | 7,123 | 24,254 | 19,121 | 22,462 | 12,660 | 15,182 | 50,014 | **150,816** |
| Power lines | 15,553 | 45,147 | 52,758 | 106,212 | 45,143 | 35,087 | 126,573 | **426,473** |
| Power Stations | 8,071 | 21,746 | 12,345 | 26,303 | 8,195 | 11,808 | 33,850 | **122,408** |
| Railroads | 2,698 | 6,202 | 6,918 | 10,202 | 1,480 | 3,432 | 6,125 | **37,057** |
| Rivers | 297 | 3,959 | 10,369 | 20,732 | 189 | 0 | 7,734 | **43,280** |
| Roads | 6,201 | 16,446 | 13,514 | 23,547 | 5,876 | 8,877 | 21,120 | **95,581** |
| **Total Restrictions** | **149,238** | **389,305** | **314,856** | **466,080** | **228,768** | **220,768** | **548,183** | **2,317,119** |

**Technological Restrictions**

| Resource Category | B | C/D | E | F | H | I-K | L-Q | Total |
|---|---|---|---|---|---|---|---|---|
| Faults | 7,766 | 24,190 | 31,361 | 51,320 | 6,759 | 8,921 | 23,122 | **153,439** |
| Too Steep | 411 | 2,049 | 75,317 | 149,818 | 412 | 6 | 1,741 | **229,754** |
| Interburden <40 ft | 526,666 | 1,213,628 | 816,566 | 1,459,332 | 852,419 | 651,756 | 1,018,263 | **6,538,630** |
| **Total Restrictions** | **534,843** | **1,239,867** | **923,244** | **1,660,470** | **859,590** | **660,683** | **1,043,126** | **6,921,823** |

| Coal Group | Coal Zone | Measured | Indicated | Inferred | Total |
|---|---|---|---|---|---|
| Middle Coal | B | 80,092 | 317,170 | 260,073 | 657,335 |
| | C/D | 214,746 | 873,944 | 1,198,596 | 2,287,286 |
| | E ($E_u$, $E_l$) | 366,474 | 1,175,883 | 1,682,061 | 3,224,418 |
| | F ($F_u$, $F_l$) | 424,693 | 1,253,603 | 2,062,519 | 3,740,815 |
| | H | 244,904 | 676,266 | 677,108 | 1,598,278 |
| Upper Coal | I,J,K | 164,560 | 448,270 | 482,060 | 1,094,890 |
| | L,M,N,O,P,Q | 379,182 | 1,166,416 | 1,911,895 | 3,457,493 |
| | | | | Total of all group | 16,060,515 |

***Table 12. Available coal resources segregated by reliability indicators, Yampa Coal Field. *All values in thousands of short tons.***

Coal zone maps for reliability purposes **Figure 22 (B seam); Figure 23 (C, D seams); Figure 24 (El, Eu, E seams); Figure 25 (Fl, Fu, F seams); Figure 26 (Hl, Hu, H seams); Figure 27 (I, J, K seams); Figure 28 (L, M, N, O, P, and Q seams**) show the drill hole coverages throughout the study area. These maps show measured, indicated, and inferred coal intercepts for each coal zone.

Overburden categories used were: 20–200 ft, 200–500 ft, 500–1,000, and 1,000–2,000 ft. The 20–200 ft depth category represents the surface minable resource (**Table 13**) typical of the Yampa Coal Field. The best surface minable resource is the 692,000 tons available in the L-Q coal group. This is the same resource extracted by Trapper Mine. The best deep resources (1,000–2,000 ft) for available coal are the F coal group with about 2.17 billion short tons. This is the resource mined by the Foidel Creek Mine.

Mincom's MineScape™ program was used to produce maps for the depth to coal (**Figure 29 (B seam); Figure 30 (C, D seams); Figure 31 (El, Eu, E seams); Figure 32 (Fl, Fu, F seams); Figure 33 (Hl, Hu, H seams); Figure 34 (I, J, K seams); Figure 35 (L, M, N, O, P, and Q seams**); show overburden categories by seam for the Yampa Coal Field.

Seven coal thickness categories including: 1.2–2.3 ft (14–28 in), 2.3–3.5 ft, 3.5–5.0 ft, 5.01–10 ft, 10.01–20 ft, 20.01–40 ft, and >40.01 ft were used. As the coal groupings or seams included multiple minable coal beds it was not possible to map individual bed thicknesses. Therefore net coal thickness isopach maps for each group or coal seam were constructed (**Figure 36 (B Seam); Figure 37 (C, D seams); Figure 38 (El, Eu, E seams); Figure 39 (Fl, Fu, F seams); Figure 40 (Hl, Hu, H seams); Figure 41 (I, J, K seams); Figure 42 (L, M, N, O, P, and Q seams**).

***Table 13. Available coal resources segregated by overburden categories, Yampa Coal Field. *All values in thousands of short tons.***

| Coal Group | Coal Zone | 20–200 ft | 200–500 ft | 500–1,000 ft | 1,000–2,000 ft | Total ft |
|---|---|---|---|---|---|---|
| Middle Coal | B | 59,146 | 58,623 | 164,698 | 374,868 | 657,335 |
| | C/D | 150,995 | 282,464 | 543,536 | 1,310,290 | 2,287,285 |
| | E ($E_u$, $E_l$) | 247,922 | 453,163 | 801,598 | 1,721,733 | 3,224,417 |
| | F ($F_u$, $F_l$) | 308,919 | 429,035 | 833,539 | 2,169,322 | 3,740,815 |
| | H | 185,917 | 209,424 | 357,692 | 845,246 | 1,598,279 |
| Upper Coal | I,J,K | 132,208 | 197,173 | 318,317 | 447,191 | 1,094,890 |
| | L,M,N,O,P,Q | 691,974 | 747,870 | 1,364,676 | 652,973 | 3,457,494 |

## MINED-OUT AND REMAINING RESOURCES

The C/D, F, H, and L-Q beds have been mined within the study area. Of the approximately 280 million tons of Williams Fork coal historically mined, 70 percent is from the Wadge or F lower beds (**Figure 43**). About 23 percent is from the Dry Creek Seams (L-Q beds), 3.2 percent is from the combined C and D seams, and about 1.9 percent is from the Fish Creek Seams (I-K seams).

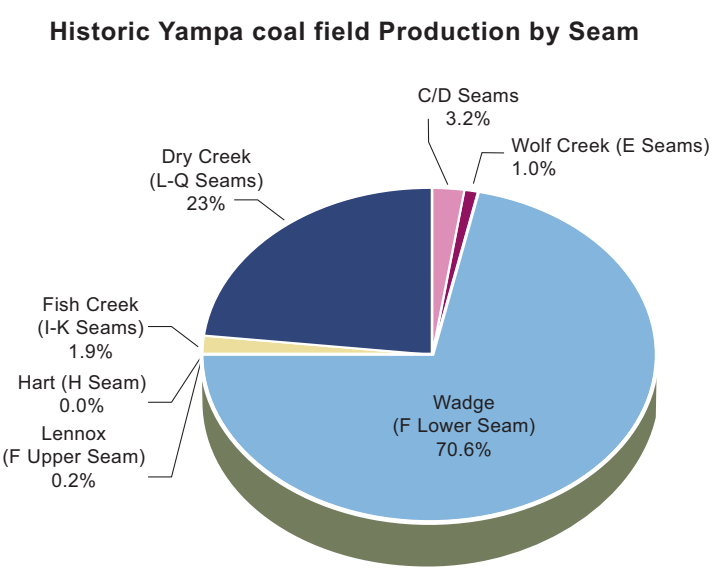



***Figure 43. Percentage chart of historic coal seam production in the Williams Fork Formation, Yampa Coal Field.***

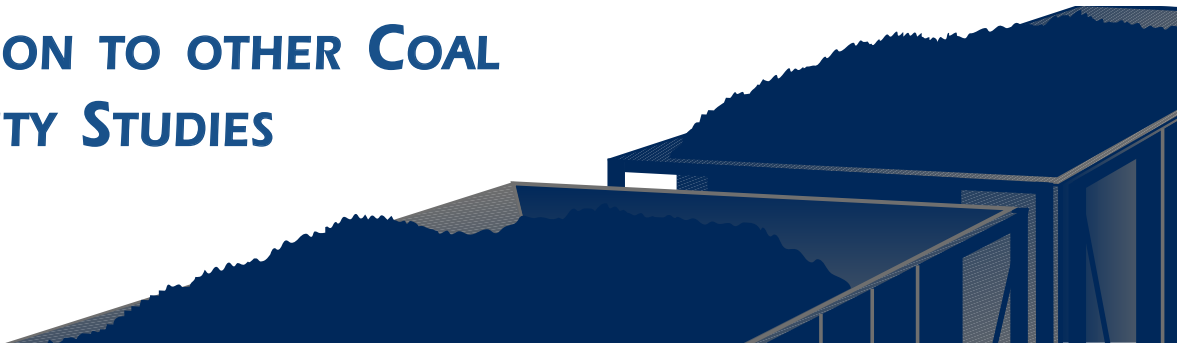
Coal lost in mining includes coal unavailable to be mined due to previous mining of adjacent beds or mining of coal within the same bed. Mining in the underlying Iles Formation was mostly in coal mines outside of the study area near Oak Creek. The amount of coal resource mined or lost-in-mining represents about 0.5 percent of the original resource of 25.5 billion tons. Remaining resources are, therefore, about 99.5 percent of the original resource, or 25.4 billion tons.

## RESTRICTIONS AND AVAILABLE RESOURCES

Land use restrictions limit the availability of 2.32 billion tons of coal, or 9 percent of the original resource. The F and L–Q groups have the highest land use restrictions (**Tables 10 and 11**) applied due to the large volumes of coal calculated. The AVF for the Yampa River is the highest volumetric restriction as 1.29 billion tons are discounted from mining. Power lines (426,473 tons) and pipelines (150,816 tons) are the next greatest land use restriction. Airports and cities (**Figure 16**) mostly restrict mining coal beds higher in the section (F, H, and the upper coal group coals) as they exist in the northern part of the study area. Technological restrictions limit the availability by 6.9 billion tons, almost 28 percent of the original resource. In cases where both land use and technological restrictions might apply, the technological restrictions have been applied, based on the established hierarchy. The primary technological restriction applied is "too thin" interburden thickness. This restriction impacts the C/D, F, and L–Q coal groups, because they have thin interburden and parting in them. These beds consist of multiple coal beds within the given letter designation of the coal seam and cannot all be mined. Surface recovery ratios applied to the L-Q seams should enhance the best locations for recoverable coal.

For available resources, more than 657 million tons, or approximately 4 percent of the available resource of 16.1 billion tons in the study area, is coal from the B beds. The C/D beds contain 2.29 billion tons, or 14 percent of the available resource. The E bed has more than 3.22 billion tons of available coal, or 20 percent of the total. The F bed contains almost 3.74 billion tons, about 23 percent of the total. The F bed had the largest original and available resource in the middle coal group. The H beds have 1.59 billion tons available, or about 10 percent of the total available. This high value may likely be reduced with detailed correlation work, as the beds are laterally discontinuous. This factor was not applied in the technological factors. The upper coal group has 1.09 billion short tons from the I, J, and K group, and 3.46 billion short tons from the L, M, N, O, P, Q zone of coal beds, the latter of which represents 22 percent of the study area's available coal. Both of the largest available coal resources are currently being mined in the Yampa Coal Field.

# Comparision to other Coal Availability Studies

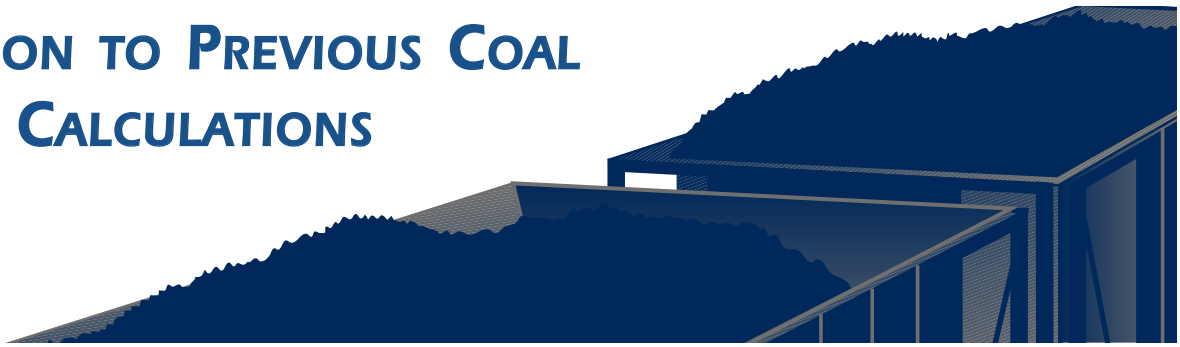


This coal availability study indicates that about 62 percent of the original coal resources (to 2,000 ft deep) in the study area are available for mining. This compares similarly to the Appalachian coal region study where approximately 50 percent of the original coal resource in that region are available for development (Carter and Gardner, 1994). The major differences between Appalachian and Green River Basin coal development include land and mineral ownership patterns, environmental regulations, mining methods, topography and land-management policies. The size of the study area and the number of drill holes also affect the total value. The Yampa study compares more favorably to the 58 percent of available coal recently calculated for the Herrin coal resource in Illinois (Treworgy and others, 2000).

USGS and former USBM coal recoverability studies of the Appalachian region have shown that less than 10 percent of the original resource can be mined and marketed at a profit (Rohrbacher and other, 1994). The coal recoverability study of the Yampa Coal Field will be conducted by the USGS to determine what percent of available coal can be economically recoverable, through design of theoretical mine plans for the study area. These mine plans will consider the restricted resources of the study area and mining practices of the Yampa Coal Field.

This estimate of available coal (62 percent) is lower than the 87 percent of original resources available in the Somerset Coal Field (Schultz and Eakins, 2000). This is due primarily to the larger study area size of the Yampa Coal Field. In this study, coal correlations were carried a much farther distance. The beds modeled in the Somerset Coal Field are all very close, continuous minable coal resources while some of the beds in the Yampa Coal Field may only be marginally economic.

# Comparision to Previous Coal Resource Calculations



Original coal resources for the Yampa Coal Field were previously calculated by the USGS (Landis, 1959). Original coal was calculated to 6,000 ft for all coal formations combined. The U.S. Bureau of Mines estimated in-place coal resources to a depth of 6,000 ft for all of the coals (Mesaverde Group, Lance and Ft. Union) in 1976. According to the estimate, the Yampa Coal Field has a total of 300 billion tons of coal (Speltz, 1976). Speltz also estimated that nearly 1 billion tons of coal are potentially surface minable. This now compares to the CGS calculation of 2.59 billion tons of surface minable coal in the Demonstrated Reserve Base (DRB) of the Williams Fork Formation (Carroll and Morgan, 2000). The CGS also calculated the DRB (measured and indicated coal) for the Williams Fork Formation in the Yampa Coal Field at 9.88 billion short tons to a depth of 2,000 ft. Those estimates used a database of 187 publicly available USGS drill holes.

According to the recent USGS coal assessment the Yampa Coal Field contains a net coal resource of 76 billion short tons in beds greater than 1.2 ft thick (Johnson and others, 2000). This value was reported for the Williams Fork coals down to 6,000 ft deep. Forty-six percent of this is identified (measured and indicated), and more than 50 percent of the coal is deeper than 3,000 ft deep. These values comprise a summary of all coal resource data collected in the 1970s and 1980s by the USGS and a geologic contractor. Dames and Moore, under contract with the USGS, compiled a series of Coal Resource Occurrence and Coal Development Potential maps of northwest Colorado. These maps show locations of public surface and subsurface data and coal resource calculations at the 7.5' quadrangle scale. This value is larger because the areal extent of the Williams Fork Formation down to 6,000 ft is a much larger study area definition of the Yampa Coal Field.

A close comparison to the available coal resources calculated here are those published by the USGS 40 to 50 years ago. In 1949, Frank Spencer (from Landis, 1959) estimated measured and indicated original subbituminous and bituminous coal resources. They calculated 5.1 billion tons of coal (Landis, 1959) in the Williams Fork and Iles Formations within the same townships as this study area. The resources were segregated into measured, indicated, and inferred resources and also classified as original, remaining and recoverable. Landis provided resources for the Yampa Coal Field by county, township and range, overburden thickness and coal thickness. Coal tonnage estimates given for the 22 townships that occur within the Yampa Coal Field are shown in **Table 14**.

The 1959 estimate of original resources, which total more than 1.9 billion tons, are for beds greater than 14-in thick and overburden less than 3,000 ft. The resource calculations for their coal evaluation include beds greater than 3,000-ft deep, hypothetical resources, and are based on additional data points. Note that in T. 5 N., R. 89 W., resource data for the coal availability study was limited to just one drill hole. This township is currently under lease for development by the Cottonwood Coal Company and all data is strictly confidential and not available for this study. Hence, resources in this area are underevaluated and not completely known. It was estimated that 5.1 billion tons of original coal exist in this area, according to the USGS (Landis, 1959). This estimate represents about 20 percent of the original coal resources of more than 25 billion tons calculated in this coal availability study.

Comparison of resource estimates for the Yampa Coal Field show the usefulness of periodically recalculating coal resources for an area where there have been significant increases in the availability of data. The coal availability calculation is a further refinement, which indicates the amount of the original coal resource that has already been mined and the amount of coal available for development.

***Table 14. Comparison of bituminous and subbituminous coal resource calculations in the Williams Fork Formation, Yampa Coal Field (1959). Values listed in millions of short tons of coal.***

| **Township and Range** | **Original Resources ;** (Million short tons; Landis, 1959) | **Original Bituminous Resources for Williams Fork Coal Seams** (measured and indicated- Million short tons; From Landis, 1959, but data calculated by Spencer, 1949) | **Original Sub-bituminous Resources for Williams Fork Coal Seams** (measured and indicated- Million short tons; From Landis, 1959, but but data calculated by Spencer, 1949) |
|---|---|---|---|
| T. 4 N., R. 85 W. | 148.96 | 18.94 | – |
| T. 4 N., R. 86 W. | 469.8 | 55.37 | – |
| T. 4 N., R. 87 W. | 57.68 | 32.32 | – |
| T. 5 N., R. 85 W. | 187.78 | 25.18 | – |
| T. 5 N., R. 86 W. | 725.6 | 185.08 | 38.49 |
| T. 5 N., R. 87 W. | 46.9 | 14 | 34.33 |
| T. 5 N., R. 88 W. | 224.02 | 224.02 | 177.17 |
| T. 5 N., R. 89 W. | 906.54 | 837.33 | 217.07 |
| T. 5 N., R. 90 W. | 492.8 | 257.29 | 46.85 |
| T. 5 N., R. 91 W. | 336.46 | – | – |
| T. 5 N., R. 92 W. | 77.08 | – | – |
| T. 5 N., R. 93 W. | 10.66 | – | – |
| T. 5 N., R 94 W. | 6.03 | – | – |
| T. 6 N., R 86 W. | 63.39 | 28.07 | 3.04 |
| T. 6 N., R 87 W. | 773.29 | 318.56 | 50.65 |
| T. 6 N., R. 88 W. | 114.05 | 114.05 | 128.71 |
| T. 6 N., R. 89 W. | – | – | 84.13 |
| T. 6 N., R. 90 W. | 76.7 | 76.7 | 120.94 |
| T. 6 N., R. 91 W. | 101.53 | – | – |
| T. 6 N., R. 92 W. | 68.92 | – | – |
| T. 6 N., R. 93 W. | 212.25 | – | – |
| T. 6 N., R 94 W. | 5.44 | – | – |
| **Total** | **5,096.88** | **2,186.91** | **901.38** |

# Summary and Recommendations

Computer calculations of coal in the Williams Fork Formation of the Yampa Coal Field to 2,000 ft deep indicate that 16.1 billion tons of coal are available from seven major coal zones. The two coal zones with the largest amount of available coal are the F beds (3.7 billion tons in the Wadge and Lennox beds of the middle coal group) and the L-Q beds (3.5 billion tons in the Dry Creek beds of the upper coal group). Of the 2.22 billion tons available to surface mining (depth <200 ft), the greatest resource is the 842 million tons in the L-Q zone of coals. Assuming that this subbituminous coal will be recovered using surface mining techniques, and using a recoverable factor of 90 percent, then 758 million tons might possibly by produced in the future. The best underground potential is in the F zones of coal in the bituminous rank middle coal group. For underground coal between 200 and 2,000 ft deep, 3.74 billion tons are available in the Wadge and Lennox beds. Assuming a 60 percent recoverable rate, and flat lenticular coal beds, then 2.24 billion tons from the F zone might possibly be mined in the future. Most Williams Fork Formation coal is low sulfur; moderately low ash and meets compliance standards for clean coal. Seam thicknesses range from 4 to 8 ft.

New calculations of the original resources for the Williams Fork Formation in the Yampa Coal Field to a depth of 2,000 ft are 25.7 billion short tons (**Table 15**). Technologic restrictions and mined-out areas have removed 6.9 billion tons from the original resource within the study area. Surface restrictions further remove 2.3 billion tons of coal. The available resource remaining is 16.1 billion short tons for this study area. Of this resource, 1.78 billion short tons, or 11 percent is less than 200 ft deep for surface minable resources, leaving 14.3 billion tons between 200 and 2,000 ft deep. Of this latter resource, 6.7 billion short tons of coal are available at a shallower underground depth between 200 and 1,000 ft. These values are slightly higher than those previously calculated for the Yampa Coal Field and are due in part to the larger drill hole database used. **Table 16** is a summary of all coal resources calculated for the Williams Fork Formation to 2,000 ft deep in the Yampa Coal Field.

For future study it is recommended that drill hole data include the underlying Iles Formation so that the deeper reserve be evaluated in the Yampa Coal Field. Computer techniques such as GIS ArcInfo™ help calculate resources quickly and allow for substantial time saving when re-calculating reserves when land use changes affect the resource. Further characterization of coal resources by quality parameters would be important to the marketing and distribution of Williams Fork compliance coal.

***Table 15. Original coal resources segregated by reliability categories, Yampa Coal Field. All values in thousands of short tons.***

| Coal Group | Coal Zone | Measured | Indicated | Inferred | Total |
|---|---|---|---|---|---|
| Middle Coal | B | 198,928 | 663,200 | 479,294 | 1,341,422 |
| | C/D | 456,116 | 1,636,805 | 1,949,935 | 4,042,856 |
| | E ($E_u$, $E_l$) | 522,909 | 1,712,061 | 2,235,164 | 4,470,134 |
| | F ($F_u$, $F_l$) | 806,643 | 2,245,235 | 3,021,170 | 6,073,048 |
| | H | 445,113 | 1,227,439 | 1,021,308 | 2,693,860 |
| Upper Coal | I,J,K | 298,392 | 964,844 | 713,027 | 1,976,263 |
| | L,M,N,O,P,Q | 648,156 | 1,984,027 | 2,500,465 | 5,132,648 |
| | | Total of Upper and Lower Groups | | | 25,730,233 |

It should also be noted that in a large regional study such as this, continuous stratigraphic assumptions are built into the resource calculations. Coal beds interpreted as lenticular throughout the entire study area are not necessarily contiguous. Further studies should take into consideration drill hole spacing to establish better continuity between coal seams. Detailed correlations on a bed by bed basis should also be done for mine planning in the Yampa Coal Field.

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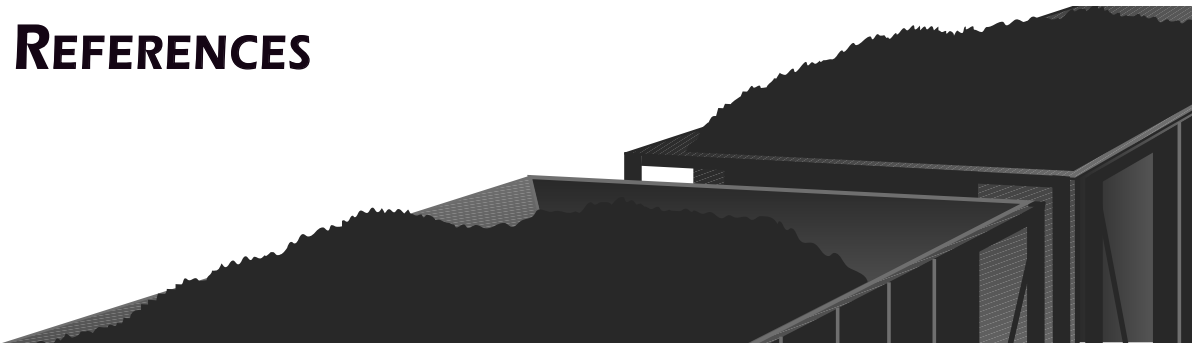


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*Table A1a.* ***Summary of estimated coal resources of the "B" coal bed, Yampa Coal Field, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 143.8 | 293.9 | 325.6 | 2,468.5 | 1,231.5 | 0.0 | 0.0 | 4,463.3 |
| | 200 - 500 | 335.1 | 968.8 | 1,008.6 | 7,451.6 | 7,191.9 | 0.0 | 0.0 | 16,956.0 |
| | 500 - 1000 | 448.7 | 1,495.2 | 2,869.9 | 19,407.4 | 28,911.3 | 4,418.6 | 0.0 | 57,551.0 |
| | 1000 - 2000 | 600.7 | 1,055.8 | 3,117.9 | 19,168.8 | 92,398.6 | 3,615.7 | 0.0 | 119,957.5 |
| | TOTAL | 1,528.3 | 3,813.6 | 7,322.0 | 48,496.3 | 129,733.3 | 8,034.3 | 0.0 | 198,927.8 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 143.8 | 293.9 | 325.6 | 2,468.5 | 1,231.5 | 0.0 | 0.0 | 4,463.3 |
| | 200 - 500 | 335.1 | 968.8 | 1,008.6 | 7,451.6 | 7,191.9 | 0.0 | 0.0 | 16,956.0 |
| | 500 - 1000 | 448.7 | 1,495.2 | 2,869.9 | 19,407.4 | 28,911.3 | 4,418.6 | 0.0 | 57,551.0 |
| | 1000 - 2000 | 600.7 | 1,055.8 | 3,117.9 | 19,168.8 | 92,398.6 | 3,615.7 | 0.0 | 119,957.5 |
| | TOTAL | 1,528.3 | 3,813.6 | 7,322.0 | 48,496.3 | 129,733.3 | 8,034.3 | 0.0 | 198,927.8 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 0.0 | 0.0 | 0.0 | 19.1 | 197.7 | 0.0 | 0.0 | 216.7 |
| | 200 - 500 | 0.0 | 0.0 | 24.0 | 288.0 | 1,493.6 | 0.0 | 0.0 | 1,805.5 |
| | 500 - 1000 | 0.9 | 4.1 | 73.5 | 487.2 | 2,916.4 | 0.0 | 0.0 | 3,482.1 |
| | 1000 - 2000 | 0.0 | 0.0 | 310.0 | 1,751.4 | 1,552.2 | 249.1 | 0.0 | 3,862.7 |
| | TOTAL | 0.9 | 4.1 | 407.4 | 2,545.7 | 6,159.8 | 249.1 | 0.0 | 9,367.0 |
| Technological | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 19.2 | 297.8 | 609.0 | 3,030.4 | 3,462.1 | 0.0 | 0.0 | 7,418.5 |
| | 500 - 1000 | 79.2 | 383.0 | 600.4 | 3,196.2 | 16,451.5 | 86.0 | 0.0 | 20,796.3 |
| | 1000 - 2000 | 521.3 | 783.5 | 1,466.2 | 7,223.1 | 67,932.8 | 3,327.3 | 0.0 | 81,254.2 |
| | TOTAL | 619.7 | 1,464.3 | 2,675.6 | 13,449.7 | 87,846.5 | 3,413.3 | 0.0 | 109,469.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 19.1 | 197.7 | 0.0 | 0.0 | 216.7 |
| | 200 - 500 | 19.2 | 297.8 | 633.0 | 3,318.4 | 4,955.7 | 0.0 | 0.0 | 9,224.1 |
| | 500 - 1000 | 80.1 | 387.1 | 673.9 | 3,683.4 | 19,367.9 | 86.0 | 0.0 | 24,278.4 |
| | 1000 - 2000 | 521.3 | 783.5 | 1,776.2 | 8,974.4 | 69,485.1 | 3,576.4 | 0.0 | 85,116.9 |
| | TOTAL | 620.6 | 1,468.4 | 3,083.0 | 15,995.3 | 94,006.3 | 3,662.4 | 0.0 | 118,836.0 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 143.8 | 293.9 | 325.6 | 2,449.5 | 1,033.8 | 0.0 | 0.0 | 4,246.5 |
| | 200 - 500 | 315.9 | 671.0 | 375.7 | 4,133.2 | 2,236.2 | 0.0 | 0.0 | 7,732.0 |
| | 500 - 1000 | 368.6 | 1,108.1 | 2,196.0 | 15,724.0 | 9,543.4 | 4,332.6 | 0.0 | 33,272.7 |
| | 1000 - 2000 | 79.4 | 272.3 | 1,341.7 | 10,194.4 | 22,913.5 | 39.3 | 0.0 | 34,840.6 |
| | TOTAL | 907.7 | 2,345.2 | 4,239.0 | 32,501.0 | 35,726.9 | 4,371.9 | 0.0 | 80,091.8 |

*Table A1b.* ***Summary of estimated coal resources of the "B" coal bed, Yampa Coal Field, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 252.2 | 817.8 | 3,115.2 | 18,191.6 | 13,434.3 | 0.0 | 0.0 | 35,811.1 |
| | 200 - 500 | 1,280.3 | 1,611.8 | 4,174.7 | 28,303.3 | 40,551.5 | 0.0 | 0.0 | 75,921.6 |
| | 500 - 1000 | 2,498.4 | 6,462.3 | 8,484.2 | 54,643.9 | 94,582.1 | 7,357.9 | 0.0 | 174,028.8 |
| | 1000 - 2000 | 3,149.3 | 9,544.1 | 19,791.7 | 102,477.5 | 239,299.6 | 3,176.2 | 0.0 | 377,438.5 |
| | TOTAL | 7,180.3 | 18,436.1 | 35,565.8 | 203,616.3 | 387,867.5 | 10,534.1 | 0.0 | 663,199.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 252.2 | 817.8 | 3,115.2 | 18,191.6 | 13,434.3 | 0.0 | 0.0 | 35,811.1 |
| | 200 - 500 | 1,280.3 | 1,611.8 | 4,174.7 | 28,303.3 | 40,551.5 | 0.0 | 0.0 | 75,921.6 |
| | 500 - 1000 | 2,498.4 | 6,462.3 | 8,484.2 | 54,643.9 | 94,582.1 | 7,357.9 | 0.0 | 174,028.8 |
| | 1000 - 2000 | 3,149.3 | 9,544.1 | 19,791.7 | 102,477.5 | 239,299.6 | 3,176.2 | 0.0 | 377,438.5 |
| | TOTAL | 7,180.3 | 18,436.1 | 35,565.8 | 203,616.3 | 387,867.5 | 10,534.1 | 0.0 | 663,199.9 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 2.8 | 5.8 | 135.3 | 1,040.0 | 2,745.0 | 0.0 | 0.0 | 3,928.9 |
| | 200 - 500 | 22.9 | 51.1 | 21.2 | 785.3 | 4,673.9 | 0.0 | 0.0 | 5,554.4 |
| | 500 - 1000 | 20.7 | 31.4 | 495.9 | 2,461.9 | 19,883.8 | 309.1 | 0.0 | 23,202.8 |
| | 1000 - 2000 | 119.6 | 500.3 | 1,669.0 | 9,392.7 | 19,106.6 | 596.8 | 0.0 | 31,384.9 |
| | TOTAL | 165.9 | 588.7 | 2,321.4 | 13,679.8 | 46,409.3 | 905.9 | 0.0 | 64,071.0 |
| Technological | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 294.7 | 782.7 | 1,287.7 | 8,169.3 | 24,876.2 | 0.0 | 0.0 | 35,410.7 |
| | 500 - 1000 | 1,124.1 | 3,221.4 | 4,468.2 | 10,117.6 | 25,857.2 | 2,852.2 | 0.0 | 47,640.7 |
| | 1000 - 2000 | 2,572.0 | 7,851.5 | 9,712.9 | 35,317.3 | 141,197.3 | 2,256.1 | 0.0 | 198,907.1 |
| | TOTAL | 3,990.8 | 11,855.6 | 15,468.8 | 53,604.3 | 191,930.7 | 5,108.3 | 0.0 | 281,958.4 |
| Total | 20 - 200 | 2.8 | 5.8 | 135.3 | 1,040.0 | 2,745.0 | 0.0 | 0.0 | 3,928.9 |
| | 200 - 500 | 317.5 | 833.8 | 1,309.0 | 8,954.7 | 29,550.2 | 0.0 | 0.0 | 40,965.1 |
| | 500 - 1000 | 1,144.8 | 3,252.8 | 4,964.1 | 12,579.5 | 45,741.0 | 3,161.3 | 0.0 | 70,843.4 |
| | 1000 - 2000 | 2,691.6 | 8,351.8 | 11,382.0 | 44,710.0 | 160,303.9 | 2,852.8 | 0.0 | 230,292.1 |
| | TOTAL | 4,156.7 | 12,444.3 | 17,790.2 | 67,284.1 | 238,340.0 | 6,014.2 | 0.0 | 346,029.4 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 249.4 | 812.0 | 2,979.9 | 17,151.6 | 10,689.3 | 0.0 | 0.0 | 31,882.2 |
| | 200 - 500 | 962.8 | 778.0 | 2,865.7 | 19,348.6 | 11,001.3 | 0.0 | 0.0 | 34,956.5 |
| | 500 - 1000 | 1,353.6 | 3,209.5 | 3,520.1 | 42,064.4 | 48,841.1 | 4,196.6 | 0.0 | 103,185.4 |
| | 1000 - 2000 | 457.7 | 1,192.3 | 8,409.8 | 57,767.6 | 78,995.7 | 323.4 | 0.0 | 147,146.4 |
| | TOTAL | 3,023.5 | 5,991.8 | 17,775.5 | 136,332.2 | 149,527.5 | 4,520.0 | 0.0 | 317,170.5 |

*Table A1c.* ***Summary of estimated coal resources of the "B" coal bed, Yampa Coal Field, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 601.2 | 1,889.8 | 3,909.6 | 14,080.2 | 9,335.5 | 0.0 | 0.0 | 29,816.3 |
| | 200 - 500 | 1,832.4 | 1,467.4 | 5,598.0 | 9,502.0 | 12,738.9 | 0.0 | 0.0 | 31,138.6 |
| | 500 - 1000 | 4,123.9 | 2,536.2 | 6,968.2 | 22,319.2 | 13,743.3 | 0.0 | 0.0 | 49,690.7 |
| | 1000 - 2000 | 11,469.2 | 27,477.4 | 56,331.4 | 182,701.8 | 90,668.7 | 0.0 | 0.0 | 368,648.5 |
| | TOTAL | 18,026.6 | 33,370.7 | 72,807.2 | 228,603.2 | 126,486.5 | 0.0 | 0.0 | 479,294.1 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 601.2 | 1,889.8 | 3,909.6 | 14,080.2 | 9,335.5 | 0.0 | 0.0 | 29,816.3 |
| | 200 - 500 | 1,832.4 | 1,467.4 | 5,598.0 | 9,502.0 | 12,738.9 | 0.0 | 0.0 | 31,138.6 |
| | 500 - 1000 | 4,123.9 | 2,536.2 | 6,968.2 | 22,319.2 | 13,743.3 | 0.0 | 0.0 | 49,690.7 |
| | 1000 - 2000 | 11,469.2 | 27,477.4 | 56,331.4 | 182,701.8 | 90,668.7 | 0.0 | 0.0 | 368,648.5 |
| | TOTAL | 18,026.6 | 33,370.7 | 72,807.2 | 228,603.2 | 126,486.5 | 0.0 | 0.0 | 479,294.1 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 21.6 | 643.0 | 545.6 | 3,654.8 | 1,719.1 | 0.0 | 0.0 | 6,584.1 |
| | 200 - 500 | 396.0 | 761.5 | 1,335.3 | 1,578.9 | 2,171.0 | 0.0 | 0.0 | 6,242.7 |
| | 500 - 1000 | 425.4 | 355.3 | 1,476.1 | 1,037.2 | 1,125.4 | 0.0 | 0.0 | 4,419.4 |
| | 1000 - 2000 | 1,496.3 | 2,454.7 | 3,824.9 | 23,510.9 | 27,270.9 | 0.0 | 0.0 | 58,557.7 |
| | TOTAL | 2,339.3 | 4,214.4 | 7,181.9 | 29,781.8 | 32,286.5 | 0.0 | 0.0 | 75,803.9 |
| Technological | 20 - 200 | 72.0 | 22.7 | 89.3 | 31.1 | 0.0 | 0.0 | 0.0 | 215.0 |
| | 200 - 500 | 300.5 | 433.2 | 2,987.8 | 1,262.3 | 3,977.2 | 0.0 | 0.0 | 8,961.1 |
| | 500 - 1000 | 875.1 | 964.8 | 4,839.0 | 8,039.0 | 2,313.4 | 0.0 | 0.0 | 17,031.4 |
| | 1000 - 2000 | 4,484.5 | 11,601.8 | 17,325.5 | 34,860.2 | 48,937.6 | 0.0 | 0.0 | 117,209.6 |
| | TOTAL | 5,732.2 | 13,022.6 | 25,241.5 | 44,192.6 | 55,228.3 | 0.0 | 0.0 | 143,417.1 |
| Total | 20 - 200 | 93.6 | 665.7 | 634.9 | 3,685.9 | 1,719.1 | 0.0 | 0.0 | 6,799.2 |
| | 200 - 500 | 696.5 | 1,194.8 | 4,323.1 | 2,841.2 | 6,148.3 | 0.0 | 0.0 | 15,203.8 |
| | 500 - 1000 | 1,300.5 | 1,320.1 | 6,315.1 | 9,076.2 | 3,438.8 | 0.0 | 0.0 | 21,450.7 |
| | 1000 - 2000 | 5,980.8 | 14,056.4 | 21,150.4 | 58,371.1 | 76,208.6 | 0.0 | 0.0 | 175,767.3 |
| | TOTAL | 8,071.5 | 17,236.9 | 32,423.4 | 73,974.4 | 87,514.8 | 0.0 | 0.0 | 219,221.0 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 507.6 | 1,224.1 | 3,274.7 | 10,394.4 | 7,616.4 | 0.0 | 0.0 | 23,017.2 |
| | 200 - 500 | 1,135.9 | 272.6 | 1,274.9 | 6,660.7 | 6,590.6 | 0.0 | 0.0 | 15,934.7 |
| | 500 - 1000 | 2,823.4 | 1,216.1 | 653.0 | 13,243.0 | 10,304.5 | 0.0 | 0.0 | 28,239.9 |
| | 1000 - 2000 | 5,488.3 | 13,421.0 | 35,181.1 | 124,330.7 | 14,460.2 | 0.0 | 0.0 | 192,881.2 |
| | TOTAL | 9,955.1 | 16,133.8 | 40,383.7 | 154,628.8 | 38,971.7 | 0.0 | 0.0 | 260,073.0 |

*Table A1d.* ***Summary of estimated coal resources of the "B" coal bed, Yampa Coal Field, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 997.1 | 3,001.5 | 7,350.4 | 34,740.3 | 24,001.3 | 0.0 | 0.0 | 70,090.7 |
| | 200 - 500 | 3,447.8 | 4,047.9 | 10,781.3 | 45,256.8 | 60,482.3 | 0.0 | 0.0 | 124,016.1 |
| | 500 - 1000 | 7,071.0 | 10,493.7 | 18,322.3 | 96,370.4 | 137,236.7 | 11,776.5 | 0.0 | 281,270.5 |
| | 1000 - 2000 | 15,219.2 | 38,077.3 | 79,241.0 | 304,348.2 | 422,366.9 | 6,791.9 | 0.0 | 866,044.5 |
| | TOTAL | 26,735.1 | 55,620.4 | 115,694.9 | 480,715.8 | 644,087.2 | 18,568.4 | 0.0 | 1,341,421.8 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 20.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 20.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 997.1 | 3,001.5 | 7,350.4 | 34,740.3 | 24,001.3 | 0.0 | 0.0 | 70,090.7 |
| | 200 - 500 | 3,447.8 | 4,047.9 | 10,781.3 | 45,256.8 | 60,482.3 | 0.0 | 0.0 | 124,016.1 |
| | 500 - 1000 | 7,071.0 | 10,493.7 | 18,322.3 | 96,370.4 | 137,236.7 | 11,776.5 | 0.0 | 281,270.5 |
| | 1000 - 2000 | 15,219.2 | 38,077.3 | 79,241.0 | 304,348.2 | 422,366.9 | 6,791.9 | 0.0 | 866,044.5 |
| | TOTAL | 26,735.1 | 55,620.4 | 115,694.9 | 480,715.8 | 644,087.2 | 18,568.4 | 0.0 | 1,341,421.8 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 24.4 | 648.8 | 680.9 | 4,713.8 | 4,661.8 | 0.0 | 0.0 | 10,729.7 |
| | 200 - 500 | 418.8 | 812.6 | 1,380.5 | 2,652.2 | 8,338.5 | 0.0 | 0.0 | 13,602.7 |
| | 500 - 1000 | 446.9 | 390.8 | 2,045.5 | 3,986.3 | 23,925.6 | 309.1 | 0.0 | 31,104.2 |
| | 1000 - 2000 | 1,615.9 | 2,955.0 | 5,803.9 | 34,654.9 | 47,929.8 | 845.9 | 0.0 | 93,805.3 |
| | TOTAL | 2,506.1 | 4,807.1 | 9,910.7 | 46,007.3 | 84,855.7 | 1,155.0 | 0.0 | 149,241.9 |
| Technological | 20 - 200 | 72.0 | 22.7 | 89.3 | 31.1 | 0.0 | 0.0 | 0.0 | 215.0 |
| | 200 - 500 | 614.4 | 1,513.7 | 4,884.5 | 12,462.1 | 32,315.6 | 0.0 | 0.0 | 51,790.3 |
| | 500 - 1000 | 2,078.5 | 4,569.2 | 9,907.5 | 21,352.8 | 44,622.1 | 2,938.2 | 0.0 | 85,468.3 |
| | 1000 - 2000 | 7,577.8 | 20,236.9 | 28,504.6 | 77,400.6 | 258,067.7 | 5,583.4 | 0.0 | 397,371.0 |
| | TOTAL | 10,342.7 | 26,342.4 | 43,385.9 | 111,246.5 | 335,005.5 | 8,521.6 | 0.0 | 534,844.6 |
| Total | 20 - 200 | 96.4 | 671.5 | 770.1 | 4,744.9 | 4,661.8 | 0.0 | 0.0 | 10,944.7 |
| | 200 - 500 | 1,033.2 | 2,326.3 | 6,265.0 | 15,114.3 | 40,654.1 | 0.0 | 0.0 | 65,393.0 |
| | 500 - 1000 | 2,525.4 | 4,959.9 | 11,953.1 | 25,339.1 | 68,547.7 | 3,247.3 | 0.0 | 116,572.5 |
| | 1000 - 2000 | 9,193.7 | 23,191.8 | 34,308.5 | 112,055.5 | 305,997.5 | 6,429.2 | 0.0 | 491,176.2 |
| | TOTAL | 12,848.8 | 31,149.6 | 53,296.6 | 157,253.8 | 419,861.1 | 9,676.5 | 0.0 | 684,086.5 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 900.7 | 2,330.0 | 6,580.3 | 29,995.4 | 19,339.5 | 0.0 | 0.0 | 59,145.9 |
| | 200 - 500 | 2,414.6 | 1,721.6 | 4,516.3 | 30,142.5 | 19,828.2 | 0.0 | 0.0 | 58,623.2 |
| | 500 - 1000 | 4,545.6 | 5,533.7 | 6,369.2 | 71,031.3 | 68,689.0 | 8,529.2 | 0.0 | 164,698.0 |
| | 1000 - 2000 | 6,025.5 | 14,885.5 | 44,932.5 | 192,292.7 | 116,369.4 | 362.7 | 0.0 | 374,868.2 |
| | TOTAL | 13,886.3 | 24,470.8 | 62,398.3 | 323,462.0 | 224,226.1 | 8,891.8 | 0.0 | 657,335.3 |

*Table A2a.* ***Summary of estimated coal resources of the "C and D" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 129.7 | 362.6 | 1,166.5 | 6,523.0 | 11,166.6 | 2,832.9 | 0.0 | 22,181.2 |
| | 200 - 500 | 503.0 | 1,269.6 | 2,132.4 | 19,279.9 | 34,715.0 | 10,921.4 | 0.0 | 68,821.2 |
| | 500 - 1000 | 1,464.5 | 3,011.9 | 6,969.4 | 43,579.4 | 80,793.4 | 20,056.6 | 0.0 | 155,875.2 |
| | 1000 - 2000 | 1,581.7 | 3,564.0 | 14,313.7 | 73,575.6 | 88,600.5 | 27,602.6 | 0.0 | 209,238.0 |
| | TOTAL | 3,678.9 | 8,208.2 | 24,581.9 | 142,957.9 | 215,275.4 | 61,413.5 | 0.0 | 456,115.7 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 59.6 | 0.0 | 0.0 | 59.6 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 59.6 | 0.0 | 0.0 | 59.6 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 858.4 | 229.9 | 1,866.0 | 0.0 | 2,954.3 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 17,613.0 | 5,527.9 | 0.0 | 23,140.9 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 858.4 | 17,842.9 | 7,393.9 | 0.0 | 26,095.2 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 59.6 | 0.0 | 0.0 | 59.6 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 858.4 | 229.9 | 1,866.0 | 0.0 | 2,954.3 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 17,613.0 | 5,527.9 | 0.0 | 23,140.9 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 858.4 | 17,902.5 | 7,393.9 | 0.0 | 26,154.8 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 129.7 | 362.6 | 1,166.5 | 6,523.0 | 11,106.9 | 2,832.9 | 0.0 | 22,121.6 |
| | 200 - 500 | 503.0 | 1,269.6 | 2,132.4 | 19,279.9 | 34,715.0 | 10,921.4 | 0.0 | 68,821.2 |
| | 500 - 1000 | 1,464.5 | 3,011.9 | 6,969.4 | 42,721.0 | 80,563.5 | 18,190.6 | 0.0 | 152,920.9 |
| | 1000 - 2000 | 1,581.7 | 3,564.0 | 14,313.7 | 73,575.6 | 70,987.5 | 22,074.7 | 0.0 | 186,097.1 |
| | TOTAL | 3,678.9 | 8,208.2 | 24,581.9 | 142,099.5 | 197,372.9 | 54,019.6 | 0.0 | 429,960.8 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 0.0 | 20.2 | 0.0 | 451.1 | 474.7 | 0.0 | 0.0 | 946.0 |
| | 200 - 500 | 0.7 | 84.6 | 27.3 | 1,368.5 | 1,003.8 | 554.3 | 0.0 | 3,039.3 |
| | 500 - 1000 | 148.5 | 264.8 | 996.0 | 852.5 | 2,235.7 | 1,677.5 | 0.0 | 6,175.1 |
| | 1000 - 2000 | 87.2 | 118.0 | 1,148.9 | 2,933.7 | 8,848.8 | 3,952.3 | 0.0 | 17,088.9 |
| | TOTAL | 236.4 | 487.6 | 2,172.1 | 5,605.8 | 12,563.1 | 6,184.1 | 0.0 | 27,249.2 |
| Technological | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 197.8 | 347.8 | 511.7 | 4,625.1 | 10,841.7 | 3,596.3 | 0.0 | 20,120.3 |
| | 500 - 1000 | 229.9 | 1,165.0 | 1,639.5 | 14,303.3 | 21,681.6 | 5,411.4 | 0.0 | 44,430.7 |
| | 1000 - 2000 | 410.8 | 2,482.3 | 9,319.6 | 49,635.0 | 41,994.1 | 19,573.3 | 0.0 | 123,415.1 |
| | TOTAL | 838.5 | 3,995.1 | 11,470.7 | 68,563.4 | 74,517.3 | 28,581.0 | 0.0 | 187,966.1 |
| Total | 20 - 200 | 0.0 | 20.2 | 0.0 | 451.1 | 474.7 | 0.0 | 0.0 | 946.0 |
| | 200 - 500 | 198.5 | 432.4 | 539.0 | 5,993.6 | 11,845.5 | 4,150.6 | 0.0 | 23,159.6 |
| | 500 - 1000 | 378.4 | 1,429.8 | 2,635.5 | 15,155.8 | 23,917.4 | 7,088.9 | 0.0 | 50,605.7 |
| | 1000 - 2000 | 498.0 | 2,600.3 | 10,468.4 | 52,568.7 | 50,842.9 | 23,525.7 | 0.0 | 140,503.9 |
| | TOTAL | 1,075.0 | 4,482.7 | 13,642.9 | 74,169.2 | 87,080.4 | 34,765.1 | 0.0 | 215,215.2 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 129.7 | 342.4 | 1,166.5 | 6,071.9 | 10,632.3 | 2,832.9 | 0.0 | 21,175.6 |
| | 200 - 500 | 304.4 | 837.2 | 1,593.4 | 13,286.3 | 22,869.4 | 6,770.8 | 0.0 | 45,661.6 |
| | 500 - 1000 | 1,086.1 | 1,582.1 | 4,333.9 | 27,565.2 | 56,646.2 | 11,101.8 | 0.0 | 102,315.2 |
| | 1000 - 2000 | 1,083.7 | 963.8 | 3,845.2 | 21,006.9 | 20,144.6 | -1,451.0 | 0.0 | 45,593.2 |
| | TOTAL | 2,603.9 | 3,725.5 | 10,939.0 | 67,930.3 | 110,292.5 | 19,254.5 | 0.0 | 214,745.6 |

*Table A2b.* ***Summary of estimated coal resources of the "C and D" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 913.3 | 1,754.8 | 3,412.7 | 33,710.9 | 69,237.9 | 5,058.7 | 0.0 | 114,088.3 |
| | 200 - 500 | 1,321.1 | 3,452.8 | 9,340.1 | 80,003.3 | 116,275.5 | 16,665.3 | 0.0 | 227,058.0 |
| | 500 - 1000 | 3,373.2 | 7,871.6 | 21,288.9 | 143,599.6 | 233,320.0 | 38,077.1 | 0.0 | 447,530.4 |
| | 1000 - 2000 | 8,201.2 | 16,219.6 | 48,706.8 | 232,960.5 | 455,478.8 | 86,561.7 | 0.0 | 848,128.5 |
| | TOTAL | 13,808.8 | 29,298.7 | 82,748.5 | 490,274.3 | 874,312.2 | 146,362.7 | 0.0 | 1,636,805.2 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 351.6 | 657.0 | 0.0 | 0.0 | 1,008.6 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 4,368.8 | 6,001.0 | 6,488.4 | 0.0 | 16,858.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 7,403.8 | 6,355.3 | 115.9 | 0.0 | 13,875.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 12,124.2 | 13,013.3 | 6,604.3 | 0.0 | 31,741.8 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 351.6 | 657.0 | 0.0 | 0.0 | 1,008.6 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 4,368.8 | 6,001.0 | 6,488.4 | 0.0 | 16,858.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 7,403.8 | 6,355.3 | 115.9 | 0.0 | 13,875.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 12,124.2 | 13,013.3 | 6,604.3 | 0.0 | 31,741.8 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 913.3 | 1,754.8 | 3,412.7 | 33,710.9 | 69,237.9 | 5,058.7 | 0.0 | 114,088.3 |
| | 200 - 500 | 1,321.1 | 3,452.8 | 9,340.1 | 79,651.7 | 115,618.5 | 16,665.3 | 0.0 | 226,049.4 |
| | 500 - 1000 | 3,373.2 | 7,871.6 | 21,288.9 | 139,230.8 | 227,319.0 | 31,588.7 | 0.0 | 430,672.2 |
| | 1000 - 2000 | 8,201.2 | 16,219.6 | 48,706.8 | 225,556.7 | 449,123.5 | 86,445.8 | 0.0 | 834,253.5 |
| | TOTAL | 13,808.8 | 29,298.7 | 82,748.5 | 478,150.1 | 861,298.9 | 139,758.4 | 0.0 | 1,605,063.4 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 34.0 | 174.4 | 555.3 | 1,960.8 | 2,148.0 | 1,479.0 | 0.0 | 6,351.5 |
| | 200 - 500 | 25.2 | 224.1 | 94.0 | 6,126.0 | 1,602.8 | 4,090.5 | 0.0 | 12,162.4 |
| | 500 - 1000 | 156.2 | 1,225.8 | 4,139.3 | 10,453.5 | 10,542.6 | 6,166.7 | 0.0 | 32,684.0 |
| | 1000 - 2000 | 331.8 | 663.5 | 3,630.9 | 19,516.3 | 65,269.1 | 2,791.4 | 0.0 | 92,202.9 |
| | TOTAL | 547.1 | 2,287.8 | 8,419.4 | 38,056.4 | 79,562.4 | 14,527.6 | 0.0 | 143,400.7 |
| Technological | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 615.6 | 889.4 | 4,734.9 | 22,140.2 | 26,199.1 | 2,878.5 | 0.0 | 57,457.6 |
| | 500 - 1000 | 913.4 | 2,796.1 | 6,044.3 | 33,509.6 | 67,542.1 | 12,530.2 | 0.0 | 123,335.7 |
| | 1000 - 2000 | 2,523.0 | 7,760.6 | 25,185.7 | 108,883.9 | 186,423.9 | 76,148.3 | 0.0 | 406,925.3 |
| | TOTAL | 4,052.0 | 11,446.1 | 35,964.9 | 164,533.8 | 280,165.1 | 91,556.9 | 0.0 | 587,718.7 |
| Total | 20 - 200 | 34.0 | 174.4 | 555.3 | 1,960.8 | 2,148.0 | 1,479.0 | 0.0 | 6,351.5 |
| | 200 - 500 | 640.8 | 1,113.4 | 4,828.9 | 28,266.2 | 27,801.9 | 6,969.0 | 0.0 | 69,620.1 |
| | 500 - 1000 | 1,069.6 | 4,021.9 | 10,183.6 | 43,963.1 | 78,084.6 | 18,696.9 | 0.0 | 156,019.7 |
| | 1000 - 2000 | 2,854.8 | 8,424.1 | 28,816.6 | 128,400.2 | 251,693.0 | 78,939.7 | 0.0 | 499,128.2 |
| | TOTAL | 4,599.1 | 13,733.8 | 44,384.3 | 202,590.2 | 359,727.5 | 106,084.5 | 0.0 | 731,119.4 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 879.3 | 1,580.4 | 2,857.4 | 31,750.2 | 67,089.9 | 3,579.6 | 0.0 | 107,736.8 |
| | 200 - 500 | 680.3 | 2,339.4 | 4,511.2 | 51,385.5 | 87,816.6 | 9,696.3 | 0.0 | 156,429.4 |
| | 500 - 1000 | 2,303.6 | 3,849.7 | 11,105.3 | 95,267.7 | 149,234.4 | 12,891.9 | 0.0 | 274,652.5 |
| | 1000 - 2000 | 5,346.4 | 7,795.5 | 19,890.3 | 97,156.5 | 197,430.6 | 7,506.1 | 0.0 | 335,125.3 |
| | TOTAL | 9,209.7 | 15,564.9 | 38,364.2 | 275,559.9 | 501,571.4 | 33,673.9 | 0.0 | 873,944.0 |

***Table A2c.*** ***Summary of estimated coal resources of the "C and D" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 1,538.3 | 1,530.4 | 2,182.2 | 22,398.3 | 35,330.9 | 15,146.5 | 0.0 | 78,126.6 |
| | 200 - 500 | 2,377.1 | 3,573.1 | 4,108.4 | 37,437.1 | 46,487.4 | 23,579.6 | 0.0 | 117,562.7 |
| | 500 - 1000 | 4,672.9 | 10,608.6 | 13,474.4 | 65,157.9 | 154,081.1 | 32,636.1 | 0.0 | 280,631.0 |
| | 1000 - 2000 | 21,366.1 | 35,157.0 | 64,247.9 | 436,053.8 | 888,322.4 | 28,467.9 | 0.0 | 1,473,615.2 |
| | TOTAL | 29,954.3 | 50,869.2 | 84,013.0 | 561,047.1 | 1,124,221.7 | 99,830.2 | 0.0 | 1,949,935.5 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 35,330.9 | 0.0 | 0.0 | 35,330.9 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 35,330.9 | 0.0 | 0.0 | 35,330.9 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 2,362.2 | 0.0 | 0.0 | 0.0 | 2,362.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 2,967.1 | 6,803.1 | 3,734.1 | 0.0 | 13,504.3 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 1,221.2 | 16,081.4 | 0.0 | 0.0 | 17,302.6 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 6,550.5 | 22,884.5 | 3,734.1 | 0.0 | 33,169.1 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 35,330.9 | 0.0 | 0.0 | 35,330.9 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 2,362.2 | 0.0 | 0.0 | 0.0 | 2,362.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 2,967.1 | 6,803.1 | 3,734.1 | 0.0 | 13,504.3 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 1,221.2 | 16,081.4 | 0.0 | 0.0 | 17,302.6 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 6,550.5 | 58,215.4 | 3,734.1 | 0.0 | 68,500.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 1,538.3 | 1,530.4 | 2,182.2 | 22,398.3 | 0.0 | 15,146.5 | 0.0 | 42,795.7 |
| | 200 - 500 | 2,377.1 | 3,573.1 | 4,108.4 | 35,074.9 | 46,487.4 | 23,579.6 | 0.0 | 115,200.5 |
| | 500 - 1000 | 4,672.9 | 10,608.6 | 13,474.4 | 62,190.8 | 147,278.0 | 28,902.0 | 0.0 | 267,126.7 |
| | 1000 - 2000 | 21,366.1 | 35,157.0 | 64,247.9 | 434,832.6 | 872,241.0 | 28,467.9 | 0.0 | 1,456,312.6 |
| | TOTAL | 29,954.3 | 50,869.2 | 84,013.0 | 554,496.6 | 1,066,006.3 | 96,096.1 | 0.0 | 1,881,435.5 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 468.0 | 9.9 | 128.6 | 2,392.8 | 6,723.7 | 8,575.9 | 0.0 | 18,298.8 |
| | 200 - 500 | 990.0 | 110.1 | 15.3 | 2,720.2 | 4,508.1 | 6,786.3 | 0.0 | 15,130.0 |
| | 500 - 1000 | 842.0 | 229.2 | 509.5 | 1,084.6 | 12,253.9 | 4,364.5 | 0.0 | 19,283.7 |
| | 1000 - 2000 | 1,239.3 | 2,779.6 | 4,701.4 | 48,819.7 | 106,983.9 | 1,420.9 | 0.0 | 165,944.8 |
| | TOTAL | 3,539.3 | 3,128.8 | 5,354.8 | 55,017.3 | 130,469.6 | 21,147.6 | 0.0 | 218,657.3 |
| Technological | 20 - 200 | 32.0 | 40.6 | 250.0 | 265.0 | 712.5 | 1,113.7 | 0.0 | 2,413.9 |
| | 200 - 500 | 783.4 | 743.5 | 329.2 | 5,121.1 | 5,616.7 | 7,103.7 | 0.0 | 19,697.6 |
| | 500 - 1000 | 1,420.8 | 2,736.1 | 3,109.6 | 11,273.6 | 41,770.0 | 20,964.2 | 0.0 | 81,274.3 |
| | 1000 - 2000 | 3,969.4 | 7,981.6 | 12,778.4 | 93,791.9 | 216,328.1 | 25,947.3 | 0.0 | 360,796.7 |
| | TOTAL | 6,205.7 | 11,501.9 | 16,467.2 | 110,451.6 | 264,427.2 | 55,128.9 | 0.0 | 464,182.5 |
| Total | 20 - 200 | 500.1 | 50.5 | 378.6 | 2,657.8 | 7,436.1 | 9,689.6 | 0.0 | 20,712.7 |
| | 200 - 500 | 1,773.5 | 853.6 | 344.5 | 7,841.3 | 10,124.7 | 13,890.1 | 0.0 | 34,827.6 |
| | 500 - 1000 | 2,262.8 | 2,965.3 | 3,619.1 | 12,358.2 | 54,023.9 | 25,328.7 | 0.0 | 100,558.0 |
| | 1000 - 2000 | 5,208.7 | 10,761.2 | 17,479.8 | 142,611.6 | 323,312.0 | 27,368.1 | 0.0 | 526,741.5 |
| | TOTAL | 9,745.0 | 14,630.7 | 21,822.0 | 165,468.8 | 394,896.8 | 76,276.5 | 0.0 | 682,839.8 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 1,038.2 | 1,479.9 | 1,803.6 | 19,740.5 | -7,436.2 | 5,456.9 | 0.0 | 22,083.0 |
| | 200 - 500 | 603.6 | 2,719.5 | 3,763.9 | 27,233.6 | 36,362.7 | 9,689.6 | 0.0 | 80,372.8 |
| | 500 - 1000 | 2,410.1 | 7,643.3 | 9,855.4 | 49,832.7 | 93,254.1 | 3,573.4 | 0.0 | 166,568.8 |
| | 1000 - 2000 | 16,157.4 | 24,395.8 | 46,768.1 | 292,221.0 | 548,929.0 | 1,099.8 | 0.0 | 929,571.1 |
| | TOTAL | 20,209.3 | 36,238.5 | 62,191.0 | 389,027.8 | 671,109.6 | 19,819.6 | 0.0 | 1,198,595.7 |

***Table A2d.*** ***Summary of estimated coal resources of the "C and D" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 2,581.3 | 3,647.9 | 6,761.4 | 62,632.2 | 115,735.3 | 23,038.0 | 0.0 | 214,396.1 |
| | 200 - 500 | 4,201.1 | 8,295.5 | 15,580.8 | 136,720.3 | 197,477.8 | 51,166.3 | 0.0 | 413,441.9 |
| | 500 - 1000 | 9,510.6 | 21,492.1 | 41,732.7 | 252,337.0 | 468,194.5 | 90,769.9 | 0.0 | 884,036.6 |
| | 1000 - 2000 | 31,148.9 | 54,940.6 | 127,268.4 | 742,589.9 | 1,432,401.7 | 142,632.2 | 0.0 | 2,530,981.7 |
| | TOTAL | 47,441.9 | 88,376.0 | 191,343.4 | 1,194,279.3 | 2,213,809.3 | 307,606.3 | 0.0 | 4,042,856.3 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 35,390.5 | 0.0 | 0.0 | 35,390.5 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 35,390.5 | 0.0 | 0.0 | 35,390.5 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 2,713.8 | 657.0 | 0.0 | 0.0 | 3,370.8 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 8,194.3 | 13,034.0 | 12,088.5 | 0.0 | 33,316.8 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 8,625.0 | 40,049.7 | 5,643.8 | 0.0 | 54,318.5 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 19,533.1 | 53,740.7 | 17,732.3 | 0.0 | 91,006.1 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 35,390.5 | 0.0 | 0.0 | 35,390.5 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 2,713.8 | 657.0 | 0.0 | 0.0 | 3,370.8 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 8,194.3 | 13,034.0 | 12,088.5 | 0.0 | 33,316.8 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 8,625.0 | 40,049.7 | 5,643.8 | 0.0 | 54,318.5 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 19,533.1 | 89,131.2 | 17,732.3 | 0.0 | 126,396.6 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 2,581.3 | 3,647.9 | 6,761.4 | 62,632.2 | 80,344.8 | 23,038.0 | 0.0 | 179,005.6 |
| | 200 - 500 | 4,201.1 | 8,295.5 | 15,580.8 | 134,006.5 | 196,820.8 | 51,166.3 | 0.0 | 410,071.1 |
| | 500 - 1000 | 9,510.6 | 21,492.1 | 41,732.7 | 244,142.7 | 455,160.5 | 78,681.4 | 0.0 | 850,719.8 |
| | 1000 - 2000 | 31,148.9 | 54,940.6 | 127,268.4 | 733,964.9 | 1,392,352.0 | 136,988.4 | 0.0 | 2,476,663.2 |
| | TOTAL | 47,441.9 | 88,376.0 | 191,343.4 | 1,174,746.2 | 2,124,678.1 | 289,874.0 | 0.0 | 3,916,459.7 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 502.0 | 204.5 | 683.9 | 4,804.7 | 9,346.3 | 10,054.9 | 0.0 | 25,596.3 |
| | 200 - 500 | 1,015.9 | 418.8 | 136.5 | 10,214.7 | 7,114.7 | 11,431.2 | 0.0 | 30,331.7 |
| | 500 - 1000 | 1,146.7 | 1,719.8 | 5,644.8 | 12,390.5 | 25,032.2 | 12,208.7 | 0.0 | 58,142.7 |
| | 1000 - 2000 | 1,658.2 | 3,561.1 | 9,481.1 | 71,269.7 | 181,101.8 | 8,164.6 | 0.0 | 275,236.5 |
| | TOTAL | 4,322.9 | 5,904.2 | 15,946.3 | 98,679.5 | 222,595.0 | 41,859.3 | 0.0 | 389,307.2 |
| Technological | 20 - 200 | 32.0 | 40.6 | 250.0 | 265.0 | 712.5 | 1,113.7 | 0.0 | 2,413.9 |
| | 200 - 500 | 1,596.9 | 1,980.6 | 5,575.8 | 31,886.4 | 42,657.4 | 13,578.5 | 0.0 | 97,275.6 |
| | 500 - 1000 | 2,564.1 | 6,697.2 | 10,793.4 | 59,086.6 | 130,993.7 | 38,905.7 | 0.0 | 249,040.6 |
| | 1000 - 2000 | 6,903.2 | 18,224.5 | 47,283.7 | 252,310.9 | 444,746.1 | 121,668.9 | 0.0 | 891,137.1 |
| | TOTAL | 11,096.2 | 26,943.0 | 63,902.9 | 343,548.8 | 619,109.6 | 175,266.8 | 0.0 | 1,239,867.2 |
| Total | 20 - 200 | 534.1 | 245.1 | 933.9 | 5,069.6 | 10,058.8 | 11,168.6 | 0.0 | 28,010.2 |
| | 200 - 500 | 2,612.7 | 2,399.4 | 5,712.3 | 42,101.1 | 49,772.1 | 25,009.6 | 0.0 | 127,607.3 |
| | 500 - 1000 | 3,710.9 | 8,417.0 | 16,438.1 | 71,477.1 | 156,025.9 | 51,114.4 | 0.0 | 307,183.3 |
| | 1000 - 2000 | 8,561.4 | 21,785.6 | 56,764.8 | 323,580.5 | 625,847.9 | 129,833.5 | 0.0 | 1,166,373.6 |
| | TOTAL | 15,419.1 | 32,847.2 | 79,849.2 | 442,228.3 | 841,704.7 | 217,126.1 | 0.0 | 1,629,174.4 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 2,047.2 | 3,402.7 | 5,827.5 | 57,562.6 | 70,286.0 | 11,869.4 | 0.0 | 150,995.4 |
| | 200 - 500 | 1,588.4 | 5,896.1 | 9,868.6 | 91,905.5 | 147,048.7 | 26,156.7 | 0.0 | 282,463.8 |
| | 500 - 1000 | 5,799.8 | 13,075.0 | 25,294.6 | 172,665.6 | 299,134.6 | 27,567.0 | 0.0 | 543,536.5 |
| | 1000 - 2000 | 22,587.5 | 33,155.1 | 70,503.6 | 410,384.3 | 766,504.2 | 7,154.9 | 0.0 | 1,310,289.6 |
| | TOTAL | 32,022.9 | 55,528.9 | 111,494.2 | 732,518.0 | 1,282,973.5 | 72,747.9 | 0.0 | 2,287,285.3 |

***Table A3a.*** ***Summary of estimated coal resources of the "Lower and upper E" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 368.8 | 1,453.4 | 5,037.1 | 14,462.6 | 29,628.4 | 9,666.6 | 0.0 | 60,616.8 |
| | 200 - 500 | 1,606.9 | 3,369.9 | 8,786.2 | 35,419.8 | 62,156.2 | 19,677.1 | 0.0 | 131,016.0 |
| | 500 - 1000 | 457.4 | 3,707.5 | 7,583.4 | 59,039.0 | 106,385.1 | 19,082.6 | 0.0 | 196,255.2 |
| | 1000 - 2000 | 674.5 | 3,047.0 | 5,107.8 | 48,748.6 | 45,881.3 | 30,897.1 | 664.8 | 135,021.1 |
| | TOTAL | 3,107.7 | 11,577.7 | 26,514.5 | 157,670.0 | 244,051.1 | 79,323.4 | 664.8 | 522,909.1 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 276.9 | 0.0 | 0.0 | 276.9 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 276.9 | 0.0 | 0.0 | 276.9 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 | 0.0 | 0.0 | 11.9 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 215.0 | 0.0 | 0.0 | 0.0 | 215.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 215.0 | 11.9 | 0.0 | 0.0 | 226.9 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 276.9 | 0.0 | 0.0 | 276.9 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 | 0.0 | 0.0 | 11.9 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 215.0 | 0.0 | 0.0 | 0.0 | 215.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 215.0 | 288.8 | 0.0 | 0.0 | 503.8 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 368.8 | 1,453.4 | 5,037.1 | 14,462.6 | 29,351.5 | 9,666.6 | 0.0 | 60,340.0 |
| | 200 - 500 | 1,606.9 | 3,369.9 | 8,786.2 | 35,419.8 | 62,144.4 | 19,677.1 | 0.0 | 131,004.1 |
| | 500 - 1000 | 457.4 | 3,707.5 | 7,583.4 | 58,824.0 | 106,385.1 | 19,082.6 | 0.0 | 196,040.2 |
| | 1000 - 2000 | 674.5 | 3,047.0 | 5,107.8 | 48,748.6 | 45,881.3 | 30,897.1 | 664.8 | 135,021.1 |
| | TOTAL | 3,107.7 | 11,577.7 | 26,514.5 | 157,455.0 | 243,762.3 | 79,323.4 | 664.8 | 522,405.3 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 12.2 | 0.4 | 61.1 | 14.8 | 693.6 | 1,942.2 | 0.0 | 2,724.3 |
| | 200 - 500 | 41.1 | 221.3 | 196.2 | 166.7 | 2,854.8 | 991.0 | 0.0 | 4,471.1 |
| | 500 - 1000 | 6.2 | 57.7 | 135.5 | 942.4 | 4,795.7 | 0.0 | 0.0 | 5,937.4 |
| | 1000 - 2000 | 9.7 | 58.1 | 318.3 | 3,081.7 | 6,203.3 | 968.5 | 0.0 | 10,639.5 |
| | TOTAL | 69.2 | 337.5 | 711.0 | 4,205.6 | 14,547.3 | 3,901.7 | 0.0 | 23,772.2 |
| Technological | 20 - 200 | 33.5 | 154.0 | 728.4 | 2,078.0 | 4,025.8 | 362.0 | 0.0 | 7,381.7 |
| | 200 - 500 | 453.0 | 407.8 | 1,072.4 | 7,439.3 | 7,436.5 | 1,137.6 | 0.0 | 17,946.5 |
| | 500 - 1000 | 114.3 | 780.6 | 1,478.7 | 19,367.4 | 28,165.3 | 4,080.0 | 0.0 | 53,986.3 |
| | 1000 - 2000 | 425.9 | 1,244.9 | 1,838.1 | 32,273.5 | 11,083.4 | 5,979.3 | 0.0 | 52,845.0 |
| | TOTAL | 1,026.7 | 2,587.3 | 5,117.6 | 61,158.1 | 50,710.9 | 11,558.8 | 0.0 | 132,159.5 |
| Total | 20 - 200 | 45.7 | 154.5 | 789.5 | 2,092.8 | 4,719.4 | 2,304.2 | 0.0 | 10,105.9 |
| | 200 - 500 | 494.0 | 629.1 | 1,268.6 | 7,605.9 | 10,291.2 | 2,128.6 | 0.0 | 22,417.6 |
| | 500 - 1000 | 120.5 | 838.3 | 1,614.2 | 20,309.8 | 32,961.0 | 4,080.0 | 0.0 | 59,923.7 |
| | 1000 - 2000 | 435.6 | 1,302.9 | 2,156.4 | 35,355.2 | 17,286.7 | 6,947.7 | 0.0 | 63,484.4 |
| | TOTAL | 1,095.8 | 2,924.8 | 5,828.6 | 65,363.6 | 65,258.3 | 15,460.5 | 0.0 | 155,931.7 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 323.1 | 1,298.9 | 4,247.6 | 12,369.8 | 24,632.2 | 7,362.5 | 0.0 | 50,234.0 |
| | 200 - 500 | 1,112.8 | 2,740.7 | 7,517.5 | 27,813.9 | 51,853.1 | 17,548.4 | 0.0 | 108,586.5 |
| | 500 - 1000 | 336.9 | 2,869.2 | 5,969.3 | 38,514.3 | 73,424.2 | 15,002.6 | 0.0 | 136,116.5 |
| | 1000 - 2000 | 239.0 | 1,744.1 | 2,951.5 | 13,393.4 | 28,594.6 | 23,949.3 | 664.8 | 71,536.7 |
| | TOTAL | 2,011.8 | 8,652.9 | 20,685.9 | 92,091.4 | 178,504.1 | 63,862.8 | 664.8 | 366,473.7 |

***Table A3b.*** ***Summary of estimated coal resources of the "Lower and upper E" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 1,304.1 | 5,610.5 | 7,082.3 | 37,124.1 | 82,995.5 | 12,247.6 | 0.0 | 146,364.1 |
| | 200 - 500 | 3,515.6 | 8,917.6 | 15,922.0 | 64,000.9 | 162,046.0 | 34,972.6 | 0.0 | 289,374.8 |
| | 500 - 1000 | 3,515.0 | 9,978.9 | 20,473.3 | 136,029.5 | 327,551.5 | 84,001.2 | 286.7 | 581,836.1 |
| | 1000 - 2000 | 5,425.5 | 12,109.6 | 32,897.9 | 160,611.0 | 341,944.4 | 137,803.9 | 3,693.8 | 694,486.1 |
| | TOTAL | 13,760.2 | 36,616.7 | 76,375.6 | 397,765.6 | 914,537.3 | 269,025.2 | 3,980.5 | 1,712,061.1 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 1,439.0 | 0.0 | 0.0 | 0.0 | 1,439.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1,439.0 | 0.0 | 0.0 | 0.0 | 1,439.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 1,439.0 | 0.0 | 0.0 | 0.0 | 1,439.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1,439.0 | 0.0 | 0.0 | 0.0 | 1,439.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 1,304.1 | 5,610.5 | 7,082.3 | 37,124.1 | 82,995.5 | 12,247.6 | 0.0 | 146,364.1 |
| | 200 - 500 | 3,515.6 | 8,917.6 | 15,922.0 | 64,000.9 | 162,046.0 | 34,972.6 | 0.0 | 289,374.8 |
| | 500 - 1000 | 3,515.0 | 9,978.9 | 20,473.3 | 134,590.5 | 327,551.5 | 84,001.2 | 286.7 | 580,397.1 |
| | 1000 - 2000 | 5,425.5 | 12,109.6 | 32,897.9 | 160,611.0 | 341,944.4 | 137,803.9 | 3,693.8 | 694,486.1 |
| | TOTAL | 13,760.2 | 36,616.7 | 76,375.6 | 396,326.6 | 914,537.3 | 269,025.2 | 3,980.5 | 1,710,622.1 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 132.8 | 139.3 | 415.8 | 466.6 | 1,700.6 | 244.6 | 0.0 | 3,099.7 |
| | 200 - 500 | 58.9 | 208.2 | 348.5 | 1,135.9 | 7,794.4 | 5,124.7 | 0.0 | 14,670.5 |
| | 500 - 1000 | 19.0 | 94.2 | 239.1 | 1,889.6 | 26,337.7 | 11,901.8 | 0.0 | 40,481.5 |
| | 1000 - 2000 | 83.7 | 354.2 | 906.6 | 13,466.4 | 30,877.3 | 12,648.9 | 0.0 | 58,337.1 |
| | TOTAL | 294.5 | 795.9 | 1,910.1 | 16,958.5 | 66,709.9 | 29,920.0 | 0.0 | 116,588.8 |
| Technological | 20 - 200 | 216.9 | 779.7 | 1,301.1 | 4,284.0 | 7,707.2 | 228.2 | 0.0 | 14,517.1 |
| | 200 - 500 | 796.9 | 1,444.8 | 3,386.5 | 15,570.4 | 31,834.0 | 886.1 | 0.0 | 53,918.6 |
| | 500 - 1000 | 531.3 | 1,168.7 | 5,151.8 | 40,474.2 | 75,957.3 | 4,616.7 | 176.0 | 128,075.8 |
| | 1000 - 2000 | 1,682.2 | 5,631.3 | 11,880.2 | 59,236.8 | 107,395.6 | 35,812.8 | 0.0 | 221,638.8 |
| | TOTAL | 3,227.4 | 9,024.4 | 21,719.5 | 119,565.3 | 222,893.9 | 41,543.8 | 176.0 | 418,150.4 |
| Total | 20 - 200 | 349.7 | 919.0 | 1,716.9 | 4,750.6 | 9,407.7 | 472.9 | 0.0 | 17,616.8 |
| | 200 - 500 | 855.8 | 1,653.0 | 3,735.0 | 16,706.3 | 39,628.3 | 6,010.7 | 0.0 | 68,589.2 |
| | 500 - 1000 | 550.4 | 1,262.9 | 5,390.9 | 42,363.8 | 102,294.9 | 16,518.5 | 176.0 | 168,557.3 |
| | 1000 - 2000 | 1,765.9 | 5,985.5 | 12,786.8 | 72,703.2 | 138,272.8 | 48,461.7 | 0.0 | 279,975.9 |
| | TOTAL | 3,521.8 | 9,820.3 | 23,629.6 | 136,523.9 | 289,603.8 | 71,463.7 | 176.0 | 534,739.1 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 954.4 | 4,691.5 | 5,365.4 | 32,373.5 | 73,587.8 | 11,774.7 | 0.0 | 128,747.3 |
| | 200 - 500 | 2,659.9 | 7,264.7 | 12,187.0 | 47,294.6 | 122,417.6 | 28,961.9 | 0.0 | 220,785.7 |
| | 500 - 1000 | 2,964.7 | 8,716.0 | 15,082.4 | 92,226.8 | 225,256.5 | 67,482.7 | 110.7 | 411,839.8 |
| | 1000 - 2000 | 3,659.5 | 6,124.1 | 20,111.2 | 87,907.8 | 203,671.6 | 89,342.2 | 3,693.8 | 414,510.3 |
| | TOTAL | 10,238.4 | 26,796.4 | 52,746.0 | 259,802.7 | 624,933.5 | 197,561.5 | 3,804.5 | 1,175,883.0 |

***Table A3c.*** ***Summary of estimated coal resources of the "Lower and upper E" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 1,174.5 | 2,346.6 | 3,474.8 | 14,194.5 | 51,993.2 | 6,967.8 | 0.0 | 80,151.4 |
| | 200 - 500 | 1,361.4 | 2,822.0 | 3,402.1 | 28,695.3 | 95,521.9 | 21,300.2 | 0.0 | 153,103.0 |
| | 500 - 1000 | 6,057.4 | 7,770.5 | 20,834.0 | 80,530.5 | 154,331.8 | 64,993.3 | 0.0 | 334,517.6 |
| | 1000 - 2000 | 15,443.2 | 26,560.4 | 67,268.7 | 434,094.5 | 985,256.3 | 138,324.2 | 445.0 | 1,667,392.4 |
| | TOTAL | 24,036.6 | 39,499.6 | 94,979.6 | 557,514.8 | 1,287,103.3 | 231,585.6 | 445.0 | 2,235,164.4 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 140.7 | 0.0 | 0.0 | 140.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 140.7 | 0.0 | 0.0 | 140.7 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 194.7 | 97.7 | 0.0 | 0.0 | 292.4 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 194.7 | 97.7 | 0.0 | 0.0 | 292.4 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 140.7 | 0.0 | 0.0 | 140.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 194.7 | 97.7 | 0.0 | 0.0 | 292.4 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 194.7 | 238.4 | 0.0 | 0.0 | 433.1 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 1,174.5 | 2,346.6 | 3,474.8 | 14,194.5 | 51,852.5 | 6,967.8 | 0.0 | 80,010.7 |
| | 200 - 500 | 1,361.4 | 2,822.0 | 3,402.1 | 28,500.6 | 95,424.2 | 21,300.2 | 0.0 | 152,810.6 |
| | 500 - 1000 | 6,057.4 | 7,770.5 | 20,834.0 | 80,530.5 | 154,331.8 | 64,993.3 | 0.0 | 334,517.6 |
| | 1000 - 2000 | 15,443.2 | 26,560.4 | 67,268.7 | 434,094.5 | 985,256.3 | 138,324.2 | 445.0 | 1,667,392.4 |
| | TOTAL | 24,036.6 | 39,499.6 | 94,979.6 | 557,320.1 | 1,286,864.9 | 231,585.6 | 445.0 | 2,234,731.3 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 28.4 | 52.1 | 15.8 | 1,179.6 | 6,554.1 | 0.0 | 0.0 | 7,830.1 |
| | 200 - 500 | 15.6 | 35.1 | 9.6 | 1,053.2 | 9,785.2 | 0.0 | 0.0 | 10,898.6 |
| | 500 - 1000 | 73.5 | 92.1 | 888.7 | 2,713.0 | 11,120.1 | 3,555.7 | 0.0 | 18,443.1 |
| | 1000 - 2000 | 537.6 | 979.8 | 2,798.0 | 31,853.5 | 93,249.4 | 7,902.6 | 0.0 | 137,320.7 |
| | TOTAL | 655.0 | 1,159.1 | 3,712.0 | 36,799.2 | 120,708.8 | 11,458.3 | 0.0 | 174,492.5 |
| Technological | 20 - 200 | 220.0 | 452.3 | 469.8 | 1,588.5 | 509.3 | 0.0 | 0.0 | 3,239.9 |
| | 200 - 500 | 485.0 | 1,158.0 | 1,481.2 | 3,775.6 | 11,221.2 | 0.0 | 0.0 | 18,120.9 |
| | 500 - 1000 | 1,707.7 | 2,477.7 | 5,057.4 | 15,799.7 | 37,389.8 | 0.0 | 0.0 | 62,432.3 |
| | 1000 - 2000 | 1,472.9 | 2,927.5 | 9,028.4 | 39,048.4 | 222,033.9 | 19,874.1 | 0.0 | 294,385.2 |
| | TOTAL | 3,885.5 | 7,015.4 | 16,036.8 | 60,212.2 | 271,154.2 | 19,874.1 | 0.0 | 378,178.2 |
| Total | 20 - 200 | 248.5 | 504.4 | 485.6 | 2,768.2 | 7,063.4 | 0.0 | 0.0 | 11,070.0 |
| | 200 - 500 | 500.6 | 1,193.0 | 1,490.8 | 4,828.8 | 21,006.4 | 0.0 | 0.0 | 29,019.5 |
| | 500 - 1000 | 1,781.1 | 2,569.8 | 5,946.1 | 18,512.7 | 48,509.9 | 3,555.7 | 0.0 | 80,875.4 |
| | 1000 - 2000 | 2,010.4 | 3,907.3 | 11,826.4 | 70,901.8 | 315,283.3 | 27,776.7 | 0.0 | 431,705.8 |
| | TOTAL | 4,540.6 | 8,174.5 | 19,748.8 | 97,011.4 | 391,863.0 | 31,332.4 | 0.0 | 552,670.7 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 926.1 | 1,842.2 | 2,989.3 | 11,426.3 | 44,789.1 | 6,967.8 | 0.0 | 68,940.8 |
| | 200 - 500 | 860.8 | 1,629.0 | 1,911.4 | 23,671.9 | 74,417.8 | 21,300.2 | 0.0 | 123,791.1 |
| | 500 - 1000 | 4,276.3 | 5,200.7 | 14,887.9 | 62,017.8 | 105,821.9 | 61,437.6 | 0.0 | 253,642.2 |
| | 1000 - 2000 | 13,432.8 | 22,653.2 | 55,442.3 | 363,192.7 | 669,973.1 | 110,547.6 | 445.0 | 1,235,686.6 |
| | TOTAL | 19,496.0 | 31,325.1 | 75,230.8 | 460,308.6 | 895,001.9 | 200,253.2 | 445.0 | 1,682,060.6 |

***Table A3d.*** ***Summary of estimated coal resources of the "Lower and upper E" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 2,847.4 | 9,410.5 | 15,594.2 | 65,781.1 | 164,617.1 | 28,882.0 | 0.0 | 287,132.4 |
| | 200 - 500 | 6,483.9 | 15,109.5 | 28,110.3 | 128,116.1 | 319,724.1 | 75,949.9 | 0.0 | 573,493.8 |
| | 500 - 1000 | 10,029.9 | 21,457.0 | 48,890.7 | 275,599.1 | 588,268.4 | 168,077.1 | 286.7 | 1,112,608.9 |
| | 1000 - 2000 | 21,543.2 | 41,717.0 | 105,274.4 | 643,454.1 | 1,373,082.1 | 307,025.2 | 4,803.6 | 2,496,899.6 |
| | TOTAL | 40,904.4 | 87,694.0 | 197,869.7 | 1,112,950.4 | 2,445,691.7 | 579,934.2 | 5,090.3 | 4,470,134.6 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 417.6 | 0.0 | 0.0 | 417.6 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 417.6 | 0.0 | 0.0 | 417.6 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 194.7 | 109.6 | 0.0 | 0.0 | 304.3 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 1,654.0 | 0.0 | 0.0 | 0.0 | 1,654.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1,848.7 | 109.6 | 0.0 | 0.0 | 1,958.3 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 417.6 | 0.0 | 0.0 | 417.6 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 194.7 | 109.6 | 0.0 | 0.0 | 304.3 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 1,654.0 | 0.0 | 0.0 | 0.0 | 1,654.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1,848.7 | 527.2 | 0.0 | 0.0 | 2,375.9 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 2,847.4 | 9,410.5 | 15,594.2 | 65,781.1 | 164,199.5 | 28,882.0 | 0.0 | 286,714.8 |
| | 200 - 500 | 6,483.9 | 15,109.5 | 28,110.3 | 127,921.4 | 319,614.5 | 75,949.9 | 0.0 | 573,189.5 |
| | 500 - 1000 | 10,029.9 | 21,457.0 | 48,890.7 | 273,945.1 | 588,268.4 | 168,077.1 | 286.7 | 1,110,954.9 |
| | 1000 - 2000 | 21,543.2 | 41,717.0 | 105,274.4 | 643,454.1 | 1,373,082.1 | 307,025.2 | 4,803.6 | 2,496,899.6 |
| | TOTAL | 40,904.4 | 87,694.0 | 197,869.7 | 1,111,101.7 | 2,445,164.5 | 579,934.2 | 5,090.3 | 4,467,758.7 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 173.4 | 191.9 | 492.7 | 1,661.0 | 8,948.3 | 2,186.8 | 0.0 | 13,654.0 |
| | 200 - 500 | 115.5 | 464.6 | 554.3 | 2,355.8 | 20,434.3 | 6,115.7 | 0.0 | 30,040.2 |
| | 500 - 1000 | 98.7 | 244.0 | 1,263.3 | 5,545.0 | 42,253.5 | 15,457.6 | 0.0 | 64,862.0 |
| | 1000 - 2000 | 631.0 | 1,392.0 | 4,022.9 | 48,401.6 | 130,329.9 | 21,519.9 | 0.0 | 206,297.2 |
| | TOTAL | 1,018.6 | 2,292.5 | 6,333.1 | 57,963.3 | 201,966.0 | 45,280.0 | 0.0 | 314,853.4 |
| Technological | 20 - 200 | 470.5 | 1,386.0 | 2,499.3 | 7,950.5 | 12,242.2 | 590.2 | 0.0 | 25,138.7 |
| | 200 - 500 | 1,734.8 | 3,010.5 | 5,940.1 | 26,785.3 | 50,491.6 | 2,023.7 | 0.0 | 89,986.0 |
| | 500 - 1000 | 2,353.3 | 4,427.0 | 11,687.9 | 75,641.2 | 141,512.4 | 8,696.7 | 176.0 | 244,494.4 |
| | 1000 - 2000 | 3,581.0 | 9,803.7 | 22,746.7 | 130,558.6 | 340,512.9 | 61,666.2 | 0.0 | 568,868.9 |
| | TOTAL | 8,139.6 | 18,627.1 | 42,873.9 | 240,935.6 | 544,759.1 | 72,976.7 | 176.0 | 928,488.0 |
| Total | 20 - 200 | 643.9 | 1,577.9 | 2,991.9 | 9,611.5 | 21,190.5 | 2,777.0 | 0.0 | 38,792.7 |
| | 200 - 500 | 1,850.4 | 3,475.1 | 6,494.4 | 29,141.0 | 70,926.0 | 8,139.4 | 0.0 | 120,026.2 |
| | 500 - 1000 | 2,452.0 | 4,670.9 | 12,951.2 | 81,186.2 | 183,765.9 | 24,154.2 | 176.0 | 309,356.4 |
| | 1000 - 2000 | 4,211.9 | 11,195.7 | 26,769.5 | 178,960.2 | 470,842.8 | 83,186.0 | 0.0 | 775,166.1 |
| | TOTAL | 9,158.2 | 20,919.6 | 49,207.0 | 298,898.9 | 746,725.1 | 118,256.7 | 176.0 | 1,243,341.4 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 2,203.5 | 7,832.6 | 12,602.3 | 56,169.6 | 143,009.0 | 26,105.0 | 0.0 | 247,922.1 |
| | 200 - 500 | 4,633.5 | 11,634.4 | 21,615.9 | 98,780.3 | 248,688.5 | 67,810.6 | 0.0 | 453,163.3 |
| | 500 - 1000 | 7,577.9 | 16,786.0 | 35,939.5 | 192,758.8 | 404,502.6 | 143,922.9 | 110.7 | 801,598.4 |
| | 1000 - 2000 | 17,331.3 | 30,521.3 | 78,504.9 | 464,494.0 | 902,239.3 | 223,839.1 | 4,803.6 | 1,721,733.5 |
| | TOTAL | 31,746.2 | 66,774.4 | 148,662.7 | 812,202.8 | 1,698,439.5 | 461,677.5 | 4,914.3 | 3,224,417.3 |

*Table A4a. Summary of estimated coal resources of the "Lower and upper F" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).*

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 4,224.4 | 6,717.0 | 9,515.0 | 61,324.5 | 80,002.1 | 16,784.6 | 0.0 | 178,567.5 |
| | 200 - 500 | 2,933.8 | 4,565.3 | 10,845.2 | 59,684.0 | 66,004.2 | 20,314.5 | 0.0 | 164,347.0 |
| | 500 - 1000 | 3,834.2 | 7,199.8 | 13,371.1 | 81,601.1 | 115,069.5 | 39,009.3 | 0.0 | 260,085.0 |
| | 1000 - 2000 | 1,434.4 | 2,080.6 | 5,214.0 | 58,417.8 | 70,109.9 | 60,725.0 | 5,661.9 | 203,643.6 |
| | TOTAL | 12,426.8 | 20,562.7 | 38,945.2 | 261,027.3 | 331,185.7 | 136,833.4 | 5,661.9 | 806,643.0 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 765.2 | 1,303.6 | 1,710.6 | 16,337.6 | 27,706.2 | 69.5 | 0.0 | 47,892.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 765.2 | 1,303.6 | 1,710.6 | 16,337.6 | 27,706.2 | 69.5 | 0.0 | 47,892.7 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 82.4 | 2,186.0 | 0.0 | 0.0 | 2,268.4 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 2,213.4 | 16,828.8 | 0.0 | 0.0 | 19,042.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 2,419.9 | 4,500.9 | 0.0 | 0.0 | 6,920.8 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 4,715.7 | 23,515.6 | 0.0 | 0.0 | 28,231.3 |
| Total | 20 - 200 | 765.2 | 1,303.6 | 1,710.6 | 16,337.6 | 27,706.2 | 69.5 | 0.0 | 47,892.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 82.4 | 2,186.0 | 0.0 | 0.0 | 2,268.4 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 2,213.4 | 16,828.8 | 0.0 | 0.0 | 19,042.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 2,419.9 | 4,500.9 | 0.0 | 0.0 | 6,920.8 |
| | TOTAL | 765.2 | 1,303.6 | 1,710.6 | 21,053.3 | 51,221.8 | 69.5 | 0.0 | 76,124.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 3,459.2 | 5,413.4 | 7,804.4 | 44,986.9 | 52,295.9 | 16,715.1 | 0.0 | 130,674.8 |
| | 200 - 500 | 2,933.8 | 4,565.3 | 10,845.2 | 59,601.6 | 63,818.2 | 20,314.5 | 0.0 | 162,078.6 |
| | 500 - 1000 | 3,834.2 | 7,199.8 | 13,371.1 | 79,387.7 | 98,240.7 | 39,009.3 | 0.0 | 241,042.8 |
| | 1000 - 2000 | 1,434.4 | 2,080.6 | 5,214.0 | 55,997.9 | 65,609.1 | 60,725.0 | 5,661.9 | 196,722.8 |
| | TOTAL | 11,661.6 | 19,259.1 | 37,234.6 | 239,974.0 | 279,963.8 | 136,764.0 | 5,661.9 | 730,519.0 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 43.1 | 46.2 | 244.5 | 743.5 | 667.0 | 0.0 | 0.0 | 1,744.2 |
| | 200 - 500 | 24.8 | 252.9 | 217.5 | 1,400.2 | 1,208.4 | 0.0 | 0.0 | 3,103.7 |
| | 500 - 1000 | 137.6 | 172.9 | 350.8 | 4,114.9 | 3,434.3 | 2,969.0 | 0.0 | 11,179.5 |
| | 1000 - 2000 | 299.2 | 285.2 | 772.3 | 6,169.7 | 6,552.4 | 2,210.3 | 0.0 | 16,289.1 |
| | TOTAL | 504.7 | 757.1 | 1,585.1 | 12,428.3 | 11,862.1 | 5,179.3 | 0.0 | 32,316.6 |
| Technological | 20 - 200 | 518.0 | 831.0 | 1,858.3 | 8,566.8 | 8,389.5 | 0.0 | 0.0 | 20,163.5 |
| | 200 - 500 | 715.3 | 686.6 | 2,433.0 | 10,126.1 | 16,088.1 | 11,241.5 | 0.0 | 41,290.6 |
| | 500 - 1000 | 912.8 | 1,340.0 | 4,202.8 | 21,264.6 | 44,480.9 | 30,008.2 | 0.0 | 102,209.3 |
| | 1000 - 2000 | 719.4 | 1,014.5 | 3,018.5 | 25,692.5 | 37,096.9 | 36,642.9 | 5,661.9 | 109,846.5 |
| | TOTAL | 2,865.5 | 3,872.1 | 11,512.5 | 65,649.9 | 106,055.3 | 77,892.6 | 5,661.9 | 273,509.8 |
| Total | 20 - 200 | 561.0 | 877.1 | 2,102.8 | 9,310.3 | 9,056.5 | 0.0 | 0.0 | 21,907.7 |
| | 200 - 500 | 740.1 | 939.5 | 2,650.5 | 11,526.2 | 17,296.4 | 11,241.5 | 0.0 | 44,394.3 |
| | 500 - 1000 | 1,050.4 | 1,512.9 | 4,553.6 | 25,379.5 | 47,915.2 | 32,977.2 | 0.0 | 113,388.8 |
| | 1000 - 2000 | 1,018.6 | 1,299.7 | 3,790.8 | 31,862.2 | 43,649.3 | 38,853.2 | 5,661.9 | 126,135.6 |
| | TOTAL | 3,370.2 | 4,629.1 | 13,097.7 | 78,078.2 | 117,917.4 | 83,071.9 | 5,661.9 | 305,826.4 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 2,898.1 | 4,536.3 | 5,701.6 | 35,676.6 | 43,239.4 | 16,715.1 | 0.0 | 108,767.1 |
| | 200 - 500 | 2,193.7 | 3,625.9 | 8,194.6 | 48,075.4 | 46,521.7 | 9,073.0 | 0.0 | 117,684.3 |
| | 500 - 1000 | 2,783.8 | 5,686.9 | 8,817.5 | 54,008.2 | 50,325.5 | 6,032.1 | 0.0 | 127,654.0 |
| | 1000 - 2000 | 415.8 | 780.9 | 1,423.3 | 24,135.7 | 21,959.8 | 21,871.8 | 0.0 | 70,587.2 |
| | TOTAL | 8,291.4 | 14,630.0 | 24,136.9 | 161,895.8 | 162,046.4 | 53,692.0 | 0.0 | 424,692.6 |

*Table A4b. Summary of estimated coal resources of the "Lower and upper F" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).*

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 4,408.5 | 6,698.3 | 13,599.9 | 63,287.8 | 71,619.6 | 31,779.4 | 0.0 | 191,393.5 |
| | 200 - 500 | 4,554.3 | 10,392.0 | 22,571.7 | 87,728.7 | 151,253.7 | 39,135.9 | 0.0 | 315,636.2 |
| | 500 - 1000 | 9,037.9 | 24,776.1 | 50,532.1 | 207,652.6 | 339,364.2 | 69,752.3 | 0.0 | 701,115.1 |
| | 1000 - 2000 | 4,577.8 | 11,265.6 | 26,928.8 | 239,400.7 | 362,777.5 | 364,593.9 | 27,546.4 | 1,037,090.7 |
| | TOTAL | 22,578.5 | 53,131.9 | 113,632.4 | 598,069.9 | 925,014.9 | 505,261.5 | 27,546.4 | 2,245,235.5 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 1,649.1 | 1,770.6 | 3,582.2 | 7,349.0 | 6,098.6 | 0.0 | 0.0 | 20,449.5 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 1,649.1 | 1,770.6 | 3,582.2 | 7,349.0 | 6,098.6 | 0.0 | 0.0 | 20,449.5 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 229.5 | 141.5 | 196.9 | 831.8 | 3,369.1 | 0.0 | 0.0 | 4,768.8 |
| | 500 - 1000 | 0.0 | 0.0 | 50.5 | 4,856.1 | 37,447.1 | 5.2 | 0.0 | 42,358.9 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 229.5 | 141.5 | 247.4 | 5,687.8 | 40,816.3 | 5.2 | 0.0 | 47,127.7 |
| Total | 20 - 200 | 1,649.1 | 1,770.6 | 3,582.2 | 7,349.0 | 6,098.6 | 0.0 | 0.0 | 20,449.5 |
| | 200 - 500 | 229.5 | 141.5 | 196.9 | 831.8 | 3,369.1 | 0.0 | 0.0 | 4,768.8 |
| | 500 - 1000 | 0.0 | 0.0 | 50.5 | 4,856.1 | 37,447.1 | 5.2 | 0.0 | 42,358.9 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 11,985.8 | 15,443.9 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 1,878.6 | 1,912.1 | 3,829.6 | 13,036.8 | 46,914.8 | 5.2 | 0.0 | 67,577.2 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 2,759.4 | 4,927.6 | 10,017.7 | 55,938.8 | 65,521.0 | 31,779.4 | 0.0 | 170,944.0 |
| | 200 - 500 | 4,324.8 | 10,250.5 | 22,374.8 | 86,897.0 | 147,884.6 | 39,135.9 | 0.0 | 310,867.5 |
| | 500 - 1000 | 9,037.9 | 24,776.1 | 50,481.6 | 202,796.6 | 301,917.0 | 69,747.1 | 0.0 | 658,756.2 |
| | 1000 - 2000 | 4,577.8 | 11,265.6 | 26,928.8 | 227,414.9 | 347,333.6 | 364,593.9 | 27,546.4 | 1,037,090.7 |
| | TOTAL | 20,699.9 | 51,219.8 | 109,802.9 | 585,033.0 | 878,100.1 | 505,256.2 | 27,546.4 | 2,177,658.3 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 115.6 | 226.4 | 218.5 | 2,529.7 | 2,464.5 | 28.3 | 0.0 | 5,583.1 |
| | 200 - 500 | 345.6 | 390.5 | 672.2 | 4,025.4 | 7,580.6 | 105.0 | 0.0 | 13,119.3 |
| | 500 - 1000 | 835.6 | 880.2 | 2,221.5 | 10,212.1 | 37,690.4 | 11,702.2 | 0.0 | 63,541.9 |
| | 1000 - 2000 | 659.6 | 1,678.1 | 2,754.0 | 19,362.6 | 48,043.0 | 23,084.9 | 0.0 | 95,582.3 |
| | TOTAL | 1,956.4 | 3,175.1 | 5,866.1 | 36,129.9 | 95,778.6 | 34,920.4 | 0.0 | 177,826.5 |
| Technological | 20 - 200 | 275.8 | 1,089.5 | 3,850.5 | 11,978.3 | 5,137.7 | 0.0 | 0.0 | 22,331.9 |
| | 200 - 500 | 955.5 | 2,451.4 | 5,950.9 | 22,436.1 | 31,796.2 | 19,374.3 | 0.0 | 82,964.4 |
| | 500 - 1000 | 1,539.8 | 4,576.2 | 10,986.5 | 50,611.2 | 107,289.1 | 42,196.0 | 0.0 | 217,198.7 |
| | 1000 - 2000 | 2,070.8 | 3,608.1 | 7,594.7 | 79,355.6 | 123,345.8 | 187,993.0 | 19,765.3 | 423,733.3 |
| | TOTAL | 4,841.9 | 11,725.2 | 28,382.5 | 164,381.2 | 267,568.7 | 249,563.4 | 19,765.3 | 746,228.3 |
| Total | 20 - 200 | 391.4 | 1,315.9 | 4,069.0 | 14,508.1 | 7,602.2 | 28.3 | 0.0 | 27,915.0 |
| | 200 - 500 | 1,301.1 | 2,841.9 | 6,623.1 | 26,461.5 | 39,376.8 | 19,479.4 | 0.0 | 96,083.7 |
| | 500 - 1000 | 2,375.3 | 5,456.3 | 13,208.0 | 60,823.3 | 144,979.5 | 53,898.2 | 0.0 | 280,740.5 |
| | 1000 - 2000 | 2,730.4 | 5,286.2 | 10,348.6 | 98,718.3 | 171,388.8 | 211,077.9 | 19,765.3 | 519,315.6 |
| | TOTAL | 6,798.3 | 14,900.3 | 34,248.6 | 200,511.1 | 363,347.3 | 284,483.8 | 19,765.3 | 924,054.8 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 2,368.0 | 3,611.7 | 5,948.7 | 41,430.8 | 57,918.8 | 31,751.1 | 0.0 | 143,029.0 |
| | 200 - 500 | 3,023.7 | 7,408.6 | 15,751.7 | 60,435.4 | 108,507.8 | 19,656.6 | 0.0 | 214,783.7 |
| | 500 - 1000 | 6,662.5 | 19,319.8 | 37,273.7 | 141,973.3 | 156,937.6 | 15,848.9 | 0.0 | 378,015.7 |
| | 1000 - 2000 | 1,847.4 | 5,979.4 | 16,580.2 | 128,696.6 | 175,944.7 | 153,516.0 | 7,781.1 | 517,775.1 |
| | TOTAL | 13,901.5 | 36,319.5 | 75,554.2 | 384,521.9 | 514,752.8 | 220,772.5 | 7,781.1 | 1,253,603.5 |

*Table A4c.* ***Summary of estimated coal resources of the "Lower and upper F" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 2,727.5 | 3,572.8 | 5,638.0 | 29,523.9 | 34,311.8 | 8,403.2 | 0.0 | 84,177.2 |
| | 200 - 500 | 1,588.1 | 4,797.4 | 7,489.7 | 52,908.6 | 59,828.3 | 9,722.4 | 0.0 | 136,334.4 |
| | 500 - 1000 | 7,270.4 | 23,269.4 | 59,604.4 | 156,977.4 | 229,574.5 | 26,924.7 | 0.0 | 503,620.7 |
| | 1000 - 2000 | 24,533.4 | 71,152.0 | 145,949.3 | 534,036.0 | 910,790.5 | 610,003.4 | 573.1 | 2,297,037.8 |
| | TOTAL | 36,119.4 | 102,791.6 | 218,681.4 | 773,446.0 | 1,234,505.1 | 655,053.7 | 573.1 | 3,021,170.1 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 265.6 | 1,831.5 | 4,422.6 | 5,762.3 | 1,057.6 | 0.0 | 0.0 | 13,339.5 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 265.6 | 1,831.5 | 4,422.6 | 5,762.3 | 1,057.6 | 0.0 | 0.0 | 13,339.5 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 1,869.4 | 1,103.9 | 2,600.0 | 0.0 | 0.0 | 5,573.2 |
| | 500 - 1000 | 39.3 | 0.0 | 0.0 | 6,322.3 | 17,439.4 | 0.0 | 0.0 | 23,800.9 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 4,668.5 | 14,600.1 | 0.0 | 0.0 | 19,268.6 |
| | TOTAL | 39.3 | 0.0 | 1,869.4 | 12,094.7 | 34,639.5 | 0.0 | 0.0 | 48,642.7 |
| Total | 20 - 200 | 265.6 | 1,831.5 | 4,422.6 | 5,762.3 | 1,057.6 | 0.0 | 0.0 | 13,339.5 |
| | 200 - 500 | 0.0 | 0.0 | 1,869.4 | 1,103.9 | 2,600.0 | 0.0 | 0.0 | 5,573.2 |
| | 500 - 1000 | 39.3 | 0.0 | 0.0 | 6,322.3 | 17,439.4 | 0.0 | 0.0 | 23,800. |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 4,668.5 | 14,600.1 | 0.0 | 0.0 | 19,268.6 |
| | TOTAL | 304.9 | 1,831.5 | 6,292.0 | 17,856.9 | 35,697.0 | 0.0 | 0.0 | 61,982.3 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 2,461.9 | 1,741.2 | 1,215.4 | 23,761.7 | 33,254.3 | 8,403.2 | 0.0 | 70,837.7 |
| | 200 - 500 | 1,588.1 | 4,797.4 | 5,620.4 | 51,804.7 | 57,228.3 | 9,722.4 | 0.0 | 130,761.2 |
| | 500 - 1000 | 7,231.1 | 23,269.4 | 59,604.4 | 150,655.1 | 212,135.1 | 26,924.7 | 0.0 | 479,819.8 |
| | 1000 - 2000 | 24,533.4 | 71,152.0 | 145,949.3 | 529,367.5 | 896,190.5 | 610,003.4 | 573.1 | 2,277,769.2 |
| | TOTAL | 35,814.5 | 100,960.1 | 212,389.4 | 755,589.0 | 1,198,808.1 | 655,053.7 | 573.1 | 2,959,187.9 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 317.6 | 59.6 | 529.9 | 3,429.8 | 1,921.3 | 263.2 | 0.0 | 6,521.5 |
| | 200 - 500 | 255.0 | 416.1 | 181.6 | 2,696.1 | 3,328.5 | 218.0 | 0.0 | 7,095.2 |
| | 500 - 1000 | 674.6 | 1,016.6 | 3,419.6 | 11,415.7 | 23,030.7 | 6,856.7 | 0.0 | 46,413.9 |
| | 1000 - 2000 | 1,870.8 | 6,352.7 | 13,749.5 | 57,584.6 | 97,448.1 | 18,900.7 | 0.0 | 195,906.3 |
| | TOTAL | 3,118.1 | 7,845.0 | 17,880.7 | 75,126.1 | 125,728.5 | 26,238.5 | 0.0 | 255,936.8 |
| Technological | 20 - 200 | 971.3 | 1,249.6 | 984.5 | 2,298.0 | 1,689.8 | 0.0 | 0.0 | 7,193.2 |
| | 200 - 500 | 434.4 | 1,925.1 | 2,374.8 | 6,416.5 | 13,224.7 | 2,723.2 | 0.0 | 27,098.6 |
| | 500 - 1000 | 1,285.2 | 3,772.3 | 10,192.6 | 30,265.8 | 50,148.1 | 9,872.9 | 0.0 | 105,536.9 |
| | 1000 - 2000 | 3,798.1 | 10,472.4 | 9,442.4 | 78,058.4 | 193,584.2 | 205,185.4 | 362.7 | 500,903.5 |
| | TOTAL | 6,489.0 | 17,419.4 | 22,994.2 | 117,038.7 | 258,646.7 | 217,781.5 | 362.7 | 640,732.3 |
| Total | 20 - 200 | 1,288.9 | 1,309.3 | 1,514.4 | 5,727.8 | 3,611.1 | 263.2 | 0.0 | 13,714.7 |
| | 200 - 500 | 689.5 | 2,341.2 | 2,556.4 | 9,112.6 | 16,553.1 | 2,941.2 | 0.0 | 34,193.9 |
| | 500 - 1000 | 1,959.9 | 4,788.8 | 13,612.3 | 41,681.5 | 73,178.8 | 16,729.6 | 0.0 | 151,950.8 |
| | 1000 - 2000 | 5,668.9 | 16,825.0 | 23,191.9 | 135,642.9 | 291,032.2 | 224,086.1 | 362.7 | 696,809.8 |
| | TOTAL | 9,607.1 | 25,264.3 | 40,874.9 | 192,164.8 | 384,375.2 | 244,020.0 | 362.7 | 896,669.1 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 1,173.0 | 432.0 | -299.0 | 18,033.9 | 29,643.2 | 8,140.0 | 0.0 | 57,123.0 |
| | 200 - 500 | 898.6 | 2,456.2 | 3,064.0 | 42,692.2 | 40,675.1 | 6,781.2 | 0.0 | 96,567.4 |
| | 500 - 1000 | 5,271.3 | 18,480.6 | 45,992.1 | 108,973.6 | 138,956.4 | 10,195.1 | 0.0 | 327,869.0 |
| | 1000 - 2000 | 18,864.6 | 54,327.0 | 122,757.4 | 393,724.6 | 605,158.2 | 385,917.3 | 210.4 | 1,580,959.4 |
| | TOTAL | 26,207.4 | 75,695.7 | 171,514.5 | 563,424.2 | 814,432.9 | 411,033.6 | 210.4 | 2,062,518.8 |

*Table A4d.* ***Summary of estimated coal resources of the "Lower and upper F" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 11,360.3 | 16,988.1 | 28,752.8 | 154,136.2 | 185,933.5 | 56,967.3 | 0.0 | 454,138.2 |
| | 200 - 500 | 9,076.2 | 19,754.7 | 40,906.5 | 200,321.3 | 277,086.1 | 69,172.8 | 0.0 | 616,317.6 |
| | 500 - 1000 | 20,142.5 | 55,245.3 | 123,507.5 | 446,231.1 | 684,008.1 | 135,686.3 | 0.0 | 1,464,820.8 |
| | 1000 - 2000 | 30,545.6 | 84,498.2 | 178,092.1 | 831,854.5 | 1,343,677.9 | 1,035,322.2 | 33,781.4 | 3,537,772.0 |
| | TOTAL | 71,124.6 | 176,486.3 | 371,259.0 | 1,632,543.2 | 2,490,705.7 | 1,297,148.6 | 33,781.4 | 6,073,048.6 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 2,679.9 | 4,905.8 | 9,715.4 | 29,448.9 | 34,862.3 | 69.5 | 0.0 | 81,681.8 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 2,679.9 | 4,905.8 | 9,715.4 | 29,448.9 | 34,862.3 | 69.5 | 0.0 | 81,681.8 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 229.5 | 141.5 | 2,066.2 | 2,018.0 | 8,155.1 | 0.0 | 0.0 | 12,610.4 |
| | 500 - 1000 | 39.3 | 0.0 | 50.5 | 13,391.8 | 71,715.3 | 5.2 | 0.0 | 85,202.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 7,088.4 | 19,101.0 | 0.0 | 0.0 | 26,189.4 |
| | TOTAL | 268.8 | 141.5 | 2,116.7 | 22,498.2 | 98,971.4 | 5.2 | 0.0 | 124,001.8 |
| Total | 20 - 200 | 2,679.9 | 4,905.8 | 9,715.4 | 29,448.9 | 34,862.3 | 69.5 | 0.0 | 81,681.8 |
| | 200 - 500 | 229.5 | 141.5 | 2,066.2 | 2,018.0 | 8,155.1 | 0.0 | 0.0 | 12,610.4 |
| | 500 - 1000 | 39.3 | 0.0 | 50.5 | 13,391.8 | 71,715.3 | 5.2 | 0.0 | 85,202.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 7,088.4 | 19,101.0 | 0.0 | 0.0 | 26,189.4 |
| | TOTAL | 2,948.7 | 5,047.3 | 11,832.1 | 51,947.1 | 133,833.7 | 74.7 | 0.0 | 205,683.5 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 8,680.4 | 12,082.3 | 19,037.4 | 124,687.4 | 151,071.2 | 56,897.8 | 0.0 | 372,456.4 |
| | 200 - 500 | 8,846.7 | 19,613.2 | 38,840.3 | 198,303.3 | 268,931.0 | 69,172.8 | 0.0 | 603,707.2 |
| | 500 - 1000 | 20,103.2 | 55,245.3 | 123,457.1 | 432,839.4 | 612,292.9 | 135,681.1 | 0.0 | 1,379,618.8 |
| | 1000 - 2000 | 30,545.6 | 84,498.2 | 178,092.1 | 824,766.1 | 1,324,577.0 | 1,035,322.2 | 33,781.4 | 3,511,582.6 |
| | TOTAL | 68,175.9 | 171,439.0 | 359,426.9 | 1,580,596.1 | 2,356,872.0 | 1,297,073.9 | 33,781.4 | 5,867,365.1 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 476.3 | 332.2 | 992.9 | 6,703.0 | 5,052.8 | 291.5 | 0.0 | 13,848.8 |
| | 200 - 500 | 625.4 | 1,059.5 | 1,071.3 | 8,121.7 | 12,117.5 | 323.0 | 0.0 | 23,318.3 |
| | 500 - 1000 | 1,647.8 | 2,069.6 | 5,991.9 | 25,742.7 | 64,155.4 | 21,527.8 | 0.0 | 121,135.2 |
| | 1000 - 2000 | 2,829.6 | 8,316.0 | 17,275.8 | 83,116.9 | 152,043.5 | 44,195.9 | 0.0 | 307,777.7 |
| | TOTAL | 5,579.1 | 11,777.2 | 25,331.9 | 123,684.3 | 233,369.1 | 66,338.2 | 0.0 | 466,079.9 |
| Technological | 20 - 200 | 1,765.1 | 3,170.1 | 6,693.2 | 22,843.1 | 15,217.0 | 0.0 | 0.0 | 49,688.6 |
| | 200 - 500 | 2,105.3 | 5,063.1 | 10,758.7 | 38,978.7 | 61,108.9 | 33,339.1 | 0.0 | 151,353.6 |
| | 500 - 1000 | 3,737.9 | 9,688.5 | 25,381.9 | 102,141.6 | 201,918.0 | 82,077.2 | 0.0 | 424,944.9 |
| | 1000 - 2000 | 6,588.3 | 15,094.9 | 20,055.5 | 183,106.5 | 354,026.8 | 429,821.3 | 25,790.0 | 1,034,483.3 |
| | TOTAL | 14,196.4 | 33,016.6 | 62,889.3 | 347,069.8 | 632,270.8 | 545,237.5 | 25,790.0 | 1,660,470.4 |
| Total | 20 - 200 | 2,241.4 | 3,502.3 | 7,686.2 | 29,546.1 | 20,269.8 | 291.5 | 0.0 | 63,537.3 |
| | 200 - 500 | 2,730.7 | 6,122.6 | 11,830.0 | 47,100.3 | 73,226.3 | 33,662.0 | 0.0 | 174,671.9 |
| | 500 - 1000 | 5,385.6 | 11,758.0 | 31,373.8 | 127,884.3 | 266,073.4 | 103,604.9 | 0.0 | 546,080.1 |
| | 1000 - 2000 | 9,417.9 | 23,410.9 | 37,331.3 | 266,223.4 | 506,070.3 | 474,017.2 | 25,790.0 | 1,342,260.9 |
| | TOTAL | 19,775.6 | 44,793.8 | 88,221.2 | 470,754.2 | 865,639.9 | 611,575.7 | 25,790.0 | 2,126,550.2 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 6,439.1 | 8,580.0 | 11,351.2 | 95,141.3 | 130,801.4 | 56,606.2 | 0.0 | 308,919.1 |
| | 200 - 500 | 6,116.0 | 13,490.6 | 27,010.3 | 151,203.0 | 195,704.7 | 35,510.8 | 0.0 | 429,035.4 |
| | 500 - 1000 | 14,717.6 | 43,487.3 | 92,083.3 | 304,955.0 | 346,219.5 | 32,076.1 | 0.0 | 833,538.7 |
| | 1000 - 2000 | 21,127.7 | 61,087.3 | 140,760.8 | 558,542.7 | 818,506.7 | 561,305.0 | 7,991.4 | 2,169,321.7 |
| | TOTAL | 48,400.4 | 126,645.2 | 271,205.7 | 1,109,842.0 | 1,491,232.1 | 685,498.2 | 7,991.4 | 3,740,814.9 |

*Table A5a. Summary of estimated coal resources of the "Lower and upper H" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).*

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 813.6 | 2,861.7 | 3,598.8 | 12,930.6 | 19,656.3 | 7,919.7 | 0.0 | 47,780.7 |
| | 200 - 500 | 515.4 | 2,486.9 | 4,576.6 | 25,340.6 | 41,609.7 | 31,638.1 | 0.0 | 106,167.3 |
| | 500 - 1000 | 3,274.1 | 5,479.1 | 7,501.0 | 53,940.2 | 98,244.1 | 46,999.3 | 0.0 | 215,437.8 |
| | 1000 - 2000 | 959.3 | 1,255.7 | 1,212.5 | 10,824.6 | 30,511.2 | 29,228.0 | 1,736.4 | 75,727.7 |
| | TOTAL | 5,562.3 | 12,083.4 | 16,889.0 | 103,036.0 | 190,021.3 | 115,785.0 | 1,736.4 | 445,113.4 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 813.6 | 2,861.7 | 3,598.8 | 12,930.6 | 19,656.3 | 7,919.7 | 0.0 | 47,780.7 |
| | 200 - 500 | 515.4 | 2,486.9 | 4,576.6 | 25,340.6 | 41,609.7 | 31,638.1 | 0.0 | 106,167.3 |
| | 500 - 1000 | 3,274.1 | 5,479.1 | 7,501.0 | 53,940.2 | 98,244.1 | 46,999.3 | 0.0 | 215,437.8 |
| | 1000 - 2000 | 959.3 | 1,255.7 | 1,212.5 | 10,824.6 | 30,511.2 | 29,228.0 | 1,736.4 | 75,727.7 |
| | TOTAL | 5,562.3 | 12,083.4 | 16,889.0 | 103,036.0 | 190,021.3 | 115,785.0 | 1,736.4 | 445,113.4 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 22.9 | 188.8 | 347.2 | 146.4 | 668.3 | 0.0 | 0.0 | 1,373.6 |
| | 200 - 500 | 14.5 | 28.9 | 43.8 | 707.7 | 3,046.0 | 313.5 | 0.0 | 4,154.4 |
| | 500 - 1000 | 130.7 | 36.2 | 0.0 | 2,034.0 | 4,952.7 | 434.1 | 0.0 | 7,587.6 |
| | 1000 - 2000 | 181.9 | 454.1 | 228.3 | 652.2 | 2,686.7 | 6,921.9 | 0.0 | 11,125.1 |
| | TOTAL | 350.0 | 708.0 | 619.3 | 3,540.2 | 11,353.7 | 7,669.6 | 0.0 | 24,240.8 |
| Technological | 20 - 200 | 0.4 | 2.5 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 3.5 |
| | 200 - 500 | 197.4 | 507.5 | 1,434.1 | 12,535.9 | 11,594.7 | 15,569.7 | 0.0 | 41,839.2 |
| | 500 - 1000 | 2,274.9 | 3,507.2 | 3,875.3 | 26,894.2 | 39,060.5 | 27,500.3 | 0.0 | 103,112.3 |
| | 1000 - 2000 | 216.2 | 411.4 | 410.2 | 2,528.5 | 9,340.6 | 16,382.8 | 1,723.6 | 31,013.2 |
| | TOTAL | 2,688.9 | 4,428.7 | 5,720.2 | 41,958.5 | 59,995.8 | 59,452.7 | 1,723.6 | 175,968.2 |
| Total | 20 - 200 | 23.3 | 191.3 | 347.9 | 146.4 | 668.3 | 0.0 | 0.0 | 1,377.1 |
| | 200 - 500 | 211.9 | 536.4 | 1,477.9 | 13,243.6 | 14,640.7 | 15,883.2 | 0.0 | 45,993.7 |
| | 500 - 1000 | 2,405.7 | 3,543.4 | 3,875.3 | 28,928.1 | 44,013.1 | 27,934.4 | 0.0 | 110,700.0 |
| | 1000 - 2000 | 398.0 | 865.5 | 638.5 | 3,180.7 | 12,027.4 | 23,304.7 | 1,723.6 | 42,138.3 |
| | TOTAL | 3,038.9 | 5,136.6 | 6,339.5 | 45,498.7 | 71,349.4 | 67,122.3 | 1,723.6 | 200,209.0 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 790.3 | 2,670.4 | 3,250.9 | 12,784.2 | 18,988.0 | 7,919.7 | 0.0 | 46,403.6 |
| | 200 - 500 | 303.4 | 1,950.5 | 3,098.7 | 12,097.1 | 26,969.0 | 15,754.9 | 0.0 | 60,173.6 |
| | 500 - 1000 | 868.4 | 1,935.7 | 3,625.8 | 25,012.1 | 54,231.0 | 19,064.9 | 0.0 | 104,737.8 |
| | 1000 - 2000 | 561.2 | 390.2 | 574.1 | 7,643.9 | 18,483.8 | 5,923.3 | 12.9 | 33,589.4 |
| | TOTAL | 2,523.4 | 6,946.8 | 10,549.5 | 57,537.3 | 118,671.9 | 48,662.7 | 12.9 | 244,904.4 |

*Table A5b. Summary of estimated coal resources of the "Lower and upper H" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).*

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 830.1 | 2,816.0 | 6,377.1 | 34,201.6 | 64,870.9 | 14,740.3 | 0.0 | 123,836.0 |
| | 200 - 500 | 2,062.0 | 4,849.8 | 8,565.6 | 56,734.1 | 117,450.9 | 22,866.0 | 0.0 | 212,528.3 |
| | 500 - 1000 | 5,281.6 | 11,661.9 | 12,825.9 | 104,856.5 | 212,715.2 | 59,723.6 | 7,264.3 | 414,328.9 |
| | 1000 - 2000 | 6,634.2 | 11,122.5 | 17,300.4 | 76,855.5 | 212,580.9 | 149,718.3 | 2,534.0 | 476,745.9 |
| | TOTAL | 14,808.0 | 30,450.3 | 45,068.9 | 272,647.7 | 607,617.8 | 247,048.2 | 9,798.3 | 1,227,439.1 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 338.0 | 0.0 | 0.0 | 338.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 338.0 | 0.0 | 0.0 | 338.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 338.0 | 0.0 | 0.0 | 338.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 338.0 | 0.0 | 0.0 | 338.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 830.1 | 2,816.0 | 6,377.1 | 34,201.6 | 64,532.9 | 14,740.3 | 0.0 | 123,498.0 |
| | 200 - 500 | 2,062.0 | 4,849.8 | 8,565.6 | 56,734.1 | 117,450.9 | 22,866.0 | 0.0 | 212,528.3 |
| | 500 - 1000 | 5,281.6 | 11,661.9 | 12,825.9 | 104,856.5 | 212,715.2 | 59,723.6 | 7,264.3 | 414,328.9 |
| | 1000 - 2000 | 6,634.2 | 11,122.5 | 17,300.4 | 76,855.5 | 212,580.9 | 149,718.3 | 2,534.0 | 476,745.9 |
| | TOTAL | 14,808.0 | 30,450.3 | 45,068.9 | 272,647.7 | 607,279.8 | 247,048.2 | 9,798.3 | 1,227,101.1 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 32.4 | 66.4 | 117.1 | 2,443.5 | 7,049.1 | 0.0 | 0.0 | 9,708.5 |
| | 200 - 500 | 64.1 | 95.6 | 95.9 | 5,901.4 | 24,598.3 | 509.7 | 0.0 | 31,265.0 |
| | 500 - 1000 | 375.2 | 931.3 | 650.1 | 6,472.3 | 21,421.8 | 823.2 | 0.0 | 30,674.0 |
| | 1000 - 2000 | 2,106.6 | 919.9 | 1,388.3 | 5,806.9 | 25,121.4 | 19,843.9 | 0.0 | 55,186.9 |
| | TOTAL | 2,578.3 | 2,013.2 | 2,251.4 | 20,624.1 | 78,190.6 | 21,176.8 | 0.0 | 126,834.3 |
| Technological | 20 - 200 | 15.1 | 3.6 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 19.9 |
| | 200 - 500 | 660.8 | 925.4 | 3,547.4 | 26,763.0 | 15,572.5 | 4,148.0 | 0.0 | 51,617.1 |
| | 500 - 1000 | 1,356.5 | 3,561.2 | 4,895.8 | 43,197.5 | 99,070.2 | 25,728.2 | 0.0 | 177,809.3 |
| | 1000 - 2000 | 1,321.1 | 5,390.3 | 6,813.2 | 29,572.2 | 71,189.7 | 80,123.2 | 144.4 | 194,554.1 |
| | TOTAL | 3,353.5 | 9,880.6 | 15,257.5 | 99,532.6 | 185,832.4 | 109,999.4 | 144.4 | 424,000.4 |
| Total | 20 - 200 | 47.5 | 70.0 | 118.3 | 2,443.5 | 7,049.1 | 0.0 | 0.0 | 9,728.4 |
| | 200 - 500 | 724.9 | 1,021.0 | 3,643.3 | 32,664.4 | 40,170.8 | 4,657.7 | 0.0 | 82,882.0 |
| | 500 - 1000 | 1,731.7 | 4,492.6 | 5,545.9 | 49,669.8 | 120,492.0 | 26,551.4 | 0.0 | 208,483.3 |
| | 1000 - 2000 | 3,427.7 | 6,310.2 | 8,201.5 | 35,379.0 | 96,311.1 | 99,967.2 | 144.4 | 249,741.0 |
| | TOTAL | 5,931.8 | 11,893.7 | 17,508.9 | 120,156.7 | 264,023.0 | 131,176.2 | 144.4 | 550,834.7 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 782.6 | 2,746.1 | 6,258.8 | 31,758.1 | 57,483.8 | 14,740.3 | 0.0 | 113,769.6 |
| | 200 - 500 | 1,337.1 | 3,828.8 | 4,922.3 | 24,069.7 | 77,280.1 | 18,208.3 | 0.0 | 129,646.3 |
| | 500 - 1000 | 3,549.9 | 7,169.3 | 7,280.0 | 55,186.7 | 92,223.2 | 33,172.3 | 7,264.3 | 205,845.7 |
| | 1000 - 2000 | 3,206.5 | 4,812.4 | 9,098.9 | 41,476.5 | 116,269.8 | 49,751.2 | 2,389.6 | 227,004.9 |
| | TOTAL | 8,876.2 | 18,556.5 | 27,560.0 | 152,491.0 | 343,256.8 | 115,872.0 | 9,653.9 | 676,266.5 |

*Table A5c.* ***Summary of estimated coal resources of the "Lower and upper H" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 187.7 | 333.3 | 496.7 | 10,680.4 | 17,442.5 | 352.2 | 0.0 | 29,492.7 |
| | 200 - 500 | 1,007.2 | 1,402.7 | 1,541.0 | 18,387.3 | 14,066.7 | 0.0 | 0.0 | 36,405.0 |
| | 500 - 1000 | 6,002.6 | 6,886.8 | 7,070.9 | 31,595.6 | 27,506.7 | 89.6 | 0.0 | 79,152.1 |
| | 1000 - 2000 | 16,709.0 | 30,361.3 | 39,222.5 | 152,061.0 | 530,088.8 | 107,815.8 | 0.0 | 876,258.5 |
| | TOTAL | 23,906.6 | 38,984.2 | 48,331.1 | 212,724.3 | 589,104.7 | 108,257.6 | 0.0 | 1,021,308.4 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 2,738.0 | 0.0 | 0.0 | 2,738.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 2,738.0 | 0.0 | 0.0 | 2,738.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 2,738.0 | 0.0 | 0.0 | 2,738.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 2,738.0 | 0.0 | 0.0 | 2,738.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 187.7 | 333.3 | 496.7 | 10,680.4 | 14,704.5 | 352.2 | 0.0 | 26,754.7 |
| | 200 - 500 | 1,007.2 | 1,402.7 | 1,541.0 | 18,387.3 | 14,066.7 | 0.0 | 0.0 | 36,405.0 |
| | 500 - 1000 | 6,002.6 | 6,886.8 | 7,070.9 | 31,595.6 | 27,506.7 | 89.6 | 0.0 | 79,152.1 |
| | 1000 - 2000 | 16,709.0 | 30,361.3 | 39,222.5 | 152,061.0 | 530,088.8 | 107,815.8 | 0.0 | 876,258.5 |
| | TOTAL | 23,906.6 | 38,984.2 | 48,331.1 | 212,724.3 | 586,366.7 | 108,257.6 | 0.0 | 1,018,570.4 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 1.4 | 0.0 | 3.7 | 501.3 | 254.7 | 0.0 | 0.0 | 761.2 |
| | 200 - 500 | 45.5 | 110.7 | 291.5 | 1,855.9 | 937.0 | 0.0 | 0.0 | 3,240.5 |
| | 500 - 1000 | 352.6 | 571.5 | 990.0 | 4,242.6 | 1,736.2 | 0.0 | 0.0 | 7,892.8 |
| | 1000 - 2000 | 2,446.6 | 4,101.4 | 5,615.5 | 18,020.2 | 30,943.3 | 4,670.5 | 0.0 | 65,797.5 |
| | TOTAL | 2,846.1 | 4,783.6 | 6,900.6 | 24,620.0 | 33,871.2 | 4,670.6 | 0.0 | 77,692.0 |
| Technological | 20 - 200 | 0.0 | 0.0 | 0.0 | 249.3 | 0.0 | 0.0 | 0.0 | 249.3 |
| | 200 - 500 | 195.4 | 283.0 | 765.0 | 8,354.0 | 3,962.7 | 0.0 | 0.0 | 13,560.0 |
| | 500 - 1000 | 1,399.1 | 1,174.6 | 1,604.6 | 6,762.4 | 13,121.1 | 89.5 | 0.0 | 24,151.1 |
| | 1000 - 2000 | 2,104.3 | 3,533.8 | 5,226.9 | 52,891.1 | 132,949.3 | 29,104.3 | 0.0 | 225,809.6 |
| | TOTAL | 3,698.7 | 4,991.3 | 7,596.4 | 68,256.7 | 150,033.1 | 29,193.8 | 0.0 | 263,770.0 |
| Total | 20 - 200 | 1.4 | 0.0 | 3.7 | 750.6 | 254.7 | 0.0 | 0.0 | 1,010.5 |
| | 200 - 500 | 240.8 | 393.7 | 1,056.4 | 10,209.9 | 4,899.7 | 0.0 | 0.0 | 16,800.6 |
| | 500 - 1000 | 1,751.6 | 1,746.1 | 2,594.6 | 11,004.9 | 14,857.2 | 89.5 | 0.0 | 32,043.9 |
| | 1000 - 2000 | 4,550.9 | 7,635.1 | 10,842.3 | 70,911.3 | 163,892.6 | 33,774.8 | 0.0 | 291,607.0 |
| | TOTAL | 6,544.8 | 9,774.9 | 14,497.0 | 92,876.7 | 183,904.3 | 33,864.3 | 0.0 | 341,462.0 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 186.3 | 333.3 | 493.0 | 9,929.8 | 14,449.7 | 352.2 | 0.0 | 25,744.3 |
| | 200 - 500 | 766.4 | 1,009.1 | 484.6 | 8,177.4 | 9,167.0 | 0.0 | 0.0 | 19,604.4 |
| | 500 - 1000 | 4,251.0 | 5,140.7 | 4,476.3 | 20,590.6 | 12,649.5 | 0.1 | 0.0 | 47,108.2 |
| | 1000 - 2000 | 12,158.1 | 22,726.2 | 28,380.2 | 81,149.8 | 366,196.2 | 74,041.0 | 0.0 | 584,651.5 |
| | TOTAL | 17,361.8 | 29,209.3 | 33,834.0 | 119,847.6 | 402,462.4 | 74,393.2 | 0.0 | 677,108.4 |

*Table A5d.* ***Summary of estimated coal resources of the "Lower and upper H" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 1,831.5 | 6,011.1 | 10,472.6 | 57,812.5 | 101,969.7 | 23,012.1 | 0.0 | 201,109.4 |
| | 200 - 500 | 3,584.6 | 8,739.5 | 14,683.2 | 100,462.0 | 173,127.3 | 54,504.0 | 0.0 | 355,100.6 |
| | 500 - 1000 | 14,558.3 | 24,027.9 | 27,397.7 | 190,392.3 | 338,466.0 | 106,812.4 | 7,264.3 | 708,918.8 |
| | 1000 - 2000 | 24,302.5 | 42,739.5 | 57,735.5 | 239,741.2 | 773,180.9 | 286,762.1 | 4,270.4 | 1,428,732.1 |
| | TOTAL | 44,276.8 | 81,517.9 | 110,288.9 | 588,408.0 | 1,386,743.8 | 471,090.7 | 11,534.7 | 2,693,860.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 3,076.0 | 0.0 | 0.0 | 3,076.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 3,076.0 | 0.0 | 0.0 | 3,076.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 3,076.0 | 0.0 | 0.0 | 3,076.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 3,076.0 | 0.0 | 0.0 | 3,076.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 1,831.5 | 6,011.1 | 10,472.6 | 57,812.5 | 98,893.7 | 23,012.1 | 0.0 | 198,033.4 |
| | 200 - 500 | 3,584.6 | 8,739.5 | 14,683.2 | 100,462.0 | 173,127.3 | 54,504.0 | 0.0 | 355,100.6 |
| | 500 - 1000 | 14,558.3 | 24,027.9 | 27,397.7 | 190,392.3 | 338,466.0 | 106,812.4 | 7,264.3 | 708,918.8 |
| | 1000 - 2000 | 24,302.5 | 42,739.5 | 57,735.5 | 239,741.2 | 773,180.9 | 286,762.1 | 4,270.4 | 1,428,732.1 |
| | TOTAL | 44,276.8 | 81,517.9 | 110,288.9 | 588,408.0 | 1,383,667.8 | 471,090.7 | 11,534.7 | 2,690,784.9 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 56.7 | 255.2 | 468.1 | 3,091.2 | 7,972.1 | 0.0 | 0.0 | 11,843.2 |
| | 200 - 500 | 124.1 | 235.3 | 431.2 | 8,464.9 | 28,581.3 | 823.2 | 0.0 | 38,659.9 |
| | 500 - 1000 | 858.5 | 1,539.0 | 1,640.1 | 12,748.8 | 28,110.6 | 1,257.4 | 0.0 | 46,154.4 |
| | 1000 - 2000 | 4,735.1 | 5,475.3 | 7,232.0 | 24,479.3 | 58,751.4 | 31,436.4 | 0.0 | 132,109.6 |
| | TOTAL | 5,774.4 | 7,504.7 | 9,771.3 | 48,784.3 | 123,415.4 | 33,516.9 | 0.0 | 228,767.1 |
| Technological | 20 - 200 | 15.5 | 6.2 | 1.8 | 249.3 | 0.0 | 0.0 | 0.0 | 272.7 |
| | 200 - 500 | 1,053.6 | 1,715.8 | 5,746.4 | 47,652.9 | 31,129.9 | 19,717.7 | 0.0 | 107,016.3 |
| | 500 - 1000 | 5,030.5 | 8,243.1 | 10,375.6 | 76,854.0 | 151,251.7 | 53,317.9 | 0.0 | 305,072.7 |
| | 1000 - 2000 | 3,641.5 | 9,335.5 | 12,450.2 | 84,991.7 | 213,479.6 | 125,610.2 | 1,868.0 | 451,376.8 |
| | TOTAL | 9,741.0 | 19,300.5 | 28,574.1 | 209,747.8 | 395,861.2 | 198,645.9 | 1,868.0 | 863,738.5 |
| Total | 20 - 200 | 72.2 | 261.3 | 469.9 | 3,340.5 | 7,972.1 | 0.0 | 0.0 | 12,115.9 |
| | 200 - 500 | 1,177.6 | 1,951.1 | 6,177.6 | 56,117.8 | 59,711.2 | 20,540.9 | 0.0 | 145,676.2 |
| | 500 - 1000 | 5,889.0 | 9,782.0 | 12,015.7 | 89,602.8 | 179,362.3 | 54,575.3 | 0.0 | 351,227.2 |
| | 1000 - 2000 | 8,376.6 | 14,810.8 | 19,682.2 | 109,471.0 | 272,231.1 | 157,046.7 | 1,868.0 | 583,486.3 |
| | TOTAL | 15,515.4 | 26,805.3 | 38,345.4 | 258,532.1 | 519,276.7 | 232,162.8 | 1,868.0 | 1,092,505.7 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 1,759.3 | 5,749.8 | 10,002.7 | 54,472.0 | 90,921.6 | 23,012.1 | 0.0 | 185,917.5 |
| | 200 - 500 | 2,407.0 | 6,788.3 | 8,505.6 | 44,344.2 | 113,416.1 | 33,963.2 | 0.0 | 209,424.3 |
| | 500 - 1000 | 8,669.3 | 14,245.8 | 15,382.0 | 100,789.5 | 159,103.6 | 52,237.2 | 7,264.3 | 357,691.7 |
| | 1000 - 2000 | 15,925.9 | 27,928.7 | 38,053.2 | 130,270.2 | 500,949.8 | 129,715.5 | 2,402.5 | 845,245.8 |
| | TOTAL | 28,761.4 | 54,712.6 | 71,943.6 | 329,875.9 | 864,391.2 | 238,927.9 | 9,666.7 | 1,598,279.2 |

***Table A6a. Summary of estimated coal resources of the "I, J, and K" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 2,008.4 | 3,521.1 | 6,896.0 | 15,479.1 | 5,699.8 | 0.0 | 0.0 | 33,604.4 |
| | 200 - 500 | 10,516.8 | 16,797.0 | 25,665.3 | 54,845.2 | 20,089.5 | 0.0 | 0.0 | 127,913.8 |
| | 500 - 1000 | 9,581.0 | 11,582.1 | 17,689.0 | 48,968.1 | 22,278.1 | 0.0 | 0.0 | 110,098.2 |
| | 1000 - 2000 | 2,731.3 | 3,547.4 | 5,234.6 | 13,716.8 | 1,545.9 | 0.0 | 0.0 | 26,775.8 |
| | TOTAL | 24,837.5 | 35,447.5 | 55,484.8 | 133,009.2 | 49,613.2 | 0.0 | 0.0 | 298,392.2 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 2,008.4 | 3,521.1 | 6,896.0 | 15,479.1 | 5,699.8 | 0.0 | 0.0 | 33,604.4 |
| | 200 - 500 | 10,516.8 | 16,797.0 | 25,665.3 | 54,845.2 | 20,089.5 | 0.0 | 0.0 | 127,913.8 |
| | 500 - 1000 | 9,581.0 | 11,582.1 | 17,689.0 | 48,968.1 | 22,278.1 | 0.0 | 0.0 | 110,098.2 |
| | 1000 - 2000 | 2,731.3 | 3,547.4 | 5,234.6 | 13,716.8 | 1,545.9 | 0.0 | 0.0 | 26,775.8 |
| | TOTAL | 24,837.5 | 35,447.5 | 55,484.8 | 133,009.2 | 49,613.2 | 0.0 | 0.0 | 298,392.2 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 106.1 | 207.4 | 134.1 | 765.5 | 368.4 | 0.0 | 0.0 | 1,581.5 |
| | 200 - 500 | 175.8 | 247.7 | 193.1 | 337.6 | 258.0 | 0.0 | 0.0 | 1,212.1 |
| | 500 - 1000 | 1,031.9 | 1,505.6 | 979.3 | 3,994.6 | 24.7 | 0.0 | 0.0 | 7,536.1 |
| | 1000 - 2000 | 311.3 | 1,264.7 | 361.0 | 1,179.6 | 405.3 | 0.0 | 0.0 | 3,521.9 |
| | TOTAL | 1,625.1 | 3,225.5 | 1,667.5 | 6,277.2 | 1,056.4 | 0.0 | 0.0 | 13,851.6 |
| Technological | 20 - 200 | 42.8 | 63.9 | 0.0 | 168.6 | 0.0 | 0.0 | 0.0 | 275.2 |
| | 200 - 500 | 1,664.0 | 6,576.1 | 12,385.0 | 28,270.0 | 7,852.0 | 0.0 | 0.0 | 56,747.1 |
| | 500 - 1000 | 3,195.7 | 3,923.7 | 7,857.0 | 20,652.3 | 13,941.4 | 0.0 | 0.0 | 49,570.1 |
| | 1000 - 2000 | 1,710.3 | 891.2 | 2,565.4 | 7,165.6 | 1,056.2 | 0.0 | 0.0 | 13,388.6 |
| | TOTAL | 6,612.7 | 11,454.8 | 22,807.5 | 56,256.4 | 22,849.7 | 0.0 | 0.0 | 119,981.1 |
| Total | 20 - 200 | 148.9 | 271.3 | 134.1 | 934.1 | 368.4 | 0.0 | 0.0 | 1,856.7 |
| | 200 - 500 | 1,839.8 | 6,823.7 | 12,578.1 | 28,607.6 | 8,110.0 | 0.0 | 0.0 | 57,959.2 |
| | 500 - 1000 | 4,227.6 | 5,429.3 | 8,836.4 | 24,646.9 | 13,966.1 | 0.0 | 0.0 | 57,106.3 |
| | 1000 - 2000 | 2,021.6 | 2,155.9 | 2,926.4 | 8,345.1 | 1,461.6 | 0.0 | 0.0 | 16,910.5 |
| | TOTAL | 8,237.8 | 14,680.2 | 24,475.0 | 62,533.6 | 23,906.0 | 0.0 | 0.0 | 133,832.6 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 1,859.6 | 3,249.8 | 6,761.9 | 14,545.1 | 5,331.4 | 0.0 | 0.0 | 31,747.7 |
| | 200 - 500 | 8,677.0 | 9,973.2 | 13,087.2 | 26,237.7 | 11,979.5 | 0.0 | 0.0 | 69,954.6 |
| | 500 - 1000 | 5,353.4 | 6,152.8 | 8,852.6 | 24,321.2 | 8,312.0 | 0.0 | 0.0 | 52,992.0 |
| | 1000 - 2000 | 709.7 | 1,391.5 | 2,308.1 | 5,371.7 | 84.3 | 0.0 | 0.0 | 9,865.3 |
| | TOTAL | 16,599.7 | 20,767.3 | 31,009.9 | 70,475.6 | 25,707.2 | 0.0 | 0.0 | 164,559.6 |

***Table A6b. Summary of estimated coal resources of the "I, J, and K" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 7,297.7 | 12,366.2 | 19,250.7 | 34,639.4 | 16,667.8 | 0.0 | 0.0 | 90,221.8 |
| | 200 - 500 | 20,250.2 | 35,996.9 | 56,122.1 | 104,297.7 | 59,303.5 | 0.0 | 0.0 | 275,970.4 |
| | 500 - 1000 | 29,437.4 | 48,641.5 | 81,934.4 | 178,663.7 | 62,666.8 | 0.0 | 0.0 | 401,343.8 |
| | 1000 - 2000 | 11,868.3 | 30,101.5 | 51,918.1 | 92,791.0 | 10,629.0 | 0.0 | 0.0 | 197,307.9 |
| | TOTAL | 68,853.6 | 127,106.1 | 209,225.2 | 410,391.9 | 149,267.1 | 0.0 | 0.0 | 964,843.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 7,297.7 | 12,366.2 | 19,250.7 | 34,639.4 | 16,667.8 | 0.0 | 0.0 | 90,221.8 |
| | 200 - 500 | 20,250.2 | 35,996.9 | 56,122.1 | 104,297.7 | 59,303.5 | 0.0 | 0.0 | 275,970.4 |
| | 500 - 1000 | 29,437.4 | 48,641.5 | 81,934.4 | 178,663.7 | 62,666.8 | 0.0 | 0.0 | 401,343.8 |
| | 1000 - 2000 | 11,868.3 | 30,101.5 | 51,918.1 | 92,791.0 | 10,629.0 | 0.0 | 0.0 | 197,307.9 |
| | TOTAL | 68,853.6 | 127,106.1 | 209,225.2 | 410,391.9 | 149,267.1 | 0.0 | 0.0 | 964,843.9 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 343.8 | 500.6 | 572.0 | 3,980.0 | 1,954.5 | 0.0 | 0.0 | 7,350.9 |
| | 200 - 500 | 860.1 | 3,193.8 | 4,006.0 | 13,664.6 | 3,420.5 | 0.0 | 0.0 | 25,144.9 |
| | 500 - 1000 | 4,250.9 | 7,101.2 | 10,357.0 | 11,760.5 | 2,496.9 | 0.0 | 0.0 | 35,966.5 |
| | 1000 - 2000 | 676.9 | 6,404.3 | 8,788.1 | 10,622.3 | 972.0 | 0.0 | 0.0 | 27,463.6 |
| | TOTAL | 6,131.8 | 17,199.8 | 23,723.1 | 40,027.3 | 8,843.9 | 0.0 | 0.0 | 95,925.8 |
| Technological | 20 - 200 | 30.5 | 148.9 | 8.8 | 258.9 | 868.3 | 0.0 | 0.0 | 1,315.3 |
| | 200 - 500 | 4,107.7 | 13,907.5 | 31,814.3 | 57,707.1 | 32,384.9 | 0.0 | 0.0 | 139,921.6 |
| | 500 - 1000 | 8,359.1 | 21,142.1 | 40,442.1 | 97,362.3 | 36,822.9 | 0.0 | 0.0 | 204,128.4 |
| | 1000 - 2000 | 5,302.0 | 11,535.6 | 15,586.3 | 41,838.7 | 1,019.6 | 0.0 | 0.0 | 75,282.3 |
| | TOTAL | 17,799.3 | 46,734.2 | 87,851.5 | 197,167.0 | 71,095.7 | 0.0 | 0.0 | 420,647.7 |
| Total | 20 - 200 | 374.3 | 649.5 | 580.7 | 4,238.9 | 2,822.8 | 0.0 | 0.0 | 8,666.2 |
| | 200 - 500 | 4,967.8 | 17,101.3 | 35,820.3 | 71,371.7 | 35,805.4 | 0.0 | 0.0 | 165,066.5 |
| | 500 - 1000 | 12,610.1 | 28,243.2 | 50,799.1 | 109,122.8 | 39,319.8 | 0.0 | 0.0 | 240,094.9 |
| | 1000 - 2000 | 5,978.9 | 17,940.0 | 24,374.4 | 52,461.0 | 1,991.6 | 0.0 | 0.0 | 102,745.9 |
| | TOTAL | 23,931.1 | 63,934.0 | 111,574.5 | 237,194.3 | 79,939.6 | 0.0 | 0.0 | 516,573.5 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 6,923.5 | 11,716.7 | 18,669.9 | 30,400.5 | 13,845.0 | 0.0 | 0.0 | 81,555.6 |
| | 200 - 500 | 15,282.4 | 18,895.6 | 20,301.8 | 32,926.1 | 23,498.1 | 0.0 | 0.0 | 110,904.0 |
| | 500 - 1000 | 16,827.3 | 20,398.3 | 31,135.3 | 69,541.0 | 23,347.0 | 0.0 | 0.0 | 161,248.9 |
| | 1000 - 2000 | 5,889.4 | 12,161.5 | 27,543.7 | 40,330.0 | 8,637.4 | 0.0 | 0.0 | 94,562.0 |
| | TOTAL | 44,922.5 | 63,172.1 | 97,650.7 | 173,197.6 | 69,327.5 | 0.0 | 0.0 | 448,270.4 |

***Table A6c.*** ***Summary of estimated coal resources of the "I, J, and K" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 3,288.8 | 2,716.0 | 2,988.0 | 9,610.9 | 4,939.4 | 0.0 | 0.0 | 23,543.1 |
| | 200 - 500 | 14,472.6 | 12,359.4 | 8,715.4 | 13,347.7 | 575.5 | 0.0 | 0.0 | 49,470.5 |
| | 500 - 1000 | 32,948.7 | 44,312.1 | 48,345.2 | 69,469.0 | 323.8 | 0.0 | 0.0 | 195,398.8 |
| | 1000 - 2000 | 27,485.8 | 56,086.6 | 96,810.0 | 230,875.6 | 33,356.5 | 0.0 | 0.0 | 444,614.4 |
| | TOTAL | 78,195.9 | 115,474.1 | 156,858.6 | 323,303.2 | 39,195.3 | 0.0 | 0.0 | 713,026.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 3,288.8 | 2,716.0 | 2,988.0 | 9,610.9 | 4,939.4 | 0.0 | 0.0 | 23,543.1 |
| | 200 - 500 | 14,472.6 | 12,359.4 | 8,715.4 | 13,347.7 | 574.4 | 0.0 | 0.0 | 49,469.5 |
| | 500 - 1000 | 32,948.7 | 44,312.1 | 48,345.2 | 69,469.0 | 323.8 | 0.0 | 0.0 | 195,398.8 |
| | 1000 - 2000 | 27,485.8 | 56,086.6 | 96,810.0 | 230,875.6 | 33,356.5 | 0.0 | 0.0 | 444,614.4 |
| | TOTAL | 78,195.9 | 115,474.1 | 156,858.6 | 323,303.2 | 39,194.2 | 0.0 | 0.0 | 713,025.8 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 110.5 | 440.3 | 509.5 | 3,252.7 | 0.0 | 0.0 | 0.0 | 4,312.9 |
| | 200 - 500 | 946.7 | 2,208.8 | 4,632.2 | 8,287.7 | 77.8 | 0.0 | 0.0 | 16,153.1 |
| | 500 - 1000 | 4,950.1 | 12,131.1 | 13,656.2 | 25,191.1 | 0.0 | 0.0 | 0.0 | 55,928.5 |
| | 1000 - 2000 | 1,332.7 | 7,669.4 | 8,025.1 | 15,981.5 | 1,508.1 | 0.0 | 0.0 | 34,516.9 |
| | TOTAL | 7,339.9 | 22,449.7 | 26,823.0 | 52,713.0 | 1,585.9 | 0.0 | 0.0 | 110,911.4 |
| Technological | 20 - 200 | 81.8 | 9.2 | 9.8 | 0.0 | 224.3 | 0.0 | 0.0 | 325.0 |
| | 200 - 500 | 3,304.2 | 5,859.0 | 3,529.9 | 3,761.0 | 547.3 | 0.0 | 0.0 | 17,001.3 |
| | 500 - 1000 | 3,444.4 | 9,726.0 | 8,511.0 | 13,318.3 | 394.6 | 0.0 | 0.0 | 35,394.4 |
| | 1000 - 2000 | 3,774.5 | 13,991.4 | 16,923.0 | 32,644.6 | 0.0 | 0.0 | 0.0 | 67,333.5 |
| | TOTAL | 10,604.9 | 29,585.6 | 28,973.7 | 49,723.8 | 1,166.1 | 0.0 | 0.0 | 120,054.2 |
| Total | 20 - 200 | 192.2 | 449.5 | 519.2 | 3,252.7 | 224.3 | 0.0 | 0.0 | 4,637.9 |
| | 200 - 500 | 4,250.9 | 8,067.8 | 8,162.1 | 12,048.7 | 625.1 | 0.0 | 0.0 | 33,154.5 |
| | 500 - 1000 | 8,394.5 | 21,857.1 | 22,167.3 | 38,509.3 | 394.6 | 0.0 | 0.0 | 91,322.9 |
| | 1000 - 2000 | 5,107.2 | 21,660.8 | 24,948.1 | 48,626.1 | 1,508.1 | 0.0 | 0.0 | 101,850.4 |
| | TOTAL | 17,944.8 | 52,035.3 | 55,796.7 | 102,436.8 | 2,752.1 | 0.0 | 0.0 | 230,965.6 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 3,096.6 | 2,266.4 | 2,468.8 | 6,358.2 | 4,715.2 | 0.0 | 0.0 | 18,905.2 |
| | 200 - 500 | 10,221.7 | 4,291.6 | 553.3 | 1,299.0 | -50.6 | 0.0 | 0.0 | 16,315.0 |
| | 500 - 1000 | 24,554.2 | 22,455.0 | 26,177.9 | 30,959.7 | -70.8 | 0.0 | 0.0 | 104,076.0 |
| | 1000 - 2000 | 22,378.6 | 34,425.7 | 71,861.9 | 182,249.4 | 31,848.4 | 0.0 | 0.0 | 342,764.0 |
| | TOTAL | 60,251.1 | 63,438.8 | 101,061.9 | 220,866.4 | 36,442.1 | 0.0 | 0.0 | 482,060.2 |

***Table A6d.*** ***Summary of estimated coal resources of the "I, J, and K" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons).***

| | Depth from Surface (feet) | Total Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 12,595.0 | 18,603.2 | 29,134.6 | 59,729.4 | 27,307.0 | 0.0 | 0.0 | 147,369.2 |
| | 200 - 500 | 45,239.6 | 65,153.3 | 90,502.8 | 172,490.6 | 79,968.5 | 0.0 | 0.0 | 453,354.7 |
| | 500 - 1000 | 71,967.0 | 104,535.8 | 147,968.6 | 297,100.8 | 85,268.7 | 0.0 | 0.0 | 706,840.8 |
| | 1000 - 2000 | 42,085.4 | 89,735.4 | 153,962.6 | 337,383.4 | 45,531.4 | 0.0 | 0.0 | 668,698.1 |
| | TOTAL | 171,887.0 | 278,027.6 | 421,568.6 | 866,704.2 | 238,075.5 | 0.0 | 0.0 | 1,976,262.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| Total | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 1.1 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 12,595.0 | 18,603.2 | 29,134.6 | 59,729.4 | 27,307.0 | 0.0 | 0.0 | 147,369.2 |
| | 200 - 500 | 45,239.6 | 65,153.3 | 90,502.8 | 172,490.6 | 79,967.4 | 0.0 | 0.0 | 453,353.7 |
| | 500 - 1000 | 71,967.0 | 104,535.8 | 147,968.6 | 297,100.8 | 85,268.7 | 0.0 | 0.0 | 706,840.8 |
| | 1000 - 2000 | 42,085.4 | 89,735.4 | 153,962.6 | 337,383.4 | 45,531.4 | 0.0 | 0.0 | 668,698.1 |
| | TOTAL | 171,887.0 | 278,027.6 | 421,568.6 | 866,704.2 | 238,074.5 | 0.0 | 0.0 | 1,976,261.9 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 560.4 | 1,148.3 | 1,215.5 | 7,998.2 | 2,322.9 | 0.0 | 0.0 | 13,245.2 |
| | 200 - 500 | 1,982.6 | 5,650.2 | 8,831.3 | 22,289.8 | 3,756.3 | 0.0 | 0.0 | 42,510.2 |
| | 500 - 1000 | 10,232.9 | 20,737.9 | 24,992.6 | 40,946.2 | 2,521.6 | 0.0 | 0.0 | 99,431.1 |
| | 1000 - 2000 | 2,320.9 | 15,338.5 | 17,174.1 | 27,783.4 | 2,885.5 | 0.0 | 0.0 | 65,502.4 |
| | TOTAL | 15,096.8 | 42,874.9 | 52,213.5 | 99,017.5 | 11,486.2 | 0.0 | 0.0 | 220,688.9 |
| Technological | 20 - 200 | 155.0 | 222.1 | 18.5 | 427.5 | 1,092.5 | 0.0 | 0.0 | 1,915.5 |
| | 200 - 500 | 9,076.0 | 26,342.6 | 47,729.2 | 89,738.1 | 40,784.2 | 0.0 | 0.0 | 213,670.0 |
| | 500 - 1000 | 14,999.3 | 34,791.7 | 56,810.2 | 131,332.8 | 51,159.0 | 0.0 | 0.0 | 289,092.9 |
| | 1000 - 2000 | 10,786.8 | 26,418.2 | 35,074.8 | 81,648.9 | 2,075.8 | 0.0 | 0.0 | 156,004.5 |
| | TOTAL | 35,016.9 | 87,774.5 | 139,632.7 | 303,147.2 | 95,111.5 | 0.0 | 0.0 | 660,682.9 |
| Total | 20 - 200 | 715.4 | 1,370.3 | 1,234.0 | 8,425.7 | 3,415.4 | 0.0 | 0.0 | 15,160.8 |
| | 200 - 500 | 11,058.5 | 31,992.8 | 56,560.5 | 112,027.9 | 44,540.5 | 0.0 | 0.0 | 256,180.1 |
| | 500 - 1000 | 25,232.1 | 55,529.7 | 81,802.8 | 172,279.0 | 53,680.5 | 0.0 | 0.0 | 388,524.0 |
| | 1000 - 2000 | 13,107.7 | 41,756.7 | 52,248.9 | 109,432.2 | 4,961.3 | 0.0 | 0.0 | 221,506.8 |
| | TOTAL | 50,113.7 | 130,649.5 | 191,846.2 | 402,164.7 | 106,597.7 | 0.0 | 0.0 | 881,371.7 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 11,879.6 | 17,232.9 | 27,900.6 | 51,303.8 | 23,891.6 | 0.0 | 0.0 | 132,208.5 |
| | 200 - 500 | 34,181.1 | 33,160.5 | 33,942.3 | 60,462.8 | 35,426.9 | 0.0 | 0.0 | 197,173.5 |
| | 500 - 1000 | 46,734.9 | 49,006.1 | 66,165.9 | 124,821.8 | 31,588.2 | 0.0 | 0.0 | 318,316.8 |
| | 1000 - 2000 | 28,977.7 | 47,978.8 | 101,713.7 | 227,951.1 | 40,570.1 | 0.0 | 0.0 | 447,191.3 |
| | TOTAL | 121,773.3 | 147,378.2 | 229,722.4 | 464,539.5 | 131,476.8 | 0.0 | 0.0 | 1,094,890.1 |

*Table A7a. Summary of estimated coal resources of the "L, M, N, O, P and Q" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons.)*

| | Depth from Surface (feet) | Measured Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 13,999.1 | 26,126.0 | 40,818.9 | 103,339.9 | 47,042.7 | 2,812.0 | 0.0 | 234,138.5 |
| | 200 - 500 | 12,745.2 | 17,659.7 | 34,499.3 | 129,683.5 | 41,469.6 | 8,258.9 | 0.0 | 244,316.2 |
| | 500 - 1000 | 6,145.2 | 11,773.1 | 24,470.1 | 73,556.4 | 31,958.3 | 4,422.6 | 0.0 | 152,325.6 |
| | 1000 - 2000 | 966.5 | 1,196.0 | 3,573.5 | 9,709.3 | 1,930.3 | 0.0 | 0.0 | 17,375.5 |
| | TOTAL | 33,856.0 | 56,754.8 | 103,361.8 | 316,289.0 | 122,400.7 | 15,493.5 | 0.0 | 648,155.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 36.7 | 115.6 | 975.0 | 49,319.3 | 10,489.3 | 0.0 | 0.0 | 60,935.9 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 36.7 | 115.6 | 975.0 | 49,319.3 | 10,489.3 | 0.0 | 0.0 | 60,935.9 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 106.0 | 23.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 129.9 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 106.0 | 23.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 129.9 |
| Total | 20 - 200 | 36.7 | 115.6 | 975.0 | 49,319.3 | 10,489.3 | 0.0 | 0.0 | 60,935.9 |
| | 200 - 500 | 106.0 | 23.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 129.9 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 142.7 | 139.5 | 975.0 | 49,319.3 | 10,489.3 | 0.0 | 0.0 | 61,065.8 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 13,962.3 | 26,010.4 | 39,843.9 | 54,020.7 | 36,553.4 | 2,812.0 | 0.0 | 173,202.6 |
| | 200 - 500 | 12,639.2 | 17,635.8 | 34,499.3 | 129,683.5 | 41,469.6 | 8,258.9 | 0.0 | 244,186.4 |
| | 500 - 1000 | 6,145.2 | 11,773.1 | 24,470.1 | 73,556.4 | 31,958.3 | 4,422.6 | 0.0 | 152,325.6 |
| | 1000 - 2000 | 966.5 | 1,196.0 | 3,573.5 | 9,709.3 | 1,930.3 | 0.0 | 0.0 | 17,375.5 |
| | TOTAL | 33,713.3 | 56,615.3 | 102,386.8 | 266,969.8 | 111,911.5 | 15,493.5 | 0.0 | 587,090.1 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 485.7 | 567.6 | 984.2 | 3,110.1 | 722.7 | 0.0 | 0.0 | 5,870.3 |
| | 200 - 500 | 374.7 | 401.2 | 1,255.8 | 5,853.3 | 1,066.5 | 763.5 | 0.0 | 9,715.0 |
| | 500 - 1000 | 792.0 | 1,007.1 | 3,791.2 | 9,668.5 | 6,962.4 | 1,922.1 | 0.0 | 24,143.3 |
| | 1000 - 2000 | 173.3 | 125.8 | 342.3 | 154.4 | 0.0 | 0.0 | 0.0 | 795.8 |
| | TOTAL | 1,825.8 | 2,101.7 | 6,373.5 | 18,786.3 | 8,751.6 | 2,685.6 | 0.0 | 40,524.4 |
| Technological | 20 - 200 | 127.0 | 153.9 | 563.3 | 1,073.2 | 183.1 | 0.0 | 0.0 | 2,100.5 |
| | 200 - 500 | 4,056.2 | 6,421.6 | 14,930.1 | 53,195.4 | 18,890.8 | 0.0 | 0.0 | 97,494.2 |
| | 500 - 1000 | 2,611.9 | 4,777.5 | 10,363.1 | 26,406.1 | 12,534.7 | 0.0 | 0.0 | 56,693.2 |
| | 1000 - 2000 | 329.3 | 471.9 | 1,876.6 | 8,417.8 | 0.0 | 0.0 | 0.0 | 11,095.5 |
| | TOTAL | 7,124.4 | 11,824.9 | 27,733.0 | 89,092.5 | 31,608.6 | 0.0 | 0.0 | 167,383.4 |
| Total | 20 - 200 | 612.7 | 721.5 | 1,547.5 | 4,183.3 | 905.8 | 0.0 | 0.0 | 7,970.8 |
| | 200 - 500 | 4,431.0 | 6,822.8 | 16,185.9 | 59,048.6 | 19,957.3 | 763.5 | 0.0 | 107,209.2 |
| | 500 - 1000 | 3,403.9 | 5,784.6 | 14,154.2 | 36,074.6 | 19,497.1 | 1,922.1 | 0.0 | 80,836.5 |
| | 1000 - 2000 | 502.6 | 597.7 | 2,218.8 | 8,572.2 | 0.0 | 0.0 | 0.0 | 11,891.3 |
| | TOTAL | 8,950.2 | 13,926.6 | 34,106.5 | 107,878.7 | 40,360.2 | 2,685.6 | 0.0 | 207,907.8 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 13,349.6 | 25,288.9 | 38,296.5 | 49,837.4 | 35,647.6 | 2,812.0 | 0.0 | 165,231.8 |
| | 200 - 500 | 8,208.3 | 10,813.0 | 18,313.4 | 70,634.9 | 21,512.3 | 7,495.3 | 0.0 | 136,977.2 |
| | 500 - 1000 | 2,741.3 | 5,988.5 | 10,315.9 | 37,481.7 | 12,461.2 | 2,500.6 | 0.0 | 71,489.2 |
| | 1000 - 2000 | 463.9 | 598.3 | 1,354.6 | 1,137.1 | 1,930.3 | 0.0 | 0.0 | 5,484.1 |
| | TOTAL | 24,763.1 | 42,688.7 | 68,280.3 | 159,091.1 | 71,551.3 | 12,807.9 | 0.0 | 379,182.3 |

*Table A7b. Summary of estimated coal resources of the "L, M, N, O, P and Q" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons.)*

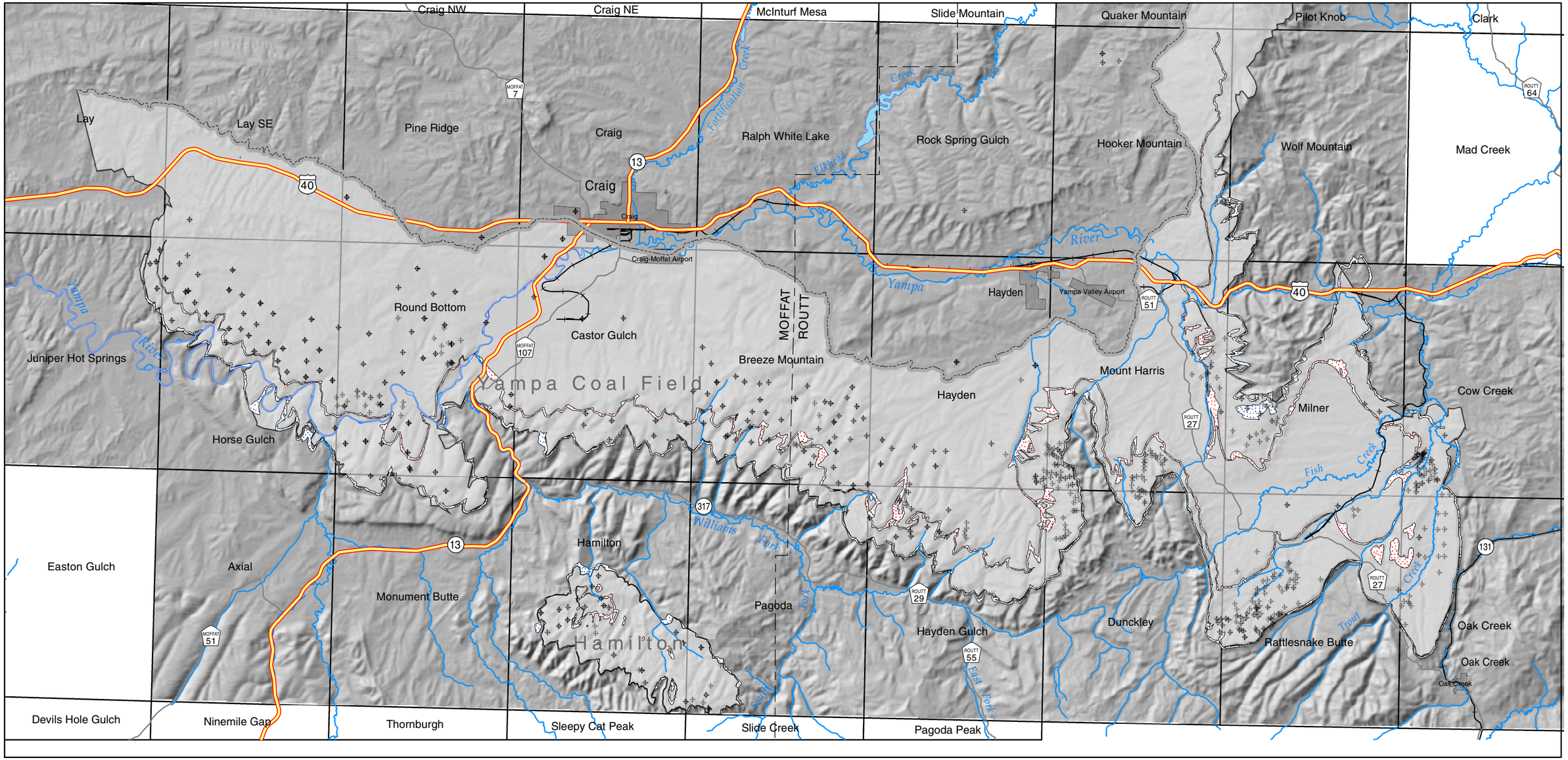
| | Depth from Surface (feet) | Indicated Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 26,654.8 | 42,781.1 | 62,310.2 | 177,661.0 | 109,689.6 | 3,040.4 | 0.0 | 422,137.2 |
| | 200 - 500 | 35,966.5 | 60,892.9 | 92,107.0 | 267,536.4 | 115,700.5 | 13,919.2 | 0.0 | 586,122.4 |
| | 500 - 1000 | 26,867.3 | 63,658.3 | 119,513.3 | 417,900.5 | 163,443.0 | 37,323.3 | 0.0 | 828,705.7 |
| | 1000 - 2000 | 4,559.2 | 7,486.5 | 25,227.2 | 90,913.6 | 18,875.4 | 0.0 | 0.0 | 147,061.9 |
| | TOTAL | 94,047.8 | 174,818.8 | 299,157.7 | 954,011.5 | 407,708.6 | 54,282.9 | 0.0 | 1,984,027.3 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 587.4 | 563.3 | 1,320.3 | 7,125.2 | 10,180.6 | 0.0 | 0.0 | 19,776.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 587.4 | 563.3 | 1,320.3 | 7,125.2 | 10,180.6 | 0.0 | 0.0 | 19,776.7 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 201.0 | 464.0 | 84.7 | 6.8 | 0.0 | 3.6 | 0.0 | 760.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 201.0 | 464.0 | 84.7 | 6.8 | 0.0 | 3.6 | 0.0 | 760.2 |
| Total | 20 - 200 | 587.4 | 563.3 | 1,320.3 | 7,125.2 | 10,180.6 | 0.0 | 0.0 | 19,776.7 |
| | 200 - 500 | 201.0 | 464.0 | 84.7 | 6.8 | 0.0 | 3.6 | 0.0 | 760.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 788.4 | 1,027.3 | 1,405.0 | 7,132.0 | 10,180.6 | 3.6 | 0.0 | 20,536.9 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 26,067.5 | 42,217.8 | 60,990.0 | 170,535.8 | 99,509.1 | 3,040.4 | 0.0 | 402,360.5 |
| | 200 - 500 | 35,765.5 | 60,428.9 | 92,022.2 | 267,529.6 | 115,700.5 | 13,915.6 | 0.0 | 585,362.2 |
| | 500 - 1000 | 26,867.3 | 63,658.3 | 119,513.3 | 417,900.5 | 163,443.0 | 37,323.3 | 0.0 | 828,705.7 |
| | 1000 - 2000 | 4,559.2 | 7,486.5 | 25,227.2 | 90,913.6 | 18,875.4 | 0.0 | 0.0 | 147,061.9 |
| | TOTAL | 93,259.4 | 173,791.4 | 297,752.7 | 946,879.5 | 397,528.0 | 54,279.3 | 0.0 | 1,963,490.4 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 1,453.2 | 2,451.0 | 4,927.6 | 16,249.9 | 10,561.6 | 0.0 | 0.0 | 35,643.4 |
| | 200 - 500 | 2,116.9 | 5,286.8 | 7,232.3 | 26,614.6 | 4,583.4 | 1,452.1 | 0.0 | 47,286.1 |
| | 500 - 1000 | 2,754.7 | 7,381.2 | 17,105.5 | 71,826.1 | 25,270.8 | 3,913.9 | 0.0 | 128,252.2 |
| | 1000 - 2000 | 170.2 | 167.7 | 2,402.6 | 9,572.9 | 1,076.5 | 0.0 | 0.0 | 13,390.0 |
| | TOTAL | 6,495.0 | 15,286.7 | 31,668.0 | 124,263.5 | 41,492.4 | 5,366.0 | 0.0 | 224,571.6 |
| Technological | 20 - 200 | 246.2 | 294.2 | 614.8 | 1,754.9 | 788.3 | 0.0 | 0.0 | 3,698.4 |
| | 200 - 500 | 11,994.6 | 23,344.3 | 44,400.9 | 96,442.5 | 52,993.9 | 0.0 | 0.0 | 229,176.2 |
| | 500 - 1000 | 11,927.6 | 25,147.1 | 48,692.1 | 138,705.1 | 48,875.4 | 0.0 | 0.0 | 273,347.3 |
| | 1000 - 2000 | 1,758.9 | 2,500.8 | 9,255.5 | 47,200.6 | 5,565.1 | 0.0 | 0.0 | 66,280.8 |
| | TOTAL | 25,927.2 | 51,286.4 | 102,963.3 | 284,103.1 | 108,222.6 | 0.0 | 0.0 | 572,502.7 |
| Total | 20 - 200 | 1,699.4 | 2,745.3 | 5,542.4 | 18,004.8 | 11,349.9 | 0.0 | 0.0 | 39,341.8 |
| | 200 - 500 | 14,111.5 | 28,631.0 | 51,633.2 | 123,057.1 | 57,577.4 | 1,452.1 | 0.0 | 276,462.3 |
| | 500 - 1000 | 14,682.3 | 32,528.3 | 65,797.6 | 210,531.2 | 74,146.2 | 3,913.9 | 0.0 | 401,599.4 |
| | 1000 - 2000 | 1,929.1 | 2,668.5 | 11,658.0 | 56,773.5 | 6,641.6 | 0.0 | 0.0 | 79,670.8 |
| | TOTAL | 32,422.3 | 66,573.1 | 134,631.3 | 408,366.6 | 149,715.1 | 5,366.0 | 0.0 | 797,074.3 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 24,368.1 | 39,472.5 | 55,447.5 | 152,531.0 | 88,159.2 | 3,040.4 | 0.0 | 363,018.7 |
| | 200 - 500 | 21,653.9 | 31,797.9 | 40,389.0 | 144,472.5 | 58,123.1 | 12,463.5 | 0.0 | 308,900.0 |
| | 500 - 1000 | 12,185.1 | 31,130.0 | 53,715.7 | 207,369.3 | 89,296.8 | 33,409.4 | 0.0 | 427,106.3 |
| | 1000 - 2000 | 2,630.1 | 4,818.0 | 13,569.1 | 34,140.1 | 12,233.8 | 0.0 | 0.0 | 67,391.1 |
| | TOTAL | 60,837.2 | 107,218.3 | 163,121.4 | 538,513.0 | 247,812.9 | 48,913.3 | 0.0 | 1,166,416.1 |

*Table A7c.* ***Summary of estimated coal resources of the "L, M, N, O, P and Q" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons.)***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 12,424.1 | 27,732.4 | 31,684.8 | 43,833.5 | 69,981.8 | 0.0 | 0.0 | 185,656.6 |
| | 200 - 500 | 22,975.1 | 55,362.7 | 78,791.1 | 136,803.9 | 97,319.8 | 649.7 | 0.0 | 391,902.3 |
| | 500 - 1000 | 35,617.9 | 76,883.3 | 188,800.9 | 502,858.9 | 374,235.1 | 10,557.2 | 0.0 | 1,188,953.4 |
| | 1000 - 2000 | 12,801.4 | 29,882.6 | 196,765.9 | 436,522.9 | 57,979.7 | 0.0 | 0.0 | 733,952.5 |
| | TOTAL | 83,818.5 | 189,861.0 | 496,042.8 | 1,120,019.2 | 599,516.5 | 11,206.9 | 0.0 | 2,500,464.8 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 184.0 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 186.7 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 184.0 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 186.7 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 588.0 | 649.0 | 622.2 | 112.9 | 0.0 | 0.0 | 0.0 | 1,972.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 77.5 | 0.0 | 83.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 588.0 | 649.0 | 622.2 | 112.9 | 5.8 | 77.5 | 0.0 | 2,055.4 |
| Total | 20 - 200 | 184.0 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 186.7 |
| | 200 - 500 | 588.0 | 649.0 | 622.2 | 112.9 | 0.0 | 0.0 | 0.0 | 1,972.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 77.5 | 0.0 | 83.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 772.0 | 651.7 | 622.2 | 112.9 | 5.8 | 77.5 | 0.0 | 2,242.1 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 12,240.1 | 27,729.7 | 31,684.8 | 43,833.5 | 69,981.8 | 0.0 | 0.0 | 185,470.0 |
| | 200 - 500 | 22,387.1 | 54,713.7 | 78,168.9 | 136,691.0 | 97,319.8 | 649.7 | 0.0 | 389,930.2 |
| | 500 - 1000 | 35,617.9 | 76,883.3 | 188,800.9 | 502,858.9 | 374,229.3 | 10,479.7 | 0.0 | 1,188,870.1 |
| | 1000 - 2000 | 12,801.4 | 29,882.6 | 196,765.9 | 436,522.9 | 57,979.7 | 0.0 | 0.0 | 733,952.5 |
| | TOTAL | 83,046.5 | 189,209.3 | 495,420.5 | 1,119,906.3 | 599,510.7 | 11,129.4 | 0.0 | 2,498,222.8 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 929.5 | 1,450.5 | 2,852.3 | 5,332.4 | 4,201.9 | 0.0 | 0.0 | 14,766.5 |
| | 200 - 500 | 1,422.3 | 3,025.7 | 4,299.5 | 18,437.9 | 8,741.9 | 99.1 | 0.0 | 36,026.4 |
| | 500 - 1000 | 5,902.7 | 12,309.1 | 16,139.1 | 79,178.7 | 66,326.1 | 939.4 | 0.0 | 180,795.0 |
| | 1000 - 2000 | 401.5 | 1,092.6 | 21,301.0 | 27,214.4 | 1,489.9 | 0.0 | 0.0 | 51,499.5 |
| | TOTAL | 8,655.9 | 17,877.9 | 44,591.8 | 130,163.4 | 80,759.7 | 1,038.5 | 0.0 | 283,087.2 |
| Technological | 20 - 200 | 345.3 | 698.5 | 806.5 | 2,153.1 | 2,976.1 | 0.0 | 0.0 | 6,979.5 |
| | 200 - 500 | 2,497.4 | 9,064.2 | 13,608.9 | 22,433.9 | 4,306.6 | 0.0 | 0.0 | 51,911.1 |
| | 500 - 1000 | 3,913.9 | 9,880.6 | 23,634.5 | 73,864.1 | 30,701.9 | 0.0 | 0.0 | 141,995.0 |
| | 1000 - 2000 | 2,654.4 | 5,186.1 | 16,456.0 | 73,240.0 | 4,818.8 | 0.0 | 0.0 | 102,355.3 |
| | TOTAL | 9,411.0 | 24,829.4 | 54,505.9 | 171,691.1 | 42,803.5 | 0.0 | 0.0 | 303,240.9 |
| Total | 20 - 200 | 1,274.8 | 2,149.0 | 3,658.8 | 7,485.4 | 7,178.0 | 0.0 | 0.0 | 21,746.0 |
| | 200 - 500 | 3,919.7 | 12,089.9 | 17,908.4 | 40,871.8 | 13,048.5 | 99.1 | 0.0 | 87,937.5 |
| | 500 - 1000 | 9,816.6 | 22,189.7 | 39,773.6 | 153,042.8 | 97,028.0 | 939.4 | 0.0 | 322,789.9 |
| | 1000 - 2000 | 3,055.9 | 6,278.7 | 37,757.0 | 100,454.4 | 6,308.7 | 0.0 | 0.0 | 153,854.8 |
| | TOTAL | 18,067.0 | 42,707.3 | 99,097.7 | 301,854.5 | 123,563.2 | 1,038.5 | 0.0 | 586,328.2 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 10,965.3 | 25,580.7 | 28,026.1 | 36,348.1 | 62,803.8 | 0.0 | 0.0 | 163,724.0 |
| | 200 - 500 | 18,467.4 | 42,623.8 | 60,260.5 | 95,819.2 | 84,271.3 | 550.5 | 0.0 | 301,992.7 |
| | 500 - 1000 | 25,801.4 | 54,693.7 | 149,027.4 | 349,816.1 | 277,201.3 | 9,540.4 | 0.0 | 866,080.2 |
| | 1000 - 2000 | 9,745.5 | 23,603.9 | 159,008.9 | 336,068.4 | 51,671.0 | 0.0 | 0.0 | 580,097.7 |
| | TOTAL | 64,979.6 | 146,502.0 | 396,322.9 | 818,051.8 | 475,947.5 | 10,090.9 | 0.0 | 1,911,894.6 |

*Table A7d.* ***Summary of estimated coal resources of the "L, M, N, O, P and Q" coal beds, Yampa Coal Field study area, Colorado (Resource estimates reported in thousands of short tons.)***

| | Depth from Surface (feet) | Inferred Resources (thickness in feet) 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 - 10 | 10 - 20 | 20 - 40 | >40 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Original** | | | | | | | | | |
| | 20 - 200 | 53,078.0 | 96,639.5 | 134,814.0 | 324,834.5 | 226,714.1 | 5,852.4 | 0.0 | 841,932.4 |
| | 200 - 500 | 71,686.8 | 133,915.3 | 205,397.4 | 534,023.9 | 254,489.9 | 22,827.8 | 0.0 | 1,222,341.0 |
| | 500 - 1000 | 68,630.5 | 152,314.7 | 332,784.3 | 994,315.8 | 569,636.4 | 52,303.1 | 0.0 | 2,169,984.7 |
| | 1000 - 2000 | 18,327.1 | 38,565.1 | 225,566.6 | 537,145.7 | 78,785.4 | 0.0 | 0.0 | 898,389.9 |
| | TOTAL | 211,722.4 | 421,434.5 | 898,562.2 | 2,390,319.8 | 1,129,625.8 | 80,983.3 | 0.0 | 5,132,647.9 |
| **Depleted (Mined out and coal unavailable due to mining)** | | | | | | | | | |
| Surface | 20 - 200 | 808.1 | 681.6 | 2,295.3 | 56,444.4 | 20,669.9 | 0.0 | 0.0 | 80,899.3 |
| | 200 - 500 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 808.1 | 681.6 | 2,295.3 | 56,444.4 | 20,669.9 | 0.0 | 0.0 | 80,899.3 |
| Deep | 20 - 200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 200 - 500 | 895.0 | 1,136.9 | 706.9 | 119.8 | 0.0 | 3.6 | 0.0 | 2,862.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 77.5 | 0.0 | 83.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 895.0 | 1,136.9 | 706.9 | 119.8 | 5.8 | 81.1 | 0.0 | 2,945.5 |
| Total | 20 - 200 | 808.1 | 681.6 | 2,295.3 | 56,444.4 | 20,669.9 | 0.0 | 0.0 | 80,899.3 |
| | 200 - 500 | 895.0 | 1,136.9 | 706.9 | 119.8 | 0.0 | 3.6 | 0.0 | 2,862.2 |
| | 500 - 1000 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 77.5 | 0.0 | 83.2 |
| | 1000 - 2000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 1,703.1 | 1,818.5 | 3,002.2 | 56,564.2 | 20,675.7 | 81.1 | 0.0 | 83,844.7 |
| **Remaining** | | | | | | | | | |
| | 20 - 200 | 52,269.9 | 95,957.9 | 132,518.7 | 268,390.0 | 206,044.2 | 5,852.4 | 0.0 | 761,033.1 |
| | 200 - 500 | 70,791.8 | 132,778.4 | 204,690.5 | 533,904.1 | 254,489.9 | 22,824.1 | 0.0 | 1,219,478.8 |
| | 500 - 1000 | 68,630.5 | 152,314.7 | 332,784.3 | 994,315.8 | 569,630.6 | 52,225.7 | 0.0 | 2,169,901.5 |
| | 1000 - 2000 | 18,327.1 | 38,565.1 | 225,566.6 | 537,145.7 | 78,785.4 | 0.0 | 0.0 | 898,389.9 |
| | TOTAL | 210,019.3 | 419,616.0 | 895,560.0 | 2,333,755.6 | 1,108,950.1 | 80,902.2 | 0.0 | 5,048,803.2 |
| **Restrictions** | | | | | | | | | |
| Land-Use | 20 - 200 | 2,868.4 | 4,469.1 | 8,764.0 | 24,692.4 | 15,486.2 | 0.0 | 0.0 | 56,280.1 |
| | 200 - 500 | 3,914.0 | 8,713.6 | 12,787.6 | 50,905.8 | 14,391.8 | 2,314.8 | 0.0 | 93,027.5 |
| | 500 - 1000 | 9,449.3 | 20,697.4 | 37,035.7 | 160,673.3 | 98,559.3 | 6,775.3 | 0.0 | 333,190.4 |
| | 1000 - 2000 | 745.1 | 1,386.2 | 24,045.9 | 36,941.7 | 2,566.4 | 0.0 | 0.0 | 65,685.2 |
| | TOTAL | 16,976.7 | 35,266.3 | 82,633.2 | 273,213.1 | 131,003.7 | 9,090.1 | 0.0 | 548,183.2 |
| Technological | 20 - 200 | 718.5 | 1,146.7 | 1,984.6 | 4,981.2 | 3,947.5 | 0.0 | 0.0 | 12,778.5 |
| | 200 - 500 | 18,548.3 | 38,830.1 | 72,939.9 | 172,071.8 | 76,191.4 | 0.0 | 0.0 | 378,581.4 |
| | 500 - 1000 | 18,453.4 | 39,805.1 | 82,689.7 | 238,975.4 | 92,112.0 | 0.0 | 0.0 | 472,035.5 |
| | 1000 - 2000 | 4,742.5 | 8,158.8 | 27,588.0 | 128,858.4 | 10,383.9 | 0.0 | 0.0 | 179,731.6 |
| | TOTAL | 42,462.7 | 87,940.6 | 185,202.2 | 544,886.7 | 182,634.8 | 0.0 | 0.0 | 1,043,127.0 |
| Total | 20 - 200 | 3,586.9 | 5,615.8 | 10,748.7 | 29,673.5 | 19,433.7 | 0.0 | 0.0 | 69,058.6 |
| | 200 - 500 | 22,462.2 | 47,543.7 | 85,727.5 | 222,977.5 | 90,583.1 | 2,314.8 | 0.0 | 471,608.9 |
| | 500 - 1000 | 27,902.7 | 60,502.5 | 119,725.4 | 399,648.7 | 190,671.3 | 6,775.3 | 0.0 | 805,225.9 |
| | 1000 - 2000 | 5,487.6 | 9,544.9 | 51,633.9 | 165,800.1 | 12,950.4 | 0.0 | 0.0 | 245,416.9 |
| | TOTAL | 59,439.4 | 123,206.9 | 267,835.4 | 818,099.9 | 313,638.5 | 9,090.1 | 0.0 | 1,591,310.2 |
| **Available** | | | | | | | | | |
| | 20 - 200 | 48,683.0 | 90,342.1 | 121,770.1 | 238,716.5 | 186,610.5 | 5,852.4 | 0.0 | 691,974.5 |
| | 200 - 500 | 48,329.6 | 85,234.7 | 118,962.9 | 310,926.6 | 163,906.7 | 20,509.3 | 0.0 | 747,869.9 |
| | 500 - 1000 | 40,727.8 | 91,812.2 | 213,058.9 | 594,667.1 | 378,959.3 | 45,450.4 | 0.0 | 1,364,675.6 |
| | 1000 - 2000 | 12,839.5 | 29,020.2 | 173,932.7 | 371,345.6 | 65,835.1 | 0.0 | 0.0 | 652,973.0 |
| | TOTAL | 150,579.9 | 296,409.1 | 627,724.6 | 1,515,655.8 | 795,311.6 | 71,812.1 | 0.0 | 3,457,493.0 |




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles

0 1.5 3 6 9 12

0 2.5 5 10 15 20

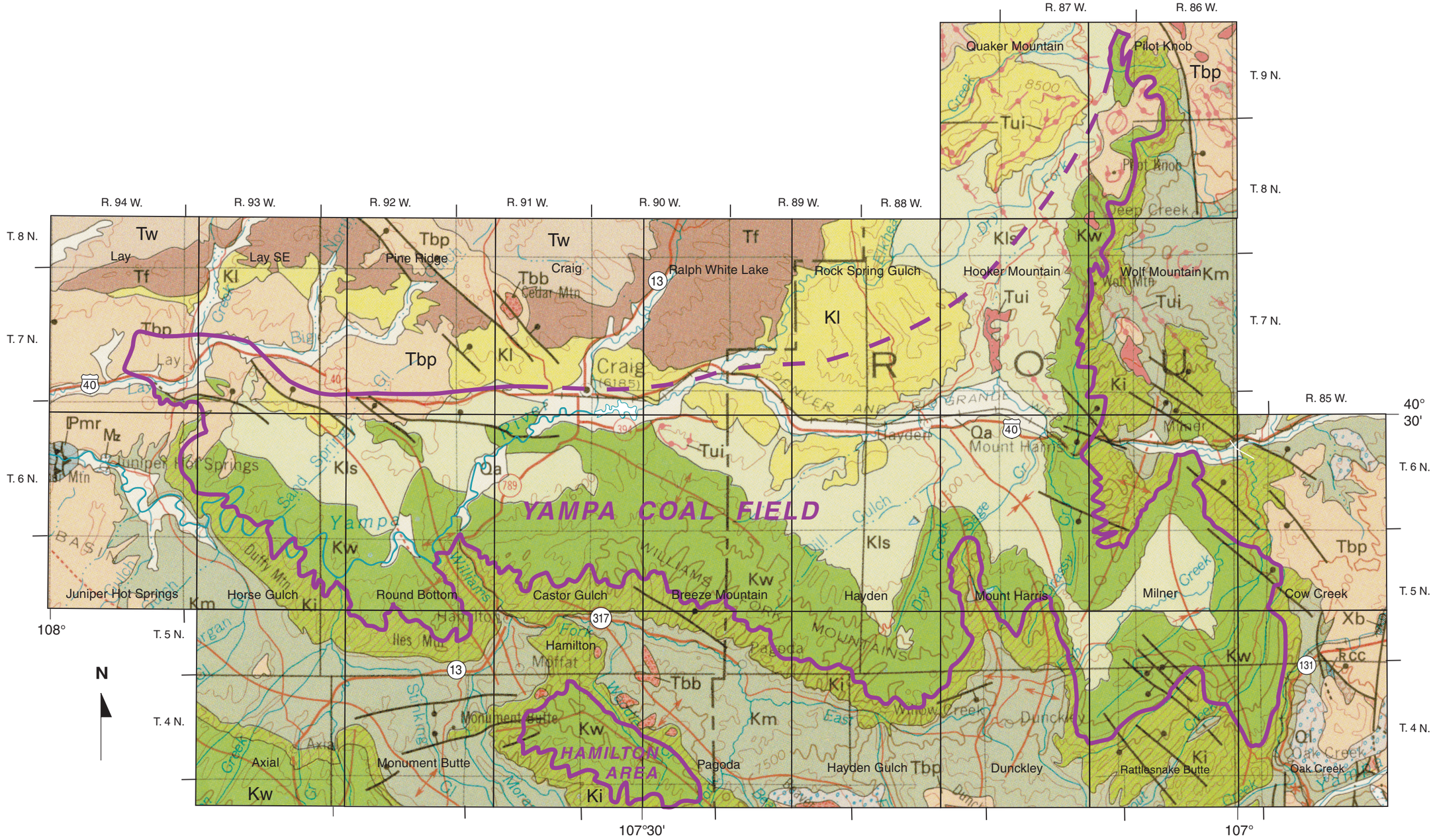
Kilometers

**Figure 2**
**Shaded Relief Map of the Yampa Coal Field with 7.5' Quadrangle Locations**

**Explanation**

- Publically Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Study Area
- Towns and Airports
- 1:24,000 quadrangle grid
- Project Extent

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




## EXPLANATION

| | | | | | |
|---|---|---|---|---|---|
| Qa | Quaternary alluvium | Tbb | Basalt flows | Kls | Lewis Shale |
| Ql | Landslide deposits | Tbp | Browns Park Formation | Kw | Williams Fork Formation |
| Tui | Upper Tertiary intrusive rocks | Tf | Fort Union Formation | Ki | Iles Formation |
| Tw | Wasatch Formation | Kl | Lance Formation | Km | Mancos Shale |

Formation contact

Fault

Anticline

Syncline

Yampa Coal Field study area boundary

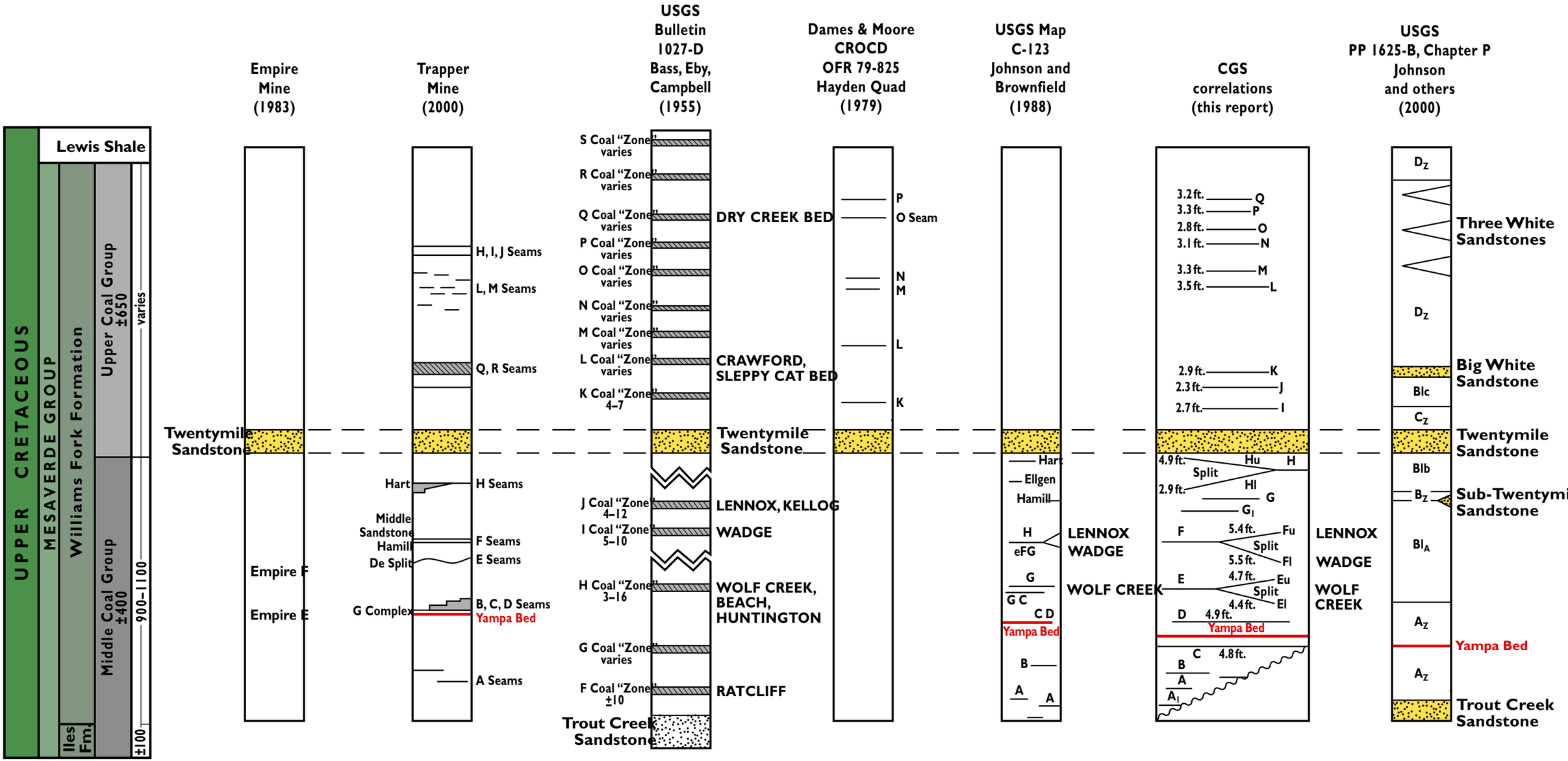
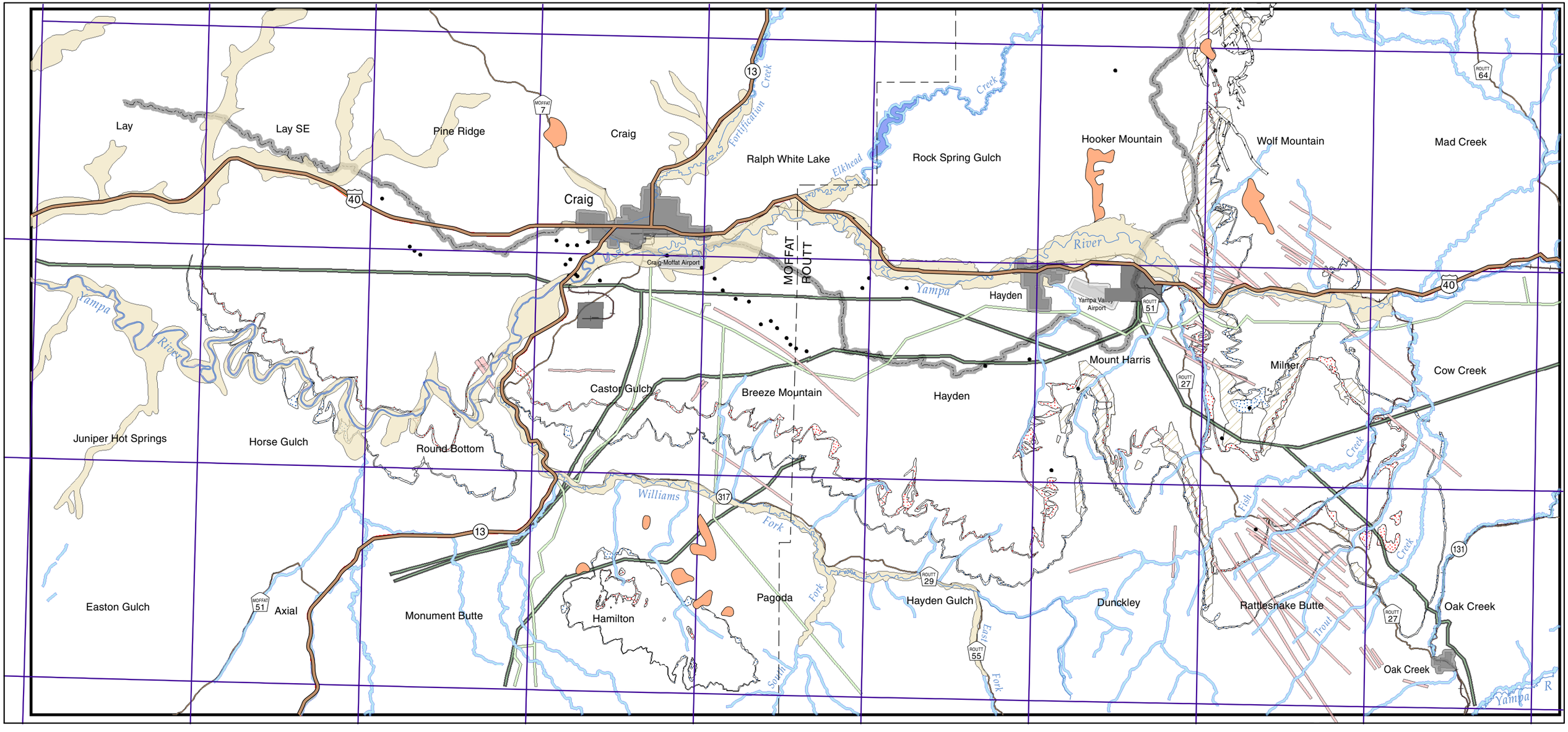



**Figure 7 Generalized correlation chart comparing various coal bed nomenclatures in the Williams Fork Formation, Yampa Coal Field**




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Feet
0 9,000 18,000 36,000 54,000 72,000

0 2.5 5 10 15 20
Kilometers

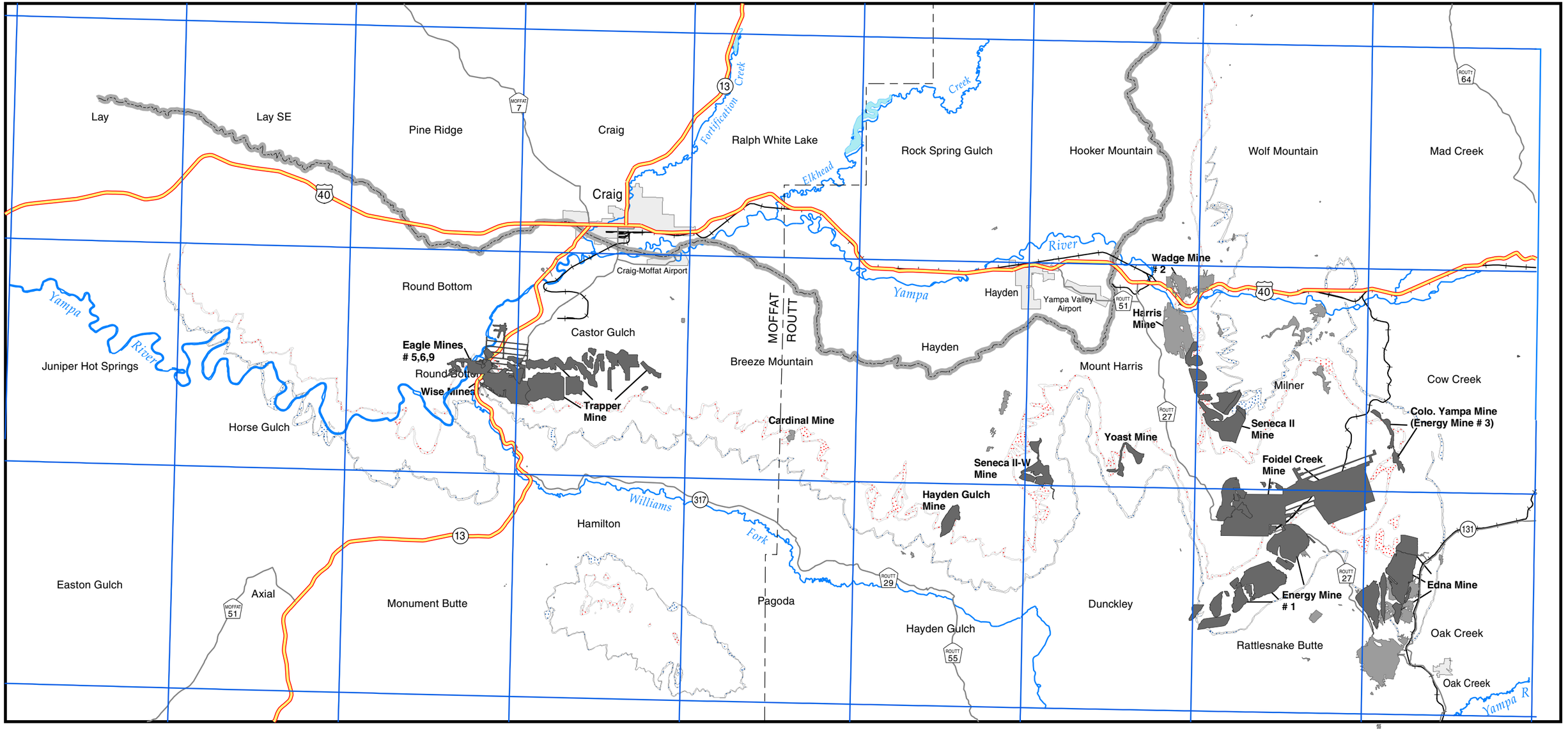
**Figure 15**
**Land Use and Technologic Restrictions to Coal Mining in the Yampa Coal Field**

**Explanation**

**Map Features**
- 2,000 ft Overburden Line
- Highway
- Local Road
- Railroad
- 1:24,000 quadrangle grid

- Trout Creek Sandstone
- Twentymile Sandstone
- Igneous Intrusion
- Steeply Dipping Strata
- Petroleum Well Completion - 250 ft

**Resource Buffers**
- Airport - 300 ft
- Town - 300 ft
- Fault - 500 ft
- Pipeline - 500 ft
- Powerline - 500 ft
- Alluvial Valley Floor - 200 ft
- Power Plant - 300 ft
- Railroad - 200 ft
- Road - 200 ft
- All Tributary Stream - 500 ft
- Lake - 500 ft




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Feet
0 8,750 17,500 35,000 52,500 70,000

0 2.5 5 10 15 20
Kilometers

# Figure 17
## Mined-Out Exclusion Areas for Yampa Coal Field
**(Only large mines producing from Williams Fork formation are labeled)**

**Explanation**

- Towns and Airports
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Coal Mines - Post 1972
- Coal Mines - Pre 1972
- Trout Creek Sandstone
- Twentymile Sandstone
- 1:24,000 quadrangle grid

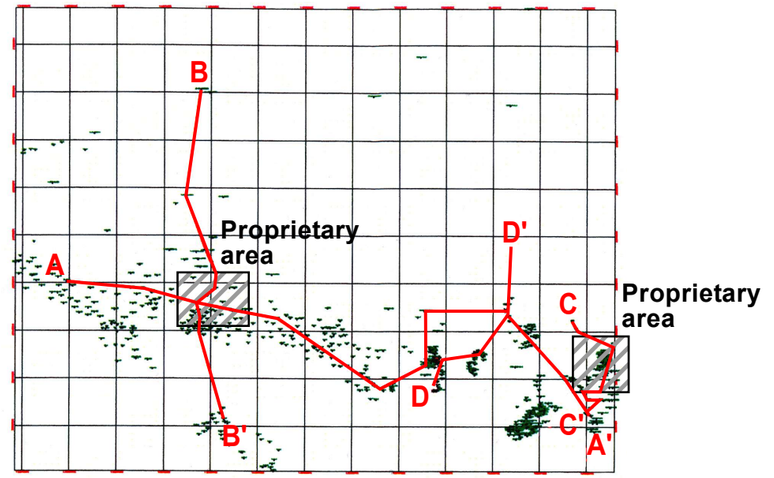
## LITHOLOGY EXPLANATION

- Coal zone with in-seam parting
- Sandstone
- Ash
- Shale
- Siltstone
- Rock – undifferentiated
- Sandstone/Shale interbedded
- Siltstone/Sandstone/Shale interbedded
- Shale/Sandstone interbedded
- Not logged

Drillhole Name ("PH"=proprietary holes)
Collar Elevation
X
Total Depth

SEAM EXPANSION EXPLANATION

| | | |
|---|---|---|
| S | – | S Seam |
| R | – | R Seam |
| $R_1$ | – | $R_1$ Seam |
| Q | – | Q Seam |
| P | – | P seam |
| O | – | O Seam |
| N | – | N Seam |
| M | – | M seam |
| L | – | L Seam |
| K | – | K Seam |
| J | – | J Seam |
| I | – | I Seam |
| 20M | – | Twentymile Sandstone Member |
| Hu | – | H Upper Seam |
| H | – | H Seam |
| Hl | – | H Lower Seam |
| G | – | G Seam |
| $G_1$ | – | $G_1$ Seam |
| Fu | – | F Upper Seam |
| Fl | – | F Lower Seam |
| FlR | – | F Lower Seam Rider |
| Eu | – | E Upper Seam |
| El | – | E Lower Seam |
| E | – | E Seam |
| D | – | D Seam |
| ASH | – | Yampa Bed (ash Layer) |
| C | – | C Seam |
| B | – | B Seam |
| A | – | A Seam |
| $A_1$ | – | $A_1$ Seam |
| TC | – | Trout Creek Sandstone Member |




A

A'

R–16–HG
6320.00

BRG–1
6460.00

PH–1
6367.00

HAYG–15A
7920.00

BM–53
7340.00

DCU–0–28–6–88
6517.00

PH–2
6834.00

OC–1
7280.00

GW–S2W–200TC
7196.70

1947.00
1763.00
1940.00
1500.00
1460.00
760.40
2152.00
1349.00
775.00

Upper Coal Group

Middle Coal Group

Figure 18 Profile A–A' correlation section in the Williams Fork Formation, Yampa Coal Field

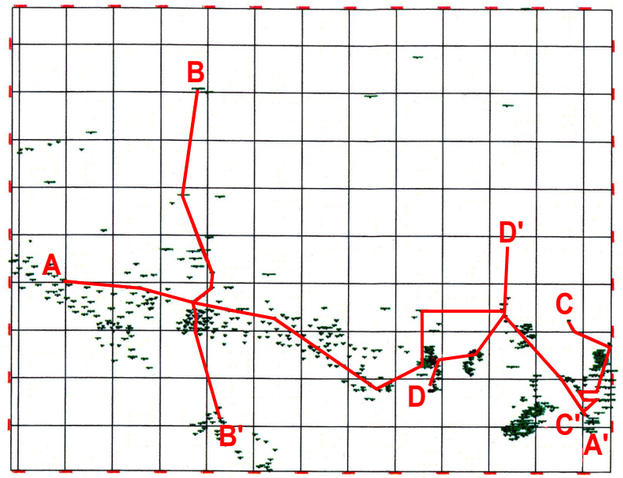
## LITHOLOGY EXPLANATION

- Coal zone with in-seam parting
- Sandstone
- Ash
- Rock – undifferentiated
- Not logged
- Shale
- Siltstone

Drillhole Name ("PH"=proprietary holes)
Collar Elevation
X
Total Depth

### SEAM EXPANSION EXPLANATION

| | | |
|---|---|---|
| S | – | S Seam |
| R | – | R Seam |
| $R_1$ | – | $R_1$ Seam |
| Q | – | Q Seam |
| P | – | P seam |
| O | – | O Seam |
| N | – | N Seam |
| M | – | M seam |
| L | – | L Seam |
| K | – | K Seam |
| J | – | J Seam |
| I | – | I Seam |
| 20M | – | Twentymile Sandstone Member |
| Hu | – | H Upper Seam |
| H | – | H Seam |
| Hl | – | H Lower Seam |
| G | – | G Seam |
| $G_1$ | – | $G_1$ Seam |
| Fu | – | F Upper Seam |
| Fl | – | F Lower Seam |
| E | – | E Seam |
| D | – | D Seam |
| ASH | – | Yampa Bed (ash Layer) |
| C | – | C Seam |
| B | – | B Seam |
| A | – | A Seam |
| $A_1$ | – | $A_1$ Seam |
| TC | – | Trout Creek Sandstone Member |



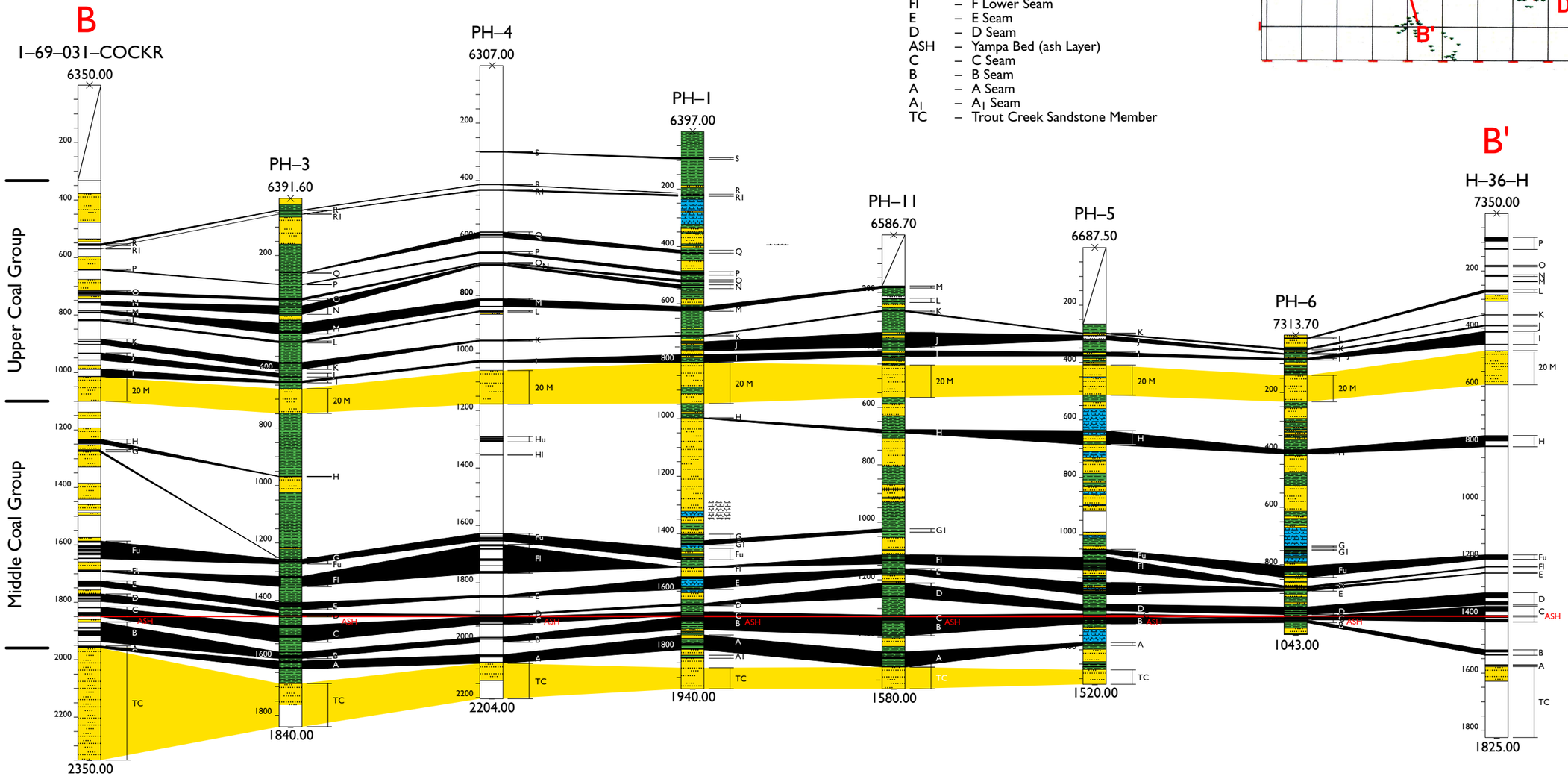




Figure 19 Profile B–B' correlation section in the Williams Fork Formation, Yampa Coal Field

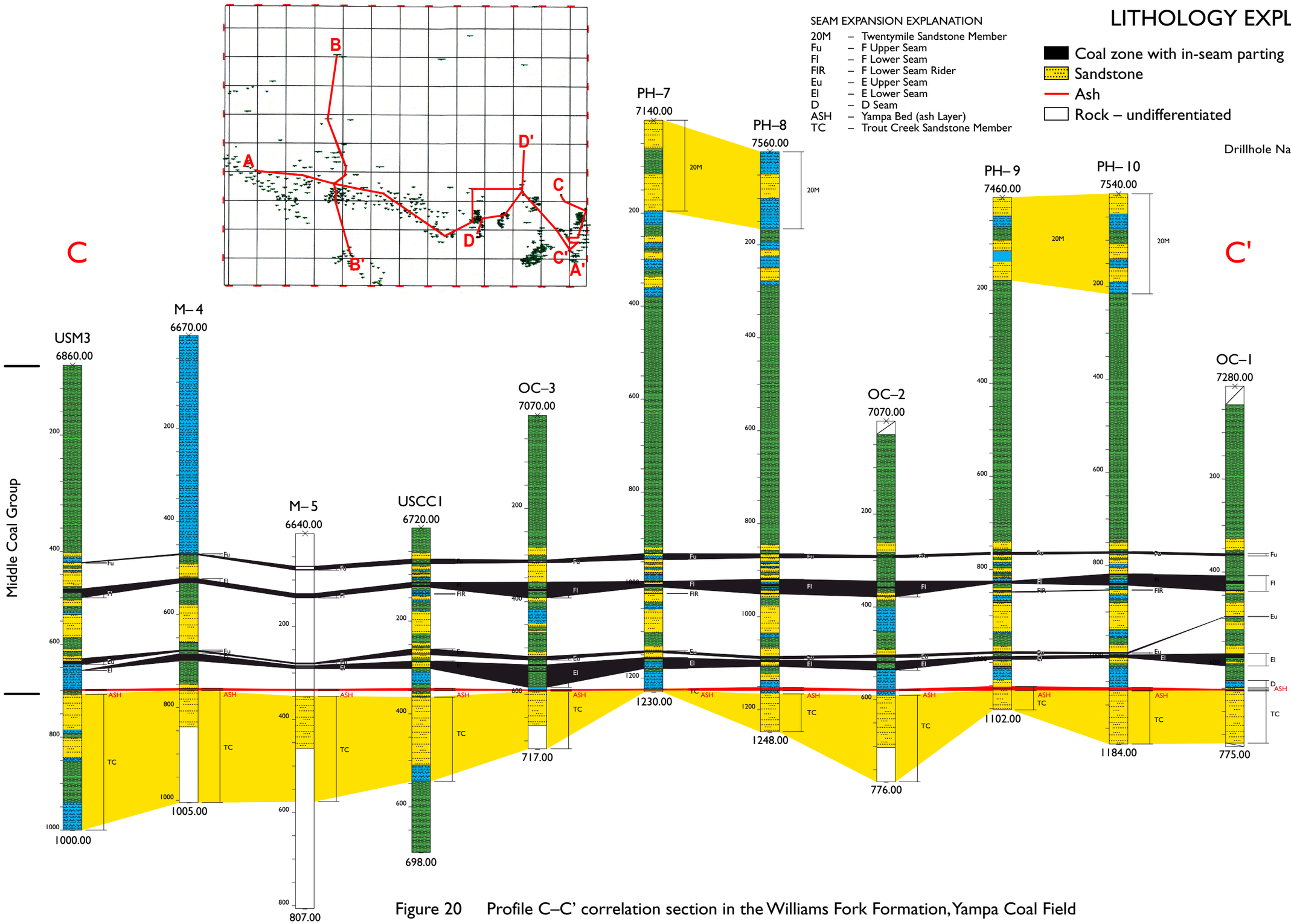



Figure 20 Profile C–C' correlation section in the Williams Fork Formation, Yampa Coal Field

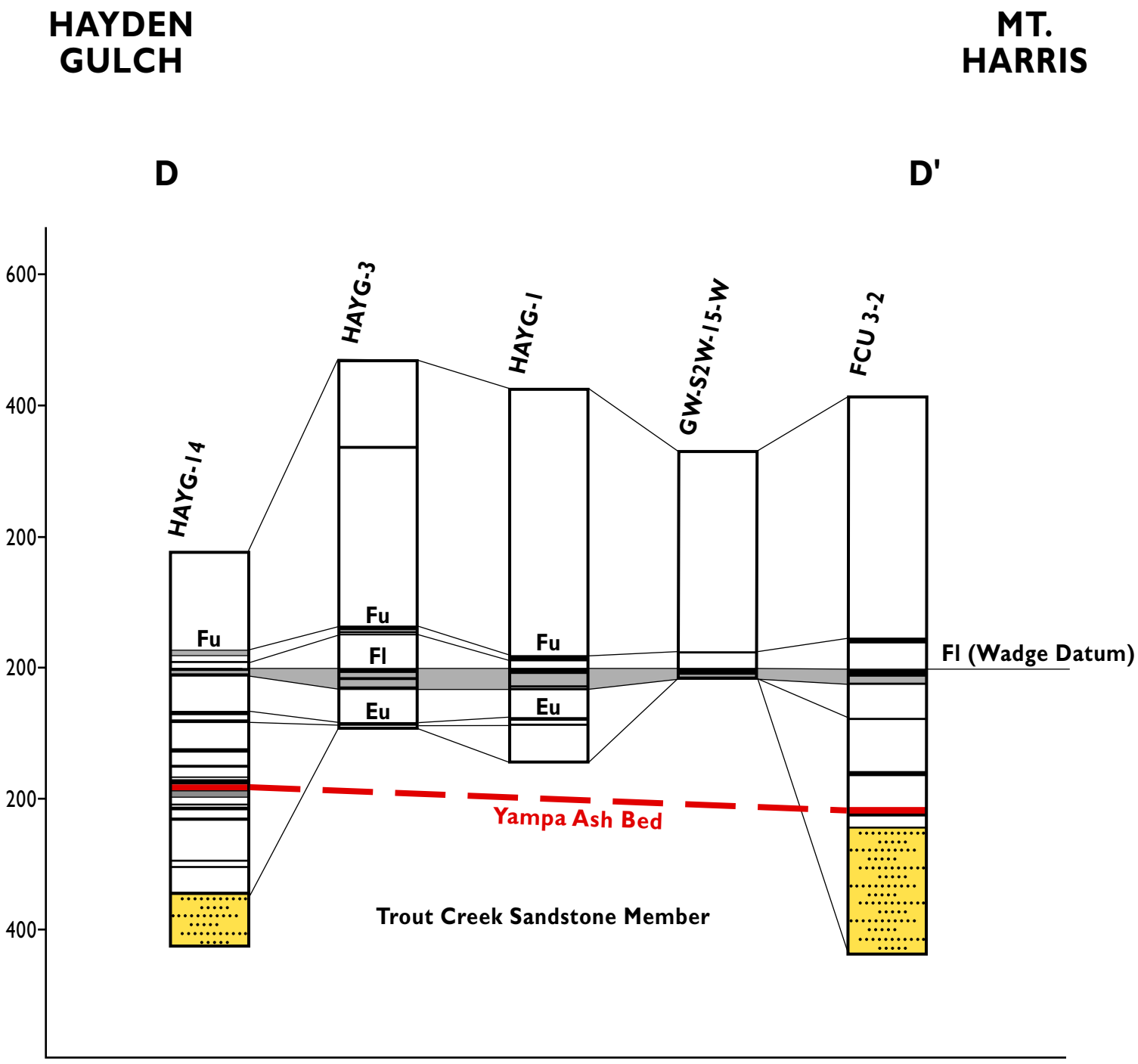
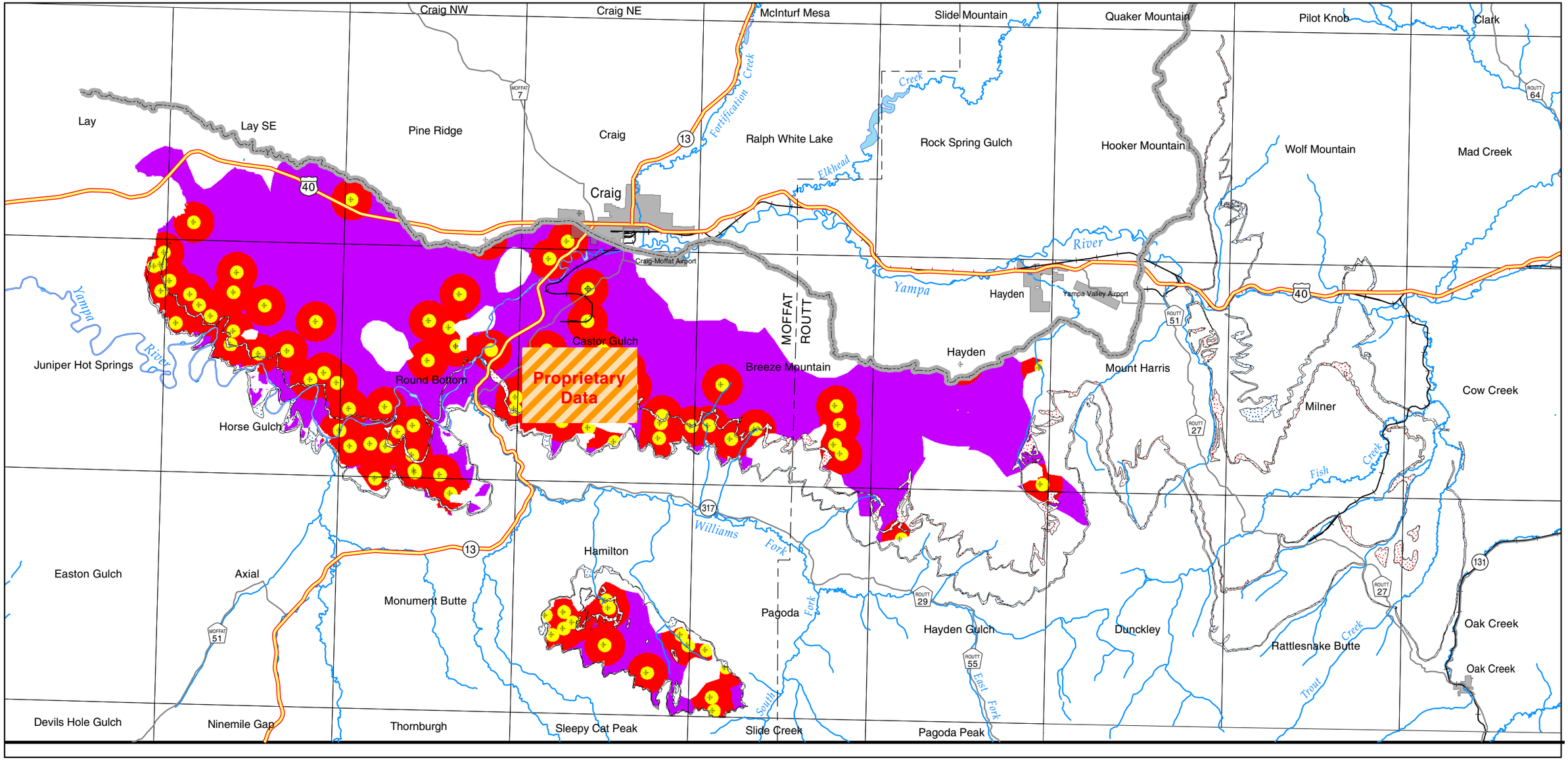



**Figure 21** Coal Correlation Diagram D–D'




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

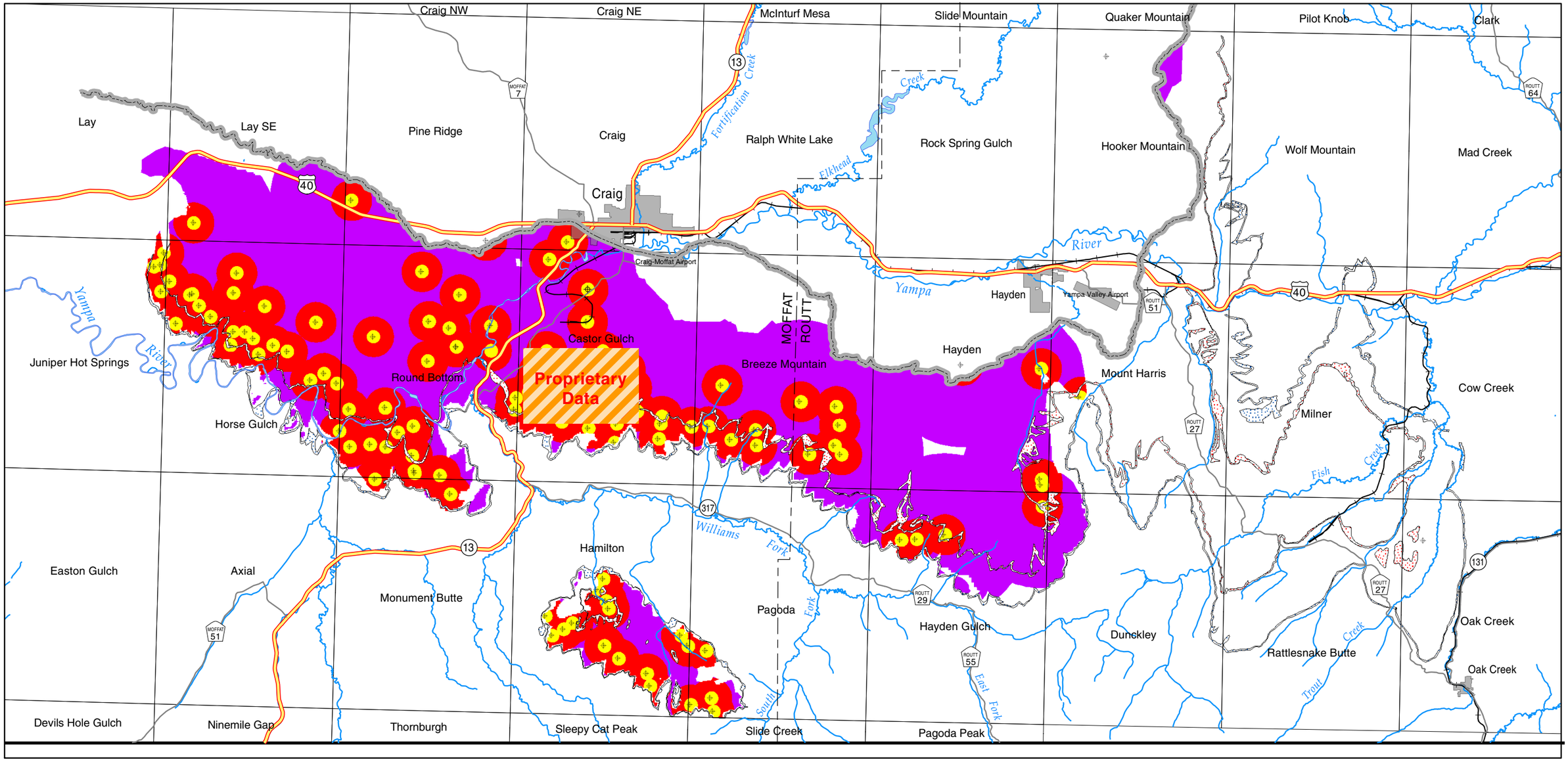
## Figure 22
## "B" Seam Area of Reliability, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

# Figure 23
# "C and D" Seam Area of Reliability, Yampa Coal Field

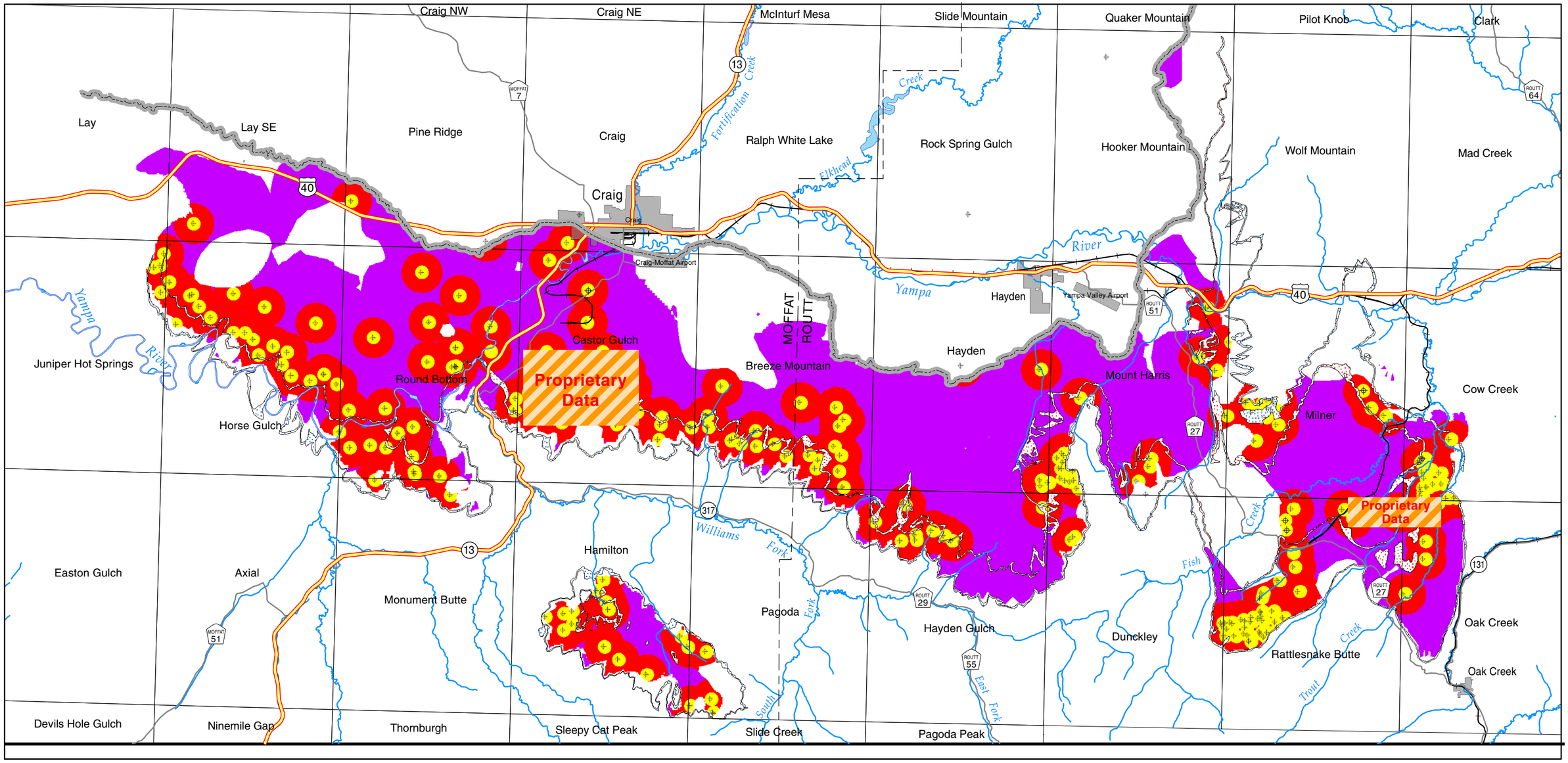
**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

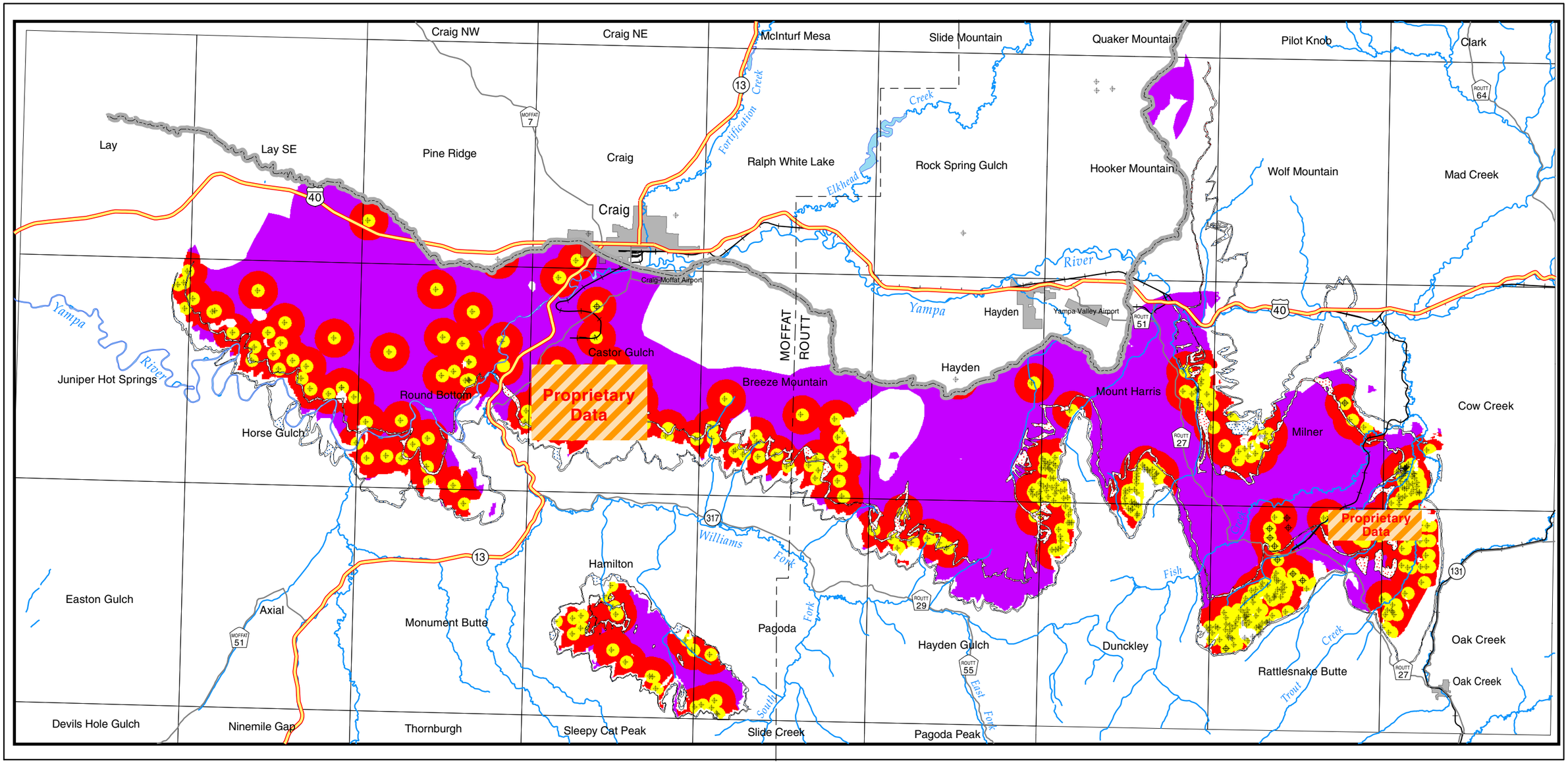
## Figure 24
## "El, Eu, and E" Seam Area of Reliability, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0, 1.5, 3, 6, 9, 12

Kilometers: 0, 2.5, 5, 10, 15, 20

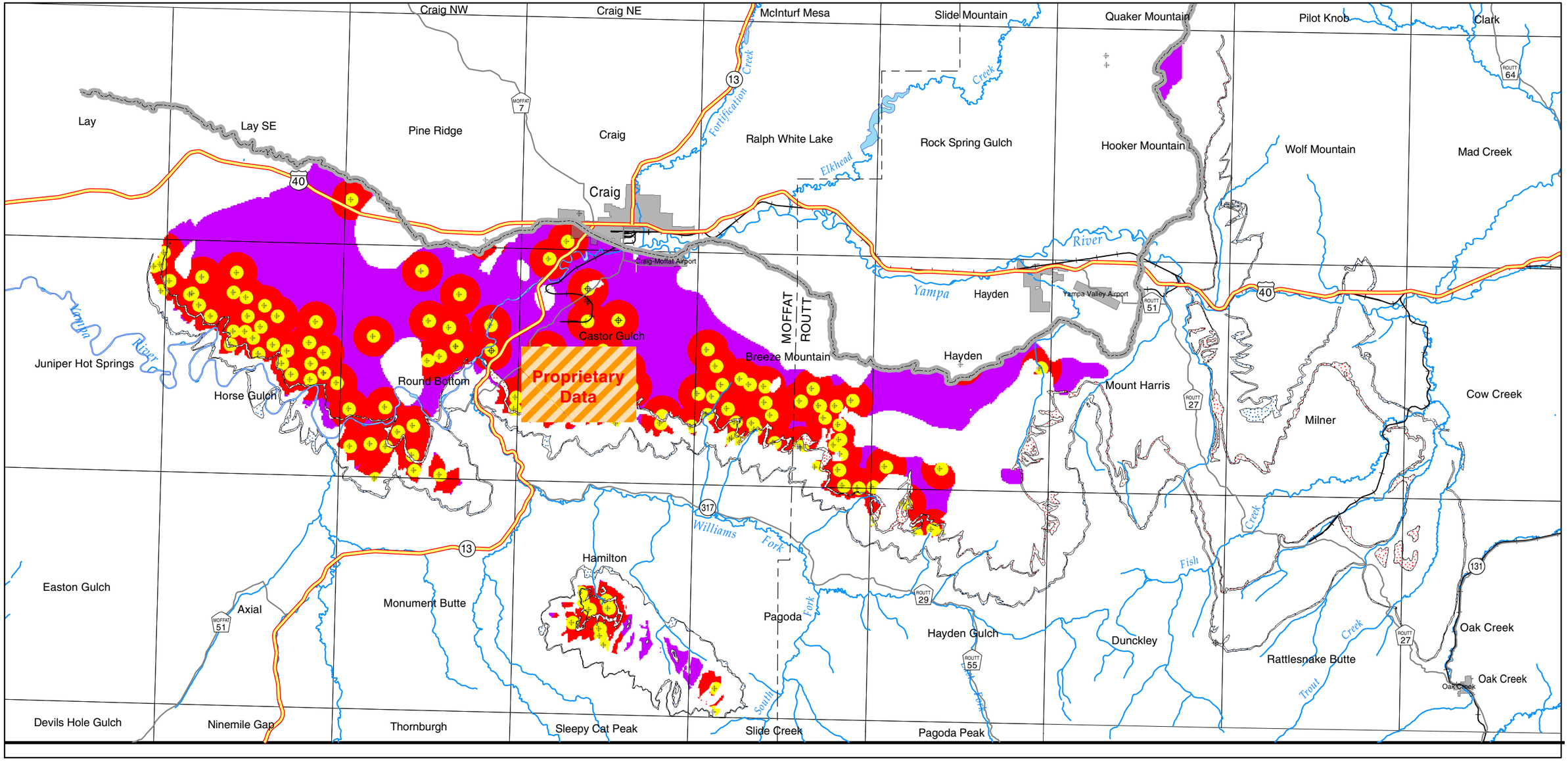
## Figure 25
## "Fl, Fu, and F" Seam Area of Reliability, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

## Figure 26
## "Hl, Hu, and H" Seam Area of Reliability, Yampa Coal Field

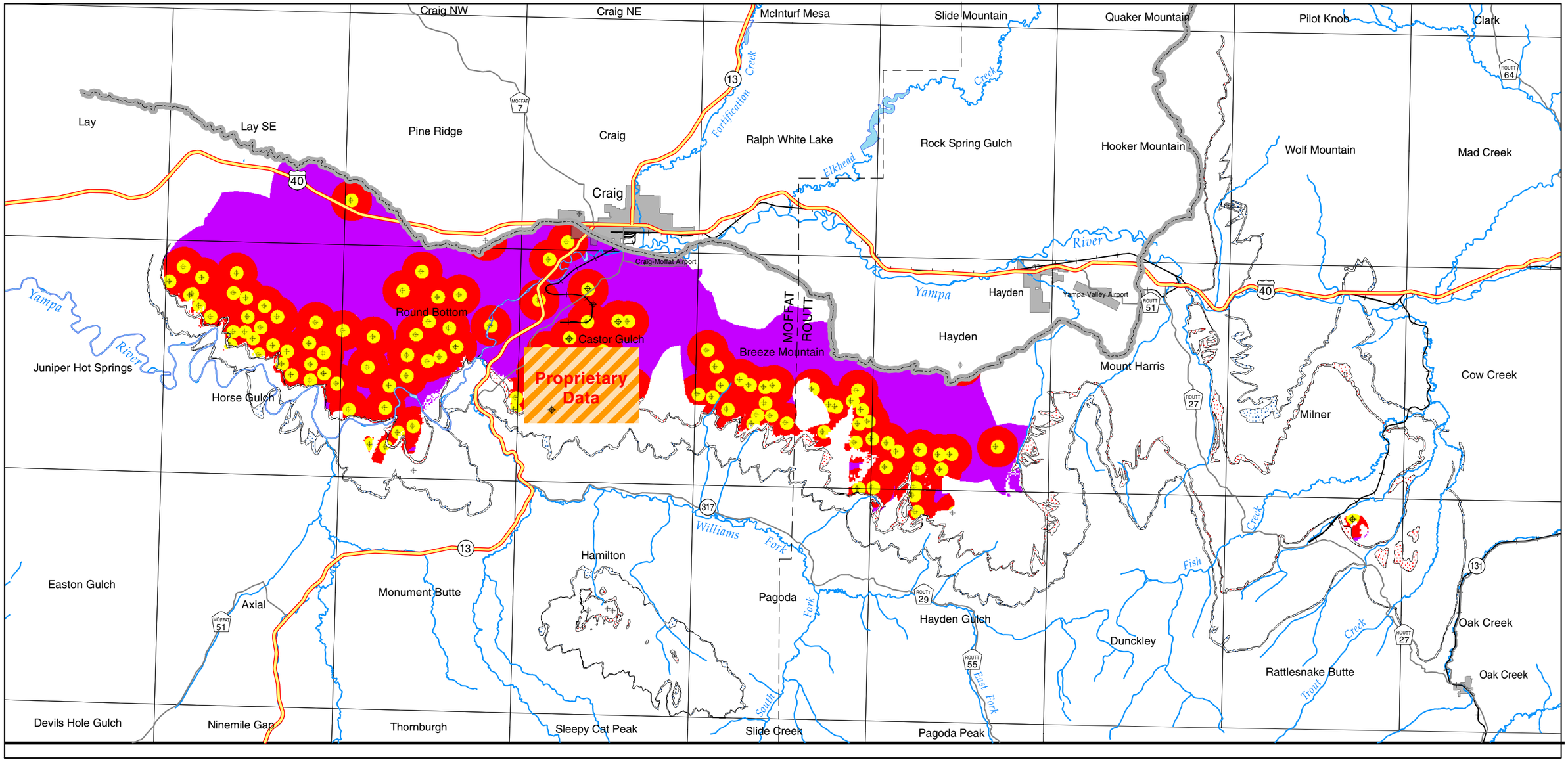
**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0, 1.5, 3, 6, 9, 12

Kilometers: 0, 2.5, 5, 10, 15, 20

# Figure 27
# "I, J and K" Seam Area of Reliability, Yampa Coal Field

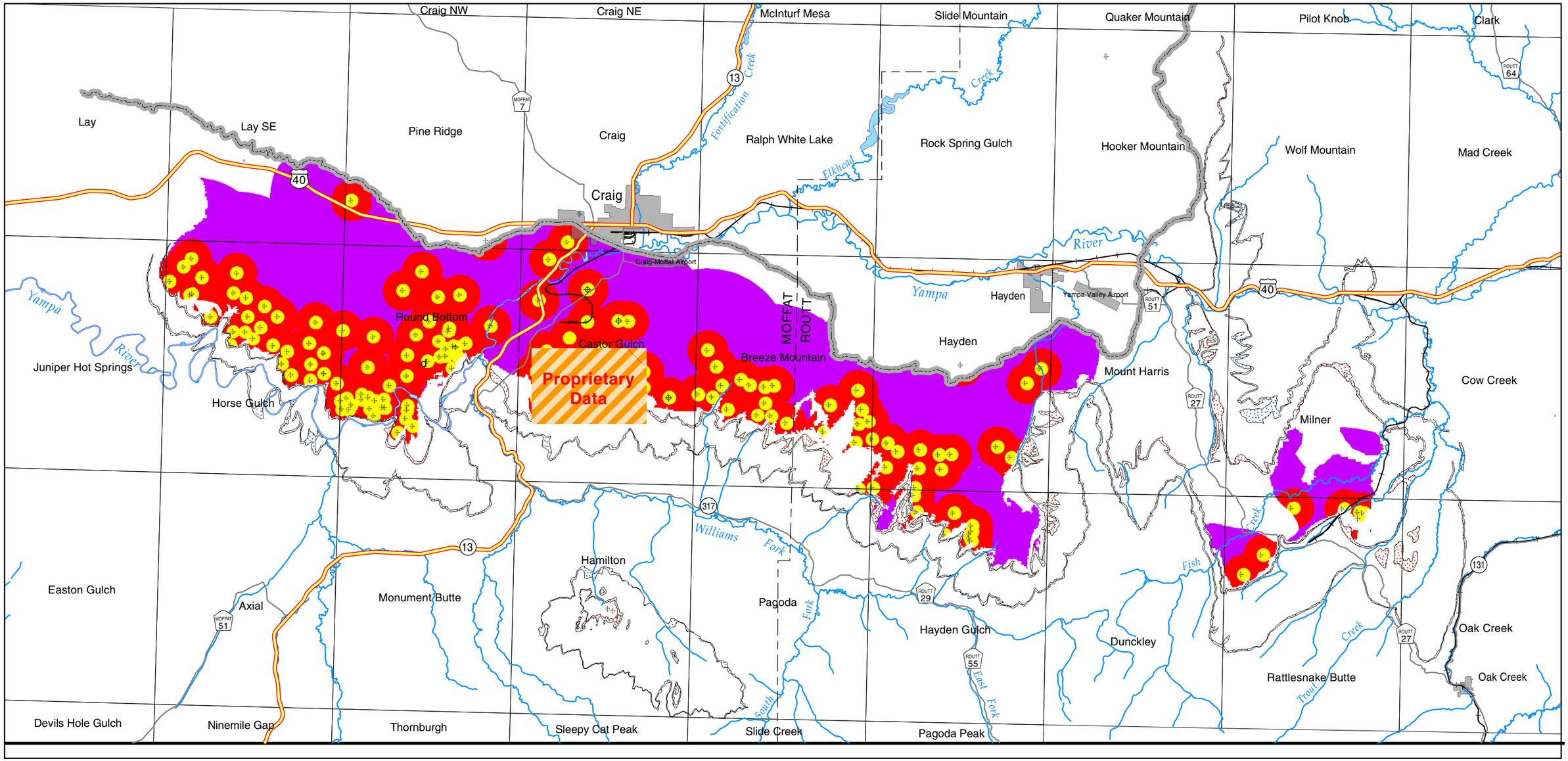
**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth

- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

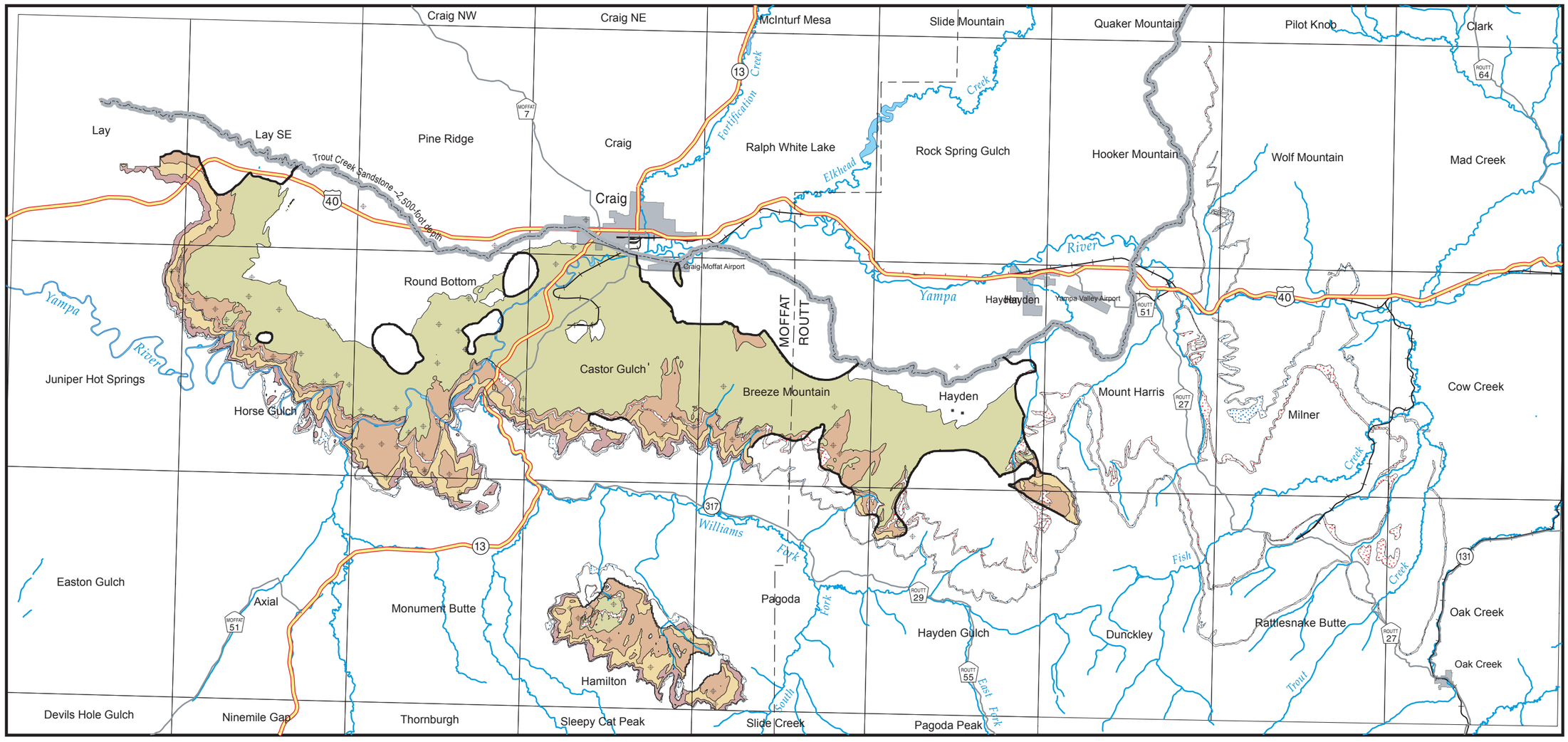
## Figure 28
## "L, M, N, O, P and Q" Seam Area of Reliability, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Depth
- Measured
- Indicated
- Inferred
- Proprietary drill holes not shown

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12
0 2.5 5 10 15 20
Kilometers

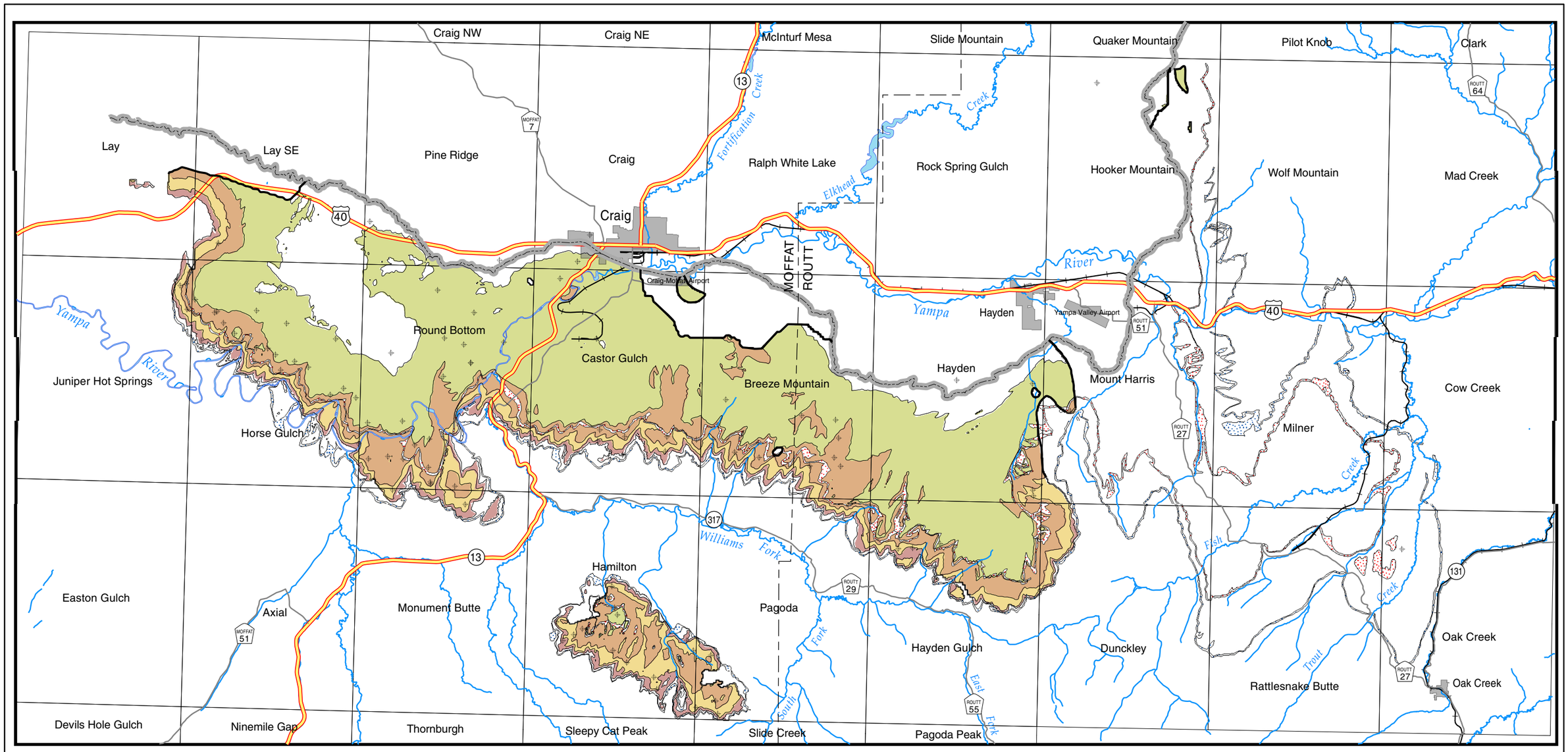
# Figure 29
# "B" Seam Coal Depth Map, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

Kilometers
0 2.5 5 10 15 20

1:244,055

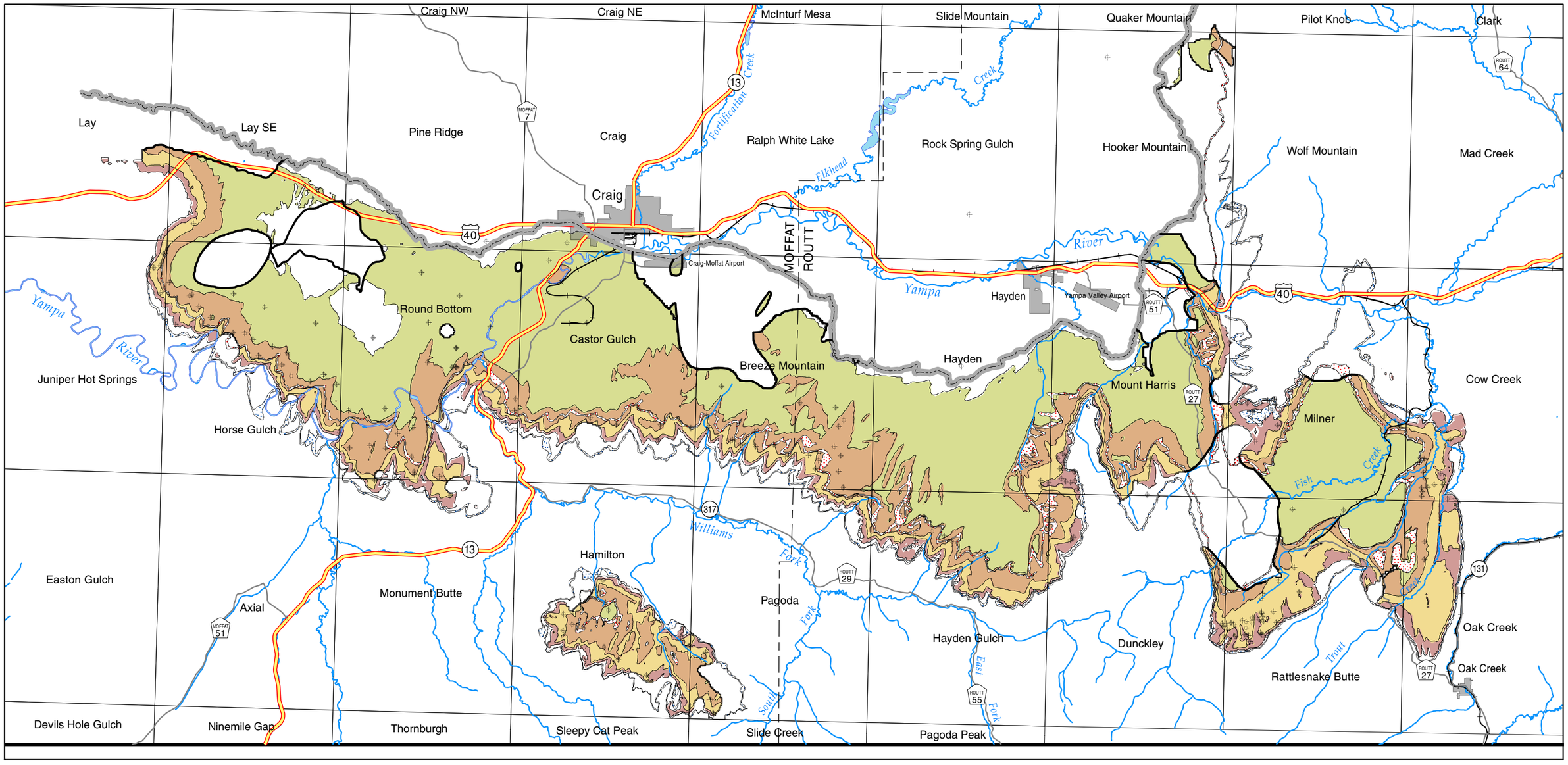
# Figure 30
# "C/D" Seam Coal Depth Map, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

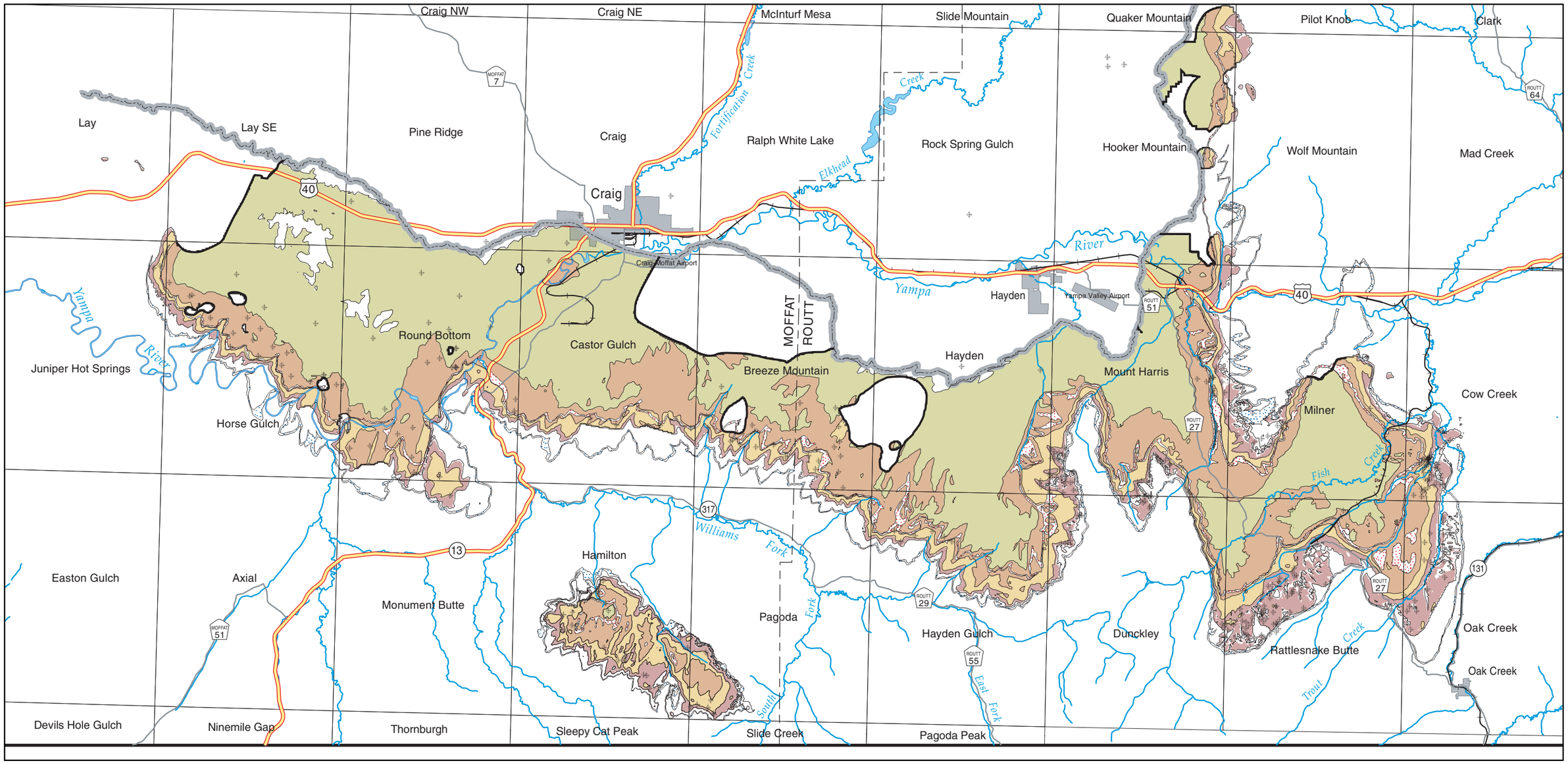
# Figure 31
# "El, Eu, and E" Seam Coal Depth, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles

0 1.5 3 6 9 12

0 2.5 5 10 15 20

Kilometers

# Figure 32
# "Fl, Fu, and F" Seam Coal Depth, Yampa Coal Field

## Explanation

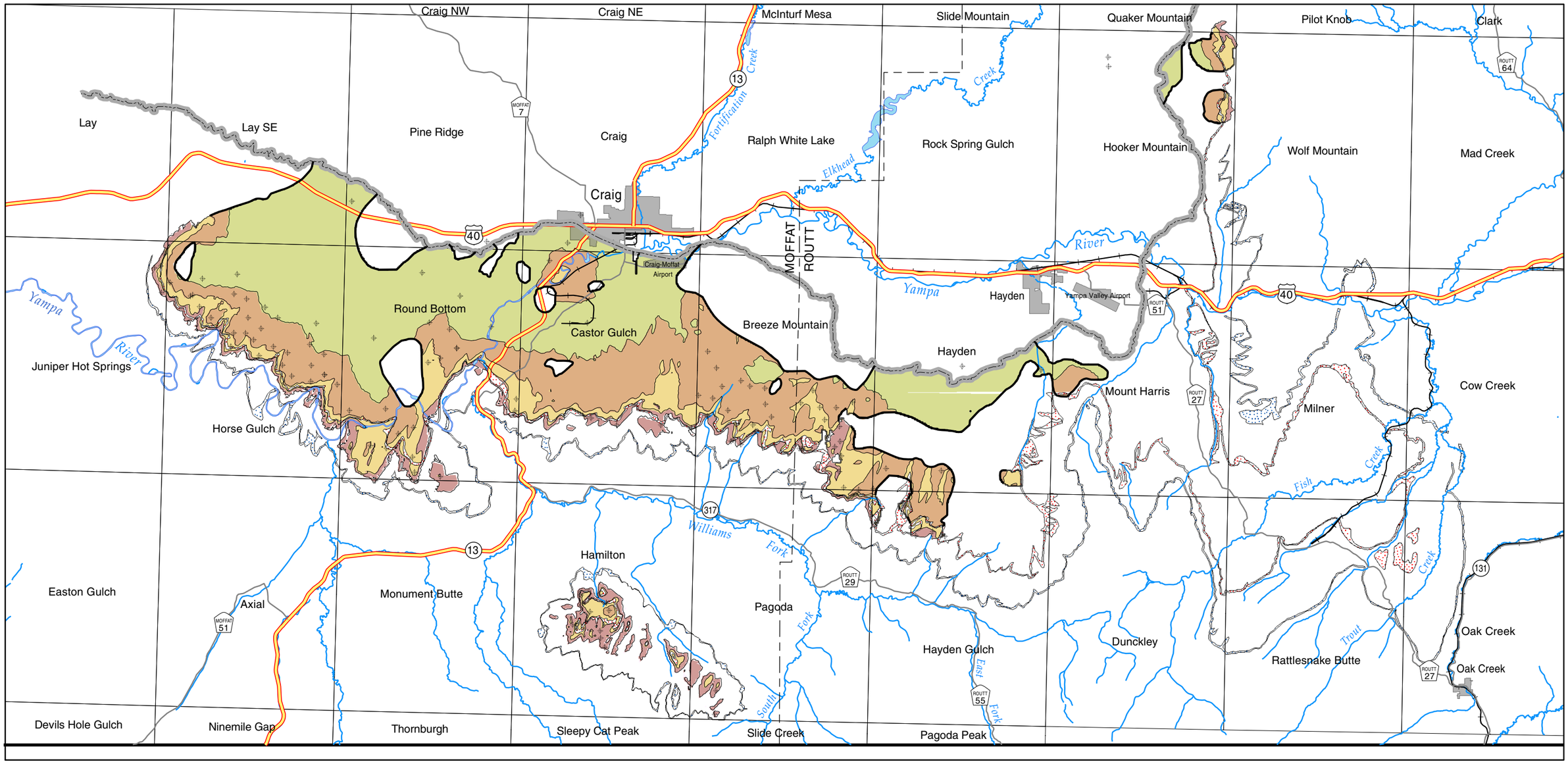
- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project Extent

Depth

- <20 ft
- 21 – 200 ft
- 201 – 500 ft
- 501 – 1000 ft
- 1001 – 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

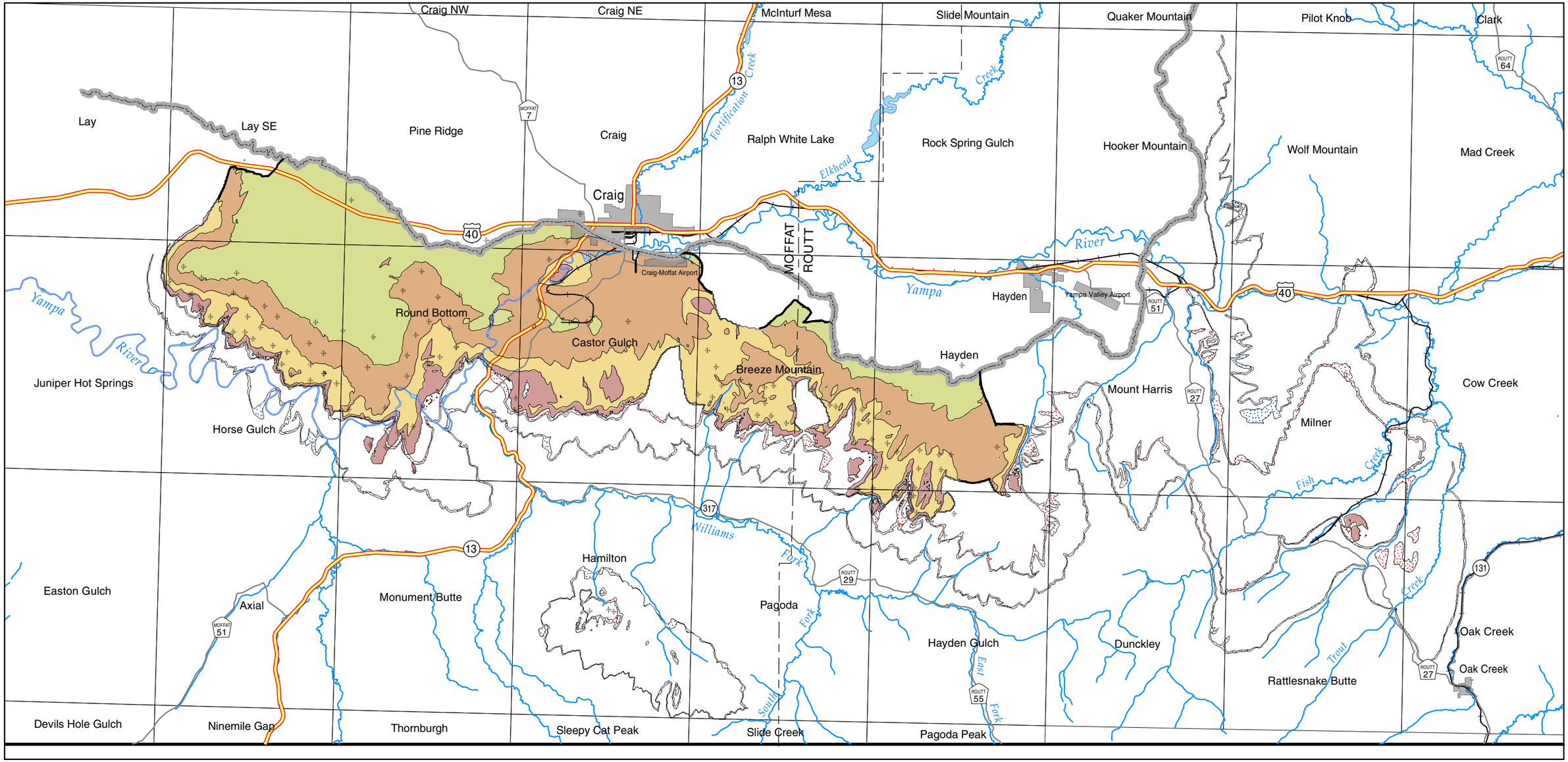
# Figure 33
# "Hl, Hu and H" Seam Coal Depth Map, Yampa Coal Field

## Explanation

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

# Figure 34
# "I. J and K" Seam Coal Depth Map, Yampa Coal Field

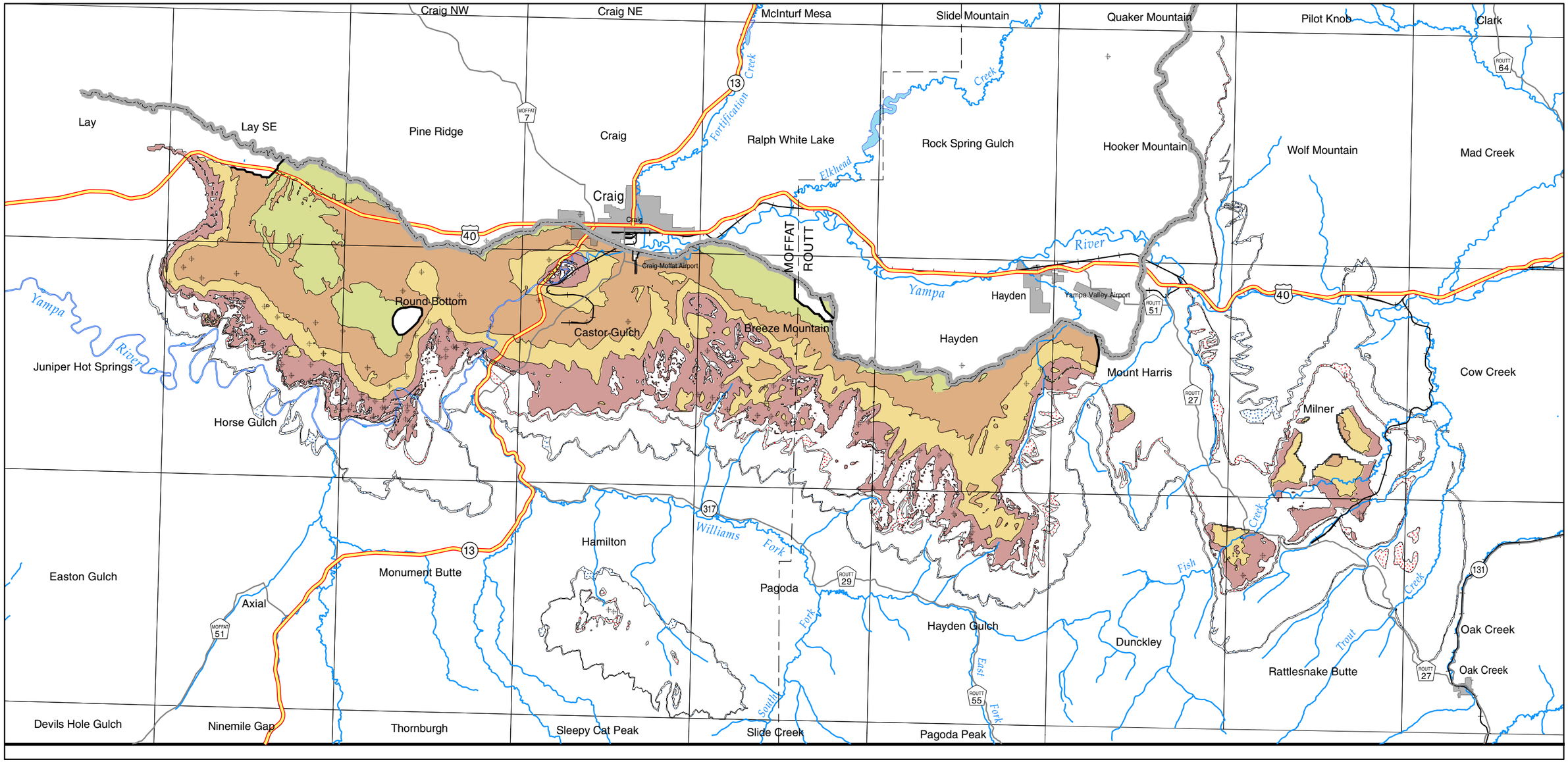
## Explanation

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

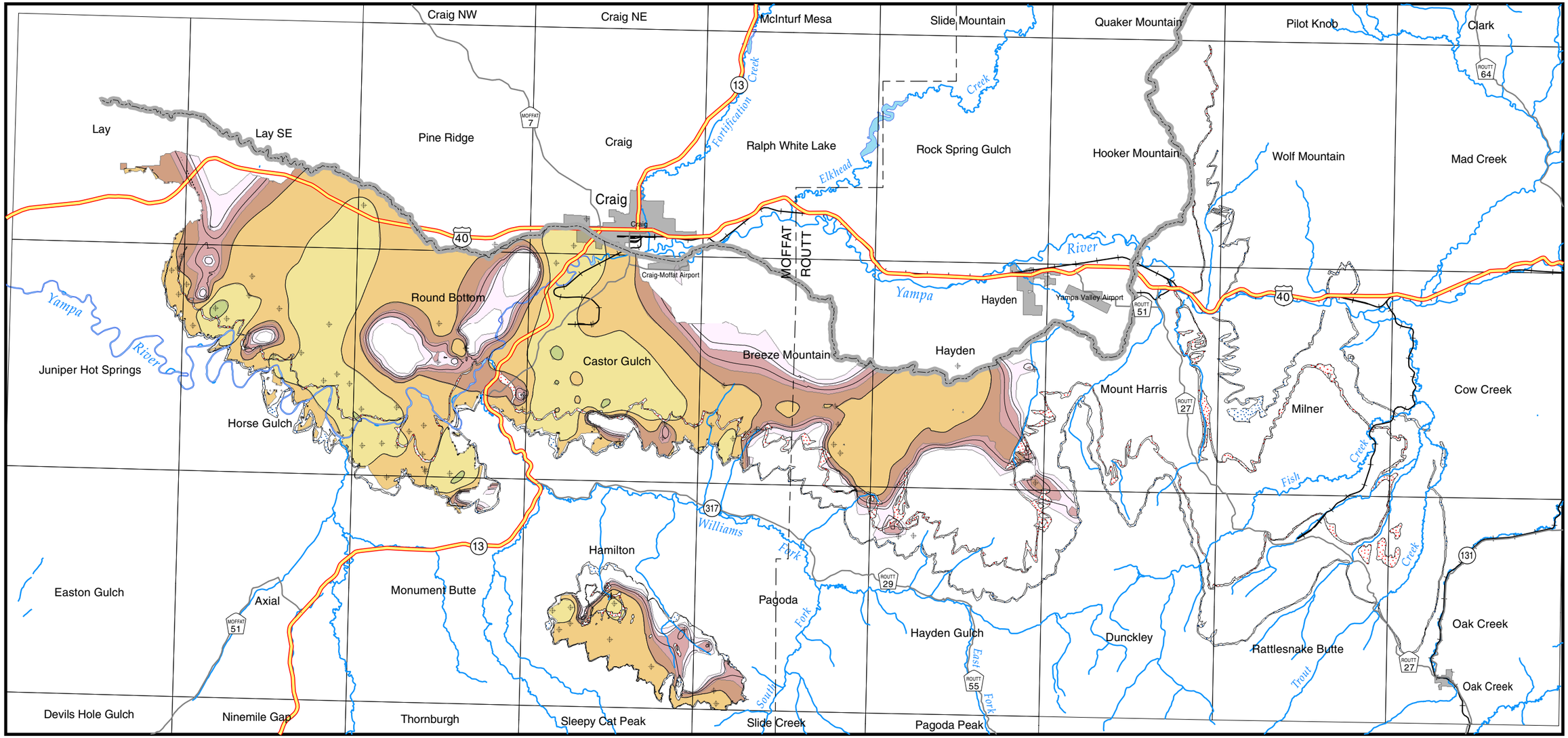
# Figure 35
# "L, M, N, O, P and Q" Seam Coal Depth Map, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid
- Project extent

Depth
- < 20 ft
- 21- 200 ft
- 201 - 500 ft
- 501 - 1000 ft
- 1001 - 2000 ft
- 2000+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

# Figure 36
# "B" Seam Net Coal Thickness Map, Yampa Coal Field

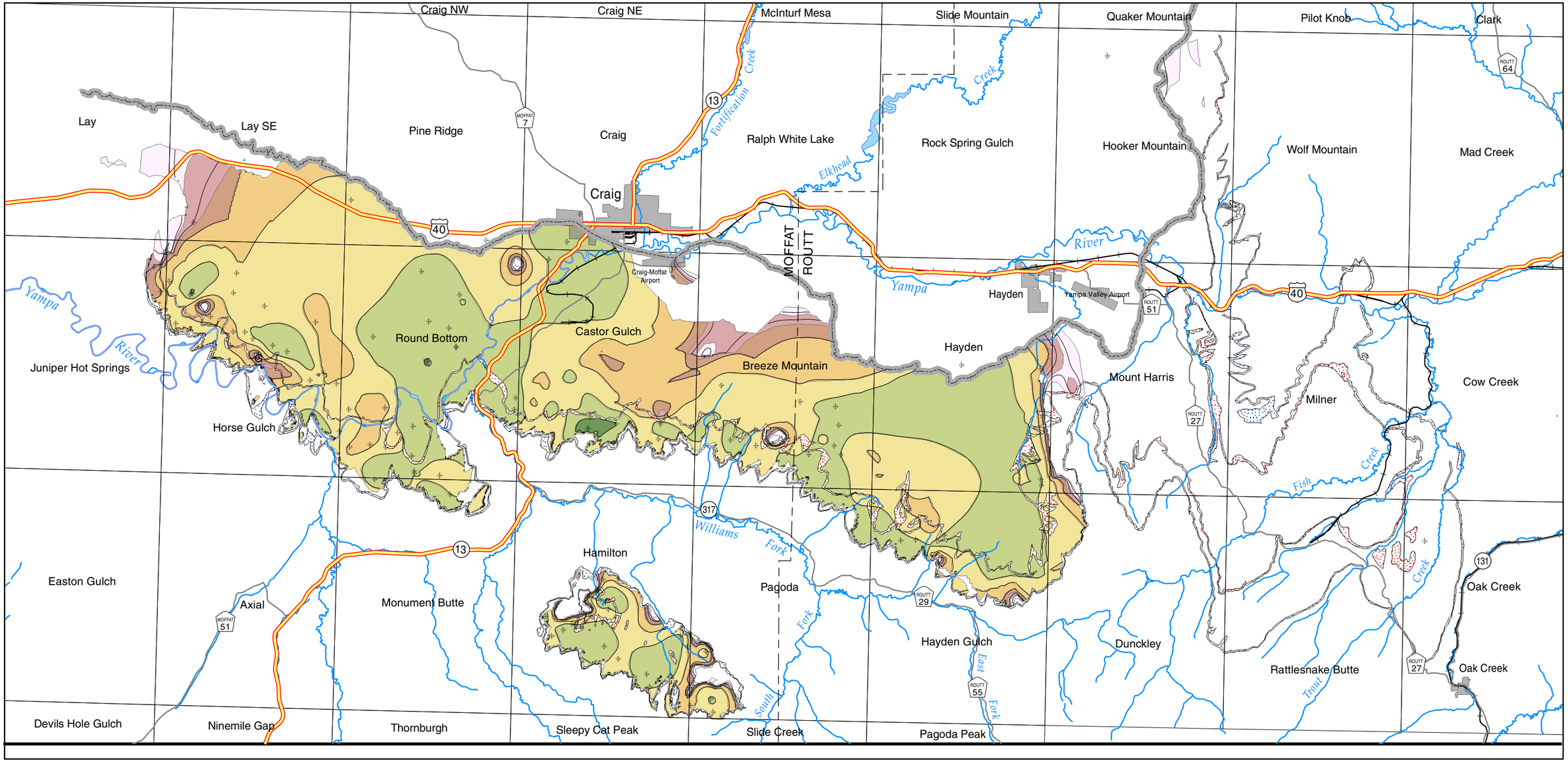
**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness

- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

# Figure 37
# "C/D" Seam Net Coal Thickness Map, Yampa Coal Field

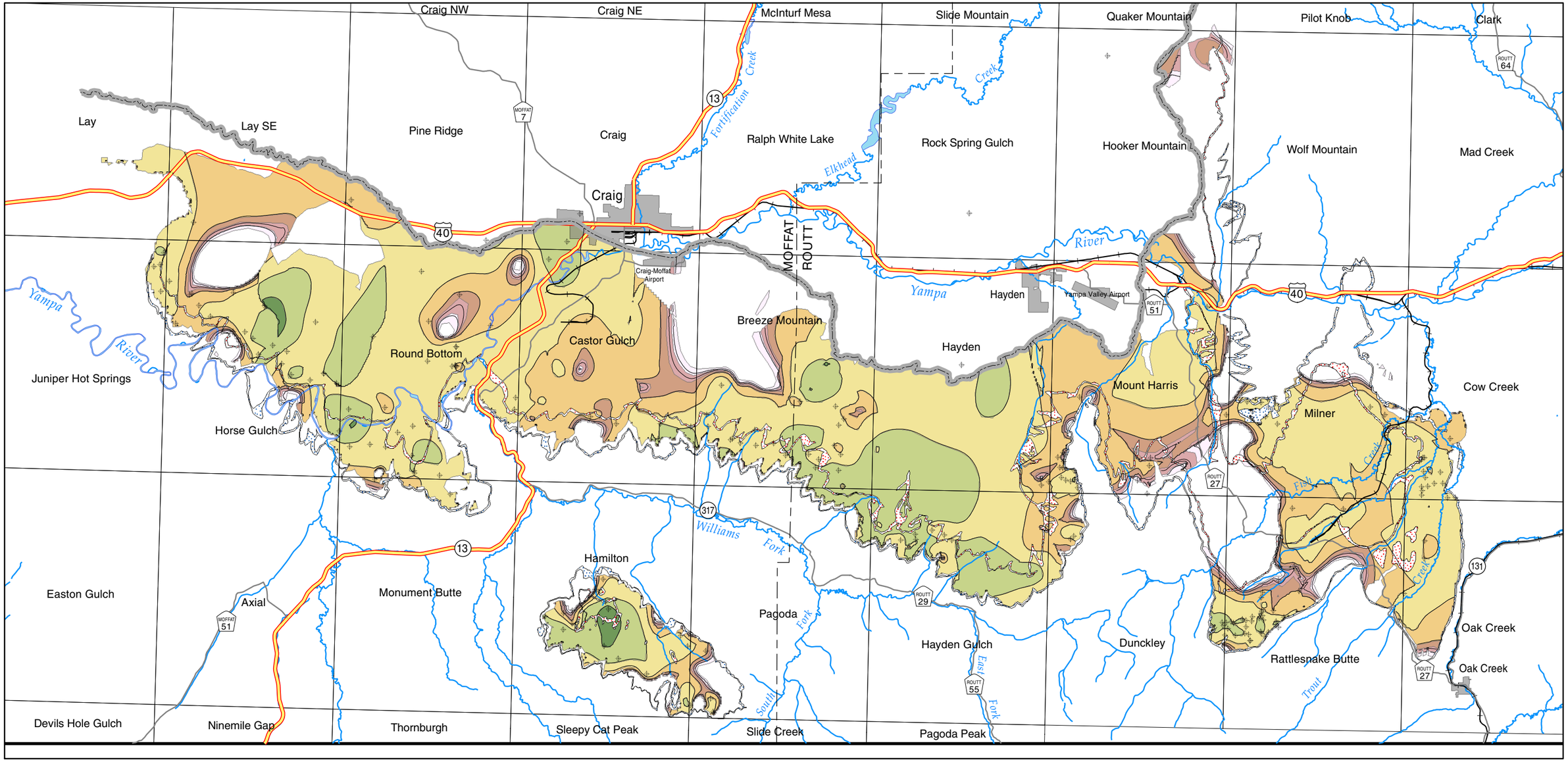
## Explanation

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness
- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles

0 1.5 3 6 9 12

0 2.5 5 10 15 20

Kilometers

# Figure 38
# "El, Eu and E" Seam Net Coal Thickness, Yampa Coal Field

## Explanation

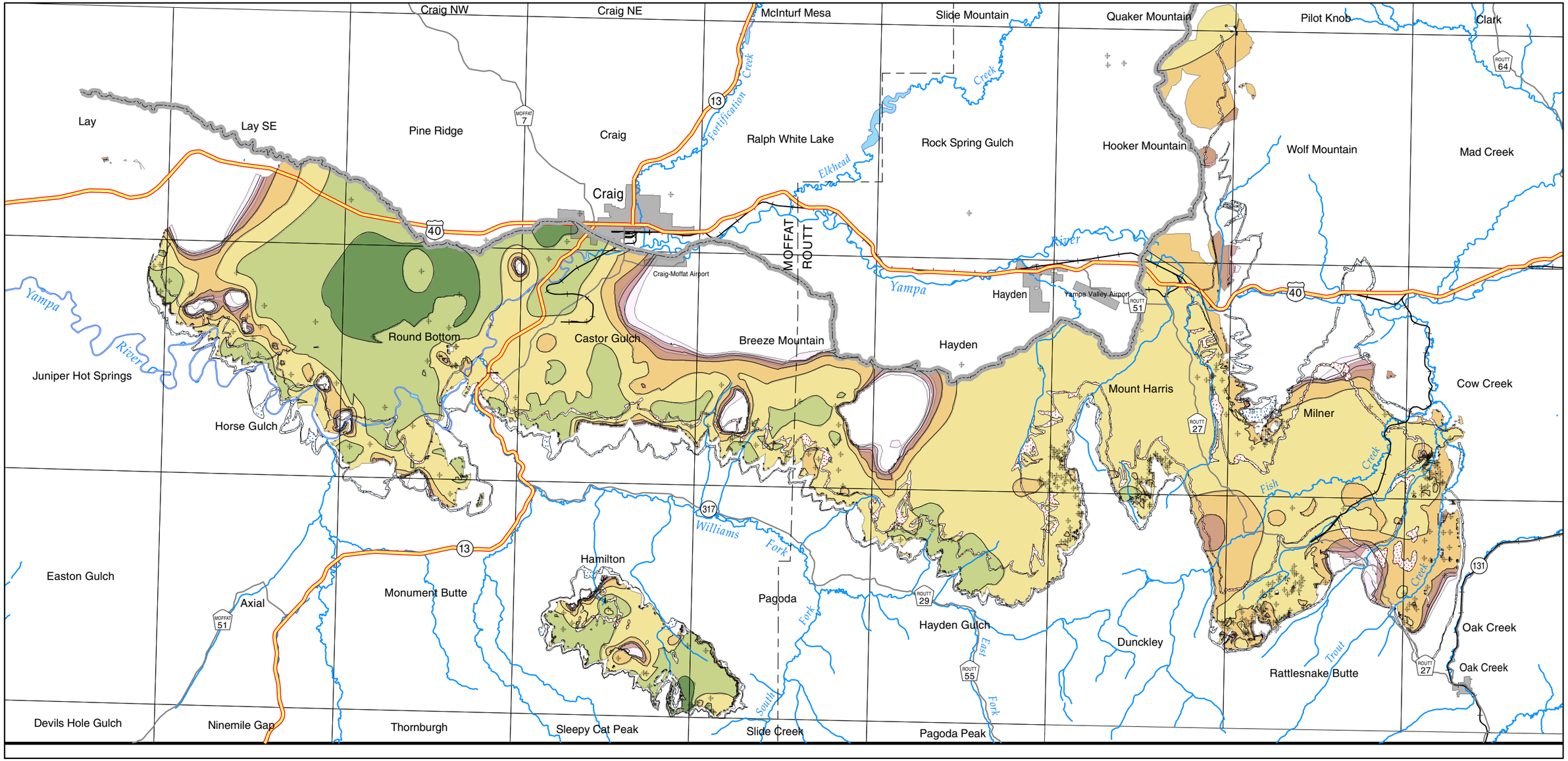
- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness

- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles

0 1.5 3 6 9 12

0 2.5 5 10 15 20

Kilometers

# Figure 39
# "Fl, Fu and F" Seam Net Coal Thickness, Yampa Coal Field

## Explanation

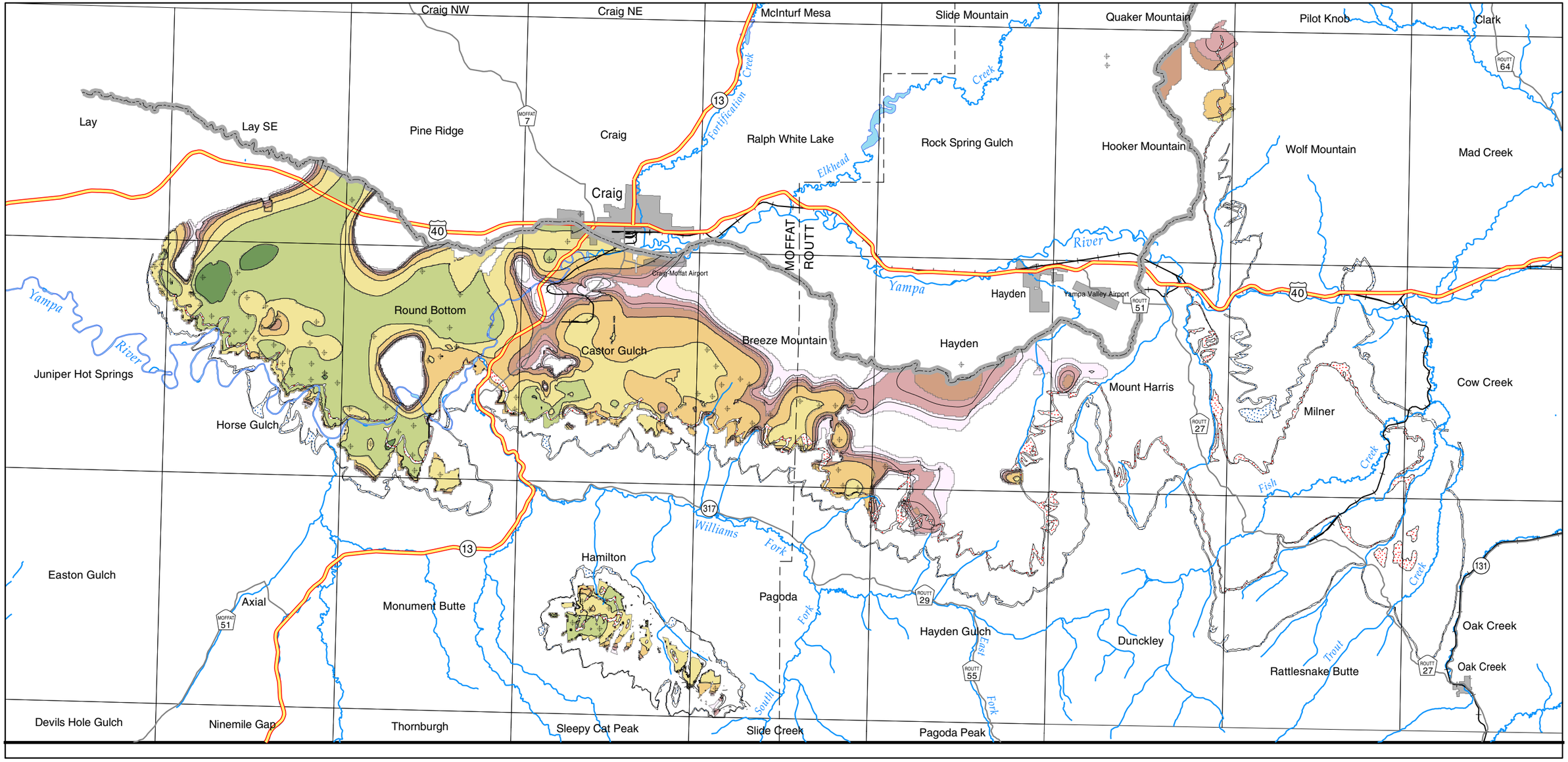
- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness

- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

# Figure 40
# "Hl, Hu and H" Seam Net Coal Thickness Map, Yampa Coal Field

## Explanation

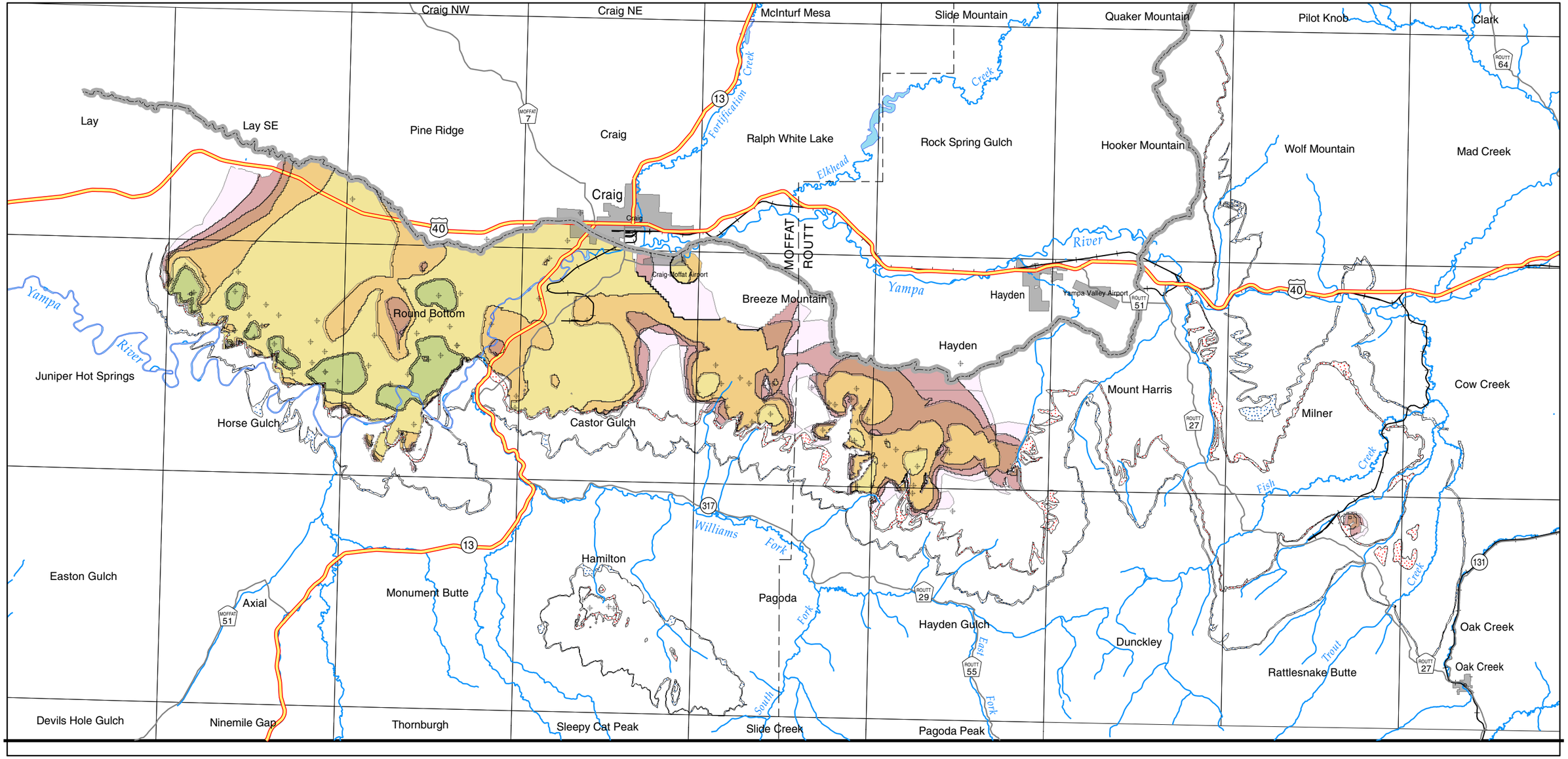
- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad

- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness

- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles
0 1.5 3 6 9 12

0 2.5 5 10 15 20
Kilometers

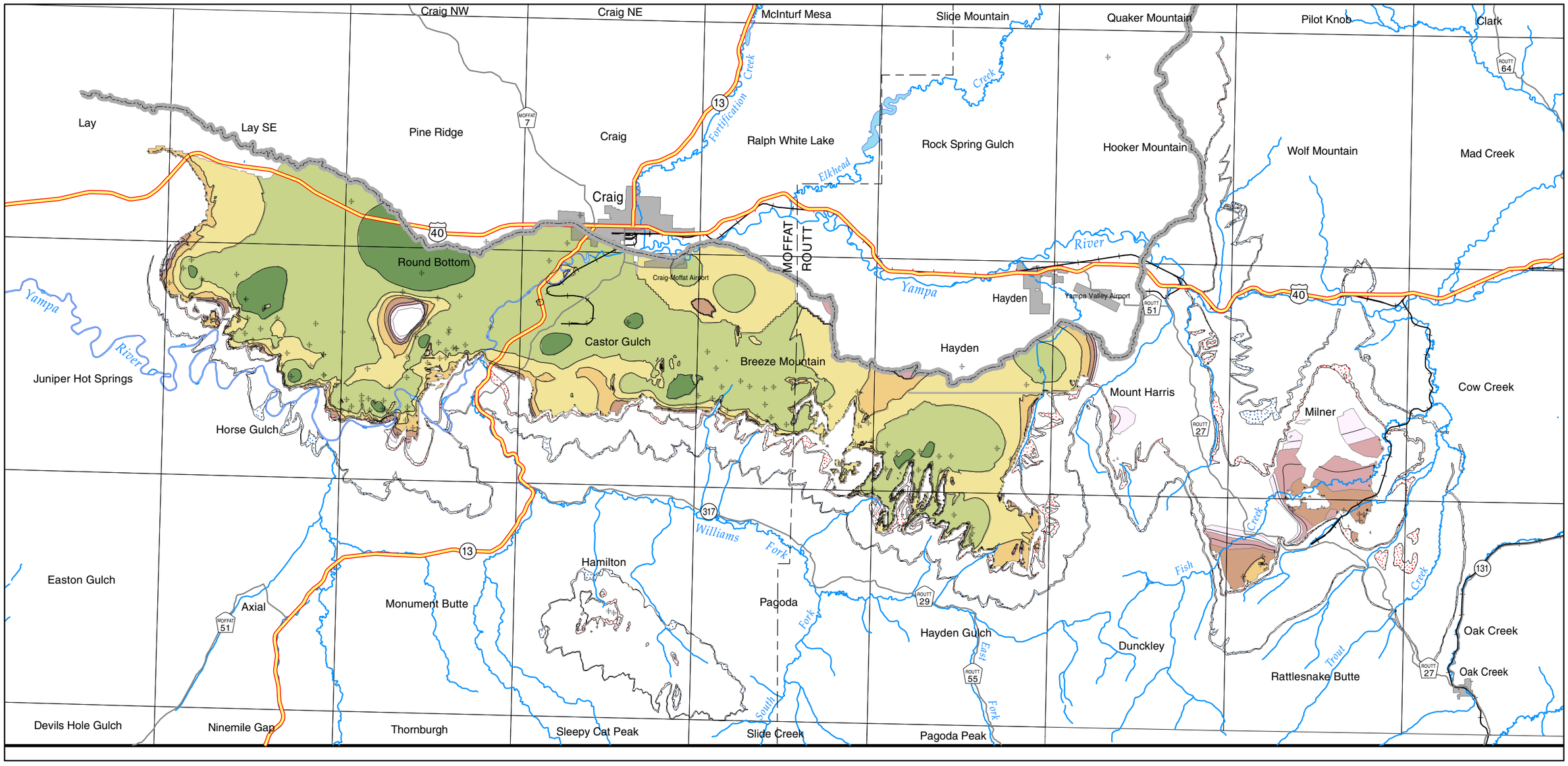
# Figure 41
# "I, J, and K" Seam Net Coal Thickness Map, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness
- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal




N

North Colorado State Plane Projection - NAD 1927

Data provided by USGS, CGS, and ESRI.

Miles: 0 1.5 3 6 9 12

Kilometers: 0 2.5 5 10 15 20

# Figure 42
# "L, M, N, O, P and Q" Seam Net Coal Thickness Map, Yampa Coal Field

**Explanation**

- Publicly Available Drill Holes
- Resource Limit*
- Highway
- Local Roads
- Railroad
- Trout Creek Sandstone
- Twentymile Sandstone
- Towns and Airports
- 1:24,000 quadrangle grid

Thickness

- < 2.3 ft
- 2.4- 3.5 ft
- 3.6 - 5 ft
- 6 - 10 ft
- 11 - 20 ft
- 21- 40 ft
- 40+ ft

* 2,500 ft depth to Trout Creek Sandstone or approximately 2,000 ft depth to coal

| | | Depth from Surface (feet) | Total Resources (thickness in feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1.2 - 2.3 | 2.3 - 3.5 | 3.5 - 5 | 5 -10 | 10 - 20 | 20 - 40 | >40 | Total |
| **Original** | | 20 - 200 | 85,290.63 | 154,301.66 | 232,880.05 | 759,666.30 | 846,277.94 | 137,751.73 | 0.00 | 2,216,168.31 |
| | | 200 - 500 | 143,719.91 | 255,015.64 | 405,962.30 | 1,317,391.00 | 1,362,356.01 | 273,620.83 | 0.00 | 3,758,065.69 |
| | | 500 - 1000 | 201,909.73 | 389,566.26 | 740,603.87 | 2,552,346.38 | 2,871,078.73 | 565,425.29 | 7,551.01 | 7,328,481.27 |
| | | 1000 - 2000 | 183,171.94 | 390,273.18 | 927,140.50 | 3,636,516.94 | 5,469,026.30 | 1,778,533.50 | 42,855.43 | 12,427,517.79 |
| | | TOTAL | 614,092.21 | 1,189,156.74 | 2,306,586.72 | 8,265,920.62 | 10,548,738.98 | 2,755,331.35 | 50,406.44 | 25,730,233.06 |
| **Depleted** (Mined out and coal unavailable due to mining) | Surface | 20 - 200 | 3,488.00 | 5,587.39 | 12,010.67 | 85,893.29 | 94,416.30 | 69.48 | 0.00 | 201,465.14 |
| | | 200 - 500 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | 500 - 1000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | 1000 - 2000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | TOTAL | 3,488.00 | 5,587.39 | 12,010.67 | 85,893.29 | 94,416.30 | 69.48 | 0.00 | 201,465.14 |
| | Deep | 20 - 200 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | 200 - 500 | 1,124.48 | 1,278.38 | 2,773.18 | 5,046.29 | 8,922.80 | 3.63 | 0.00 | 19,148.75 |
| | | 500 - 1000 | 39.28 | 0.00 | 50.47 | 23,240.06 | 84,755.05 | 12,171.19 | 0.00 | 120,256.05 |
| | | 1000 - 2000 | 0.00 | 0.00 | 0.00 | 15,713.41 | 59,150.66 | 5,663.84 | 0.00 | 80,527.91 |
| | | TOTAL | 1,163.76 | 1,278.38 | 2,823.65 | 43,999.76 | 152,828.51 | 17,838.65 | 0.00 | 219,932.70 |
| | Total | 20 - 200 | 3,488.00 | 5,587.39 | 12,010.67 | 85,893.29 | 94,416.30 | 69.48 | 0.00 | 201,465.14 |
| | | 200 - 500 | 1,124.48 | 1,278.38 | 2,773.18 | 5,046.29 | 8,922.80 | 3.63 | 0.00 | 19,148.75 |
| | | 500 - 1000 | 39.28 | 0.00 | 50.47 | 23,240.06 | 84,755.05 | 12,171.19 | 0.00 | 120,256.05 |
| | | 1000 - 2000 | 0.00 | 0.00 | 0.00 | 15,713.41 | 59,150.66 | 5,643.80 | 0.00 | 80,507.87 |
| | | TOTAL | 4,651.76 | 6,865.77 | 14,834.32 | 129,893.05 | 247,244.81 | 17,888.10 | 0.00 | 421,377.81 |
| **Remaining** | | 20 - 200 | 81,802.63 | 148,714.27 | 220,869.38 | 673,773.01 | 751,861.64 | 137,682.25 | 0.00 | 2,014,703.17 |
| | | 200 - 500 | 142,595.43 | 253,737.26 | 403,189.12 | 1,312,344.71 | 1,353,433.21 | 273,617.21 | 0.00 | 3,738,916.94 |
| | | 500 - 1000 | 201,870.45 | 389,566.26 | 740,553.40 | 2,529,106.32 | 2,786,323.68 | 553,254.10 | 7,551.01 | 7,208,225.22 |
| | | 1000 - 2000 | 183,171.94 | 390,273.18 | 927,140.50 | 3,620,803.53 | 5,409,875.64 | 1,772,889.70 | 42,855.43 | 12,347,009.92 |
| | | TOTAL | 609,440.45 | 1,182,290.97 | 2,291,752.40 | 8,136,027.57 | 10,301,494.17 | 2,737,443.25 | 50,406.44 | 25,308,855.25 |
| **Restrictions** | Land-Use | 20 - 200 | 4,661.74 | 7,249.80 | 13,297.98 | 53,664.24 | 53,790.26 | 12,533.26 | 0.00 | 145,197.28 |
| | | 200 - 500 | 8,196.22 | 17,354.63 | 25,192.53 | 105,004.84 | 94,734.37 | 21,007.82 | 0.00 | 271,490.41 |
| | | 500 - 1000 | 23,880.85 | 47,398.48 | 78,613.91 | 262,032.84 | 284,558.20 | 57,535.77 | 0.00 | 754,020.05 |
| | | 1000 - 2000 | 14,535.84 | 38,423.98 | 85,035.64 | 326,647.45 | 575,608.25 | 106,162.64 | 0.00 | 1,146,413.80 |
| | | TOTAL | 51,274.65 | 110,426.89 | 202,140.06 | 747,349.37 | 1,008,691.08 | 197,239.49 | 0.00 | 2,317,121.54 |
| | Technological | 20 - 200 | 3,228.51 | 5,994.41 | 11,536.71 | 36,747.56 | 33,211.77 | 1,703.92 | 0.00 | 92,422.88 |
| | | 200 - 500 | 34,729.13 | 78,456.45 | 153,574.63 | 419,575.07 | 334,679.02 | 68,658.86 | 0.00 | 1,089,673.16 |
| | | 500 - 1000 | 49,216.88 | 108,221.64 | 207,646.08 | 705,384.32 | 813,568.75 | 185,935.68 | 176.04 | 2,070,149.39 |
| | | 1000 - 2000 | 43,820.97 | 107,272.35 | 193,703.47 | 938,875.53 | 1,623,292.91 | 744,349.92 | 27,657.94 | 3,678,973.09 |
| | | TOTAL | 130,995.49 | 299,944.85 | 566,460.89 | 2,100,582.48 | 2,804,752.45 | 1,000,648.38 | 27,833.98 | 6,931,218.52 |
| | Total | 20 - 200 | 7,890.25 | 13,244.21 | 24,834.69 | 90,411.80 | 87,002.03 | 14,237.18 | 0.00 | 237,620.16 |
| | | 200 - 500 | 42,925.35 | 95,811.08 | 178,767.16 | 524,579.91 | 429,413.39 | 89,666.68 | 0.00 | 1,361,163.57 |
| | | 500 - 1000 | 73,097.73 | 155,620.12 | 286,259.99 | 967,417.16 | 1,098,126.95 | 243,471.45 | 176.04 | 2,824,169.44 |
| | | 1000 - 2000 | 58,356.81 | 145,696.33 | 278,739.11 | 1,265,522.98 | 2,198,901.16 | 850,512.56 | 27,657.94 | 4,825,386.89 |
| | | TOTAL | 182,270.14 | 410,371.74 | 768,600.95 | 2,847,931.85 | 3,813,443.53 | 1,197,887.87 | 27,833.98 | 9,248,340.06 |
| **Available** | | 20 - 200 | 73,912.38 | 135,470.06 | 196,034.69 | 583,361.21 | 664,859.61 | 123,445.07 | 0.00 | 1,777,083.01 |
| | | 200 - 500 | 99,670.08 | 157,926.18 | 224,421.96 | 787,764.80 | 924,019.82 | 183,950.53 | 0.00 | 2,377,753.37 |
| | | 500 - 1000 | 128,772.72 | 233,946.14 | 454,293.41 | 1,561,689.16 | 1,688,196.73 | 309,782.65 | 7,374.97 | 4,384,055.78 |
| | | 1000 - 2000 | 124,815.13 | 244,576.85 | 648,401.39 | 2,355,280.55 | 3,210,974.48 | 922,377.14 | 15,197.49 | 7,521,623.03 |
| | | TOTAL | 427,170.31 | 771,919.23 | 1,523,151.45 | 5,288,095.72 | 6,488,050.64 | 1,539,555.38 | 22,572.46 | 16,060,515.19 |

***Table 16. Summary of estimated coal resources of the Williams Fork Formation, Yampa coal field, Colorado. (Resource estimates reported in thousands of short tons).***