Regional Information

1) Location

The NKC/NEDO project area and National King Coal Mine are located in the southwest United States in the “Four Corners area.” This is the only place in the United States where four different states have a point in common. These states are Colorado, Utah, Arizona and New Mexico.

The project is located at 37° 15’ North Longitude and 108° 06’ West Latitude, in the State of Colorado, La Plata County, at an elevation of 7,400 feet (figure 1). The small town of Hesperus is approximately six miles by road northeast of the project. The town of Durango is located 16 miles east on US Highway 160. The city of Farmington, New Mexico is about 45 miles south on Colorado Highway 140.

2) Climate

The climate is referred to as "high desert," with little rainfall or snow. The following table is taken from the records of the nearby town of Durango, Colorado.

Month	Low Temp. deg F	High Temp. deg F	Snow, Inches	Rain, Inches	Month	Low Temp. deg F	High Temp. deg F	Snow, Inches	Rain, Inches
Jan.	10.5	39.5	16.9	1.62	July	50.0	85.0	0.0	1.95
Feb.	16.0	44.7	14.2	1.49	Aug.	49.0	83.1	0.0	2.31
March	22.6	51.8	10.5	1.68	Sept.	41.0	76.4	0.0	1.85
April	29.2	61.2	3.4	1.35	Oct.	31.3	65.5	1.1	1.92
May	35.5	70.2	0.5	1.12	Nov.	21.5	52.1	5.5	1.33
June	42.0	80.6	0.0	0.8	Dec.	13.0	41.3	16.3	0.0

The region is mountainous, varying from about 5,000 feet in elevation south of the project area, to over 13,000 feet in the La Plata Mountains north of Hesperus.

3) Culture

The area is thinly populated with about 150,000 people within a 150 mile radius of the project area. Population centers include Farmington, New Mexico (pop. 40,000), Durango, Colorado (pop. 15,000) and Cortez Colorado (pop. 8,700). The surrounding region is evenly divided between town and rural dwellers. Besides the named cities there are three Indian tribes that have

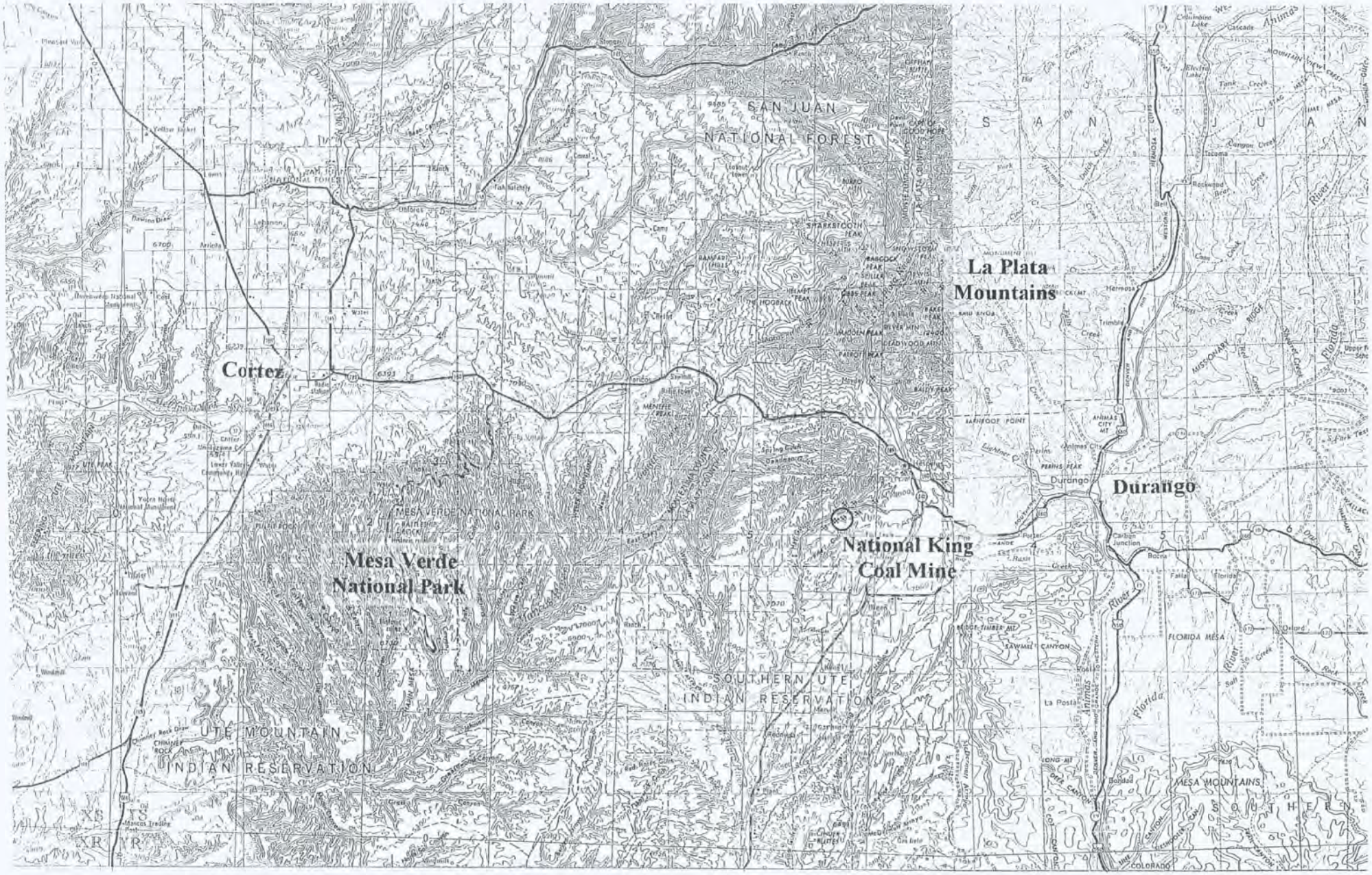


Figure 1 - National King Coal Mine Location and Surrounding Vicinity.

reservations within the surrounding area: the Ute Mountain Ute Tribe, the Southern Ute Tribe and the Navajo Tribe. The project area, which lies immediately northwest of the National King Coal Mine, lies within the Ute Mountain Ute Tribe surface ownership.

The modern history of this area began about 1776 when the Fransciscan Friars from Spain discovered this lush mountain land while on their way to California. The land was inhabited by the Ute Indians but contained the structures of earlier peoples, now called the Anasazi. Mineral exploration and discovery was the first development of this area, followed by the building of railroads into what was expected to be a major gold and silver area. A large number of small mines justified the building of concentrators and smelters in the Durango region. The superb climate and the improved roads and transportation has led to major tourist developments in the last 40 years.

Culturally, the Four Corners area is extremely diversified. The population is a mixture of Anglo, northern European, Spanish and Indian. In spite of racial strife in other places in America the Four Corners area has had none of this type of divisiveness. As is usual in America, all the many small towns in the region have public schools; those on the reservations are usually limited to Indian students. Durango is the home of Fort Lewis College, a four year college giving degrees in both science and business subjects. Fort Lewis College has about 4,500 students and a faculty of 174 full time instructors. Additionally, both the San Juan Community College, located in Farmington, and the Pueblo Community College in Cortez are branches of Fort Lewis College. Also, nearby Durango is growing into a software center, developing computer programs for Cad-Cam, Internet and other systems applications. Several Internet service providers are located in Durango as well as in Farmington. The religious climate of the area is a mixture of Roman Catholic, Protestant and Indian. The area supports a vigorous artistic community, supporting graphic arts, stage and musical performances. The community is also extremely active outdoor with summer activities of horseback riding, mountain hiking and river rafting/kayaking, and winter activities of skiing, snowmobiling, and desert/canyon hiking.

The Four Corners area is still strongly agricultural, raising sheep, cattle and horses. This is readily apparent of the area immediately surrounding National King Coal Mine and the project area. About 50% of the area population is involved with agriculture. The primary grain crop is animal feed required during the winters. The water supplies on the southwestern and western side of the Rocky Mountains depend on rivers and streams fed by the annual snow fall. The water regulations of Colorado are unique, similar to those found in New Mexico. Acquisition of “water rights” under these regulations is essential to all agricultural and industrial activities in Colorado.

Mining at National King Coal began prior to 1941. Hay Gulch lies between the present mine and the project area. Land use of Hay Gulch has historically been coal mining, grazing of livestock and wildlife habitat. Some hay crops are produced along the bottom drainage field, and numerous small, abandoned coal mines dot the gulch slopes where coal seams outcrop. Northeast of Hay Gulch, the project area lies on a dissected plateau cut by moderately steep-sided canyons and valleys with a topographic relief of about 500 feet.
The project area is located on Ute Mountain Ute Tribe land. However, the land is not reservation land, but land purchased by the tribe. At the time of acquisition, the government retained all mineral

rights below the surface. It is unusual in the history of the American Indians that this land was also part of the historical territory of this tribe.

4) General Geology

National King Coal Mine lies at the northwest edge of the immense San Juan Basin, which covers approximately 26,000 square miles of northwestern New Mexico and southwestern Colorado. The sedimentary strata of the basin was deposited at the western margin of a vast epeirogenic sea that occupied the central part of the continent during the late Cretaceous Epoch (figure 2). Extensive coal formation occurred during a succession of regressive/transgressive migrations of the shoreline in a northeast (seaward) and southwest (landward) direction. Each major cycle resulted in a gradual shift in the maximum transgressive position of the shoreline to the northeast until the sea withdrew for the last time. The result is a jagged wedge of nonmarine sediments in the southwestern portion of the basin intertonguing to the northeast with marine strata (figure 3). The transitional strata of barrier beach, marginal-shore swamps (coal), paludal (coal), and other lower coastal-plain deposits accumulated with each cycle.

a) Stratigraphy

The late Cretaceous age strata of regional interest is from bottom to top: 1) Mancos Shale, 2) Point Lookout Sandstone, 3) Menefee Formation, 4) Cliff House Sandstone and 5) Lewis Shale (figure 3). Quaternary age sediments of primarily sand and gravel are present in the valley bottoms.

Mancos Shale: The Mancos Shale is of marine origin and composed of dark-gray to black shale and silty to fine sandy shale with small amounts of dark gray argillaceous limestone in lenses and concretions. The Mancos Shale has an average local thickness of 2000 feet.

Point Lookout Sandstone: The Point Lookout Formation, which is the basal member of the Mesa Verde Group, is divided into two members. The lower member consists of thin sandstone beds with interbedded transitional shale (Mancos Shale). The upper member consists of thick, massive beds of even textured, medium grained sandstone that form cliffs north of the mine area. The upper member thins to the east as the lower member thickens (seaward). In the project area the Point Lookout Formation has an average local thickness of 400 feet, with the upper sandstone member at about 100 feet thick and the lower transitional member at about 300 feet thick

Menefee Formation: The Menefee Formation, which is the middle member of the Mesa Verde Group is composed of a complex assemblage of non-marine origin, consisting of crossbedded sandstones, black shales and coal beds. The formation is characterized by irregular bedding and rapid lateral changes in lithology. The Menefee is the primary coal bearing formation and up to seven coal seams have been identified by the U.S. Geological Survey. The Menefee Formation has an average local thickness of 300 feet, but thins eastward to about 123 feet in the Florida River valley (near Durango).

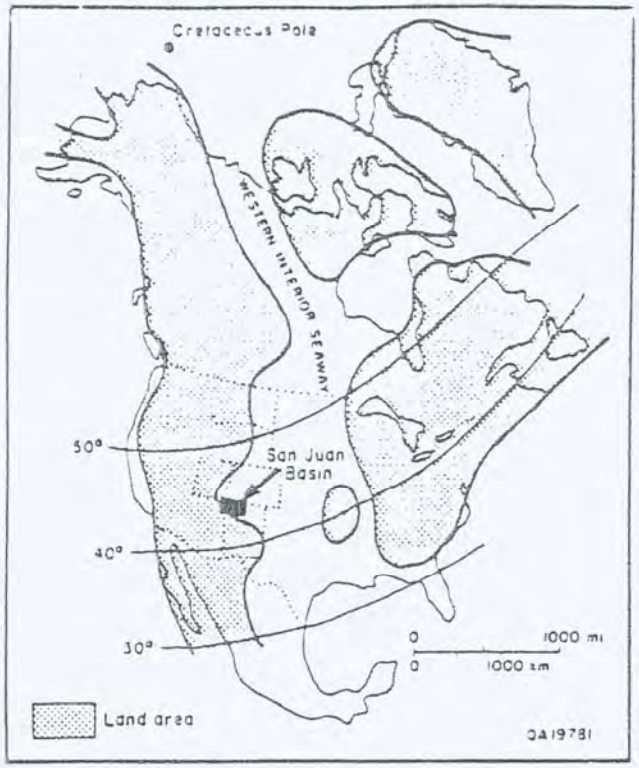


Figure 2 - Location of the San Juan Basin relative to the Western Interior Seaway, (modified from Palmer and Scott, 1984).

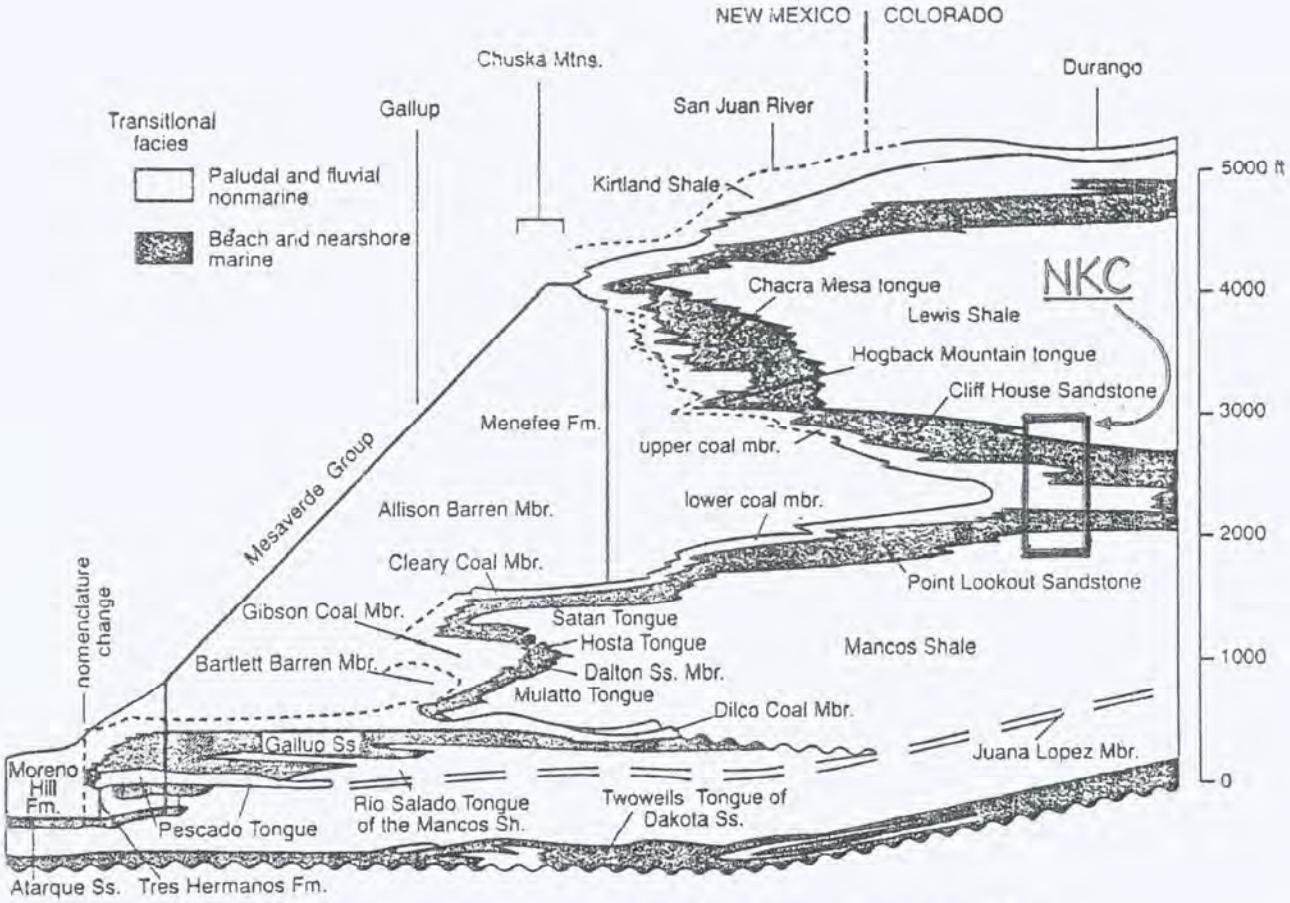


Figure 3 - Straitigraphic diagram showing sequence, thickness and nomenclature of Creataceous rocks in the San Juan Basin, New Mexico and Colorado, (modified from Beaumont, 1982).

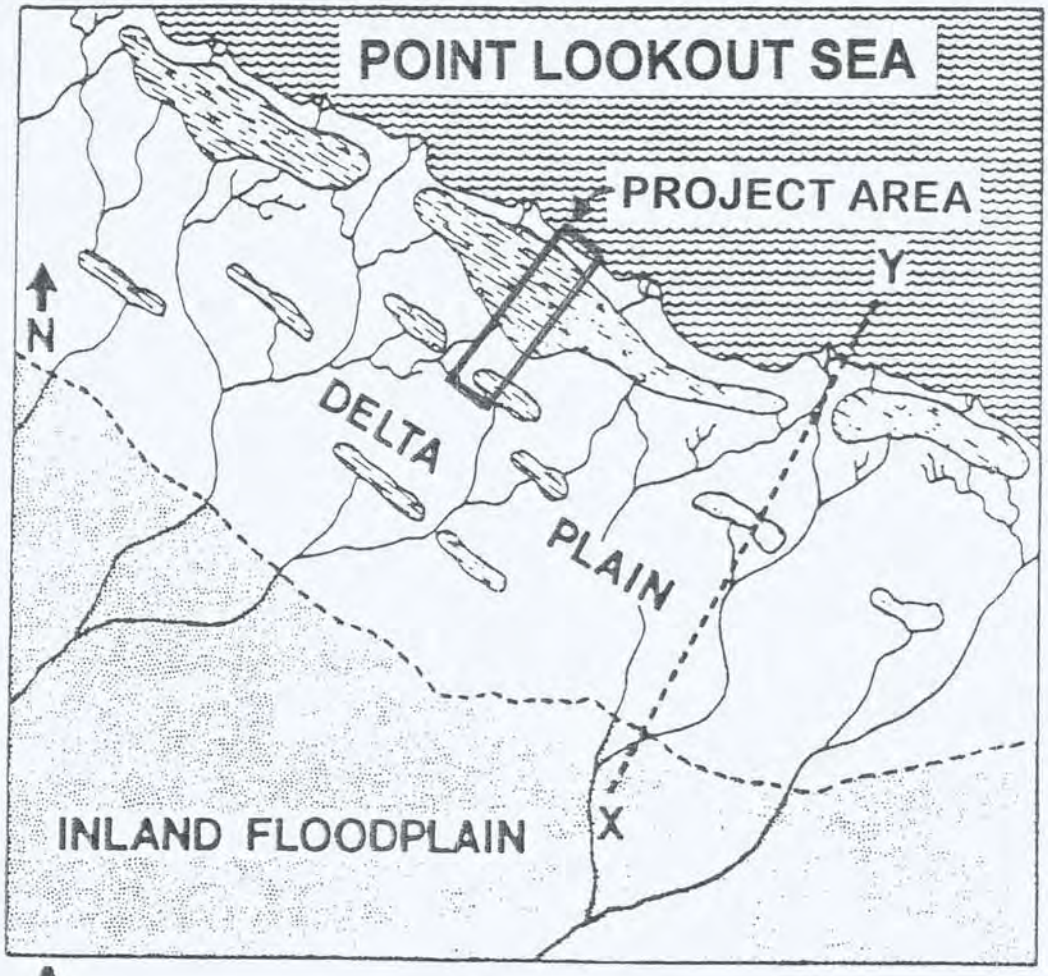
Cliff House Sandstone: The uppermost formation exposed locally is the Cliff House Formation which is the upper member of the Mesa Verde Group. It is of marine origin and is composed of lenticular ledges of hard, fine to medium grained, calcareous sandstone in softer argillaceous fine sandstone, mudstone and silty shale. Like the Point Lookout Sandstone, the Cliff House Sandstone thins eastward to mudstone and silty shale. The formation has an average thickness of 350 feet within the project area, capping the drainage dissected plateau.

Lewis Shale: The Lewis Shale is of marine origin, consisting of dark gray to black clay shale. The formation is reported to be about 1825 feet thick and pinches out southward as the Cliff House Sandstone merges with the overlying regressive Pictured Cliffs Sandstone (the basal sandstone of several thick coal seams presently mined around Farmington, NM). The Lewis Shale is not present in the immediate project/mine area.

b) Depositional Trends

The various depositional environments present in the San Juan Basin fluctuated laterally and vertically with the rate of shoreline shift present; a result of basin subsidence and/or sediment supply. The conditions favorable for a sufficient amount of peat accumulation to produce coal of economic value would require a slow shifting or static shoreline. Strong linear trends were formed by these shorelines and thick deposits of peat accumulated behind the shoreline sediments (beach sands) parallel to the coasts (figure 4). Consequently, lenticular deposits of coal were formed with a long axis parallel to the strand lines (coasts). The strand line direction common to the major events of Cretaceous age in the basin was predominant in a northwest-southeast direction (average N55W, Beaumont, 1971). However, these linear trends were interrupted and modified locally by streams and rivers normal to the strand line carrying sediment to the coastline, creating features such as deltas, estuaries, and open lagoons.

The predominant northwest-southeast direction is important in understanding the depositional environments of the National King Coal Mine and NKC/NEDO project area. The trend is also common (with local modifications) in depositional models I have created for BHP (Broken Hills Proprietary) along the entire western margin of the basin. It is also important to understand that the major drainages present at the time of coal formation were perpendicular to the shoreline at roughly N35E. The major drainage channels effected the coal formation in several ways, including: 1) non-deposition, 2) coal seam cut-outs (partial or total) and 3) splitting/thinning of the coal.



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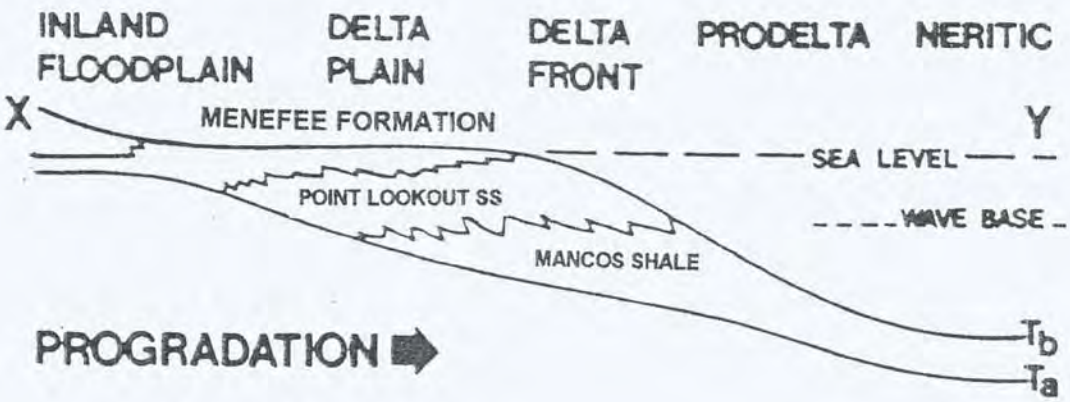

Figure 4 - Depositional environments of the Point Lookout Sandstone and Menefee Formations. Diagrammatic paleogeopraphic map of the northwestern New Mexico, (modified from Lucas and Mateer, 1986)

c) Structure

The National King Coal Mine and NKC/NEDO project area lies in a broad area of slightly undulating strata known as the Four Corners platform. The area is slightly northwest of the steeply dipping Hogback monocline which can be traced for 130 miles and clearly defines the northwest margin of the San Juan Basin in this area (figure 5). The Four Corners platform dips slightly southward at two to seven degrees away from the high La Plata Mountains to the north. Bedding within the coal at National King Coal Mine dips 2 degrees (3.5% grade) in a south/southeastern direction.

It is highly probable that faulting is present in the region surrounding the project area, however the results (core descriptions, geophysical logs and structure map) of drilling both the mine and project areas have not revealed the presence of any significant faults (>30 feet displacement). While no faults have been encountered within National King Coal Mine, only minor rolls and low coal thickness areas have been detected; and a weak roof rock trend has been mapped with a N50-60W degree trend.

While no faults are known to exist in the immediate area, it is important to understand that the relationship between structure and stratigraphic deposition is very strong in the San Juan Basin. The northwest trending strand lines are generally accumulations along sub-surface, en echelon basinal compaction features created as the Createous basin continued to fill. The dominant northeast trending channel features accumulate (stack) along extremely deep crustal strike-slip faults (Pre-Cambrian or Palaeozoic age) which created depositional lows attracting the sediment load. It is highly likely that the uplifted La Plata Mountains to the north would have influence upon these weaker trends, with potential sub-surface and surface fracturing (i.e., National King Coal Mine weak roof rock trend).

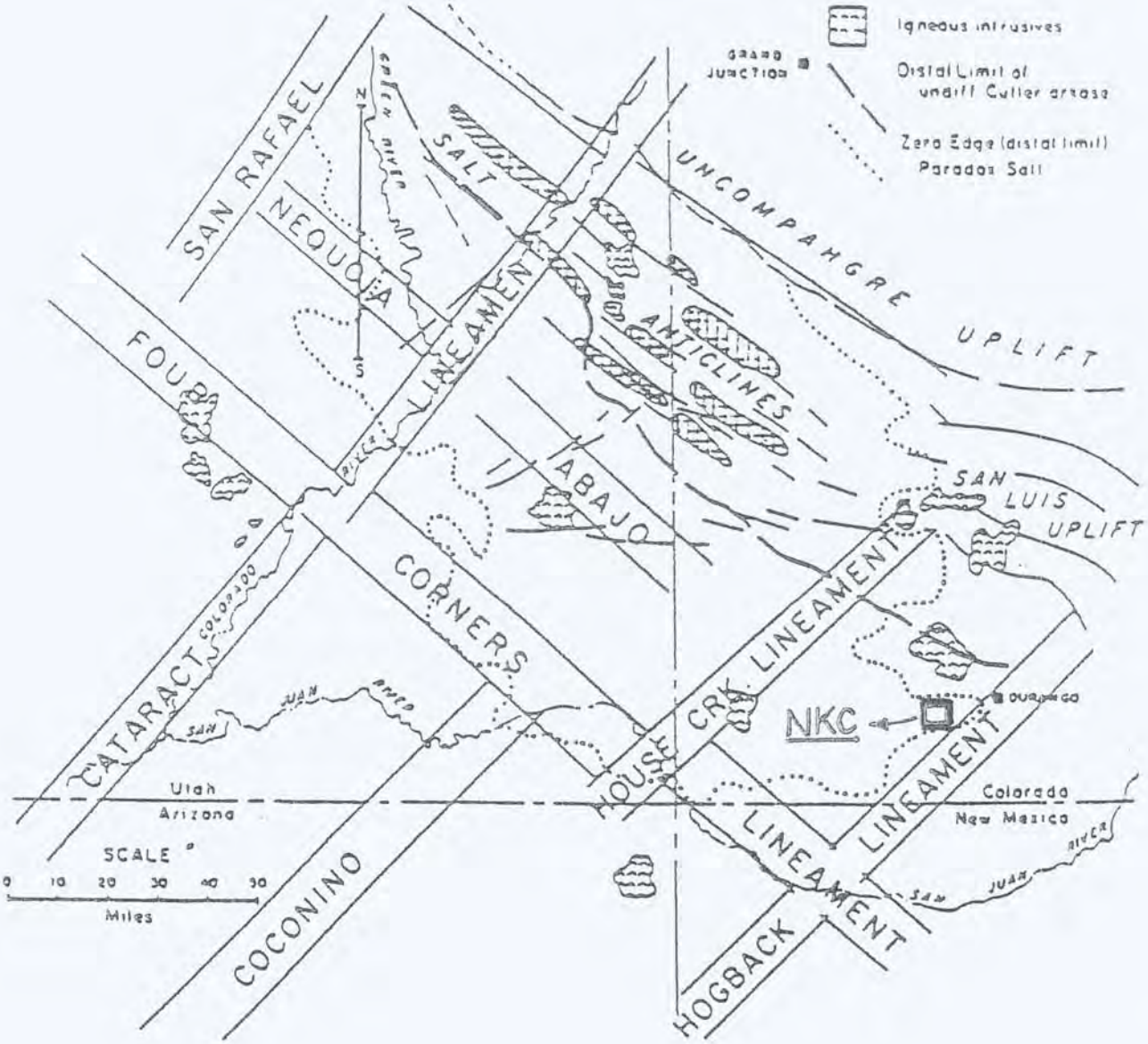

Figure 5 - Locations of specific Precambrain and Paleozoic fault zones in the eastern Colorado Plateau, (Baars and Stevenson, 1981).

Geology & Depositional Model

2) Geologic Modeling

Part of the task of evaluating the underground potential of the NKC/NEDO project area is the development of a geological interpretation (depositional model) that can relate the historical sequence which resulted in the accumulation of the coal beds and associated strata. The principle value of the model is that it can become a predictive tool to determine areas where coal beds thin or split, areas of potentially dangerous roof conditions and coal quality. While this report will not be a detailed depositional model since the older drill hole data was not available with complete lithologic interpretation (in order to compete detailed coal parting and interburden isopachs), I will discuss the more easily defined trends present.

Perhaps the most important factor influencing local distribution of the thicker coal is the character of the surface upon which the plant material accumulated. Geologists often refer to such a surface as the paleotopography, paleodrainage or depositional platform. The shape and extent of a depositional platform is often controlled by the varying thickness of the sediments below. The sediments below the platform are often controlled by various rates of compaction. Thicker trends in a lower coal seam or shale bed are often subjected to higher rates of compaction, therefore, they form paleotopographic lows that can influence or attract drainage patterns (i.e. sand channel systems resulting in sediment accumulation) in the coal forming environment. Conversely, the previous (now buried) channel would be composed of less compactable lithologies (sandstone to siltstone) forming a paleotopographic high, which would allow for the growth and accumulation of peat.

Mapping each vertical sequence of coal/sediment accumulation represents a full cycle of deposition. Observing the lateral changes within each depositional sequence and interrelating (overlaying) this information can help define the extent of the thicker coal, parting trends, quality variations within a given area and to some extent the sand channel trends overlying a mine roof.

Additionally, the observation of depositional trends, such as sand channels or seam splits, can indicate local and regional structural features. Variations in the thickness (and/or stacking), width, or lateral direction of seam splits or sand channels may represent basinal compaction during coal formation and/or older pre-depositional tectonic activity. Not only would these features influence the accumulation of the peat but may represent zones affecting the minability of the coal by inclusion of lineaments, shears/slips, and/or faults.

When the data is observed as an interrelated sequence of events, the best interpretation can be surmised. The geologic model provides a baseline of information that can be added to, changed or even completely revised as additional data is obtained. It allows the geologist to provide mine personnel with the best critical mine planning/operational information available, and also can assist in locating sites where additional information would be useful, with less expense and wasted time. Finally, the model is invaluable in targeting additional areas for reserve acquisition or exploration.

3) Depositional Model Of The "A" Seam

a) Depositional Floor Trends: The primary paleotopography or depositional platform upon which the coal formed extends to the Point Lookout Sandstone Formation. While the drilling did not reach this deep, it is assumed to be the reason for the major regional trends present within the area (i.e., major coal seam splits and primary sandstone drainage channels). Upward from this sequence are the "B" Seam coals that are thin and laterally discontinuous throughout much of the area. The number of thin coal seams present represent a rapid transgression sequence with abundant sediment (possibly braided sandstone channels) being deposited. Examining the "B" Seam isopach from the "National King Coal, Inc. Geologic Report" (Henderson, 1995), it is easy to see the narrow, lateral extent of the deposits extending both N55W and N35E, which are the predominant structural and depositional trends. The narrow deposits of coal are approximately 2000-3000 feet wide and 5-6 feet thick, with numerous thin to large partings present.

> *Note: In such an extremely variable, depositional sequence, such as the "B" seam deposits, individual seam correlation's are often very difficult to establish and it is imperative to map the relationship of the fluvial sandstone channels surrounding the coals. It is highly probable that the several thicker coal trends do not correlate laterally into each other, but are separate coal "pods" defined by the sandstone channels around them, with possible splitting and merging of thinner coal seams.*

These ridges of coal deposition probably reflect changes in thickness, lithologic character or even structure within the Point Lookout Sandstone below the "B" Seam coal (i.e. basin compaction features). However, they also set up the character of the deposits that will become the depositional platform of the "A" Seam. From the drilling data, the sequence between the "B" Seam coals and the "A" Seam is impacted by numerous fluvial sandstone channels (possibly braided). These sandstone channels most likely were attracted to the structural lows surrounding the thicker "B" Seam coal deposits. It is upon these variable fluvial deposits that the "A" Seam coal was deposited and that the character of the coal was established (e.g., sulfur and ash trends).

Of special interest is the immediate floor character of the drill holes completed at the northern margin of the project area. These holes have a very distinct sandstone present directly below (within 1-2 feet) the coal seam. The sandstone ranges from 10-12 feet thick and appears from the geophysical logs to be of very uniform grain size, suggesting a barrier beach sand deposition. The sandstone may represent a lower tongue of the above Cliff House Sandstone Formation, which would increase in thickness and merge to the north. The coal seam thickness supports this idea; the coal seam "pod" very quickly splits and thins where this sandstone is present and also the Cliff House Sandstone is closer to the top of the remaining thin coal. If this relationship is correct, the "A" Seam coal will most likely continue to thin and disappear to the north as the tongue and Cliff House Sandstone merge.

This trend appears to be present on the "A" Seam coal isopach map included in the "*National King Coal, Inc. Geologic Report"* (Henderson, 1995). The northern project area would correspond with the thin coal boundary (<4.0 feet thick) identified in the report to the northeast of the mine. This would result in a northwest/southeast trend for the tongue, with a strike of approximately 50-60 degrees. However, the tongue may have an irregular shape and while the general trend may be correct, the influence of the trend may vary with slight transgressions and regressions of the sand along en echelon lineaments or deeper structures (i.e., basinal compaction features). This may explain the presence of the isolated coal deposit up Roberts Canyon and extending to the old Hesperus Coal Mine, however correlation of the coal seams would need to be checked.

b) "A" Seam Coal Deposition: It became evident that the "A" Seam coal had several strong depositional trends. Of extreme importance, it became evident that the National King Coal Mine is not mining within the thick coal pod of the "A" Seam, but is mining only the upper seam of the primary thick coal "pod" present to the northwest (figure 6 and 7). And second, that the higher sulfur trend along the eastern edge of National King Coal Mine is not present in the thicker central coal "pod" of the project area.

1) "A" Seam Coal "Pod": The presence of a thick "A" Seam coal "pod" to the northwest of the National King Coal Mine (figure 7). The formation of the thick coal "pod" was controlled by depositional features present in the Point Lookout Sandstone and the fluvial sandstones directly below, which created a stable depositional platform upon which the "A" Seam coal swamp was established. The "A" Seam "pod" (9-11 feet thick) splits into the Upper "A" Seam coal (4.5-6.0 feet thick) and the Lower "A" Seam coal (3.0-5.0 feet thick) towards the National King Coal Mine. The lower split of the "A" seam quickly splits and thins within a distance of 2000-3000 feet to the southeast. *Note: Thin remnants of the Lower "A" Seam are visible below the Upper "A" Seam as dirty coal bands 0.5-1.0 feet thick in many of the geophysical logs present at National King Coal Mine.*

The "A" Seam "pod" ranges in thickness from 7.9 to 11.7 feet thick, averaging 9.9 feet. The variation in thickness of the pod can be directly related to the immediate fluvial sandstone channels deposited below; the thinner 7.9 feet thick coal has only minor sandstone thickness (6.5 feet thick), while the thicker surrounding holes have 20-35 feet of sandstone present. This slight reduction in the sandstone platform allowed additional sediment into the swamp (drainages), generally reducing the coal thickness at the top and bottom of the bed. While the reduced coal thickness is not a mining concern, it is along the lower thickness trends that minor in-seam partings may also be encountered as thin, lenticular, meandering bands.

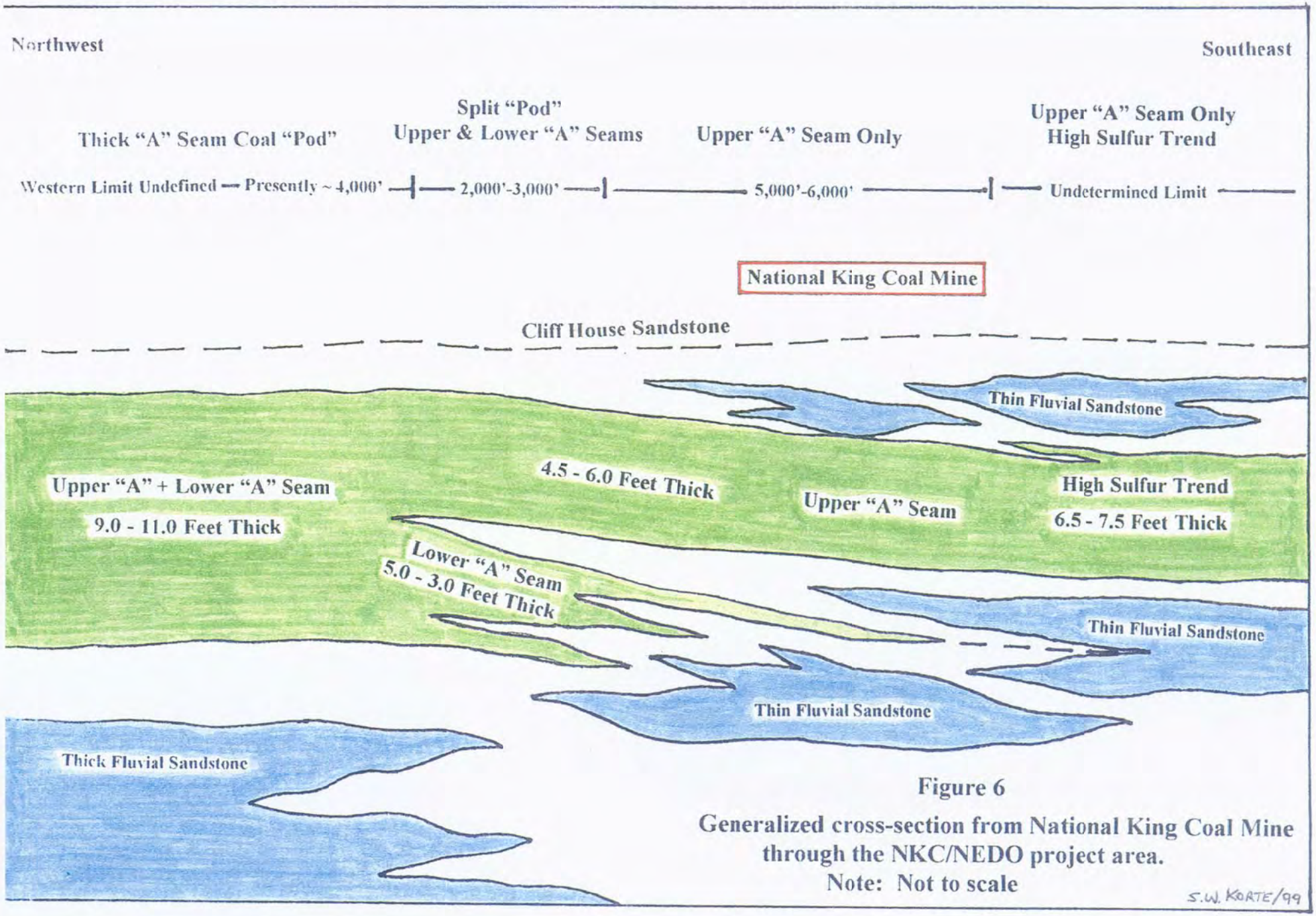

Figure 6

Generalized cross-section from National King Coal Mine through the NKC/NEDO project area.
Note: Not to scale

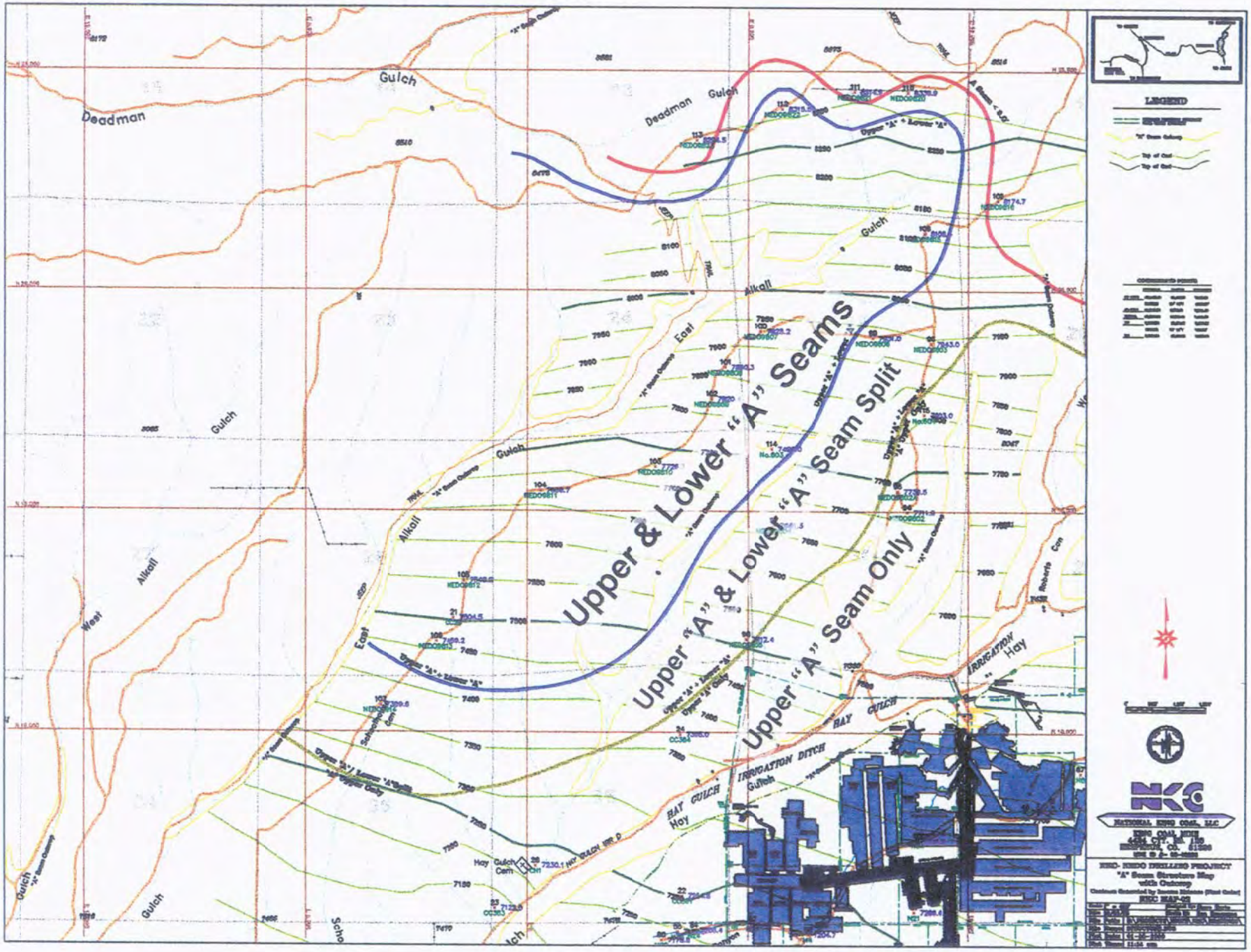

Figure 7 - "A" Seam Structure and Coal Split Lines

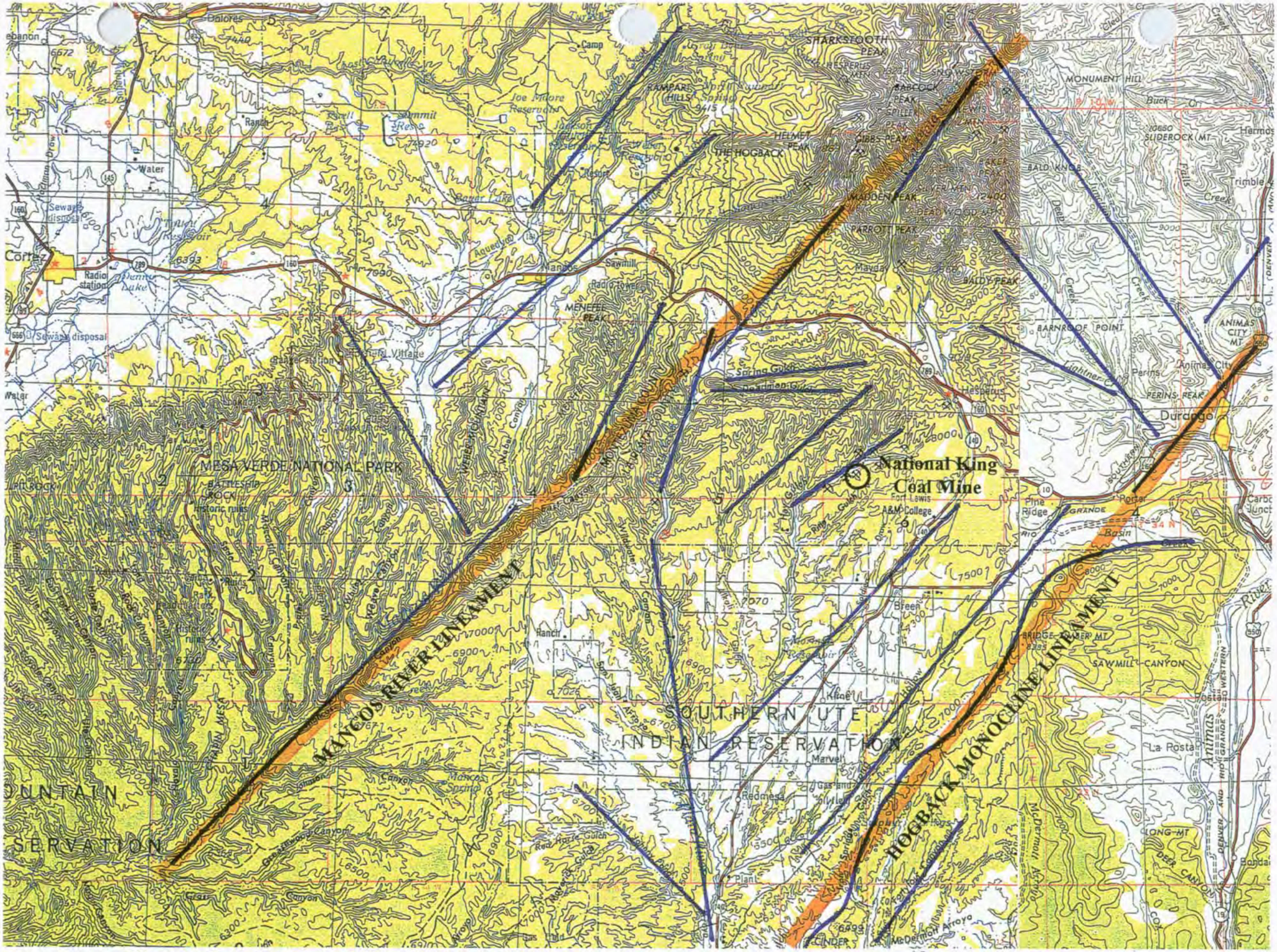

Figure 8 - Regional Surface Lineaments (Blue) and Major Lineament Trends (Orange).

The extent of the thick "A" Seam coal "pod" to the west is presently unknown, however further study on the shape of the deposit is discussed below in the *Structural Trends* section. Dependent upon a continued east-west, structural strike of the seam (figure 7), the coal deposit should extend across the succeeding north-south trending drainages to the west (East and West Alkali Gulchs). While potentially numerous scenarios exist for the western extension of the coal seam (thick "pod", split seams, thin trace or nondepositional), I do not believe that the coal seam will extend at a minable thickness (>4.0 feet) beyond Cherry Creek. However, each additional ridge with minable coal present will greatly increase the reserve total due to the increasing size of the ridge acreage (see Reserve section).

Note: There is an old mine location shown on the topography map along the west side of Cherry Creek (figure 9), however the mine name and coal seam are presently unknown. This should be examined and a visit made to the mine if possible to determine the coal's stratigraphic position and thickness.

2) Sulfur Trends: The high sulfur trends encountered along the eastern margin of National King Coal Mine and found in the mine's core hole data to the east/southeast are the influence of a high sulfur (slightly shaley) coal directly deposited upon the Upper "A" coal seam. The data shows a slight increase in the total thickness of the coal (from 5.0-6.5 to 6.5-7.5 feet) with a corresponding large increase in sulfur content (from 0.60-0.85 to 0.95-1.80 sulfur). The high sulfur trend may represent the initial regression of the Cliff House Sandstone above, resulting in tidal and estuary deposits overlying the coal before the thicker sandstone was deposited. This carbonaceous, salt-water-influenced shale/coal deposit would have been deposited around the depositionally higher, thick central "A" seam "pod."

c) Depositional Roof Trends: The primary depositional feature is the thick Cliff House Sandstone Formation which caps the topographic ridges of the area. The sandstone is very uniform and provides a stable upper roof sequence. Within the project area the interburden between the "A" Seam coal and the Cliff House Sandstone is a series of thin, interbedded silty sandstones and shale layers. Two depositional features of interest are: 1) the Cliff House Sandstone is closer to the "A" Seam coal (less interburden) within the project area and 2) at National King Coal Mine the interburden has increased with a series of small sandstone channel features (i.e., overbank/splay deposits). Within the project area the closer proximity of the Cliff House Sandstone may provide a more stable roof lithology with decreased shale and thin sandstone interbedding.

d) Structural Trends: There are two dominant regional lineament trends present in the area surrounding the project; the Hogback monocline and the Mancos River (figure 8). Both trend N30-40E and represent the influence of deeper crustal strike-slip faults. The two lineaments appear to form the block upon which the "A" seam coal was formed and may have had a significant influence on the character of the deposit. While National King Coal Mine lies within the center of the block, the thicker coal "pod" lies to the west of center (figure 9). It can be assumed that the coal deposit is not uniform, but that the

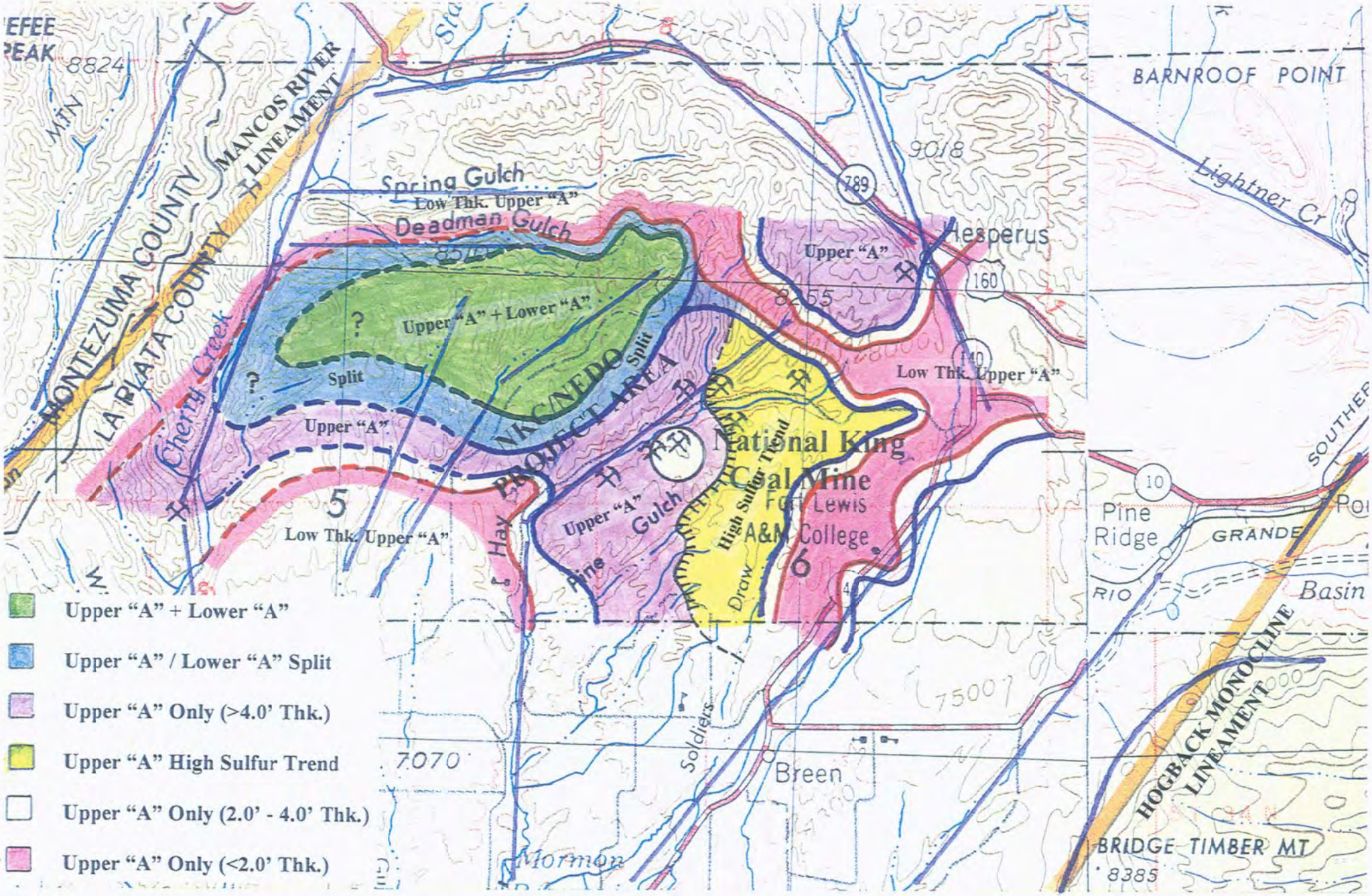

Figure 9 - Local Lineament Trends and "A" Seam Coal Thickness

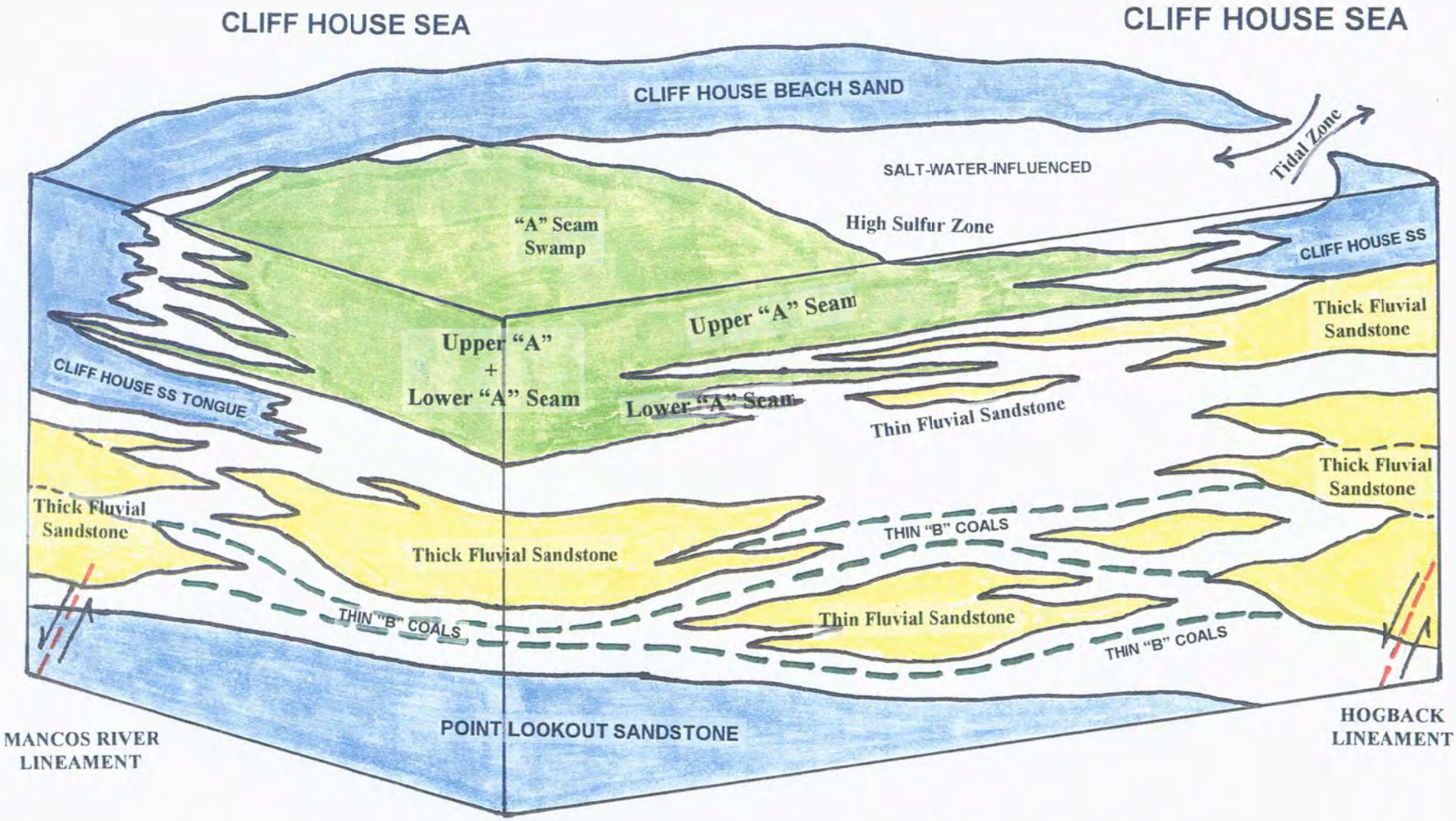

Figure 10 - Generalized Fence Diagram of "A" Seam Depositional Environments

higher, depositional center of the deposit lies along the western margin of the block and that the coal gradually thins to the east with increasing sediment influence (e.g., partings and higher sulfur trend, figure 10).

If the model holds true, then the gradual decline of the coal deposit to the east is opposite to a sharp decline in the thick coal "pod" along the western margin. This could occur by an increase in influence of the Cliff House Sandstone tongue from the northeast (presently visible on the geophysical logs immediately below the "A" Seam in the drill sites on the northern edge of the project area). Another explanation would be the presence of a large fluvial sandstone channel system flowing from the southwest along the Mancos River lineament trend (parallel to Cherry Creek).

The northern edge of the thick coal "pod" is controlled by the northwest-southeast trending strand line (beach sand, figure 10). Beaumont has observed that "the transgressive nearshore and beach facies tend to be lacking in the crossbedded massive sands that are associated with some typical beach deposits" (Beaumont, 1971). This implies that the sandy beach sequences are likely to be in close proximity to the peat deposits, resulting in rapid depositional changes. The data supports this idea, and the coal quickly thins at the northern margin of the deposit. The southern edge of the deposit should have a gradual thinning of the coal similar to the eastern margin, however the distance of depositional change would be greatly decreased (e.g., short axis of the coal deposit normal to the strand line). Variations of this northwest to southeast oriented wedge shaped deposit of coal, bounded by strong structural lineament features, is common in the depositional models which I have created along the western margin of the San Juan Basin.

> *Note: While I feel the above interpretation is sound, the potential extension of the coal reserve to the west is "my best guess" and requires additional information. I have seen lineament trends become the center axis of the coal deposit, however I feel the strength of the Mancos River lineament and the nature of the depositional environment would exclude this possibility.*

The strength of the lineaments present and the area's proximity to the uplifted La Plata Mountains suggest the potential presence of faults or at least weakened rock trends. While there is no evidence of faulting present, it is within the primary depositional directions and lineament trends that structure may occur. Since no strong lineament trends criss-cross the project area, only localized weak roof rock and compaction fractures are anticipated.

National King Coal, LLC
Monitoring Well Analysis - Field Data
King II Project

	1/3/05	1/26/05	2/28/05	3/17/05	4/27/05	5/24/05	6/6/05	7/31/05	8/5/05	9/6/05	10/5/05	12/2/05	3/27/06
Well #1 (Upgradient)													
Time	2:20pm	2:30pm	9:35am	2:45pm	12:01pm	2:25pm	11:03am	9:45am	11:15am	9:05am	3:42pm	1:28pm	11:25am
Temp (deg. C)	7.6	7.1	6.4	8.0	8.9	10.4	12.6	14.4	14.7	14.4	14.2	9.9	8.6
pH	9.41	9.58	9.08	9.45	9.41	9.52	9.67	9.52	9.66	9.55	9.47	9.46	9.72
EC	1157	1146	1156	1159	1137	1122	1103	1134	1124	1115	1110	1125	1135
Depth to Water (inches)	41	36	32	30	26	30	34	44	49	50	52	49	46
TDS	574	579	575	576	568	560	556	550	562	560	555	566	571
Well #2 (Downgradient)													
Time	2:47pm	2:05pm	9:55am	3:07pm	12:15pm	2:40pm	11:20am	10:05am	11:40am	9:22am	3:20pm	1:47pm	11:47am
Temp (deg. C)	4.7	4.0	3.9	5.3	10.5	12.1	16.4	16.1	16.5	15.4	14.1	9.8	7.2
pH	7.05	7.24	7.19	7.55	8.08	7.83	7.66	7.55	7.66	7.7	7.78	7.69	7.45
EC	1051	1057	1032	1061	1011	922	827	740	752	766	788	992	1051
Depth to Water (inches)	26	8	5	2	3	7	11	72	79	77	76	83	88
TDS	527	525	519	536	507	508	413	380	371	384	394	497	524
Hay Gulch Ditch (North of CR 120)													
Time	3:15pm	2:15pm	10:10am	3:22pm	12:40pm	2:53pm	11:42am	10:23am	11:50am	9:40am	3:05pm	2:10pm	11:59am
Temp (deg. C)	1.7	3.0	1.1	8.0	10.7	11.8	12.4	15.3	14.9	14.8	17.0	2.9	6.3
pH	7.91	7.52	8.03	8.01	8.43	8.40	8.35	8.55	8.62	8.22	8.71	8.42	7.91
EC	348	373	470	369	544	473	331	370	382	383	816	840	495
Depth to Water (inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TDS	174	187	236	183	272	236	169	185	191	185	410	415	251

National King Coal, LLC
King II Mine

Montitoring Well Analysis
Well #1: Upgradient

DATE	CALCIUM (mg/L)	IRON (mg/l)	Mg (mg/L)	Mn (mg/L)	SODIUM (mg/L)	Hardness, as CaCO3		Alkalinity, as $CaCO_{3(mg/L)}$	Bicarbonate, as $CaCO_{3(mg/L)}$	Carbonate, as $CaCO_{3(mg/L)}$	Hydroxide, as $CaCO_{3(mg/L)}$	pH	Sulphate (mg/L)	T.D.S. (mg/L)	Temperatue (°C)	Depth to Water (in.)	Conductivity: Field Data (µS/cm)
1/3/2005	3.6	<.05	6.8	<.005	322.0	37		690	390	300	<10	9.51	<10	585	7.6	41	1157
3/17/2005	2.9	0.23	5.5	0.005	253.0	30		620	520	100	<10	9.51	<10	620	8.0	30	1157
6/6/2005	3.1	0.08	6	0.006	248.0	32		600	520	80	<10	9.45	<10	635	12.6	34	1103
8/5/2005	2.9	0.28	7.8	0.010	234.0	39		590	410	180	<10	9.41	<10	600	14.7	49	1124
12/2/2005	2.9	0.05	7.6	0.005	232.0	39		590	410	180	<10	9.13	<10	640	9.9	49	1125
3/27/2006	2.9	0.23	7.5	0.003	245.0	38		610	610	<10	<10	9.58	<10	590	8.6	46	1135

National King Coal, LLC
King II Mine

Monitoring Well Analysis
Well #2: Downgradient

DATE	CALCIUM (mg/L)	IRON (mg/l)	Mg (mg/L)	Mn (mg/L)	SODIUM (mg/L)	Hardness, as CaCO3		Alkalinity, as $CaCO_{3(mg/L)}$	Bicarbonate, as $CaCO_{3(mg/L)}$	Carbonate, as $CaCO_{3(mg/L)}$	Hydroxide, as $CaCO_{3(mg/L)}$	pH	Sulphate (mg/L)	T.D.S. (mg/L)	Temperatue (°C)	Depth to Water (in.)	Conductivity: Field Data (µS/cm)
1/3/2005	97.3	<.05	99.3	0.377	31.9	652		405	405	<10	<10	7.81	190	505	4.7	26	1051
3/17/2005	81.4	<.05	77.5	0.372	25.4	522		376	376	<10	<10	7.70	195	625	5.3	2	1061
6/6/2005	66.2	<.05	60	0.257	23.6	412		324	324	<10	<10	7.69	126	495	16.4	11	827
8/5/2005	55.9	<.05	53.1	0.192	19.4	358		286	286	<10	<10	7.81	108	410	16.5	79	752
12/2/2005	76.4	<.05	73.2	0.189	23.4	492		362	362	<10	<10	7.52	176	610	9.8	83	992
3/27/2006	78.5	<.05	75.7	0.044	26.7	508		400	400	<10	<10	7.81	205	605	7.2	88	1051

National King Coal, LLC
King II Mine

Monitoring Well Analysis
#3: Hay Gulch Ditch

DATE	CALCIUM (mg/L)	IRON (mg/l)	Mg (mg/L)	Mn (mg/L)	SODIUM (mg/L)	Hardness, as CaCO3		Alkalinity, as $CaCO_{3(mg/L)}$	Bicarbonate, as $CaCO_{3(mg/L)}$	Carbonate, as $CaCO_{3(mg/L)}$	Hydroxide, as $CaCO_{3(mg/L)}$	pH	Sulphate (mg/L)	T.D.S. (mg/L)	Temperatue (°C)	Depth to Water (in.)	Conductivity: Field Data (µS/cm)
1/3/2005	48.4	0.05	15.6	<.005	6.1	185		103	103	<10	<10	7.93	57	45	1.7	N/A	348
3/17/2005	42.4	0.06	13.1	0.008	5.5	160		102	100	<10	<10	8.16	67	220	8.0	N/A	369
6/6/2005	36.3	0.07	14.4	0.005	6.3	150		98	96	<10	<10	8.32	62	205	12.4	N/A	331
8/5/2005	39.7	0.08	15.8	<.005	7.0	164		123	121	<10	<10	8.04	62	185	14.9	N/A	382
12/2/2005	78	0.05	44.5	0.008	21.3	378		252	240	12	<10	8.06	162	490	2.9	N/A	840
3/27/2006	48.7	0.05	21.5	0.007	9.4	210		139	133	<10	<10	8.32	96	280	6.3	N/A	495

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-01**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up - Grad.

Sample Date: 01/03/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	3.6	1		
Iron	200.7	0.05	<0.05	1		
Magnesium	200.7	0.5	6.8	1		
Manganese	200.7	0.005	<0.005	1		
Sodium	200.7	0.5	322	1		
Hardness as $CaCO_3$	Calc	10	37	1		

D. Zufelt
for John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-01**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up - Grad.

Sample Date: 01/03/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	690	mg/L		
Bicarbonate as CaCO3	2320B	10	390	mg/L		
Carbonate as CaCO3	2320B	10	300	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	9.51	SU		
Sulfate	4500SO4	10	<10	mg/L		
TDS	2540C	10	585	mg/L		

D. Zufelt
for: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-01**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up - Grad.

Sample Date: 01/03/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	690	mg/L		
Bicarbonate as CaCO3	2320B	10	390	mg/L		
Carbonate as CaCO3	2320B	10	300	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	9.51	SU		
Sulfate	4500SO4	10	<10	mg/L		
TDS	2540C	10	585	mg/L		

D. Zufelt
for: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-02**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down - Grad.

Sample Date: 01/03/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	97.3	1		
Iron	200.7	0.05	<0.05	1		
Magnesium	200.7	0.5	99.3	1		
Manganese	200.7	0.005	0.377	1		
Sodium	200.7	0.5	31.9	1		
Hardness as $CaCO_3$	Calc	10	652	1		

D. Zufelt
FOR: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-02**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down - Grad.

Sample Date: 01/03/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	405	mg/L		
Bicarbonate as CaCO3	2320B	10	405	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	7.81	SU		
Sulfate	4500SO4	10	190	mg/L		
TDS	2540C	10	505	mg/L		

D. Zufelt
FOR John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-03**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Ditch

Sample Date: 01/03/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	48.5	1		
Iron	200.7	0.05	0.05	1		
Magnesium	200.7	0.5	15.6	1		
Manganese	200.7	0.005	<0.005	1		
Sodium	200.7	0.5	6.1	1		
Hardness as $CaCO_3$	Calc	10	185	1		

D. Zufelt
FOR John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **501-032-03**
Date Received: 01/10/05
Date Reported: 01/25/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Ditch

Sample Date: 01/03/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	103	mg/L		
Bicarbonate as CaCO3	2320B	10	103	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	7.93	SU		
Sulfate	4500SO4	10	57	mg/L		
TDS	2540C	10	45	mg/L		

D. Zufelt
FOR John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **503-090-03**
Date Received: 03/22/05
Date Reported: 04/08/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up-Grad.

Sample Date: 03/17/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	2.9	1		
Iron	200.7	0.05	0.23	1		
Magnesium	200.7	0.5	5.5	1		
Manganese	200.7	0.005	0.005	1		
Sodium	200.7	0.5	253	1		
Hardness as $CaCO_3$	Calc	10	30	1		

D. Zufelt
For John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **503-090-03**
Date Received: 03/22/05
Date Reported: 04/08/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up-Grad.

Sample Date: 03/17/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	620	mg/L		
Bicarbonate as CaCO3	2320B	10	520	mg/L		
Carbonate as CaCO3	2320B	10	100	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	9.51	SU		
Sulfate	4500SO4	10	<10	mg/L		
TDS	2540C	10	620	mg/L		

D. Zufelt
For John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.:	**503-090-04**
Date Received:	03/22/05
Date Reported:	04/08/05
QC Batches:	

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down-Grad.

Sample Date:	03/17/05
Sample Matrix:	Water
Units:	mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	81.4	1		
Iron	200.7	0.05	<0.05	1		
Magnesium	200.7	0.5	77.5	1		
Manganese	200.7	0.005	0.372	1		
Sodium	200.7	0.5	25.4	1		
Hardness as $CaCO_3$	Calc	10	522	1		

D. Zufelt
FOR: *John Green, Laboratory Director*

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **503-090-04**
Date Received: 03/22/05
Date Reported: 04/08/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down-Grad.

Sample Date: 03/17/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	376	mg/L		
Bicarbonate as CaCO3	2320B	10	376	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	7.70	SU		
Sulfate	4500SO4	10	195	mg/L		
TDS	2540C	10	625	mg/L		

D. Zerfelt
FOR: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **503-090-05**
Date Received: 03/22/05
Date Reported: 04/08/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Dirn

Sample Date: 03/17/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	42.4	1		
Iron	200.7	0.05	0.06	1		
Magnesium	200.7	0.5	13.1	1		
Manganese	200.7	0.005	0.008	1		
Sodium	200.7	0.5	5.5	1		
Hardness as $CaCO_3$	Calc	10	160	1		

D. Zufelt
FOR: *John Green, Laboratory Director*

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **503-090-05**
Date Received: 03/22/05
Date Reported: 04/08/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Dirn

Sample Date: 03/17/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	102	mg/L		
Bicarbonate as CaCO3	2320B	10	100	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	8.16	SU		
Sulfate	4500SO4	10	67	mg/L		
TDS	2540C	10	220	mg/L		

D. Zuckett
For: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.:	**506-045-03**
Date Received:	06/10/05
Date Reported:	07/01/05
QC Batches:	

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up - Grad.

Sample Date:	06/06/05
Sample Matrix:	Water
Units:	mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	3.1	1		
Iron	200.7	0.05	0.08	1		
Magnesium	200.7	0.5	6.0	1		
Manganese	200.7	0.005	0.006	1		
Sodium	200.7	0.5	248	1		
Hardness as $CaCO_3$	Calc	10	32	1		

D. Zufelt
For: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.:	**506-045-03**
Date Received:	06/10/05
Date Reported:	07/01/05
QC Batches:	

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #1 Up - Grad.

Sample Date: 06/06/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	600	mg/L		
Bicarbonate as CaCO3	2320B	10	520	mg/L		
Carbonate as CaCO3	2320B	10	80	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	9.45	SU		
Sulfate	4500SO4	10	<10	mg/L		
TDS	2540C	10	635	mg/L		

D. Zufelt
For: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.:	**506-045-04**
Date Received:	06/10/05
Date Reported:	07/01/05
QC Batches:	

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down - Grad.

Sample Date:	06/06/05
Sample Matrix:	Water
Units:	mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	66.2	1		
Iron	200.7	0.05	<0.05	1		
Magnesium	200.7	0.5	60	1		
Manganese	200.7	0.005	0.257	1		
Sodium	200.7	0.5	23.6	1		
Hardness as $CaCO_3$	Calc	10	412	1		

D. Zufelt
For: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

GAL I.D.: **506-045-04**
Date Received: 06/10/05
Date Reported: 07/01/05
QC Batches:

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #2 Down - Grad.

Sample Date: 06/06/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	324	mg/L		
Bicarbonate as CaCO3	2320B	10	324	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	7.69	SU		
Sulfate	4500SO4	10	126	mg/L		
TDS	2540C	10	495	mg/L		

D. Zufelt
For John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **506-045-05**
Date Received: 06/10/05
Date Reported: 07/01/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Ditch

Sample Date: 06/06/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	36.3	1		
Iron	200.7	0.05	0.07	1		
Magnesium	200.7	0.5	14.4	1		
Manganese	200.7	0.005	0.005	1		
Sodium	200.7	0.5	6.3	1		
Hardness as $CaCO_3$	Calc	10	150	1		

D. Zufelt
For John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **506-045-05**
Date Received: 06/10/05
Date Reported: 07/01/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME: King / East Alkali
PROJECT NUMBER:
SAMPLE I.D.: #3 Hay Gulch Ditch

Sample Date: 06/06/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	98	mg/L		
Bicarbonate as CaCO3	2320B	10	96	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	8.32	SU		
Sulfate	4500SO4	10	62	mg/L		
TDS	2540C	10	205	mg/L		

D. Zufelt
for John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **508-101-03**
Date Received: 08/11/05
Date Reported: 09/09/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #1 - Up Grad.

Sample Date: 08/05/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	2.9	1		
Iron	200.7	0.05	0.28	1		
Magnesium	200.7	0.5	7.8	1		
Manganese	200.7	0.005	0.010	1		
Sodium	200.7	0.5	234	1		
Hardness as $CaCO_3$	Calc	10	39	1		

D. Zufelt
FOR: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **508-101-03**
Date Received: 08/11/05
Date Reported: 09/09/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #1 - Up Grad.

Sample Date: 08/05/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	590	mg/L		
Bicarbonate as CaCO3	2320B	10	410	mg/L		
Carbonate as CaCO3	2320B	10	180	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	9.41	SU		
Sulfate	4500SO4	10	<10	mg/L		
TDS	2540C	10	600	mg/L		

D. Zufelt
FOR: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.:	**508-101-04**
Date Received:	08/11/05
Date Reported:	09/09/05
QC Batches:	

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #2 - Down Grad.

Sample Date:	08/05/05
Sample Matrix:	Water
Units:	mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	55.9	1		
Iron	200.7	0.05	<0.05	1		
Magnesium	200.7	0.5	53.1	1		
Manganese	200.7	0.005	0.192	1		
Sodium	200.7	0.5	19.4	1		
Hardness as $CaCO_3$	Calc	10	358	1		

D. Zufelt
FOR: John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **508-101-04**
Date Received: 08/11/05
Date Reported: 09/09/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #2 - Down Grad.

Sample Date: 08/05/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	286	mg/L		
Bicarbonate as CaCO3	2320B	10	286	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	7.81	SU		
Sulfate	4500SO4	10	108	mg/L		
TDS	2540C	10	410	mg/L		

For: D. Zufelt
John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **508-101-05**
Date Received: 08/11/05
Date Reported: 09/09/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #3 - Haygulch Ditch

Sample Date: 08/05/05
Sample Matrix: Water
Units: mg/L

Dissolved Metals

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DILUTION	DATE ANALYZED	ANALYST
Calcium	200.7	0.5	39.7	1		
Iron	200.7	0.05	0.08	1		
Magnesium	200.7	0.5	15.8	1		
Manganese	200.7	0.005	<0.005	1		
Sodium	200.7	0.5	7.0	1		
Hardness as $CaCO_3$	Calc	10	164	1		

FOR: D. Zufelt
John Green, Laboratory Director

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **508-101-05**
Date Received: 08/11/05
Date Reported: 09/09/05
QC Batches:

National King Coal, LLC
4424 CR 120
Hesperus, CO 81326
Attention: Tom Bird

PROJECT NAME:
PROJECT NUMBER:
SAMPLE I.D.: #3 - Haygulch Ditch

Sample Date: 08/05/05
Sample Matrix: Water

Wet Chemistry

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	UNITS	DATE ANALYZED	ANALYST
Alkalinity as CaCO3	2320B	10	123	mg/L		
Bicarbonate as CaCO3	2320B	10	121	mg/L		
Carbonate as CaCO3	2320B	10	<10	mg/L		
Hydroxide as CaCO3	2320B	10	<10	mg/L		
pH	150.1	NA	8.04	SU		
Sulfate	4500SO4	10	62	mg/L		
TDS	2540C	10	185	mg/L		

D. Zufelt
For: John Green, Laboratory Director

Fri Aug 26 12:26:48 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0432338
Permit 210372

Div	7	**Wd**	33
Basin		**Md**	
Engineer	DV7	**User**	RAB

Full Name
UTE MOUNTAIN UTE INDIAN TRIBE

Address
C/O STANLEY LONGWELL
5652 CO RD 120

City	**State**	**Zip**
HESPERUS	CO	81334

Telephone
(970) 565-3751

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SE

Q160 NE

Sec 36

Ts 35 North

Rng 12 West

Pm New Mex

3400 feet from South Section line

400 feet from East Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
35.01

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Depth**
Proposed	15.00	0.00	0
Actual	0.00	0.00	0

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 1300

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	06-19-1998	Well permit issued.
Interim Status		
Last Action	08-14-1998	Record change. A portion of the file was modified/corrected.
Permit Issued	06-23-1998	
Permit Expires	06-23-2000	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

Fri Aug 26 12:28:20 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0013226
Permit 8218 AD

Div 7 **Wd** 33
Basin **Md**
Engineer JST **User** JST

Full Name
CO BRD LND COMMISSIONERS
Address

City DENVER **State** CO **Zip** 80203
Telephone
( ) -

Case
Permit XRef
Well Name
County LA PLATA
Q10
Q40 SW
Q160 SW
Sec 36
Ts 35 North
Rng 12 West
Pm New Mex

Subdivision **Filing** **Block Lot**

Parcel Size **PIN**
0.00

Uses
IRRIGATION

	Pump Rate	Ann Amt	Dept
Proposed	0.00	0.00	0
Actual	0.00	0.00	0

Irrigated Area 0.00 acres
Elevation 0
Perf Casing Top 0
Perf Casing Bottom 0
Water Level 0
Aquifer1 ALL UNNAMED AQUIFERS
Aquifer2
Driller
Pump Installer

Statute	Meter	Log	Qual	AbReq
	No	No	No	No

Comment

Main Activity		Application denied.
Interim Status		
Last Action	08-12-2005	Record change. A portion of the file was modified/corrected.
Permit Issued	06-06-1979	
Permit Expires		
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:45:23 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0532066
Permit 260656

Div 7 **Wd** 33
Basin **Md**
Engineer DDW **User** DDW

Full Name
NATIONAL KING COAL INC

Address
4424 CR 120

City HESPERUS **State** CO **Zip** 81326-

Telephone
(970) 385-4528

Case

Permit XRef

Well Name HAY GULCH ALLUVIAL 2

County LA PLATA

Q10

Q40 SW

Q160 SW

Sec 36

Ts 35 North

Rng 12 West

Pm New Mex

50 feet from South Section line

700 feet from West Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses

OTHER

MONITORING WELL

	Pump Rate	Ann Amt	Dept
Proposed	0.00	0.00	15
Actual	0.00	0.00	0

Irrigated Area 0.00
Elevation 0
Perf Casing Top 0
Perf Casing Bottom 0
Water Level 0
Aquifer1 ALL UNNAMED AQUIFERS
Aquifer2
Driller LIC
Pump Installer

Statute	Meter	Log	Qual	AbReq
6023	No	No	No	No

Comment

Main Activity	11-17-2004	Well permit issued.
Interim Status		
Last Action	12-01-2004	Well permit issued.
Permit Issued	12-01-2004	
Permit Expires	12-01-2006	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:35:26 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0016554
Permit 90325 VE

Div 7 **Wd** 33
Basin **Md**
Engineer **User** RAB

Full Name
WILSON JOHN

Address
13400 CO RD 120

City HESPERUS **State** CO **Zip** 81326

Telephone
( ) -

Case

Permit XRef 108185 A

Well Name

County LA PLATA

Q10

Q40 NW

Q160 NE

Sec 6

Ts 34 North

Rng 11 West

Pm New Mex

530 feet from South Section line

2400 feet from East Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

	Pump Rate	Ann Amt	Dep
Proposed	0.00	0.00	0
Actual	0.00	0.00	0

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 858

Pump Installer

Statute	Meter	Log	Qual	AbReq
	No	No	No	No

Comment

Main Activity	07-11-1990	Verbal approval granted to well construction contractor.
Interim Status		
Last Action	03-08-1995	Record change. A portion of the file was modified/corrected.
Permit Issued	07-11-1990	
Permit Expires		
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:35:47 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 9123673
Permit 92816

Div	7	**Wd**	33
Basin		**Md**	
Engineer		**User**	

Full Name
SHAFER CHARLES

Address
840 E. 6TH AVE.

City	**State**	**Zip**
DURANGO	CO	81301

Telephone
( ) -

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SE

Q160 SE

Sec 6

Ts 34 North

Rng 11 West

Pm New Mex

400 feet from South Section line

50 feet from East Section line

Subdivision **Filing** **Block Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

	Pump Rate	**Ann Amt**	**Dep**
Proposed	0.00	0.00	0
Actual	7.00	0.00	115

Irrigated Area 1.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 52

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
	No	No	No	No

Comment

Main Activity
Interim Status
Last Action
Permit Issued
Permit Expires
Expire Notice Sent
Well Const Report
Well Const Complete
Well Report (Non-trib)
Pump Install Report
Pump Install Complete
1st Beneficial Use 11-09-1977
Statement Benef. Use
Benef Use (Non-trib)
Abandonment Report
Well Plugged

ri Aug 26 12:36:10 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0107467
Permit 108185

Div	7	**Wd**	33
Basin		**Md**	
Engineer		**User**	RAB

Full Name
PAUL JOHN

Address
4318 COUNTY ROAD 203

City	**State**	**Zip**
DURANGO	CO	81301

Telephone
( ) -

Case

Permit XRef 173238

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SE

Sec 6 U

Ts 34 North

Rng 11 West

Pm New Mex

990 feet from South Section line

2200 feet from East Section line

Subdivision **Filing** **Block Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Dep**
Proposed	15.00	1.50	50
Actual	0.50	0.00	372

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 317

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 344

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
	No	No	No	No

Comment

Main Activity	06-04-1979	Canceled well permit.
Interim Status	09-27-1993	Canceled well permit.
Last Action	03-08-1995	Record change. A portion of the file was modified/corrected.
Permit Issued	07-02-1979	
Permit Expires		
Expire Notice Sent		
Well Const Report	10-09-1979	
Well Const Complete	09-21-1979	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use	09-21-1979	
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report	*08-19-1992*	
Well Plugged	07-21-1992	

ri Aug 26 12:36:43 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0358185
Permit 173238

Div	7	**Wd**	33
Basin		**Md**	
Engineer	FML	**User**	RAB

Full Name
WILSON JOHN

Address
13400 CR 120

City	**State**	**Zip**
HESPERUS	CO	81326

Telephone
(303) 247-5056

Case

Permit XRef 108185

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SE

Sec 6 U

Ts 34 North

Rng 11 West

Pm New Mex

530 feet from South Section line

2400 feet from East Section line

Subdivision **Filing** **Block Lot**

Parcel Size **PIN**
0.00

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	Ann Amt	Dep
Proposed	0.00	0.00	0
Actual	15.00	0.00	55

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 34

Perf Casing Bottom 55

Water Level 30

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 858

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	07-29-1993	Well permit issued.
Interim Status		
Last Action	03-08-1995	Record change. A portion of the file was modified/corrected.
Permit Issued	09-27-1993	
Permit Expires	09-27-1995	
Expire Notice Sent		
Well Const Report	03-11-1993	
Well Const Complete	08-29-1990	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:36:28 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0315596
Permit 108185 A

Div 7 **Wd** 33
Basin **Md**
Engineer MAM **User** RAB

Full Name
WILSON JOHN

Address
13400 CR 120

City HESPERUS **State** CO **Zip** 81326

Telephone
( ) -

Case

Permit XRef 173238

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SE

Sec 6 U

Ts 34 North

Rng 11 West

Pm New Mex

530 feet from South Section line

2400 feet from East Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	Ann Amt	Depth
Proposed	15.00	1.50	50
Actual	15.00	0.00	55

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 34

Perf Casing Bottom 55

Water Level 30

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 858

Pump Installer

Statute	Meter	Log	Qual	AbReq
6023	No	No	Yes	No

Comment
90325 VE

Main Activity	07-16-1990	Well permit issued.
Interim Status	08-28-1992	Expired well permit.
Last Action	03-08-1995	Record change. A portion of the file was modified/corrected.
Permit Issued	08-28-1990	
Permit Expires		
Expire Notice Sent		
Well Const Report	03-11-1991	
Well Const Complete	08-29-1990	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:37:09 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0406318
Permit 197706

Div 7 **Wd** 33
Basin **Md**
Engineer DV7 **User** LMD

Full Name
ASPAAS HELEN RUTH

Address
17238 STATE HIGHWAY 140

City HESPERUS **State** CO **Zip** 81326

Telephone
(970) 385-4500

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SE

Sec 6

Ts 34 North

Rng 11 West

Pm New Mex

1000 feet from South Section line

550 feet from West Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

	Pump Rate	Ann Amt	Depth
Proposed	0.00	0.00	0
Actual	15.00	3.00	70

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller LR

Pump Installer

Statute	Meter	Log	Qual	AbReq
6025	No	No	No	No

Comment
1ST USE-07/01/1890

Main Activity	09-06-1996	Well permit issued.
Interim Status		
Last Action	09-17-1996	Well permit issued.
Permit Issued	09-10-1996	
Permit Expires		
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:38:21 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 9701317
Permit 249530

Div	7	**Wd**	33
Basin		**Md**	
Engineer	HMP	**User**	JD1

Full Name
WATERS BILL

Address
3016 E 6TH AVE

City	**State**	**Zip**
DURANGO	CO	81301-

Telephone
(970) 247-5848

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 NW

Q160 SW

Sec 1

Ts 34 North

Rng 12 West

Pm New Mex

1534 feet from South Section line

110 feet from West Section line

Subdivision **Filing** **Block Lot**

Parcel Size	**PIN**
40.00	5665-024-00-004

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Depth**
Proposed	15.00	3.00	200
Actual	0.00	0.00	180

Irrigated Area 1.00 ACRES

Elevation 0

Perf Casing Top 60

Perf Casing Bottom 160

Water Level 5

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 1374

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	02-28-2003	Well permit expiration date extended.
Interim Status	05-23-2005	Well location amendment accepted and updated.
Last Action	06-10-2005	Well construction report received.
Permit Issued	04-21-2003	
Permit Expires	04-21-2006	
Expire Notice Sent		
Well Const Report	06-08-2005	
Well Const Complete	06-01-2005	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:38:33 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 9701316A
Permit 249531

Div	7	**Wd**	33
Basin		**Md**	
Engineer	HMP	**User**	HMP

Full Name
PAULEK TYLER

Address
35 CR 231

City	**State**	**Zip**
DURANGO	CO	81303-

Telephone
(970) 259-5979

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SW

Sec 1

Ts 34 North

Rng 12 West

Pm New Mex

1000 feet from South Section line

1150 feet from West Section line

Subdivision **Filing** **Block Lot**

Parcel Size	**PIN**
40.00	5655-024-00-004

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Depth**
Proposed	15.00	3.00	200
Actual	0.00	0.00	0

Irrigated Area 1.00 ACRES

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller LIC

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	02-28-2003	Well permit issued.
Interim Status		
Last Action	04-21-2003	Well permit issued.
Permit Issued	04-21-2003	
Permit Expires	04-21-2005	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:38:41 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0106499
Permit 106701

Div	7	**Wd**	33
Basin		**Md**	
Engineer	DAN	**User**	DAN

Full Name
CRAIG MARY ANN

Address
1901 FLORIDA RD

City	**State**	**Zip**
DURANGO	CO	81301

Telephone
( ) -

Case

Permit XRef 189391

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SW

Sec 1 U

Ts 34 North

Rng 12 West

Pm New Mex

100 feet from South Section line

1200 feet from West Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Deptl**
Proposed	15.00	1.50	50
Actual	0.00	0.00	0

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller LIC

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
	No	No	No	No

Comment

Main Activity	05-10-1979	Well permit issued.
Interim Status	05-22-1981	Expired well permit.
Last Action	08-29-2001	Record change. A portion of the file was modified/corrected.
Permit Issued	05-22-1979	
Permit Expires	05-22-1981	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:38:50 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0390613
Permit 189391

Div 7 **Wd** 33
Basin **Md**
Engineer DV7 **User** RJG

Full Name
BONTRAGER DANIEL

Address
1710 C R 121

City HESPERUS **State** CO **Zip** 81326

Telephone
( ) -

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SW

Sec 1 U

Ts 34 North

Rng 12 West

Pm New Mex

100 feet from South Section line

1200 feet from West Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
0.00

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	Ann Amt	Dept
Proposed	15.00	3.00	50
Actual	4.00	0.00	230

Irrigated Area 0.00 acres

Elevation 0

Perf Casing Top 40

Perf Casing Bottom 60

Water Level 28

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 1300

Pump Installer

Statute	Meter	Log	Qual	AbReq
6023	No	No	No	No

Comment

Main Activity	08-31-1995	Well permit issued.
Interim Status	02-25-1998	Change in ownership accepted and updated.
Last Action	02-26-1998	Change in ownership accepted and updated.
Permit Issued	09-05-1995	
Permit Expires	09-05-1997	
Expire Notice Sent		
Well Const Report	09-22-1997	
Well Const Complete	11-28-1996	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:39:02 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0461287
Permit 189391 A

Div 7 **Wd** 33
Basin **Md**
Engineer DAN **User** DAN

Full Name
BONTRAGER DANIEL

Address
1710 C R 121

City HESPERUS **State** CO **Zip** 81326-

Telephone
(970) 385-4209

Case

Permit XRef 189391

Well Name

County LA PLATA

Q10

Q40 SW

Q160 SW

Sec 1 U

Ts 34 North

Rng 12 West

Pm New Mex

100 feet from South Section line

1200 feet from West Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size **PIN**
37.00

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	Ann Amt	Depth
Proposed	4.00	0.00	230
Actual	0.00	0.00	0

Irrigated Area 1.00 ACRES

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 871

Pump Installer

Statute	Meter	Log	Qual	AbReq
6023	No	No	No	No

Comment

Acreage including county road easement measu res to approximately 37 acres (county assesso rs map)

Main Activity	05-30-2000	Well permit issued.
Interim Status		
Last Action	06-09-2000	Well permit issued.
Permit Issued	06-13-2000	
Permit Expires	06-13-2002	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

Fri Aug 26 12:40:30 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 0538866A
Permit 263365

Div	7	**Wd**	33
Basin		**Md**	
Engineer	CDK	**User**	CDK

Full Name
PAULEK RANDY

Address
5000 CR 116

City	**State**	**Zip**
HESPERUS	CO	81326-

Telephone
(970) 385-4381

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 NE

Q160 SE

Sec 2

Ts 34 North

Rng 12 West

Pm New Mex

1583 feet from South Section line

656 feet from East Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size	**PIN**
40.00	5655-027-00-004

Uses

DOMESTIC

STOCK

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Depth**
Proposed	15.00	3.00	260
Actual	0.00	0.00	0

Irrigated Area 1.00 ACRES

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller LIC

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	05-17-2005	Well permit issued.
Interim Status		
Last Action	05-23-2005	Well permit issued.
Permit Issued	05-23-2005	
Permit Expires	05-23-2007	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

ri Aug 26 12:40:52 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 9701316
Permit 249532

Div	7	**Wd**	33
Basin		**Md**	
Engineer	HMP	**User**	HMP

Full Name
PAULEK TYLER

Address
85 CR 231

City	**State**	**Zip**
DURANGO	CO	81303-

Telephone
(970) 259-5979

Case

Permit XRef

Well Name

County LA PLATA

Q10

Q40 SE

Q160 SE

Sec 2

Ts 34 North

Rng 12 West

Pm New Mex

1160 feet from South Section line

480 feet from East Section line

Subdivision **Filing** **Block** **Lot**

Parcel Size	**PIN**
40.00	5655-024-00-004

Uses

DOMESTIC

ISSUED UNDER PRESUMPTION 3b-IIA

	Pump Rate	**Ann Amt**	**Deptl**
Proposed	15.00	3.00	200
Actual	0.00	0.00	0

Irrigated Area 1.00 ACRES

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 0

Water Level 0

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller LIC

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
6023	No	No	No	No

Comment

Main Activity	02-28-2003	Well permit issued.
Interim Status		
Last Action	04-21-2003	Well permit issued.
Permit Issued	04-21-2003	
Permit Expires	04-21-2005	
Expire Notice Sent		
Well Const Report		
Well Const Complete		
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use		
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

Fri Aug 26 12:41:00 MDT 2005

COLORADO DIVISION OF WATER RESOURCES

Receipt 9123889
Permit 100453

Div	7	**Wd**	33
Basin		**Md**	
Engineer		**User**	RAB

Full Name
CRAWFORD PAUL

Address
1220 FAIRGROUNDS RD SP104

City	**State**	**Zip**
FARMINGTON	NM	87401

Telephone
( ) -

Case

Permit XRef

Well Name CRAWFORD #1

County LA PLATA

Q10

Q40 NW

Q160 NW

Sec 2 U

Ts 34 North

Rng 12 West

Pm New Mex

600 feet from North Section line

600 feet from West Section line

Subdivision **Filing** **Block Lot**

Parcel Size **PIN**
0.00

Uses
DOMESTIC

	Pump Rate	**Ann Amt**	**Deptl**
Proposed	0.00	0.00	0
Actual	8.00	1.30	339

Irrigated Area 1.00 acres

Elevation 0

Perf Casing Top 0

Perf Casing Bottom 46

Water Level 196

Aquifer1 ALL UNNAMED AQUIFERS

Aquifer2

Driller 344

Pump Installer

Statute	**Meter**	**Log**	**Qual**	**AbReq**
	No	No	No	No

Comment

Main Activity	07-17-1978	Well permit issued.
Interim Status		Exempt wells where no statement of use is required (obsolete).
Last Action	07-02-1997	A portion of the file was updated during general review.
Permit Issued	10-04-1953	
Permit Expires		
Expire Notice Sent		
Well Const Report	10-04-1978	
Well Const Complete	08-18-1978	
Well Report (Non-trib)		
Pump Install Report		
Pump Install Complete		
1st Beneficial Use	08-18-1978	
Statement Benef. Use		
Benef Use (Non-trib)		
Abandonment Report		
Well Plugged		

STANDARD LABORATORIES INC.
NORTHERN DIVISION
P.O. BOX 214
CRESSON, PA 16630
(814) 886-7400

STANDARD LABORATORIES,INC.

DATE: 10-20-2005
SAMPLE NO. 871136

NATIONAL KING COAL, LLC
P.O. BOX 2827
DURANGO, COL. 81301

SAMPLE ID: NEDO 13 FLOOR

OPERATING CO.:
SAMPLED BY: CUSTOMER PROVIDED
MINE:
LOCATION:

DATE SAMPLED: 9/22/05
WEATHER:
GROSS WEIGHT:

DATE RECEIVED: 9/22/05

OTHER ID:

CERTIFICATE OF ANALYSIS

	ASTM METHOD	AS DETERMINED
PYRITIC SULFUR	D2492	0.21%
SULFATE SULFUR	D2492	0.38%

TRACE ELEMENTS

D3683 D3684 D3684 (MODIFIED)

ARSENIC		20.96 PPM
BARIUM		580.10 PPM
CADMIUM	<	0.05 PPM
CHROMIUM		34.80 PPM
COPPER		23.20 PPM
IRON		11834.60 PPM
MERCURY	<	0.50 PPB
MAGNESIUM		1113.80 PPM
MANGANESE		34.80 PPM
MOLYBDENUM	<	0.30 PPM
LEAD		78.90 PPM
SELENIUM		2.32 PPM
ZINC		39.40 PPM

APPROVED BY
APPROVED BY

N/A

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STANDARD LABORATORIES, INC.

GOULD ENERGY DIVISION
P.O. BOX 214
CRESSON, PA 16630
(814) 886-7400

NATIONAL KING COAL, LLC
P.O. BOX 2827
DURANGO, CO 81301

DATE: 10-20-2005
SAMPLE NO: 871136

DATE SAMPLED: 9/22/05

DATE RECEIVED: 9/22/05

SAMPLE ID: NEDO 13 FLOOR

CERTIFICATE OF ANALYSIS

Paste pH		4.9	
Conductivity		350	umho/cm
Total Combustible Solids		2.15%	

SOLUBLE ELEMENTS

Calcium		11.5	ppm
Magnesium		6.40	ppm
Sodium		79.0	ppm
Nitrate	<	0.10	ppm
Boron		0.052	ppm

APPROVED BY Lori Patray

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STANDARD LABORATORIES INC.
NORTHERN DIVISION
P.O. BOX 214
CRESSON, PA 16630
(814) 886-7400

STANDARD LABORATORIES,INC.

DATE: 10-26-2005
SAMPLE NO. 871137

NATIONAL KING COAL,LLC
P.O. BOX 2827
DURANGO, COL. 81301

SAMPLE ID: NEDO 13 ROOF

OPERATING CO.:
SAMPLED BY: CUSTOMER PROVIDED
MINE:
LOCATION:

DATE SAMPLED: 9/22/05
DATE RECEIVED: 9/22/05
WEATHER:
GROSS WEIGHT:

OTHER ID:

CERTIFICATE OF ANALYSIS

	ASTM METHOD	AS DETERMINED
PYRITIC SULFUR	D2492	0.13%
SULFATE SULFUR	D2492	0.25%

TRACE ELEMENTS

D3683 D3684 D3684 (MODIFIED)

ARSENIC		15.58 PPM
BARIUM		130.00 PPM
CADMIUM	<	0.05 PPM
CHROMIUM		24.00 PPM
COPPER		16.80 PPM
IRON		10094.70 PPM
MERCURY	<	0.50 PPB
MAGNESIUM		1321.90 PPM
MANGANESE		60.10 PPM
MOLYBDENUM	<	0.30 PPM
SELENIUM		1.72 PPM
ZINC		74.50 PPM
LEAD		69.70 PPM

APPROVED BY Lori Pathney

APPROVED BY

N/A

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STANDARD LABORATORIES, INC.

GOULD ENERGY DIVISION
P.O. BOX 214
CRESSON, PA 16630
(814) 886-7400

NATIONAL KING COAL, LLC
P.O. BOX 2827
DURANGO, CO 81301

DATE: 10-20-2005
SAMPLE NO: 871137

DATE SAMPLED: 9/22/05

DATE RECEIVED: 9/22/05

SAMPLE ID: NEDO 13 ROOF

CERTIFICATE OF ANALYSIS

Paste pH		5.3	
Conductivity		638	umho/cm
Total Combustible Solids		0.75%	

SOLUBLE ELEMENTS

Calcium		54.0	ppm
Magnesium		25.0	ppm
Sodium		72.0	ppm
Nitrate	<	0.10	ppm
Boron	<	0.050	ppm

APPROVED BY

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History Colorado- Office of Archaeology and Historic Preservation
COLORADO CULTURAL RESOURCE SURVEY
LIMITED-RESULTS CULTURAL RESOURCE SURVEY FORM
(Page 1 of 3)

OAHP 1420
Revised 9/98

This form (#1420) is for small scale limited results projects - block surveys less than 160 acres with linear surveys under four miles. Additionally, there should be no sites and a maximum of four Isolated Finds. This form must be typed.

I. IDENTIFICATION

1. Report Title (include County): A Class III Cultural Resources Inventory for King II Mine 2014 Exploration Core Drilling, La Plata County, Colorado
2. Date of Field Work: 01/29/2014
3. Form completed by: Kathy Mowrer Date: 02/19/2014
4. Survey Organization/Agency: SWCA Environmental Consultants (SWCA)
   Principal Investigator: Alex Wesson
   Principal Investigator's Signature: A L Wesson
   Other Crew: Kathy Mowrer
   Address: 130 Rock Point Dr., Suite A, Durango, CO 81301
5. Lead Agency / Land Owner: Colorado State Land Board
   Contact: Tobin Follenweider
   Address: 1127 Sherman Street, #300, Denver, Colorado 80203
6. Client: GCC Energy LLC
7. Permit Type and Number: CO State 2013-57
8. Report / Contract Number: SWCA Report No. 14-56
9. Comments: The proposed project area is on state land.

II. DESCRIPTION OF UNDERTAKING / PROJECT

10. Type of Undertaking: SWCA was contracted by GCC Energy, LLC, to conduct an intensive pedestrian survey for nine proposed exploration core drilling sites.
11. Size of Undertaking (acres): 2.07 Size of Project (if different)
12. Nature of the Anticipated Disturbance: The exploration drilling program will be implemented using a truck-mounted drill rig utilizing existing graded roads to access the drill hole locations. No grading or other ground-disturbing activity is proposed for the existing access roads.
13. Comments: GCC will require an area of approximately 100 feet X 100 feet (10,000 square feet or 0.23 acre) at each proposed drill hole location.

III. PROJECT LOCATION

Please attach a photocopy of USGS Quad. clearly showing the project location. The Quad. should be clearly labeled with the Prime Meridian, Township, Range, Section(s), Quad. map name, size, and date. Please do not reduce or enlarge the photocopy.

14. Description: The proposed project is in Section 36, Township 35 North, and Range 12 West, west of the town of Durango in La Plata County, Colorado.

15. Legal Location: Quad. Map: Hesperus 37108-C1 Date(s): 1968
Principal Meridian: 6th __ NM X Ute __

NOTE: Only generalized subdivision ("quarter quarters") within each section is needed

Township: 35N Range: 12W Sec.: 36 1/4s NW,
Township: 35N Range: 12W Sec.: 36 1/4s NE,
Township: 35N Range: 12W Sec.: 36 1/4s SW

If section(s) is irregular, explain alignment method: _____

16. Total number of acres surveyed: 9

17. Comments: Although the current project is not located on Bureau of Land Management (BLM) land, SWCA surveyed a 1-square-acre area at each proposed drill hole location following BLM guidelines for coal drilling projects (BLM Colorado Handbook of Guidelines and Procedures for Inventory, Evacuation and Mitigation of Cultural Resources). This allows for an approximately 100-foot cultural resource survey buffer around the proposed 0.23-acre area of disturbance at each location.

IV. ENVIRONMENT

18. General Topographic Setting: The project area is characterized by forested, south-facing ridges surrounded by steep canyons and mountainous terrain. Most of the proposed drill hole locations sit on ridge tops along graded roads.

Current Land Use: Although the project area is within the State Permit Boundary for the King II Mine, the area does not appear to have been used recently.

19. Flora: Natural vegetation varies slightly at each of the proposed drill hole locations but is generally characterized by piñon and juniper trees, with a few ponderosa pine and sagebrush, cottonwood, Gambel oak, rabbitbrush, yucca, and various grasses and forbs.

20. Soils/Geology: The primary types of soil in the project area are approximately 50 percent Zyme soils, 20 percent rock outcrops, 15 percent Ustic Torriorthent soils, and 15 percent other minor soil components (Natural Resources Conservation Service 2012). The soil observed in the field was a loose to moderately compacted, brownish orange sandy clay loam.

21. Ground Visibility: Surface visibility was good, ranging between 80 and 100 percent.

22. Comments: Small patches of snow were present within the survey area at most of the nine drill holes.

V. LITERATURE REVIEW

23. Location of File Search: Online Compass database Date: January 30, 2014

24. Previous Survey Activity - In the project area: Two previous surveys have been conducted within Section 36. Survey LP.CO.R4 consisted of a Cultural Resource Inventory of East Alkali Mine, Hay Gulch Area, La Plata County, Colorado, conducted in 2005. Survey LP.NP.R1 was conducted for Archaeological Resources for the Animas La Plata Project for the 1975 Season.

III. LITERATURE REVIEW (continued)

25. Known Cultural Resources - In the project area: None

    In the general region (summarize): Two sites, one isolated find (IF), and one isolated feature, were previously recorded within Section 36 (outside of the current project area). The sites consist of 5LP.1418, the Tipotsch Mine recorded in 1985, and 5LP.197, a possible multicomponent site recorded in 1976. The Tipotsch Mine was determined not eligible for the National Register of Historical Places (NRHP) and no determination of eligibility is listed for 5LP.197, the multicomponent site. The isolated feature, 5LP.7831, consists of a historic trash dump recorded in 1985. The site is considered not eligible for the NRHP. The isolated find, 5LP.7830, consists of two prehistoric stone tools and is also considered not eligible for the NRHP.

26. Expected Results: Results were expected to be limited, based on the file search.

VI. STATEMENT OF OBJECTIVES

27. To locate, record, and evaluate any prehistoric and historic cultural resources in the proposed project area.

VII. FIELD METHODS

28. Definitions: Site A discrete locus of patterned human activity greater than 50 years of age and consisting of 10 or more artifacts, with or without features.

    IF One artifact, or very few artifacts, that do not represent patterned behavior.

29. Describe Survey Method: This investigation was a Class III, 100 percent, pedestrian survey of the project area. Two SWCA archaeologists completed the pedestrian survey by walking parallel transects spaced approximately 15 m (50 feet) apart. The total surveyed area was 9 acres, which encompassed the nine proposed drill hole locations. Mapping was conducted with a handheld Trimble global positioning system (GPS) unit.

VIII. RESULTS

30. List IFs if applicable. Indicate IF locations on the map completed for Part III.

    A. Smithsonian Number: 5LP10542 Description: Isolated Find

    One IF was identified near proposed drill hole CO-14-4. The IF consists of two fragments of aqua bottle glass. The fragments measured 3.5 × 2.5 × 0.5 cm and 5 × 2 × 0.5 cm. The largest appears to be a bottle base with maker's mark "B57." See map below for location.

31. Using your professional knowledge of the region, why are there none or very limited cultural remains in the project area? The overall small area of the survey and the rugged terrain most likely account for the lack of cultural remains observed. Is there subsurface potential? Buried cultural remains are unlikely in this erosional environment.

Figure 1. Overview of proposed drill hole CO-14-8, view to the south.

Figure 2. Overview of proposed drill hole CO-14-3, view to the east.

Figure 3. Overview of project vegetation northeast of CO-14-9, La Plata Mountains in the background, view to the north.

Figure 4. Detail of aqua bottle glass bottle base, 5LP10542.

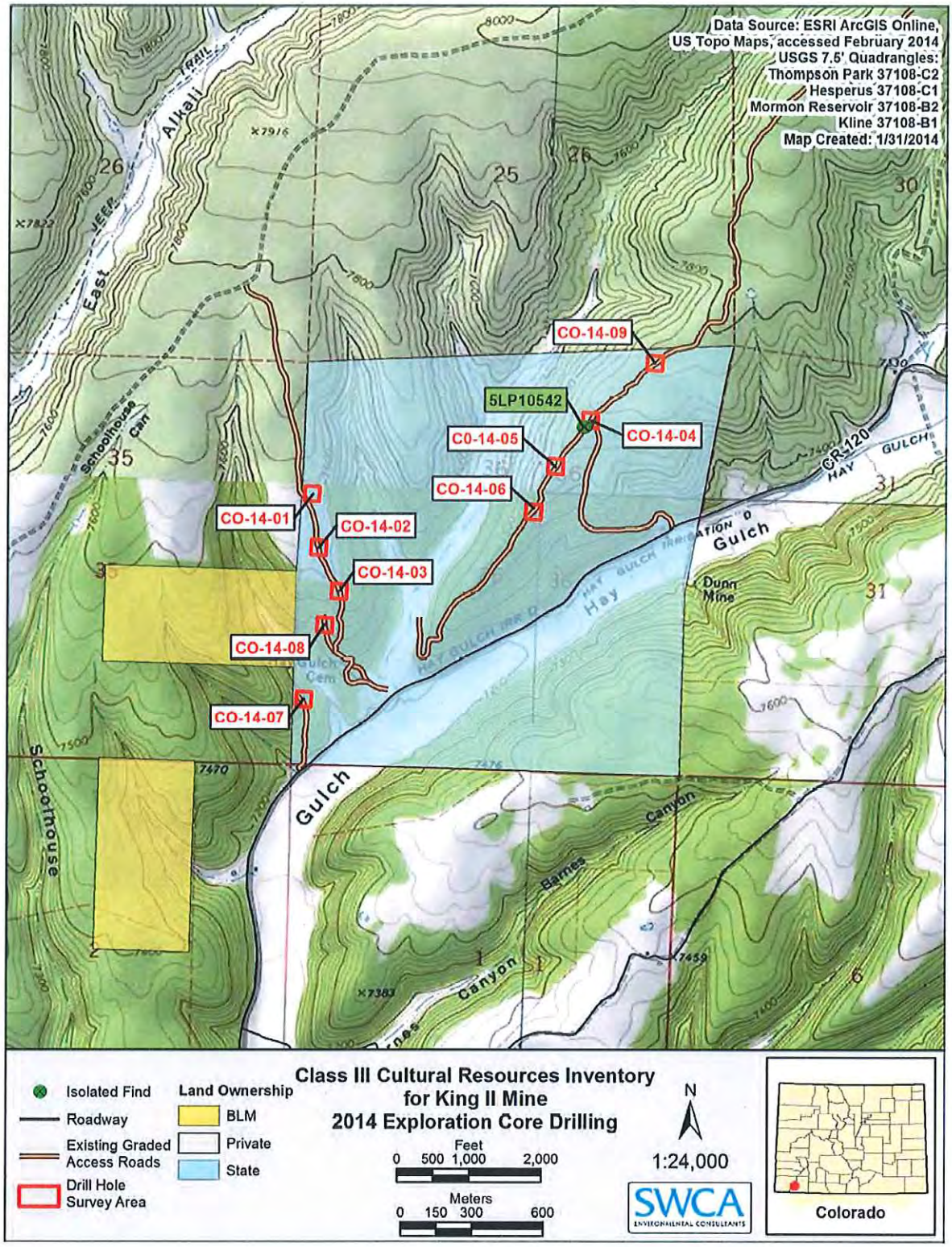


Figure 5. Project area.

EFFECTS OF MINING ON GROUND WATER

King Coal Mine

La Plata County, Colorado

Fred M. Johnson, Geologist

May 18, 1981

November 1993

CONTENTS

Location Map
Introduction
Conclusions
Geology
Hydrogeology
    Surface Water
    Ground Water
Water Pollution Control
Geologic Plan and
Idealized Cross Section

November 1993

INTRODUCTION

This report was prepared at the request of National King Coal, Inc. The report is an addendum to Colorado Mined Land Reclamation Permit No. C-81-035. The purpose of the investigation and report is to determine the effects of underground mining on ground water at the King Coal Mine. The mine permit area is located in portions of Section 28, 29, 31 and 32, T35N, R11W, N.M.P.M., La Plata County, Colorado. The investigation included an examination of both the underground workings and the surface plant and a review of all available geologic and hydrogeologic literature and maps.

CONCLUSIONS

1) Underground mining at the King Coal Mine will have no effect on water within the aquifers of the Mesa Verde Group nor on water within the Hay Gulch alluvial valley fill. This includes all surface and subsurface waters within and adjacent to the area of investigation.
2) The mine area lies stratigraphically above the favorable aquifer of the Mesa Verde Group and vertically above the piezometric surface of the Hay Gulch drainage. Underground workings are dry.
3) The mined seam is breached by erosion up dip.
4) Surface runoff through the mine plant area is treated in sedimentation ponds to prevent contamination of the Hay Gulch drainage.
5) Shales within the lower Menefee Formation prevent downward percolation of water into underlying aquifers.
6) A search of the records of the Colorado Division of Water Resources indicates no water wells down dip (south) of the mine area which would be affected by mining. A field search of Pine Gulch and its tributaries found no springs which would be affected by mining. Additionally, the erosion breach up dip would prevent any effect on wells to the north.
7) Examination of out crops and underground workings indicates no water within or above the mined seam.

8) By definition (Section 1.04.10 page 9), Pine Gulch within and adjacent to the permit area is not an alluvial valley floor.

GEOLOGY

The King Coal Mine lies within an area which consists entirely of sedimentary rocks of the Mesa Verde Group of Cretaceous alluvial valley fill of Hay Gulch.

Higher elevations are capped by the Cliff House Sandstone which is the youngest formation of the Mesa Verde Group. The formation consists of irregular to lenticular ledges of hard fine-to medium-grained calcareous sandstone enclosed in softer argillaceous fine sandstone, mudstone and silty shale. The upper portion of the formation has been eroded, leaving a local average thickness of 350 feet. The Cliff House Sandstone overlies the Menefee Formation.

The Menefee Formation is the middle and coal bearing formation of the Gulch. The Menefee consists of a complex assemblage of lenticular cross-bedded sandstones, gray brown and black shales and coal beds. The formation is characterized by irregular bedding and rapid lateral changes in lithology. The Menefee Formation has a local average thickness of 300 feet. The Menefee formation overlies the Point Lookout Sandstone which is the basal formation of the Mesa Verde Group.

The Point Lookout Sandstone is not exposed within the area of investigation but outcrops from 2 to 4 miles to the north and up dip. The formation is divided into two members; an upper massive sandstone member, consisting of thick, massive beds of even-textured, medium-grained sandstone which forms conspicuous cliffs to the north of the area of investigation (2 to 4 miles); and a lower member made up of thin sandstone beds and inter-bedded shale that comprises a transition sequence above the Mancos Shale. The Point Lookout Sandstone has a local average thickness of 400 feet.

The Mancos shale, also a Cretaceous age, is a dark gray to black marine shale which outcrops approximately 4 miles north and up dip. The Mancos Shale has a local thickness which may exceed 2,000 feet. Bedding strikes east-west and dips 2° to 3° south. .

HYDRO-GEOLOGY

Surface Water:

The property lies on the drainage divide between Hay Gulch and Pine Gulch (a tributary of Hay Gulch). The property drains well to the north and south, with all drainage tributary to Hay Gulch and thence the La Plata River. Surface drainage flows directly into Hay Gulch or Pine Gulch and recharges or saturates the alluvial valley fill of Hay Gulch. Only limited surface water might enter the exposed bedrock because of poor aquifer characteristics.

The King Coal Mine entries lie vertically above the Hay Gulch drainage.

Athough Hay Gulch is an alluvial valley floor with water availability sufficient for subirrigation or flood irrigation agricultural activities, Pine Gulc is not. Unconsolidated deposits of debris form at the junction of tributanies. Bedrock is exposed on steeper gradients of Pine Gulch and its tributaries. Unconsolidated deposits are frequently breached to bedrock with rapid runoff. Inspections during the wettest periods of the years May 1988, 1989 & 1990, have revealed no surface flow, no springs and no flow in the breached unconsolidated deposits. It is the practice to visually survey the area each spring and National King Coal, Inc. will continue to monitor the surface water hydrology.

Ground Water

The formations which are exposed in the area of investigation (Cliff House Sandstone and Menefee Formation) are not considered adequate aquifers because of their poor porosity and lack of continuous permeability. The physical characteristics of these formations are described under Geology. These formations have been breached by erosion up dip (north). Indication of their poor aquifer characteristics is lack of water in mine workings, over 4000 feet down dip from the coal outcrop.

The Massive Sandstone Member of the underlying Point Lookout Sandstone is considered a potential aquifer. Porosity and permeability are generally good. Recharge of the aquifer is along

the outcrop which is approximately 2 to 4 miles to the north of the mine area. This member of the Point Lookout Sandstone is separated from the overlying minable coal seams by generally impermeable clay shales of the Lower Menefee Formation. The lower member of the Point Lookout Sandstone lacks the porosity and permeability to be considered a potential source of water and grades into the underlying Mancos Shale.

The Mancos Shale, which underlies the Point Lookout Sandstone, is almost totally impermeable except where fractured.

WATER POLLUTION CONTROL

Surface runoff through the mine plant surface is caught in drainage ditches and carried to settling ponds. Retention in these ponds prevents contamination of Hay Gulch drainage and the La Plata River.

During periods of heavy precipitation, uncontaminated water from above the mine area can be diverted directly to Hay Gulch (See Drainage Plan). Such water would be from the west drainage above the mine entry. Drainage from the east is not diverted to Hay Gulch as it crosses the disturbed area created by an access road and cattle trail used by a neighboring property owner. Reclamation of this area would eliminate this owner's access to his property.

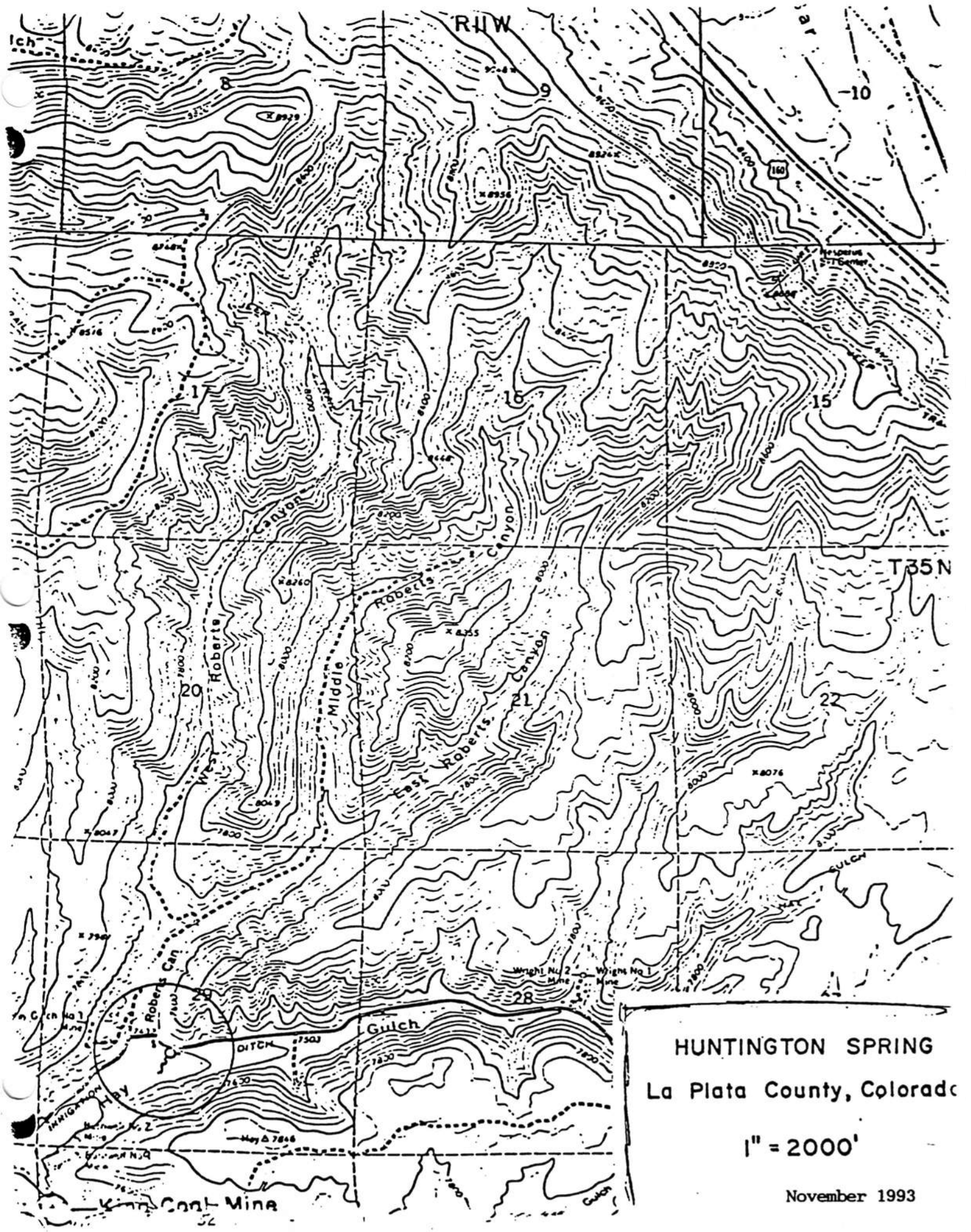
Field examination of the outcrops of the Menefee Formation indicates that shales within the Lower Menefee Formation will prevent downward percolation of waters and thus prevent possible contamination of the potential aquifer within the underlying Massive Sandstone Member of the Point Lookout Sandstone.

Other control measures, which include diversion of water away from the mine entry have been designed by National King Coal. These measures are beyond the scope of this report.

Fred M. Johnson

Fred M. Johnson, C.P.G., A.I.P.G. #2718

November 1993



HUNTINGTON SPRING

La Plata County, Colorado

1" = 2000'

November 1993

RESOURCE HYDROGEOLOGIC SERVICES

101 W. 11TH ST. #103
DURANGO, CO 81301
TELEPHONE: (970) 764-4920
EMAIL: INFO@RESOURCEHYDROGEOLOGIC.COM

TECHNICAL MEMORANDUM

To	GCC Energy LLC	**Ref #**	TM 2017-005-022
CC	Ecosphere Environmental Services	**Date**	March 8, 2017
From	Terry Gulliver, Landon Beck		
Subject	Probable Hydrologic Consequences – King II Mine Expansion		

This Probable Hydrologic Consequences (PHC) is intended to be a stand-alone summary of the likely hydrologic impacts of the expansion of the King II Mine in Hay Gulch, near Hesperus, CO. It sketches the hydrologic environment as defined by baseline studies and the monitoring program which was the basis of that baseline definition, and which will continue to report the continuance of, or any impacts to, the hydrologic balance of the permit area and the vicinity.

The current application for expansion is for an existing room-and-pillar coal mine into adjoining panels. The operator, GCC, has operated this mine and the King I Mine on the other side of Hay Gulch, in the same seam, for almost 20 years. This experience adds significant confidence in the understanding of the probable hydrologic impacts of the expansion, which is also extended by an expansion of the monitoring program (several new monitoring well clusters are being installed at the time of this application, and new data will be incorporated as addenda). It is anticipated that the new data will confirm earlier baseline characterization, that the potential for impacts from the King II expansion to the hydrology of the permit area and vicinity is not significant.

The target coal is a high grade metallurgical coal in a tongue of sedimentary strata laid down by advance and retreat of a shoreline of the inland sea that occupied the western interior of North America in the Cretaceous. The wedge of shoreline sandstone (the Point Lookout Sandstone), swamps behind the coastal barrier (the Menefee Formation containing shales and some coals), and the overlying Cliff House Sandstone deposited as the shoreline receded, overly the marine Mancos Shale and underlie the Lewis Shale (though the Lewis is eroded away near the King mines). The gently tilted strata are moderately dissected in the area of interest by ephemeral drainages cut into the Menefee Formation, with ridges capped by the Cliff House Sandstone. King II portals are driven directly into the target “A” seam, off Hay Gulch and above the elevation of its alluvial valley floor. Both mines have single portal areas. Mining height is approximately equal to the seam thickness so there is very little waste rock, and what there is is presently staged with containment near the King I portal.

Bedrock aquifers in the area are the lower Menefee, which contains some sandstones and coal, and the Point Lookout. Many domestic wells in the general area are screened across the two, to achieve sufficient yield of poor to acceptable water quality. There are no municipal wells in the area, nor water resources which would support them. The Cliff House is unsaturated in the area and there are no wells completed in it, though some perched water supports small transient roof inflow to the mine, and one seep discovered in 2015 with poor quality and a flow less than a gallon per hour, but significant to wildlife (seasonally it is a wallow). Both Cliff House and Point Lookout sandstones are fine grained and somewhat cemented, and have low permeabilities even where they are saturated. Lateral flow in the Cliff House from recharge at higher elevation is precluded by its long ridge cap exposure between steep gulches on most sides.

There are no alluvial domestic wells in the area, that water having undesirably high salts concentrations. GCC maintains several monitoring wells in the Hay Gulch alluvium, upgradient of King I and downgradient of King II portals, and in between.

The only surface water in the mine area is an irrigation ditch (Hay Ditch) which imports water into the catchment from the La Plata River to promote pasture via spreader dikes, and the single seep.

A branch of the Hay Gulch Ditch is routed via ditch and pipeline to furnish water to the King II mine. All the water use at the mine is consumed by bathhouse facilities (which have underground septic waste capture) and dust control. Apart from the very small occasional roof seeps there is no mine inflow, and the mine discharges no water.

Surface facilities (buildings and work areas near the portals) are isolated by diversion ditches to capture sediments from storm events through the operational period. The pond is designed to contain the modeled sediment of nine, 25-year, 24-hour storm events. Annual inspections of the pond and residual capacity, and regular inspections of diversion structures, are part of the regular monitoring program.

Potential hydrologic impacts of mines typically considered are diminution of groundwater resources by diversion, damage to existing water wells, or contamination through either mine discharge or leachates from waste.

- There is small likelihood of diminution of groundwater. The overburden is essentially dry, and there are no mine inflows to date other than transient roof drips.
- The upper Menefee containing the target coal is an aquitard, the coal itself is dry and there are no floor or wall seeps. Existing domestic wells source aquifers below the mine interval, and with water levels below the mined seam.
- There has been no subsidence over mined panels in the past due to the competence of the Cliff House Sandstone roof, except that some minor cracking has been observed at surface. There are no gulches whose water is liable to diversion by subsidence. There will be no impacts to alluvial groundwater since there is no mining under alluvium (the seam is everywhere above the valley floor).
- The mine currently discharges no water, and is unlikely to generate any leachate which will reach surface in the future as a gravity discharge. Mine water use will desist when operations cease.
- Waste rock is not staged in valley fill where it might be subjected to leaching (and generation of acidity by oxidation of pyrite). The very small amount of waste rock generated is staged in a pile with ditch and sediment pond containments, and the leachate potential (and its acid/alkali generation) are currently being quantified by drilling and lab analyses. No acidity has been observed to date, indicating oxidation of pyrite is probably balanced by dissolution of calcium carbonate in the waste.

A hydrology reclamation plan is currently limited to the abandonment, recontouring and vegetation of surface facilities such as portals, offices and maintenance buildings, and diversion ditches and the pond. The monitoring of groundwater and surface water will continue to the reclamation phase, and any adverse impacts that might occur, unforeseen, will be responded to appropriately through communication with the agency and approval of mitigation plans.

There are no other active mining operations in the area (there were several historic small mines directly off upper Hay Gulch), and so the cumulative hydrologic consequences of the King II expansion in the catchment are also not susceptible of prediction.

KING I & II COAL MINE AREA HYDROLOGIC STUDY LA PLATA COUNTY, COLORADO

Submitted to:
GCC ENERGY, LLC

Date:
January 31, 2016

Resource Hydrogeologic Services, Inc.
PO Box 2836
Durango, CO 81302
Tel: (970) 403-3665
Email info@resourcehydrogeologic.com

RESOURCE HYDROGEOLOGIC SERVICES

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1 OBJECTIVE

The objective of this report is to compile, analyze and review all available hydrologic data collected in the Hay Gulch study area, La Plata County, Colorado, with specific focus on the potentially affected area near the GCC Energy (GCC) King I and II Coal Mines.

2 INTRODUCTION

The Hay Gulch study area is located in rural La Plata County, Colorado. The nearest town of Hesperus, CO has a population of approximately 2,200 people. The area is traditional ranch land with division amongst private, State of Colorado, Bureau of Land Management (BLM) Ute Mountain Ute and Southern Ute land and mineral ownership. A more recent subdivision of parcels for housing developments has occurred and is generally scattered throughout. A location map of the area is provided as Figure 2-1. Underground coal mining, specifically in the immediate Hay Gulch area and accessed by La Plata County Road 120, has been ongoing for approximately 120 years. Current mining is ongoing at the King II Mine with operations conducted by GCC Energy LLC (GCC) at that location since 2006. The approximate area of underground operations is 565 acres as of July 2015 with production of roughly 1 million tons per year. Previously, GCC operated the King I underground coal mine located approximately 2 road miles to the southeast. The King I mine was in operation since 1938. Most of the coal produced at King II is transported by truck to Gallup, New Mexico for transfer by rail to markets in the Southwestern US and Mexico for the manufacture of cement. GCC operates under regulatory authority of the Colorado Department of Reclamation, Mining and Safety (CDRMS) and the Mine Safety and Health and Administration (MSHA).

3 REGIONAL GEOLOGY & THE COAL RESOURCE

The study area is located at the northwest margin of the San Juan Basin, which extends from southwestern Colorado into northwestern New Mexico, covering an area of approximately 26,000 square miles. This sedimentary basin contains rocks of Late Cretaceous age (100-65 Ma), which were deposited along the extreme western boundary of the very large Western Interior Seaway, a feature which essentially cut North America, as we know it today, into eastern and western halves. Coal formation was prominent in this environment due to a series of regressive/transgressive migrations of the shoreline in a northeast/southwest trend. These cycles created an inter-fingered deposition of non-marine and marine sediments specifically from barrier beach, marginal-shore swamps, marsh and other lower coastal-plain sourced sediments. (CDRMS, 2014) The low energy swamp and marsh environments were the coal-forming depositional areas.

STRATIGRAPHY

Exposed bedrock within the study is representative of lithologic units contained within the late Cretaceous age Mesaverde Group. In order of increasing depth from land surface, these formations are the Cliff House Sandstone Formation (Cliff House), the Menefee Formation (Menefee) and the Point Lookout Sandstone Formation (Point Lookout). Quaternary age sediments are primarily present in stream channels or otherwise eroded areas as fluvial and colluvial deposits including clays, silts, sands and gravels. Some glacial outwash material has been observed in isolated areas. (Consulting & Coal Services, 1995). Figure 3-1 shows the geologic mapping that has been conducted regionally. Figure 3-2 shows the relevant stratigraphy of the study area.

Cliff House Sandstone Formation

The Cliff House is the youngest and uppermost formation in the study area and therefore dominates the surface exposure. The thickness averages 350 feet within the study area and is dissected by drainages originating from mesa tops. The Cliff House is of marine origin and is characterized by lenticular ledges of hard, fine to medium-grained, calcareous sandstone in a matrix of softer, clayey sandstones, silty shales and mudstones. This formation thins to the east and transitions to finer-grain rock. (CDRMS, 2014)

Menefee Formation

The Menefee is a non-marine assemblage of sandstones, shales, siltstones and coals. This formation thins at the eastern and western margins of the study area, and is generally observed to have irregular bedding and rapid lateral transitions in lithology. The thickness within study area is approximately 300 feet. No true marker bed identifies the contact between the overlying Cliff House and the Menefee (Consulting & Coal Services, 1995). The coal seams of interest to the Hay Gulch study area are contained within the Menefee. Up to seven coal seams have been documented by the US Geological Survey (CDRMS, 2014). However two seams, the “A” and “B”, are the most substantially characterized by previous studies, due to the exploration focus on these seams for their preferred thickness, quality and consistency to the remaining seams.

Point Lookout Formation

The Point Lookout is the lowermost formation of the Mesaverde Group and is divided into two members. The upper member is characterized by homogenous, massive, thick medium-grained sandstone. The basal member consists of thin sandstone beds interbedded with shale. This lower member thickens to the east (seaward), while the upper member thins to the west (landward). In the study area, the Point Lookout averages a total thickness of 400 feet, with the upper member approximately 100 feet thick and the lower member about 300 feet thick. (CDRMS, 2014)

DEPOSITION

The depositional environment during the formation of the San Juan Basin was created by a condition of shoreline fluctuations due to local erosion events and the general rise and fall of the Western Interior Seaway. Numerous studies document the depositional trends of the San Juan Basin, with particular focus on the Mesaverde Group and coal formation. These studies include Beaumont, 1971; Johnson, 1981; Consulting & Coal Services, Inc. 1995; CDRMS, 2014. Historical shorelines created linear trends where thick deposits of peat could accumulate behind barrier beach sands. This environment was characterized as low energy and is evidenced by the presence of deposits of adequate peat thickness necessary to eventually form coal. The result was lenticular coal deposits that formed with their long axis parallel to the shoreline. Despite the general low energy environment of deposition, major drainages cross-cut the peat accumulation in a general perpendicular direction, as rivers and streams generally flow perpendicular to the shoreline. In the study area, these drainages are oriented in a northeast/southwest trend, which continues to persist in present day... Erosion caused by these cross-cutting drainages led to localized sediment deposition features including deltas, estuaries and open lagoons. This Cretaceous age drainage pattern is important to the Menefee coal formation as it caused non-deposition, partial and total coal cut-outs as well as splitting and thinning of seams.

Sandstone observed immediately above the "A" seam, the uppermost Menefee coal seam, exhibits ripple-mark bedding features with some thin laminations of coal. Ripple-marks found in non-marine environments could have been caused when stream beds became choked with sediment resulting in braided conditions. Consulting & Coal Services, 1995, suggests that this abundance of sediment could have been introduced by increased mountain building activity at that time. However, braided stream channels are generally low energy and the slow, gentle deposition of these sediments seems to have preserved much of the peat accumulation, observed in present day as the "A" seam.

Similar interpretations were made with regard to the formation of the "B" seam, although its poor lateral continuity suggests even more interruptions in peat deposition by increased sediment loading of local drainage systems. Characteristics of the "B" seam roof rock suggest a more dynamic burial and deposition of the "B" seam swamp than the "A" seam swamp. Additionally the discontinuous "B" seam may reflect the relatively weaker depositional platform (i.e. the foundation upon which it settled). Major structures dominating the paleotopography of the Point Lookout likely compromised the ability for the "B" seam swamp sediments to uniformly compact, causing what is observed in present day as seam splits, thinning and disappearance. Channel sands appear to have settled in these low areas surrounding the "B" seam deposits, resulting in the observed fluvial sandstones.

Overall, this dynamic depositional environment created the lateral discontinuities in rock type and characteristics observed in outcrop and drill hole data of the Menefee Formation. In order to fully

evaluate the coal production potential and assess the risks associated with exploration and mining of the study area, a depositional model was prepared, in part for the support of the mine permit (CDRMS, 2014) which is used as a predictive tool for best practice mine planning. This model is based on a wealth of drill hole, core hole and mined coal data held by GCC. The model defines the coal into "A" and "B" seam pods, with focus on the "A" seam pod. The "A" seam pod averages a thickness of 9.9 feet with a range of 7.9 to 11.7 feet and is the current mined interval at King II.

The Cliff House represents the greater roof sequence of the subject coals in the study area. As discussed previously, the Cliff House is a very uniform and thick sandstone. The interburden between the Cliff House and the "A" seam is a series of thin interbedded silty sandstones and shales. (CDRMS, 2014) The deposition of the Cliff House signals the change from a lower energy transitional depositional environment to a higher energy marine depositional environment.

STRUCTURE

The study area has been impacted by numerous structural trends in the Four Corners area as documented by Baars and Stevenson, 1981, but dominated by the uplift of the La Plata and greater San Juan Mountains to the north. As a result, the bedding in the Mesaverde Group and the coals in particular dip at 2-3 degrees to the south/southwest. With respect to faulting in the study area, CDRMS, 2014 indicates "It is highly probable that faulting is present in the region surrounding the project area, however the results (core descriptions, geophysical logs and structure map) of drilling both the mine and project areas have not revealed the presence of any significant faults (>30 feet displacement)."

HISTORICAL COAL MINING IN HAY GULCH

Coal mining in the Hesperus and Hay Gulch area has been ongoing for the last 120 years with the earliest mine, Hesperus Coal Mine, beginning operations in 1892. The bulk of historical mining activity occurred between the 1920s and 1970s, providing coal for domestic use. King Coal Mine (King I) opened in 1936 and was the last mine in Hay Gulch to close (2007), as the owner GCC moved operations one mile west/northwest to what is now the King II mine. La Plata County's first coal mines were small independent, unregulated operations, drift mining hillside exposures and eventually developing underground shafts. Table 3-1 provides the dates of operation and available information on these mining operations. Figure 3-3 shows the location of these historical coal mines and their proximity to the King I and II mines.

At the King I mine, resources from both the "A" and "B" seams were mined. Information related to historical mining at the King I mine is limited and the naming conventions used for the seams have varied over the years, and from mine to mine. However, based on the known coal resources of the Hay Gulch

area, the remaining mines were likely extracting from the "A", and/or "B" seams. It is possible that some of the thinner and deeper seams may have been targeted if proven to be economic at those specific locations. As of 2016, the only coal bed being mined in the Hay Gulch area is the "A" seam.

4 REGIONAL HYDROGEOLOGY AND GEOCHEMICAL PROCESSES

To properly frame the hydrogeology and geochemical processes of the King I and II Mine study area, background information regarding the recorded climate data is presented as Table 4-1. The study area is characterized as a high desert with a fairly large daily temperature variance, low precipitation and very low humidity. The area surrounding the study area is mountainous, with an elevation range of approximately 5,000 feet above mean sea level to the south of the study area and over 13,000 feet in the La Plata Mountains to the north of the town of Hesperus.

SURFACE WATER

Surface water in the study area, and specifically the vicinity of the King I and II mines, is very limited. No perennial streams or otherwise natural bodies of water exist in the Hay Gulch watershed, a tributary to the La Plata River. The meandering distance of Hay Gulch from the portal of the King I Mine to the confluence of the La Plata River is approximately 9 miles. Just upstream of the confluence is Mormon Reservoir, an approximate 26 acre reservoir constructed in 1910 for irrigation water. The approximate capacity is 1100 acre-feet and it is a stock holder-owned project. (Seyfarth, 2010) The shortest direct distance from the King I Mine underground workings to the La Plata River is approximately 1.5 miles, but this distance crosses a topographic high that represents the Hay Gulch surface watershed boundary to the east. Pine Gulch and Rattlesnake Gulch are ephemeral drainages that cross above the King I Mine underground workings but are tributary to Hay Gulch. Figure 4-1 shows the surface water features within the study area.

The Hay Gulch Ditch is routed from the La Plata River at Hesperus, CO to the area on the mesa east of Hay Gulch. From there it splits to go down into Hay Gulch with a lateral feature called Huntington Ditch which continues south approximately one mile and then turns west across the mesa crossing over the King I mine. The Huntington Ditch continues westward beyond the King I mine workings to a small pond that drains toward the Huntington Pipeline. The pipeline was installed in the late 1980's or early 1990s. As a precaution, GCC lined a section of the ditch, just west of the pond, in an area which had been mined at depth. The ditch runs year-round and continues westward to just south of King II surface facilities, where it drops off the hill and feeds ranch property below. (Bird, 2016)

Approximately 14.07 acre-feet of water is acquired by GCC from the Ditch each year for mining dust suppression and bath house facility operations. The water is purchased from a commercial water provider in accordance with the Colorado District Court Water Division 7 (Decree 07W100, April 20, 2011). The purpose and fate of the water used within the mine is discussed in Section 6, however, it is important to note here that no water is discharged out of the mine onto the ground surface.

The contribution of groundwater to surface water is expected to be low, temporary and possibly only occurring during excessively high precipitation years. This follows the general principle that in arid climates, surface water feeds groundwater systems. This topic is discussed in more detail in the following sections regarding interconnection of surface water, alluvial groundwater and bedrock groundwater.

Because of the arid climate and lack of perennial streams, natural surface water in the study area is therefore limited to stormwater runoff. Winter and spring snowmelt as well as flash flooding resulting from thunderstorms feed the receiving drainages during these events. La Plata County maintains hydrologic structures such as ditches, culverts and headwalls along the County roads within the study area to control and minimize effects of stormwater runoff. GCC also maintains engineered stormwater diversion and collection structures including ditches, culverts, retention basins within King I and II Mine permit areas. These structures are in part required to meet standards for a facility wastewater discharge permit by Colorado Department of Public Health and Environment (CDPHE). This permit addresses effluent and stormwater discharges, and imposes significant monitoring, inspection, and maintenance requirements.

Surface water quality data for the area is very limited, due to the infrequent flow. Hay Gulch Ditch is an irrigation ditch with some spreader dikes following the valley floor, gaining considerably during storm events from side tributaries such as Pine Gulch. The ditch effectively empties into Mormon Reservoir at a distance approximately 9 miles below the King I Mine. Only one water sample analysis from 1975 is available from the Mormon Reservoir, and quarterly compliance samples are collected from the Hay Gulch Ditch. Water quality data from the Mormon Reservoir sample and average water quality data from Hay Gulch Ditch were compared to alluvial groundwater composition, as represented by samples collected from the Wiltze well and alluvial GCC Well #2 Downgradient, and presented in Figure 4-2... Water quality in the Merman Reservoir appears to be most similar to the alluvial groundwater composition exhibited in the Wiltze well, with additional evapoconcentration processes affecting the composition of Mormon Reservoir. Both the Wiltze well and Mormon Reservoir appear to have some chloride, showing as the difference between sum of major ions (except chloride) and TDS. Water quality in the alluvial GCC Well #2 Downgradient also indicates relatively low solute groundwater... Results of the Hay Gulch Ditch indicate relatively dilute, fresh water from the La Plata River. It is discussed in Section 4 how salinity varies in the Hay Gulch alluvial aquifer, and potential sources of increased sulfate and TDS observed in the Wiltze well.

Figure 4-3 shows the range of salinity values (as TDS) in Hay Gulch Ditch between 2005 and 2015. Salinity does not appear to vary seasonally in the Hay Gulch Ditch.

GROUNDWATER

Groundwater in the study area generally exists in shallow alluvial aquifers and deep bedrock aquifers. Very limited groundwater may occur in perched intervals near-surface (‹300 feet below ground surface) above the topographical high mesa areas. An aquifer is defined by Fetter, 1994 as "Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs." Generalized cross-sections based on GCC core hole data and best available DWR Well Construction and Test Reports have been prepared for this study along two transects as shown in Figure 4-4. The cross-sections are presented as Figures 4-5 and 4-6.

Alluvial Groundwater

Alluvial groundwater is present in the unconsolidated sediments that fill topographic lows either coinciding with active perennial stream systems or ephemeral stream systems. These alluvial sediments are themselves a stream of eroded solids, which are mostly composed of fine sand from the Mesaverde sandstones and silt and clay from the shales. Alluvium in the upper reaches of drainages typically are not saturated, whereas the lower reaches of drainages, such as Hay Gulch, are saturated with seasonal fluctuations in the water table from near surface (spring) to greater than 6 feet below ground surface (fall-winter). Alluvial aquifers in the study area are not known to have any substantial or extensive clay cover (loess), as would be present in recent glaciated terrains, and are therefore characterized as unconfined.

The presence and character of alluvial groundwater in the study area is documented in publically available well construction reports for domestic or commercial installations or facility monitoring wells. An extensive inventory of these wells has been compiled for review in this study; the locations are indicated on Figure 4-7. The La Plata River alluvial aquifer at the eastern margin of the study area is very productive with hundreds of permitted domestic water wells that Colorado Division of Water Resources (CDWR) Well Construction and Test Reports indicate yields up to 65 gallons per minute (gpm). Similar records for the domestic water wells in the Cherry Creek alluvium, which forms the western boundary of the study area, indicate yields up to 30 gpm. In contrast, the ephemeral drainage alluvium throughout the study area has been developed for groundwater resources to a much lesser extent, which could be for several reasons. First, these are not densely populated areas so demand for groundwater is relatively low. Second, the water quality of these alluvial aquifers may be known locally to be poor (high sulfate concentration affects taste and is emetic). Third, yield may be low because of the presence of clay, and a short saturated

interval. Finally, alluvial water is tributary to the over-appropriated La Plata River and new permits are unlikely to be issued.

The Hay Gulch alluvial aquifer contains three wells utilized by GCC as groundwater compliance monitoring locations. While no formal DWR Well Construction and Test Reports exist for these wells it is known that the well depths are up to 20 feet below ground surface, and therefore indicating an alluvium thickness of at least 20 feet in in those locations. The quarterly measured water level at these locations is within ten feet of ground surface. A hydrograph of these alluvial groundwater levels, measured quarterly, for the period of record is presented as Figure 4-8, plotting groundwater elevation (ftamsl) versus time. Records of six hand-dug alluvial wells, located downgradient from the King II mine in the southern reach of Hay Gulch, were found during the DWR Well Construction and Test Report review. These wells were constructed as early as 1924 and range in depth from 13 to 35 feet. No formal aquifer tests, such as pumping tests or slug tests, are known to have been conducted at any of these wells in order to estimate hydraulic conductivity or specific storage parameters. No records of informal well tests to calculate specific capacity appear to exist. Water quality in these hand-dug alluvial wells is considered suitable for stock or drinking water in places (near the King II surface facilities, for instance), but contains high sulfate in other locations (for instance near the King I portal)

Along the western margin of the current King II underground workings, East Alkali Gulch alluvium appears to have spatially limited saturation as only one DWR-permitted water well (#268168) has been successfully completed in gravel to 100 feet depth. However, another DWR-permitted water well (#268278), located approximately 675 feet downgradient, was dry through the alluvium and was completed in the underlying Menefee Formation shale. This pair of wells could be useful for further study to gain a better understanding of any possible alluvium/bedrock interconnection with the Menefee Formation.

The named and unnamed ephemeral drainages that make up East and West Roberts Canyon to the east of proposed King II workings do not have any reported DWR water wells. Therefore, the presence and extent of alluvial saturation is unknown.

The Wiltze well, GCC Well#1 Upgradient, and GCC Well#2 Downgradient wells are completed in Hay Gulch alluvium, with the Wiltze well located near the portal of the King I Mine, GCC Well#2 (as it will be abbreviated here) located near the King II surface facilities, and GCC Well#1 Upgradient located approximately halfway between. It was noted above that there is significant variability in the TDS of the GCC Well#2, and that the Wiltze well exhibits a much higher TDS than the other two wells, however it is declining with time. Some of the variability in the GCC Well#2 may be due to dilution by runoff off the ridge overlying the King I Mine. The high TDS observed in the Wiltze well may potentially be related to the mine spoil pile located upstream of the well, or anywhere along the reach from King I Mine (which opened

in 1938) to the head of Hay Gulch. The Wiltze data shown in Figure 4-9 are only those analyses for which there was a "full" analytical suite, which was initiated in 2011, five years after the King II Mine was opened. Sampling of this well began in February of 1982, when TDS was reported at 2,130 mg/L and sulfate at 1,160 mg/L. It can be seen in Figure 4-9 that TDS and sulfate have decreased almost 50% over the longer period, and continue to decline.

The velocity of a potential solute plume (of a conservative, not readily adsorbed constituent such as sulfate) in the alluvium may be estimated by Darcy's law, which states bulk velocity = hydraulic gradient times hydraulic conductivity ($q = i \times K$), and pore velocity is the bulk velocity divided by porosity (since water flows only in the pores, not the whole medium; this leads to $v = i \times K/n$). Hydraulic gradient (i) is approximately equal to the valley floor slope, or 10 ft per mile. Porosity (n) may be assumed to be 0.3, and hydraulic conductivity (K) somewhere between 5 and 10 ft/day (given it is largely fine to medium-grained sand derived from Mesaverde sandstones with some clay from shales). This gives a pore velocity of 23 feet per year (at the higher conductivity value), or one mile in 230 years. It is about 10,000 feet from King I to King II portals (GCC Well#1 to GCC Well#2), which the groundwater would cross in about 500 years. Given the climatological record inferred from tree rings (Funkhouser et al, 2002), it is likely that strong variations in salinity should occur in alluvial water over this distance. Such variation would be partly stratified and partly piston pulses. There is almost no information available to assess such variability, except that the climatological variation does propose a possible natural cause for the variation in salinity shown below, and suggest a need for further study to identify the source of the increased sulfate and TDS observed in this well.

Figures 4-10 through 4-12 show the major ion composition of the three alluvial wells in stacked bars, with TDS and pH presented as line plots. TDS values should exceed the sum of the major ions represented, however TDS does not match the sum of constituents in some cases because parameters potassium and chloride were not analyzed. On the plots showing GCC Well#1 and GCC Well#2 ,the TDS is close to the sum of major ions in most samples, indicating there is not much potassium or chloride present, and the difference between TDS and the bar sums is an indicator of data precision (adequate). On the Wiltze plot, the TDS value is always greater than the bar sum, suggesting there is some chloride present. The missing analytes make trilinear plots of [Ca-Mg-(K+Na)] and [HCO_3-SO_4-Cl] impractical, however the comparison of TDS and sum of the analyzed ions show K and Cl are minor.

The highest sulfate levels in the alluvium may make the water mildly emetic but do not disqualify it as drinking water.

Few trace elements have been analyzed in alluvial groundwater of Hay Gulch, but manganese has been, as a constituent of common concern in coal region waters. The range of manganese concentrations in all

samples from the three alluvial wells, GCC Well#1, GCC Well#2 and Wiltze, are shown in Figure 4-13. Results reported as less than detection limits are represented as zero in this plot. Figure 4-13 shows that a single sample was reported with 2.5 mg/L dissolved manganese, and most were less than 1 mg/L. Health effects from manganese in drinking water are a concern at concentrations higher than 0.5 mg/L.

Bedrock Groundwater

The discussion of bedrock groundwater in this section is organized by geologic formations as presented in Section 3, and is based on data collected from wells located to the south of the coal properties. In fact, there are no known saturated aquifers or domestic wells in the coal leases area. The limited number of bedrock groundwater studies within the study area completed to date do not allow for a detailed delineation of the hydrostratigraphy at this time. While GCC holds a large body of detailed geologic information, the data collection is for the purposes of coal resource evaluation. The exploration boreholes extend through the mining target "A" and "B" coal seams, however this interval has been demonstrated to be dry with no aquifers intercepted. The domestic water wells in the area are completed in such a manner that very large intervals, many greater than 400 feet in length, are open to any and all water-bearing intervals in order to contribute a maximum yield. This well completion methodology, while serving the well owner's primary interest, generally does not allow for definitive correlation of hydrostratigraphic units from well to well.

CLIFF HOUSE SANDSTONE FORMATION

The Cliff House is known regionally to be an aquifer with wells reportedly producing as much as 17 gpm with an average closer to 10 gpm. Estimated transmissivity values are on the order of 2 ft^2/day. (Brooks, 1985). However, this is not the case in the study area, primarily due to the position of this formation with respect to the deeply incised drainage patterns. The northeast/southwest drainage pattern follows the paleotopography discussed in the Section 3. The erosional processes creating these drainages has effectively isolated the Cliff House into elongated, lobed geometric bodies which lack the ability to develop into an aquifer. These topographic features, locally referred to as mesas, generally range from ½ to 1 mile in width and several miles long. In the northern part of the study area, generally north of Hay Gulch and in the several mile vicinity of the King II mine, these Cliff House structural bodies are isolated on all sides with outcrop exposures including at the northern side of Hay Gulch. The outcrops are sufficiently above the drainage areas where potential alluvium saturation could act as an effective recharge area. In the southern portion of the study area, inclusive of the King I mine and several miles south and southwest, the incised nature of the Cliff House is similar but the mesas are wider at approximately 1.5 miles. Some perched water bearing intervals have been identified during GCC mining operations. These water bearing intervals have presented as minor leakage at the roof, with drainage on the order of several gallons lasting several minutes. (Bird. 2015) Geological mapping shown in Figure 3-1 demonstrates that the local terminus of any potential Cliff House groundwater is the Quaternary La Plata River alluvium. The Cliff

House mesa tops typically have five or more feet of soil cover, based on review of drilling reports for this study, and are otherwise at least moderately vegetated. The combination of the arid climate with high potential evapotranspiration substantially limits the capacity for deep precipitation infiltration. Further analysis of available data to support the conclusion that the Cliff House does not represent an aquifer in the study area is presented in Section 6 of this report. No ground water chemistry data is known to exist that is relevant to the study area.

MENEFEE FORMATION

Regionally, the lower Menefee is known to be an aquifer with well yields as much as 15 gpm. Estimated transmissivity is 50 ft^2/day or less. (Brooks, 1985). This possibly includes the local study area, however the domestic well completion methods generally prevent a true interpretation of the host formation where intercepted water bearing intervals occur. It is possible that the specific water bearing intervals producing in these wells may be coming from the upper Point Lookout. No formal aquifer tests such as pumping tests or slug tests are known to have been conducted within the study area in order to estimate parameters such hydraulic conductivity or specific storage. No records of informal well tests to calculate specific capacity appear to exist. Data has been collected and interpreted from aquifer testing in the Menefee in Durango, CO at the former Uranium Mill Tailings Reclamation Act (UMTRA) site during several waste characterization projects. This will be discussed in the Section 6.

However it is important to note that the upper Menefee, the interval targeted in the study area for coal mining is not known locally or regionally to be an aquifer. This interval is known locally to be unsaturated based on the review of extensive exploration drilling and mining regulator reports of this interval. (GCC Permit 2015, Johnson 1981, Consulting & Coal Services, 1995) The lower Menefee is considered an aquifer in some areas, generally in the southern portion of the study area as the formation deepens with the regional 2-3 degree dip of the Mesaverde Group. This interpretation is based on comparison of detailed geologic information from GCC logs against DWR Well Construction and Test Reports. Coal seams, especially in the arid western US, are often aquifers where permeability is conferred by cleat (fracture) sets, whereas shales and cemented sandstones in the coal-bearing sequence are commonly low yield, with low water quality because of long residence times (see for instance Robson and Stewart, 1990)

In the northern part of the study area, there are areas where the upper Menefee outcrops, exposing the "A" seam. To the far north in the study area, substantial outcrops are the primary groundwater recharge areas for the lower Menefee. The upper Menefee has been incised in the same manner as described for the Cliff House, but to a slightly lesser extent as it lies stratigraphically below the Cliff House so exhibits less outcropping exposure. It is assumed that ground water flow in the Menefee is in the general directions of dip to the south. The character of the upper Menefee incisions by the numerous drainages appear to create the framework for the "A" seam to have limited groundwater potential. In the immediate vicinity of the King II Mine, the "A" seam is generally exposed on all three down or cross-gradient sides

creating what would be discharge zones rather than recharge zones. Figure 3-1 shows the erosion-pinched upper Menefee that is present and has prevented any substantial ground water flow towards the current King II mine area from the north. No springs or seeps from the Menefee are known to occur in this location indicating that it is unlikely that any groundwater is present in the upper Menefee in this area. As with the Cliff House in this area, the "A" seam outcrop of the Menefee is above the drainage bottoms where alluvial groundwater could contribute to recharge. Because the Cliff House contains minimal groundwater and does not bear any aquifers in this area, any vertical infiltration from the Cliff House to the Menefee is insignificant. The presence of very minimal perched mine roof drainage discussed above corroborates this. The upper Menefee and "A" seam outcrops at Hay Gulch, however no springs or seeps have been identified to suggest groundwater discharge to the Hay Gulch alluvium. The "A" seam outcrop is presented in numerous figures in this study beginning with Figure 3-3. Areas of Menefee surface exposure in Hay Gulch, East Alkali Gulch and the multiple drainages of Roberts Canyon are all potential recharge areas, especially given they are in part overlain by alluvium or colluvium. However, given the upper Menefee is known to have low hydraulic conductivity, the likelihood for significant recharge is low. As discussed in the previous alluvial groundwater section, further study of the East Alkali Gulch adjacent water wells, one completed in the alluvium and one in the immediately underlying upper Menefee formation, may help with this assessment.

In the southern area of the study area, the upper Menefee outcrops along the south side of Hay Gulch along the row of historical coal mines including King I. This is presented in Figure 3-3. The "A" seam is located above the Hay Gulch alluvium and therefore recharge potential from groundwater is limited to the west where the "A" seam outcrop dives below ground surface. Extensive drilling data compiled by GCC south of Hay Gulch for King I coal exploration of the "A" seam and the "B" seam approximately 80 feet below ground surface encountered no ground water (Consulting & Coal Services, 1995). South of King I, numerous domestic water wells were identified for this study through DWR Well Construction and Test Reports. As discussed previously, these records have limited utility because of the long completion interval, effectively co-mingling any and all water bearing intervals intercepted by the borehole. Detailed geologic cuttings descriptions and/or geophysical logs were not completed and therefore a definitive correlation of the coals from the GCC records to the DWR records is not possible.

Limited bedrock groundwater chemistry data exists that is relevant to the study area, including domestic well installations in the Vista del Oro subdivision west and southwest of King II in the study area (CDS, 2013), and a 1983 USGS sampling program investigating domestic wells over a broader regional area (Brooks, 1985). Menefee bedrock groundwater analytical data are available from multiple samples of the Haugen well, as well as one-time samples from a number of other domestic wells.

The Haugen well is located near the confluence of Pine and Hay Gulches. The other domestic wells and USGS sample points are all within T34N and 35N, R 11W and 12W. All of these wells are completed in coal bearing strata of the Mesaverde Group, and all of the wells for which completion data are available include coal seams in their open intervals. .

Bar plots of water quality are given in Figures 4-15 and 4-16, the first plot provides data for those wells with only a single analysis and the second plot provides data for the Haugen well with a number of analyses. The TDS - should be slightly higher than the sum of the major ions, and the DWR permit #251673 well analysis indicates an inconsistency in the dataset. Three of these wells show relatively high sulfate concentrations, while two wells show very low sulfate which might suggest reduction to sulfide (and presence of hydrogen sulfide in the well). Further data collection would be needed to confirm the presence of any reduced sulfur species in the wells where low sulfate content was observed.

Data in the Haugen well analyses, shown in Figure 4-16, suggest a couple of years of purging was necessary to clear up drilling fluid residual, evidenced by a decline in TDS and minor sulfate, an stabilizing as a sodium bicarbonate water with a pH near 8.

USGS data from the "NBO" series of wells has apparent missing pH values for many samples, and TDS values highlight data inconsistencies (6th well presented from the left in Figure 4-17). Groundwater data collected from the "NBO" series of wells indicates low sulfate, with the other constituent values consistent with the sodium bicarbonate groundwater observed in other Mesaverde wells, indicative of groundwater that has not been impacted by mining activities. .

Trace element analysis of groundwater samples was incorporated in the USGS sampling of the NBO wells. These analytes are used to establish a chemical fingerprint of each groundwater and determine the geochemical processes affecting groundwater quality at depth.

Figure 4-18 includes trace element analyses for 40 NBO samples reported by USGS within six townships centered on Hay Gulch. Analytical results reported less than detectable are represented in these figures as zero (the first "bin". The constituents shown include arsenic (As), fluoride (F), selenium (Se) and silica (SiO2), which are likely to represent natural ranges of these constituents in Mesaverde groundwater, and copper, which may not. Arsenic and selenium are likely to originate from sulfides (pyrite) oxidation but migrate on different geochemical trajectories and concentrations do not correlate directly with sulfate or one another. Fluoride is likely to be a significant impurity in Ca-Mg carbonates in Mesaverde sandstone. Silica concentration tends to correlate with depth since its solubility is primarily controlled by temperature, and it has a roughly normal distribution for the range of well depths; all other trace elements represented are biased toward the detection limit. Copper, lead and iron (the latter two not shown) are

probably due to the plumbing systems in domestic wells from which samples were taken, and are scattered and do not correlate with any other water quality parameter.

While the distributions of trace elements represented in Figure 4-18, and major ions in Figure 4-15 through Figure 4-17, show a range of constituents that may be expected in wells completed in the Mesaverde strata in this area, they do not indicate any mining impacts. The mining activity in this area has occurred in dry seams isolated from lenses of overburden water and confined underburden formation water, and there is no discharge of mine supply water (applied for dust control) to any surface or groundwater body. The data shown here represent the variability in water quality in bedrock wells due to natural interactions of infiltrating water with bedrock and some perturbations due to imperfect well completions, particularly wells intersecting coals and allowing communication between aquifers of different character.

POINT LOOKOUT SANDSTONE FORMATION

The Point Lookout Sandstone Formation is known to be a fairly productive aquifer where extensively fractured in the upper homogenous, massive, medium-grained sandstone. The basal Point Lookout has low porosity and permeability and is not considered an aquifer (Johnson, 1981). Transmissivity has been reported 240 ft^2/day in New Mexico (Brooks, 1985). As with the alluvium, Cliff House and Menefee, no aquifer testing has been conducted in the study area to determine the basic aquifer coefficients of hydraulic conductivity and storage.

The Point Lookout only outcrops in the extreme northern part of the study area. The geologic mapping in Figure 3-1 shows the areas of outcrop which are expected to be the groundwater recharge areas. The 2-3 degree dip of bedding generally to the south to a depth that coincides with many reported domestic water well DWR records. It is likely that many or most of the deep bedrock water wells in the study are drawing water from the Point Lookout aquifer. Additionally, it is possible that the upper Point Lookout aquifer is hydraulically connected with the sandstones, siltstones and shales present in lower Menefee. Geologic log data recorded on DWR Well Construction and Test Reports typically do not distinguish this formation contact.

While Point Lookout wells are difficult to distinguish from DWR well report geologic log data, produced water would be expected to have high salinity (from long residence times and cement-reduced permeability) and high sulfate and chloride concentrations.

5 REVIEW OF GCC HYDROLOGIC MONITORING – CURRENT & PROPOSED

OVERVIEW

GCC is required by CDRMS to collect specific water quality samples for field parameters as well as submittal to an accredited analytical laboratory for water quality analysis on a quarterly basis for

compliance with their CDRMS mining permits for the King I and II Mines. This list of parameters is presented in Table 5-1. Currently, the monitoring program includes the following locations:

- Hay Gulch Ditch (Downgradient of King II surface facility entrance on CR 120
- King II Upgradient #1 Monitoring Well (aka Ute Mountain Ute, Permit #210372)
- King II Downgradient #2 Monitoring Well (aka National King Coal LLC, Permit #262656)
- King I Downgradient Monitoring Well (aka Wiltze, unpermitted)

Review of the King II hydrologic monitoring programs by GCC, CDRMS, the Office of Surface Mining, Reclamation and Enforcement (OSMRE), Bureau of Land Management (BLM), La Plata County (LPC) and concerned citizen groups has occurred over the last several years. There are two main reasons for this review; the determination by LPC that a Class II Land Use Permit is required for continued operation of the King II Mine, and second, GCC's pursuit of a Federal Coal Lease Modification for an expansion of underground mining operations in order to extend the life of mine. The latter is subject to preparation and approval of an Environmental Assessment (EA) by the BLM. This review process has determined need for a full review and analysis of existing hydrologic data for the affected area which is the purpose of this study. Additionally, new or enhanced hydrologic data collection has been proposed by GCC to further the understanding of potential impacts from mining operations. At this time, GCC has initiated expansion of hydrologic monitoring to include installation of bedrock monitoring wells, the inventory and survey of King II area springs and seeps, and the addition of an upstream Hay Gulch Ditch surface water monitoring station. These locations, some still proposed, are displayed in Figure 5-1.

Bedrock Monitoring Wells

As a result of GCC and their predecessor's dry mining operations of the "A" and "B" seam coals in the Upper Menefee at the King I and II Mine locations since 1938, bedrock groundwater monitoring was not considered either a requirement for operations' best management practices or for CDRMS permit compliance. As discussed in the previous Bedrock Groundwater Section, substantial Hay Gulch area exploration drilling of the minable coals in the upper Menefee, including drilling below the "A" seam by 125 feet at many locations in the 1998 drilling program focused around what became King II, never encountered groundwater from ground surface to total depth. (Korte, 2015) This experience previously supported GCC and regulatory acceptance that bedrock groundwater monitoring was not necessary.

Recent attention to GCC mining operations in Hay Gulch has led to GCC support of the installation of bedrock groundwater monitoring wells at four new locations. At this time, final well designs are in the approval stage with CDRMS and the surface landowner agreements for the proposed locations are in negotiation. Each of the four locations will have three wells spaced approximately 20 feet apart, with the sites referred to as clustered monitoring well locations. Each well will be drilled with no water added (dry

drilling methodology) and have the cuttings logged by a qualified geologist or hydrogeologist, with wireline coring of any or all of the holes at GCC's discretion. Each open borehole will be geophysically logged for caliper, gamma, and bulk density, ahead of well installation. The wells will be installed by industry environmental monitoring well standard practices, which include strict prevention of cross-contamination of well construction materials and the equipment and personnel involved in installation. These standards also include onsite oversight by a qualified hydrogeologist to ensure that the completion intervals are properly isolated to the discrete hydrostratigraphic targets as follows:

- Cliff House – entire formation from DWR required surface casing at 19 feet depth to base
- "A" seam – discrete "A" seam coal completion
- "A"/"B" seam interburden – discrete Menefee interval below "A" seam and above "B" seam

Once completed, if water manifests in the wells, they will be properly developed by industry environmental monitoring well standards. Following this, the wells will be subject to no less than quarterly monitoring for four quarters by measurement of depth to water and collection of a water quality sample, per the CDRMS standards in place for the current groundwater monitoring program. If water does not manifest in the wells, quarterly monitoring of the wells will continue with documentation of a "dry" or "no water level" condition. Assessment will occur in a reasonable time following four quarters of data collection at these wells to shape the future GCC regulatory bedrock monitoring requirements.

Spring and Seep Survey

A spring and seep survey is a field reconnaissance to locate and inventory spring and seep conditions including flow rate, field water quality parameters and collect a water quality sample for submittal to an accredited analytical laboratory. This type of study characterizes groundwater discharge from one groundwater source at ground surface where it then either enters back into another groundwater system, into surface water or evaporation into the atmosphere. At the direction of CDRMS, in December 2015 GCC initiated a spring and seep survey for specific areas surrounding the King II Mine. This was conducted by RHS. While no springs or seeps were known to exist in this area, a reasonable expectation was that if springs or seeps relevant to the hydrologic characterization of the study area are to exist they would manifest either at the Cliff House/Menefee contact outcrop or at the "A" seam outcrop. The outcrops were hiked as reconnaissance per Figure 5-2, with one seep located and documented as SEEP-1 in an unnamed drainage approximately 2 miles northwest of the King II Mine surface facilities. Interpretation of the analytical results is presented in discussion later in this study. This spring and seep survey will continue quarterly for no less than a total of four quarters. Assessment will occur in a reasonable time following four quarters of data collection at these locations to shape the future GCC regulatory spring and seep monitoring requirements.

Hay Gulch Ditch

Per direction from the CDRMS, to compliment current (downgradient) GCC Hay Gulch Ditch water quality monitoring at the King II Mine driveway intersection with CR 120, GCC will begin sampling at an upstream

location as shown on Figure 5-1. This will allow for better interpretation of potential impact sources, should an exceedance ever be detected at the downgradient/downstream location.

6 OTHER SPECIFIC AREAS OF ANALYSIS

SURFACE WATER

Surface water in the lease area is limited to the imported Hay Gulch Ditch (diverted from the La Plata River), spring thaw and occasional summer storm runoff, and the primary receptor is the Mormon Reservoir several miles to the south. There has not typically been any water in spoil or stormwater catchment ponds to sample, except in rare storm events when flooding and gullying were regional concerns (and operations were too preoccupied with flooding control to perform any special sampling).

The typical concern of an underground mine with respect to surface water is discharge of mine water with deleterious quality. The absence of measurements is reflected by and absence of mine discharge. However, a mine water balance was performed in 2014 by CDS with a subsequent report submitted to La Plata County, partly to substantiate that water used by the mine for dust control does not discharge and otherwise to assess the water consumed by King II. This analysis was based on February, 2014 data collected at the mine. Dry air density was estimated from elevation and temperature, and water vapor content was calculated in the ventilation entry and two exhaust portals based on measurements of relative humidity. The exhaust flow rates and vapor content yielded computed vapor flux to compare with water piped in for dust control. Vapor in exhaust over 14 days was within 0.5% of piped in water, the 0.55% being 122 gallons per day with an uncertainty of 218 gallons /day based on the precision of measurements. Therefore the study demonstrated that the known water input to King II is in balance with the water output from King II.

GROUND WATER

Alluvial Aquifer

A ground water hydrograph of the three alluvial wells monitored by GCC for the period of record has been prepared as Figure 4-8. The hydrograph, based on depth to water levels converted to elevation (ftamsl) demonstrates the seasonal fluctuation in groundwater level as observed in Hay Gulch. The previously referenced Hay Gulch alluvium water table map has also been prepared and is presented as Figure 4-7 which demonstrates the groundwater gradient of 10 feet per mile.

Water quality in the alluvial aquifer is quite variable over the monitored reach, and zones with elevated sulfate concentrations may be linked to either upstream spoil pile oxidation and leachates, or to climatic variations causing draining and re-saturation of the alluvium over decadal (or longer) periods, as indicated

by tree ring research. Installation of new alluvial wells upgradient of the King I portal should resolve whether that mine has been responsible for observed high sulfates there. Hydraulic well testing (pumping and /or slug) the alluvial aquifer in the new wells will also confirm the estimated speed of solute plumes and contribute to resolution of this issue.

Bedrock Aquifer

GROUNDWATER LEVELS

No single database of groundwater wells including construction information, water levels or water quality for the study area was known to exist prior to this study. Therefore, RHS has prepared a comprehensive database for this study using publically available data from DWR and published reports as well as GCC's proprietary drillhole and corehole data.

No previously documented alluvial or bedrock groundwater level maps are known to have been prepared for the study area or greater regional area. For this study, RHS compiled all publically available DWR Well Construction and Test Reports. Key information in each of those reports, when available, included the location, the well construction information that indicates what part of the formation are open to the well, the driller's geologic log, the initial well test production rate and the static water level. These documents are required by the DWR to be filed shortly after the well construction is completed and the DWR scans the one-page report to be posted at http://www.dwr.state.co.us/wellpermitsearch/ available for public search and download. There have been several versions of this report form over many decades but the information requested by DWR has not changed much, however the quality of the scanned documents available for download can be poor. Similarly, the quality of the information reported varies widely from driller to driller with the accuracy and details of the reported geologic log, the documentation of dimensions of the well construction materials and the static water level and production rate. Location data required at the time of well construction has traditionally been by measurement from section lines using the public land survey system (PLSS). Modern ease of survey by hand-held GPS has improved the X, Y, and Z location data collection, however this has only been implemented by some water well drillers and of those only within the last few years. For this study GPS survey data has been found to only apply to a very small subset of DWR reports. The DWR maintains a water well database with some of this information including the survey information transformed into the National Elevation Dataset (NED) to greatly improve that accuracy but at this time it does not appear have the detailed geologic log or the interpretation of the true open completion intervals included in that database. RHS reviewed and compiled the relevant data directly from the individual DWR Well Construction and Test Reports and combined it with the DWR database to create one complete study area water well data set. Proprietary GCC borehole data from numerous exploratory drilling projects completed by GCC its predecessor and other coal companies that conducted exploration into the 1980's has also been integrated. This borehole data, while not deep enough to present any groundwater level information, was used with the DWR data

set for construction of cross-sectional drawings, a bedrock groundwater elevation map and a bedrock groundwater presence map, to be discussed below.

While clearly the DWR reports are subject to error, this is a readily available source for a large body of data that needs to be considered for a comprehensive hydrologic study of any area. Generally, the more focused the study (small area) the more critical it is that the water level data be collected in a short period of time. With a regional scale, it is less critical as the contour intervals are typically larger, however it must be noted that in this data set, reported water levels span many decades. The earliest well found in this study was a hand-dug alluvial well in the lower reach of Hay Gulch constructed in 1924, but the DWR well records show that substantial documentation of groundwater development, as indicated by submittal of these well reports in the study area, began in the early 1960's.

Figure 6-1 presents the calculated bedrock groundwater elevations for each domestic water well with an available DWR report. The groundwater elevation was calculated from subtracting the driller-reported static water levels at the time of well construction from the DWR NED-interpreted well surface elevation. Attempts to contour the groundwater elevations at a large interval of 500 feet was not successful in that it was apparent that outliers dominated more than could be reasonably expected for a study area of this geographic area. When contoured at 1000 feet intervals, it could possibly be interpreted that the study area bedrock groundwater flow direction may be south/southwest, the dip of the Mesaverde Group, so likely to be true. It must be recognized that plotting all bedrock groundwater levels together, without regard for specific water-bearing interval elevations, is a simplification that assumes the lower Menefee and upper Point Lookout, are hydraulically connected and behave as one aquifer. This may not have been true prior to groundwater development in this area by installation of domestic water wells, but comingling water well completion methods are typical and have been documented in the 179 bedrock DWR records compiled for this study show that the minimum effective completion interval is 8 feet, the maximum is 1,548 feet and the arithmetic mean is 290 feet.

In order to assess the bedrock groundwater wells in the study area that likely have intersected the "A" seam across their completion interval, the top of coal surface elevation, based on GCC drill hole data, has been extended across the study area to the extent that it can be reasonably projected. As was discussed in Section 3, while the "A" seam is the most consistent of the Menefee coal seams, some inconsistencies in thickness can be expected. Regardless, the geologic depositional model presented in the mine permit (CDRMS, 2014) indicates that the "A" seam likely maintains thickness of four feet or more as far west as Cherry Creek. These bedrock groundwater wells are plotted at their locations with the projected top of coal elevation, the driller reported "first water" elevation and the driller reported static water level elevation. This is shown in Figure 6-2. Based on this analysis 114 of 179 wells documented in the study area likely intersect the "A" seam within their effective open interval, which is in almost all cases, the

length of borehole comingled behind the PVC well casing between the cemented surface casing and total drilled depth.

CONFINING LAYER

To analyze the deep bedrock groundwater potentiometric surface with respect to the "A" seam mined at King II, the top of coal surface, based on extensive GCC drill hole data, has been projected across the study area. The reported water level elevations have been labeled at each corresponding well location. As the DWR Well Construction and Test Reports, with their inherent quality concerns, currently are the only source of water level data for these wells, there is error associated with this exercise. However, it gives a general spatial understanding of the distribution of areas where the deep bedrock aquifer presents an upward hydraulic gradient under confining conditions. As discussed in Section 4, based on geologic mapping of the Menefee and Point Lookout, the substantial recharge area for this aquifer or aquifers is likely only several miles to the north within the study area. Given this, at some distance south of the recharge area, the aquifer is expected to transition from unconfined to confined as the Mesaverde Group dips further into the San Juan Basin. Figure 6-3 presents a general schematic cross-section cartoon of the difference between a confined and unconfined aquifer. Confining conditions present when the hydrostatic pressure as measured in the well by a depth to water reading, is above the depth of the particular water bearing interval. The descriptions of the subject rock formations in Sections 3 and 4 indicate that the groundwater flow system(s) is dominated by fracture flow, although the sandstones will typically contribute water from minor secondary porosity which can be observed as a delayed yield in aquifer testing. The difference in hydrostatic pressure as measured at the top of the water bearing interval (aquifer) to the measured well water level represents the excess or confining pressure that the natural overlying formation is restricting from upward flow. This overlying (or underlying) geologic unit is referred to as confining layer, which is simply a body of material of low hydraulic conductivity that is stratigraphically adjacent to one or more aquifers (Fetter, 1994). A qualitative assessment of a confining layer is that when excess hydrostatic pressure from an underlying or overlying aquifer exists based on knowledge that the measured water level is above the aquifer, there is a geologic seal. Generally speaking, during drilling operations, this is observed when a formation is penetrated and the water level in the borehole immediately rises. An extreme case is when the water rises in the hole to the point that it begins to flow at surface, the demonstration of an artesian well. No true artesian wells have been documented by RHS in this study area. A semi-quantitative assessment of that seal is determined by calculating the hydrostatic head pressure difference across the confining layer, as presented in Figure 6-4. It is important to understand that the relationship of the confining layer that is the "A"/"B" seam Menefee interburden that overlies the lower Menefee/upper Point Lookout aquifer has been in place over geologic time, millions of years. That is not to say it must be a perfect seal, however dry "A" seam mining operations at King I since 1938 and King II since 2006 of thousands of underground acres is a very strong case for a more than adequate seal. Additionally,157 of 179 documented water wells in the study area that have

demonstrated confining conditions show that this excess hydrostatic pressure appears to only be released by borehole penetration completely through the confining layer.

A fully quantitative assessment of a confining layer, and thus its full competency, can be determined accurately by conducting in-situ borehole or well permeability testing. This testing methodology is typically applied to sites where there are concerns with potential leakage across a confining or semi-confining layers in overall saturated conditions. While no testing of this type has been conducted in the Menefee in the study area, it has been conducted at two project sites 12 miles from the King mines to the northeast in Durango, Colorado near the intersection of US Highways 160 and 550. (USDOE, 2001)

The first project site was known as the Durango Uranium Mill Tailings Remedial Action (UMTRA) Project site. This was a location that the U.S. Department of Energy (USDOE) was tasked with conducting detailed hydrogeologic characterization of a former uranium mill waste tailings pile area requiring determination of hydraulic conductivity of several subject geologic formations including the Menefee. Two separate aquifer testing programs were conducted, one program in 1983 with slug testing of a single Menefee monitoring well and a second program in 2001 which slug tested seven Menefee monitoring wells and two additional Menefee monitoring wells completed specifically in coal.

The second project site was known as the Durango Pumping Plant and hydrogeologic characterization to determine hydraulic conductivity was conducted in 1990 at this location for Animas-La Plata Project whereby a major pumping station was constructed to lift Animas River water up into fill a new reservoir that became Lake Nighthorse. Bail-slug tests were conducted in two Menefee test holes by the U.S. Bureau of Reclamation.

The results of these three aquifer testing programs is summarized in Table 6-1. These test results demonstrate that the Menefee coal has a much higher hydraulic conductivity than the Menefee without coal, over one order of magnitude larger at approximately 5 feet/day. This quantitative data supports the concepts discussed in Section 4, stating that coal seams are generally considered aquifers relative to the overlying and underlying strata when saturated. The analytical solutions that are used to derive hydraulic conductivity from slug tests (among other aquifer test methods as well) are based on assumption of flow, primarily in the horizontal direction. In the case of investigations regarding the hydraulic properties of confining layers, it is important to understand the concept of anisotropy. The term anisotropic is used to describe materials where the hydraulic conductivity at a point has a directional dependency. (Domenico and Schwartz, 1990) In geologic materials, specifically in fine-grained sedimentary rocks (shale) as applies here, deposition of clay occurs in horizontal bedding planes due to gravity within the deep marine low energy environment. The resulting hydraulic conductivity is described as anisotropic because the dominant flow direction will be with the horizontal clay mineral assemblage. The subsequent vertical

hydraulic conductivity in a shale confining layer is greatly reduced, typically by an accepted conservative one order of magnitude. (Domenico and Schwartz, 1990). Table 6-1 shows the geometric mean of slug testing results for the Menefee confining layer to be 0.009 feet/day. These values are greater than typical textbook values for shales, however are still very much within the range of low permeability geologic materials and demonstrate conditions for hydraulic confinement.

To date, the Durango UMTRA and Pumping Plant test results serve as the best currently available Menefee horizontal and vertical horizontal conductivity data. There is direct application of this data to the concerns with potential vertical migration of water inside mine workings downward through what has been demonstrated to be a confining layer below the "A" seam. As documented in numerous references within this study, the King I and King II mines are dry. Water imported into the mine for OSMRE-required dust suppression has been addressed by preparation of the previously discussed mine water balance performed by CDS in 2014 and has in fact been demonstrated to be in balance owing primarily to very high evaporation from the mine ventilation system and the mining and removal of the very coal where most of the dust suppression water is applied. Water introduced via infiltration through potential subsidence fracturing has been discussed in previously in Section 4 and likelihood of occurrence is deemed very unlikely due to observation of past subsidence features above King I healing with two years, the very high evapotranspiration rates in the study area and the lack of perennial surface water flowing or stored in natural channels on ground surface above potential subsidence areas.. The plans for an underground 20 acre-foot mine operations water storage reservoir at King II have been abandoned in favor of a traditional water storage pond constructed near the Huntington King II diversion pipeline near the King I mine. Therefore concerns with water infiltration through the mine floor at King I and II are generally within the last hypotheticals of possible introduction such as an unchecked freshwater spill. This is highly unlikely as King I is not operating and no charged water lines remain; the operating King II mine is staffed 24/7 and routine inspections are completed GCC staff and numerous regulators including the Mine Safety and Health Administration (MSHA), CDRMS, BLM and OSMRE. As discussed in the mine water balance report, (CDS, 2014) excess water use by GCC is completely counter to the operation from an economic standpoint as not only is the water itself and operating expense, but mined coal wetted in excess can potentially violate GCC customer contractual obligations committing to designated maximum moisture content.

A Menefee mine floor with vertical hydraulic conductivity on the order of 0.009 ft/day, as discussed above from the nearest available (Durango, CO) test data, represents a substantial barrier to flow to infiltration through the unsaturated "A" seam underburden and yields an acceptable mechanism to prevent hydraulic communication with the underlying lower Menefee/upper Point Lookout aquifer.

DRY CLIFF HOUSE BOREHOLES AND DOMESTIC WATER WELL PENETRATIONS – THE DRY TREND

In order to evaluate the unsaturated condition of the Cliff House in the study area, specifically in contiguous or semi-contiguous areas of present or projected overburden, a mapping exercise has been completed by plotting all GCC boreholes that fully penetrated this formation. Additionally, with compilation and review of the available DWR Well Construction and Test Reports, the driller's reported "first water" depth during drilling was compared against the top of the "A" seam. As the "A" seam is approximately 20 feet below the base of the Cliff House, this is seen as a conservative depth for the purposes of this demonstration. Figure 6-4 shows the well and borehole locations with the reported "first water" elevation and projected elevation of the "A" seam in the label. A "first water" elevation less than the projected "A" seam elevation indicates no water-bearing intervals in the Cliff House at that location at the time of drilling. For the GCC boreholes in which no water bearing intervals have ever been encountered at all (Korte, 2015), they are simply plotted on the map as "Coreholes" and should be understood to have been dry. As can be seen in the figure, there is a strong dry Cliff House trend in the middle of the study area. This can be explained by the presence of the most substantially eroded areas of the Cliff House, through the entire formation visually apparent by the mapping of the eroded underlying "A" coal seam throughout Hay Gulch, the several reaches of Roberts Canyon and East Alkali Gulch. These areas were, and continue to be subject to Cliff House discharge of any remaining groundwater given dissection by these drainages. The result is that at present age, extremely limited groundwater is found in this part of the study area. Drainages throughout the study area that dissect the Cliff House but not completely to the base of the formation, are expected to be Cliff House recharge areas contributing to more perched groundwater occurrences and in the southern portion of the study area perhaps aquifers.

The location of the numerous historical Hay Gulch area coal mines, as well as the modern-age King I and II mines does not appear to be coincident with lack of bedrock overburden and coal seam groundwater.

It must be noted that during this study one domestic water well, DWR permit #92816 had been incorrectly plotted by GCC in the King II CDRMS permit document "Map King II-004 Geology-Hydrology". The DWR legal description for this well is T34N R11W Section 6U SE1/4, SE1/4, however it had been spotted in Section 6, which erroneously placed it directly above King I mine underground workings. The actual location of this well is approximately 1.5 miles southeast of the nearest King I mine underground workings.

Groundwater in bedrock aquifers in which mining occurs is generally potentially subject to quantity impacts through diversion on new flowpaths, and to quality impacts through mixing of separate water bodies or exposure to oxidation or dissolution of solutes on new flowpaths. Since the mines have been historically dry, no aquifers are known in the overburden, and ongoing regulatory-mandated subsidence monitoring at King I and II has been documented subsidence to be minimal in occurrence and extent, there are no readily apprehended mechanisms for such impacts. Inflow to the mine through the

underburden via pillar punching is also precluded by virtue of the thickness and low hydraulic conductivity of the confining layer.

7 CONCLUSION

The significant, and sole, concern regarding water quality impact is variable salinity (particularly sulfate) in the alluvial aquifer. Collection of water samples and performance of some hydraulic testing of alluvial wells will determine whether one such saline front near the King I portal has anything to do with leachates from that mine, and how fast such fronts are migrating in the alluvium. Analysis of bicarbonate C14 and water isotopes D and O18 at the top and bottom of the new wells will date the alluvial water and discriminate whether the sulfate is due to other mine spoil leachates or climatic variability.

Because King I and King II mines have historically been dry, hydrologic data relating to background and to operations is somewhat sparse. Water quality data has been taken from domestic wells at some distance from the permit areas. Alluvial groundwater monitoring data exhibits spatial variability that has not yet been explained, although climatological variation may be implicated, and some new monitoring points upstream of the old King I Mine are warranted. Surface water is restricted to a ditch diverted from the La Plata River, and occasional flood events, neither of which relates to any possible mining impact. One water balance exercise confirmed that ventilation carries out as vapor all water piped in for dust control, so there is zero measurable mine discharge

Evaluation of available bedrock hydraulic data, including publically available information from DWR Well Construction and Test Reports and GCC borehole data has determined that bedrock groundwater occurrence in the Hay Gulch area is controlled by drainage erosion of the Cliff House and upper Menefee Formations. The groundwater discharge areas created by the erosion of Hay Gulch, East Alkali Gulch and the various reaches of Roberts Canyon, combined with the limited infiltration potential of the region, have apparently prevented any significant groundwater accumulation and thus a substantial dry trend from surface through the substantially drilled and mined upper Menefee coal seams. Domestic water wells to the south and southwest of the King I & II mines do present Cliff House groundwater in perched water bearing intervals, but well DWR well reports indicated that it is not in significant quantities as the wells are completed in the underlying lower Menefee or upper Point Lookout aquifer. Demonstration of confined conditions in this aquifer by quantification of the hydrostatic pressure has been presented as evidence for a substantial confining layer below the upper Menefee coal sequence, specifically relevant as the King I and II mine floor. Additional quantitative basis for the recognition of this Menefee confining layer has been presented with regional hydraulic testing results characterizing the interval as consistent with low permeability geologic materials.

Information that will be collected during the installation of bedrock cluster monitoring wells planned for 2016 at King II, as well as the data that will be generated from them through routine monitoring will assist with further hydrogeologic characterization. Likewise, continued spring and seep survey in the vicinity of King II will yield data for interpretation to a better understanding of Cliff House discharge areas.

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TABLES

Table 3-1: List of Historical mines in the vicinity of the study area.

Mine Name	Dates of Operation	Easting (UTM83_12NX)	Northing (UTM83_12NY)	Elevation (ft amsl)	Total Coal Produced (Short Tons)	Seam (Interpreted)	Seam Thickness (ft)
Burnwell #1 Mine	1958-1970	757375	4127020	7487	39,947	("A" and/or "B")	6.5
Burnwell #2 Mine	1949-1967	757510	4127040	7647	47,270	Peacock, C coal group ("A" and/or "B")	6.5
Lucky Strike (Dunn Mine)	1950-1951 1921-1947	755640	4126093	7336	10,718	Peacock, C coal group ("A" and/or "B")	5.5
Durkan Mine	1935-1951	755869	4126615	7331	unknown	("A" and/or "B")	NR
Hay Gulch Mine	1933-1964	757445	4127651	7550	unknown	Pueblo ("A" & "B")	7
Hesperus Mine – Check Hesperus Coal	1892-1922	762416	4130376	8076	845,666	"A" & "B"	NR
Hunt Mine	unknown	758852	4127842	7569		("A" and/or "B")	NR
Peacock Mine (Peacock-Porter Mine)	1914-unknown 1922-1977	757776	4127721	7542	3,052,800	"A" & "B"	NR
Rasmussen Mine (Minoletti Mine) (Dufur Mine)	1958-1961 1945-1959 1941-1944	758488	4127382	7595	45,281	("A" and/or "B")	6
Supreme Mine	1937-1947	759316	4127698	7727	unknown	("A" and/or "B")	NR
Tipotsch Mine	1923-1953	755259	4126322	7413	unknown	("A" and/or "B")	NR
Wright Mine #1	1955-1969	759589	4127889	7645	10,605	("A" and/or "B")	NR
Wright Mine #2	1941-1955	759896	4127986	7685	34,024	("A" and/or "B")	NR
King Coal Mine #1	1936-2007	757247	4126693	7449	4,175,993	"A" & "B"	6

Notes:

NR = No Record

ft = feet

ft amsl = feet above mean sea level

Table 4-1: Climate data reported for the study area.

Month	Low Temperature (˚F)	High Temperature (˚F)	Snow (inches)	Precipitation (inches)
January	11	35	22	1.54
February	15	39	18	1.42
March	22	46	12	1.5
April	28	55	5	1.1
May	35	65	1	0.98
June	42	75	0	0.67
July	50	80	0	2.13
August	50	77	0	2.28
September	42	70	0	2.17
October	31	58	1	1.57
November	21	45	13	1.57
December	13	36	17	1.26
Average	30	56.8	-	-
Average Annual	-	-	89	18.19

Notes:
Source: January 2016, Hesperus, Colorado U.S. Climate Data;
Climate data for Ft. Lewis, CO Longitude: -108.051, Latitude: 37.2308

Table 5-1: King I and II CDRMS quarterly compliance groundwater and surface water analytical suite and field parameter monitoring.

Parameter	Units
Calcium (Ca)	mg/L
Iron (Fe)	mg/L
Magnesium (Mg)	mg/L
Manganese (mg/L)	mg/L
Sodium (Na)	mg/L
Hardness, as $CaCO_3$	mg/L
Bicarbonate, as CaCO3	mg/L
Carbonate, as CaCO3	mg/L
Hydroxide, as CaCO3	mg/L
pH (field)	SU
Sulfate (SO4)	mg/L
Total Dissolved Solids (TDS)	mg/L
Temperature	Degrees C
Specific Conductivity (field)	mS/cm
Depth to Water (field, wells only)	ft

Notes:

CDRMS = Colorado Division of Reclamation Mining and Safety

mg/L = milligrams per liter

SU = standard units

mS/cm millisiemens per centimeter

ft = feet

Table 6-1: Summary of Menefee Hydraulic Conductivity (K) values calculated from slug test results.

Project Location	Formation	Well ID	Kh (ft/d)	Kv (ft/d)	Kh Geometric Mean (ft/d)	Kv Geometric Mean (ft/d)
Durango UMTRA	Menefee (coal)	882	4.700	0.470	**4.991**	**0.499**
	Menefee (coal)	882 (test repeat)	5.300	0.530		
	Menefee	602	0.260	0.026	**0.094**	**0.009**
	Menefee	875	0.090	0.009		
	Menefee	878	1.000	0.100		
	Menefee	879	0.043	0.004		
	Menefee	883	0.017	0.002		
	Menefee	890	0.300	0.030		
	Menefee	902	0.003	0.000		
Durango UMTRA	Menefee	DR-82-02	0.890	0.089		
Durango Animas-La Plata Pumping Plant	Menefee	116	0.059	0.006		
	Menefee	117	0.068	0.007		

Kh = Horizontal Hydraulic Conductivity

Kv = Interpreted Vertical Hydraulic Conductivity

ft/d = feet per day

FIGURES

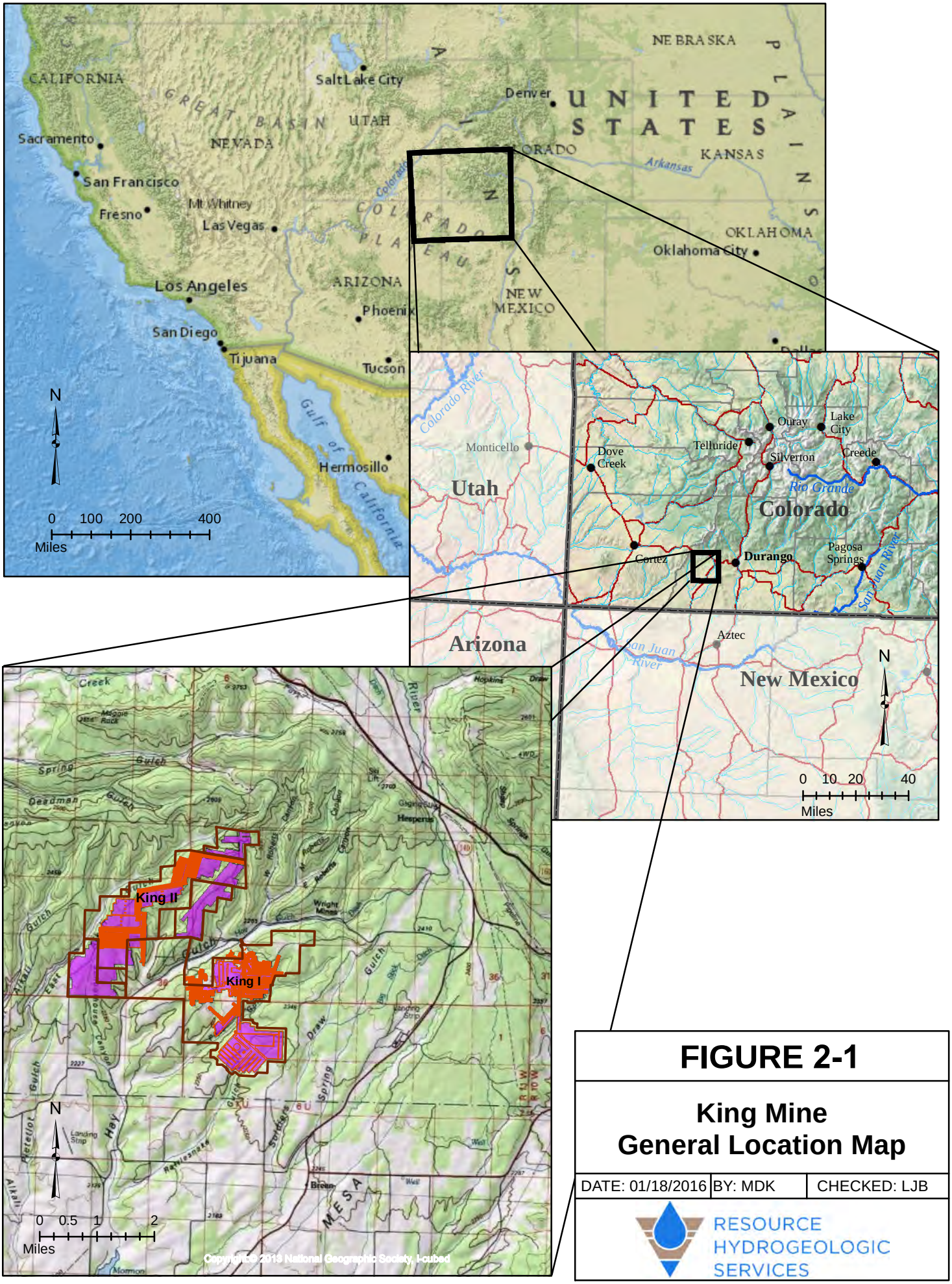
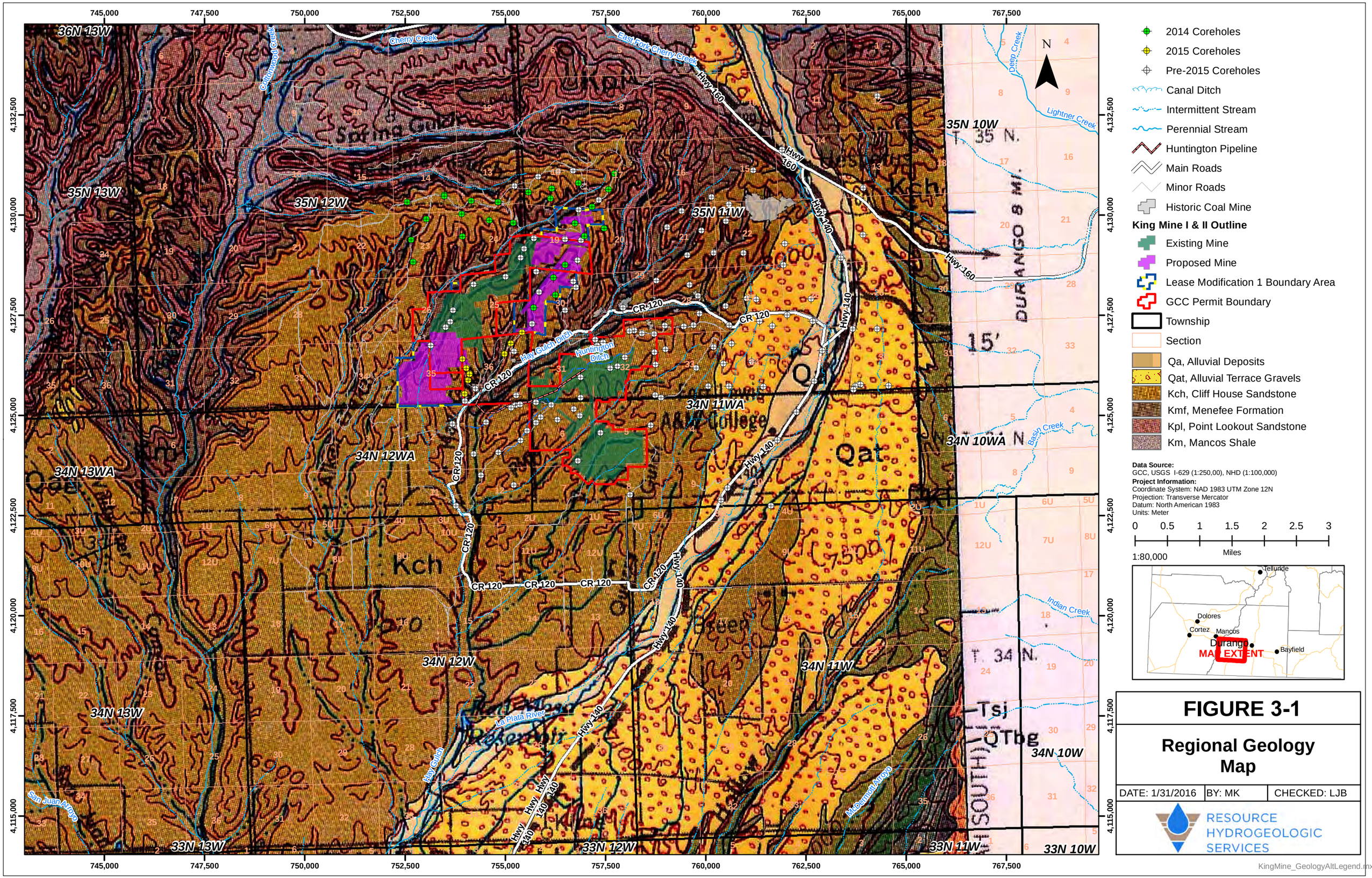


FIGURE 2-1

King Mine General Location Map

DATE: 01/18/2016	BY: MDK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES



2014 Coreholes
2015 Coreholes
Pre-2015 Coreholes
Canal Ditch
Intermittent Stream
Perennial Stream
Huntington Pipeline
Main Roads
Minor Roads
Historic Coal Mine

King Mine I & II Outline

Existing Mine
Proposed Mine
Lease Modification 1 Boundary Area
GCC Permit Boundary
Township
Section

Qa, Alluvial Deposits
Qat, Alluvial Terrace Gravels
Kch, Cliff House Sandstone
Kmf, Menefee Formation
Kpl, Point Lookout Sandstone
Km, Mancos Shale

Data Source:
GCC, USGS I-629 (1:250,00), NHD (1:100,000)
Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2 2.5 3
Miles
1:80,000

FIGURE 3-1

Regional Geology Map

DATE: 1/31/2016	BY: MK	CHECKED: LJB

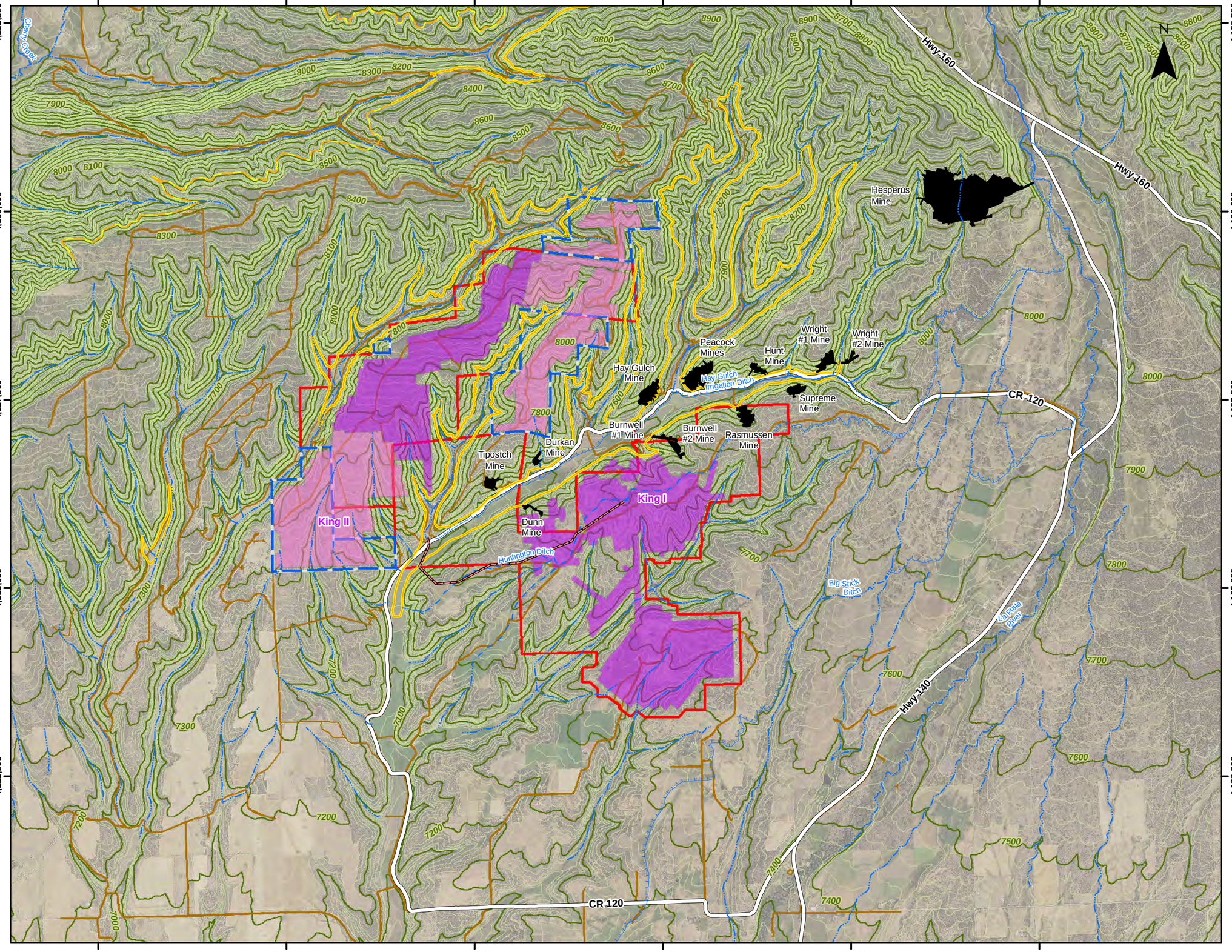
RESOURCE HYDROGEOLOGIC SERVICES

KingMine_GeologyAltLegend.mxd

GEOLOGIC UNIT		GEOLOGIC PERIOD	DESCRIPTION
Mesaverde Group	Cliff House Sandstone Formation	Late Cretaceous	Marine sandstone of irregular to lenticular ledges averaging 350 feet thickness. Uppermost exposed throughout most of study area.
	Menefee Formation		Complex of cross-bedded sandstone, shales, siltstones, sandstones and coal beds averaging 300 feet thickness. Characterized by irregular bedding and rapid lateral changes in lithology.
	Point Lookout Sandstone Formation		Upper member massive, medium-grained sandstone approximately 100 feet thick in project area. Basal member includes thin beds of sandstone interbedded with shale, approximately 300 feet thick in project area.
Mancos Shale			Marine shales to 2000 feet thick. Outcrops at extreme northern study area.

RESOURCE HYDROGEOLOGIC SERVICES

Figure 3-2: Stratigraphic column description of the study area.



Canal Ditch
Intermittent Stream
Perennial Stream
"A" Coal Seam Outcrop
"A" Coal Seam Outcrop - Projected
Huntington Pipeline
Main Roads
Minor Roads

Topography

Major Contours (100ft)
Minor Contours (20ft)
Historic Coal Mine
GCC Permit Boundary
Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Existing
Proposed

Data Source:
GCC, NED, NHD
USDA - Aerial Imagery (2015)

Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 4,000 feet

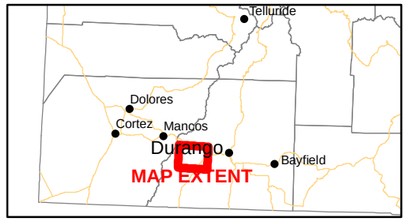


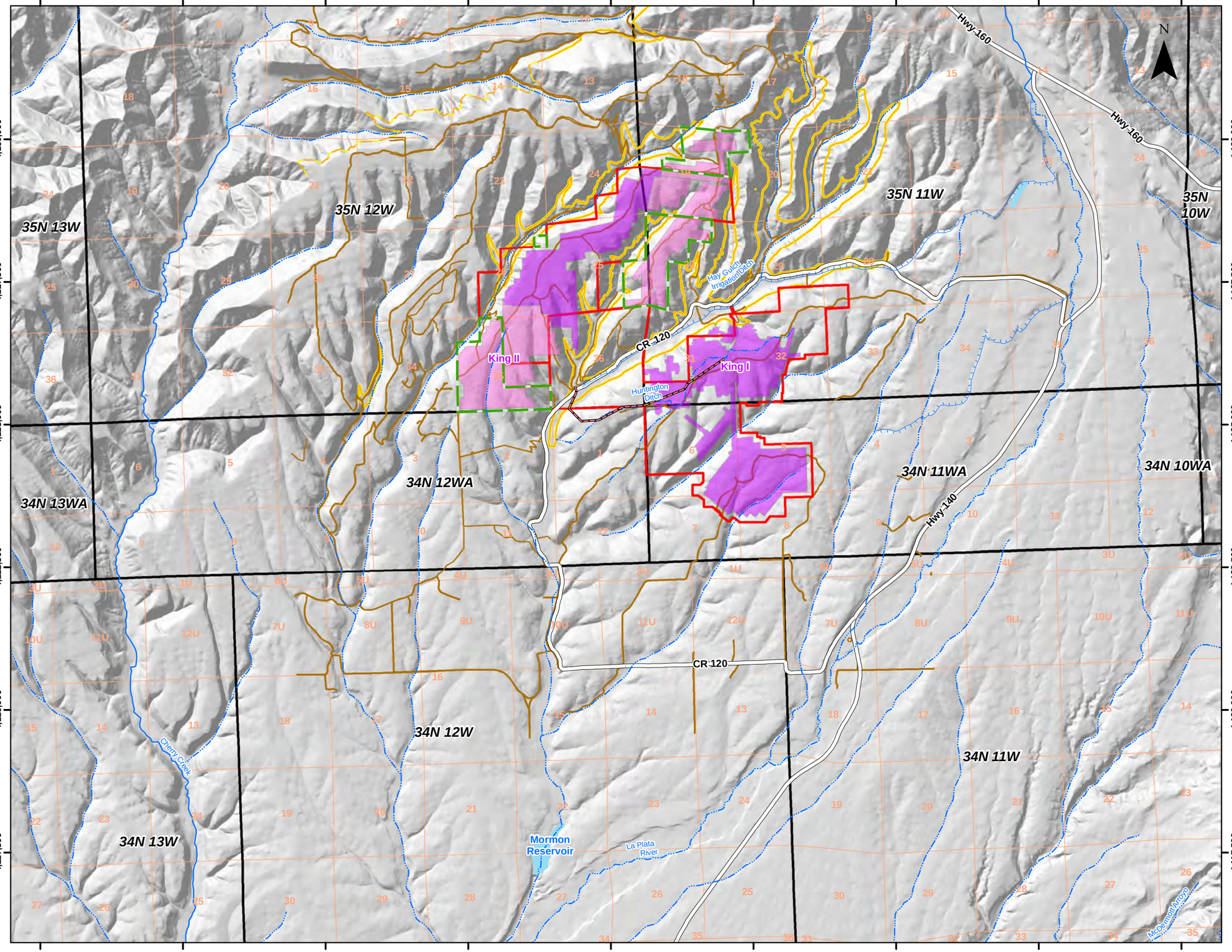
FIGURE 3-3

Hay Gulch Current and Historic Coal Mines

DATE: 1/29/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

KingMine_HistoricMines.mxd



"A" Coal Seam Outcrop
"A" Coal Seam Outcrop - Projected
Canal Ditch
Intermittent Stream
Perennial Stream
Huntington Pipeline
Main Roads
Minor Roads
Water Body
Township
Section
GCC Permit Boundary
Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Existing
Proposed

Data Source:
GCC, NED, NHD (1:100,000)
Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 1 mile

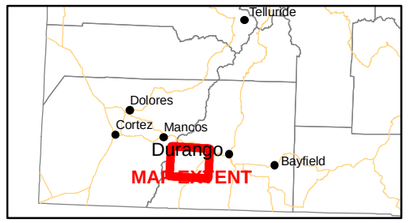


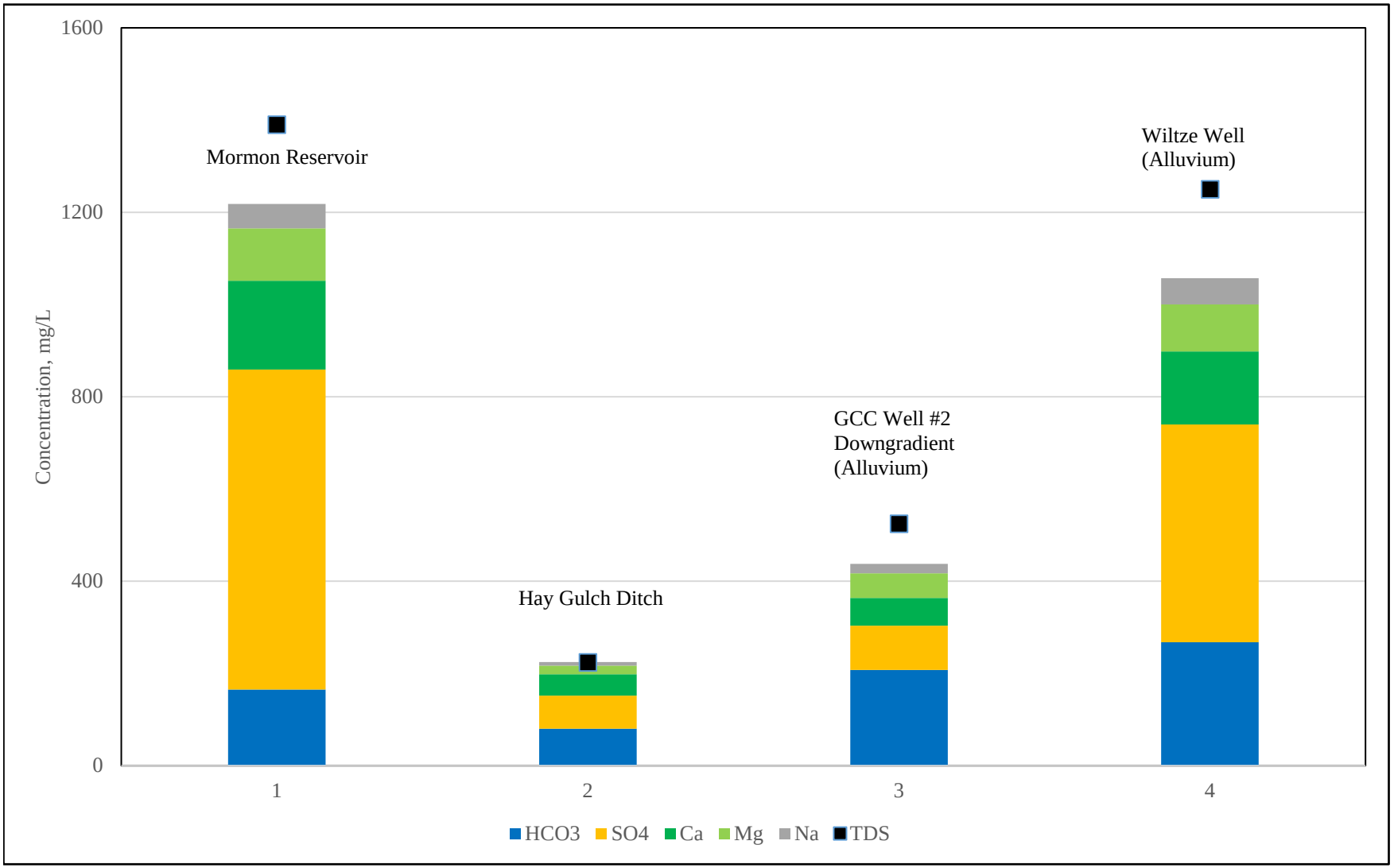
FIGURE 4-1

Surface Water Features

DATE: 1/31/2016	BY: MK	CHECKED: LJB

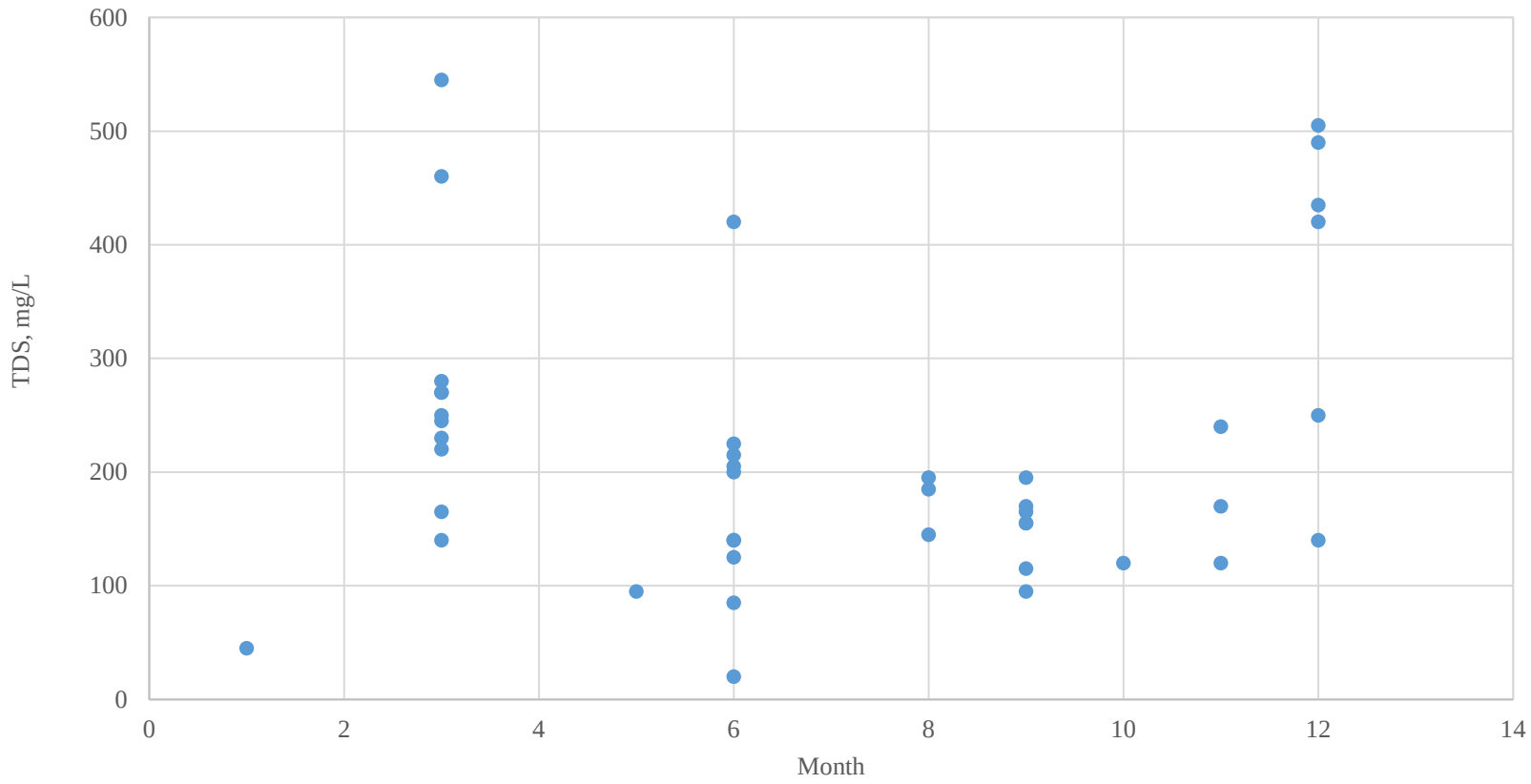
RESOURCE HYDROGEOLOGIC SERVICES

KingMine_SurfaceWater.mxd



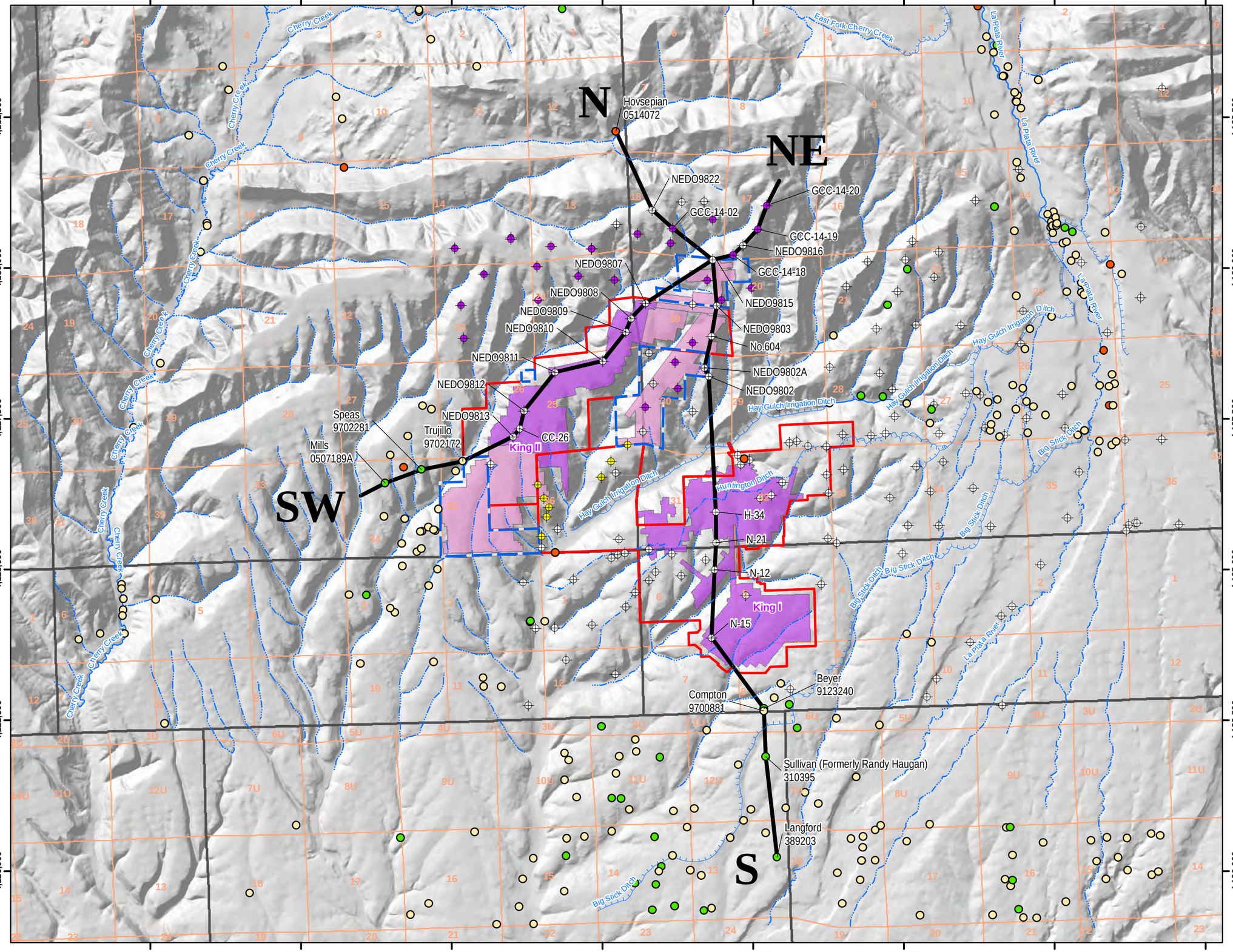
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-2: Major ions and TDS in surface water and alluvial wells of Hay Gulch.



RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-3: Correlation of TDS with month, Hay Gulch Ditch.



Geologic Cross-section
Coreholes
2015 Coreholes
2014 Coreholes

Domestic Wells 2016 (Receipt #)

CDWR Report Quality

Superior
Average
Poor

Canal Ditch
Intermittent Stream
Perennial Stream

King I & II Mine Underground Workings Outline

Existing
Proposed
GCC Permit Boundary
Lease Modification 1 Boundary Area
Section
Township
Section

Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5
Miles

1 inch = 5,000 feet

FIGURE 4-4

King Mine Geologic Cross-sections

DATE: 1/30/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

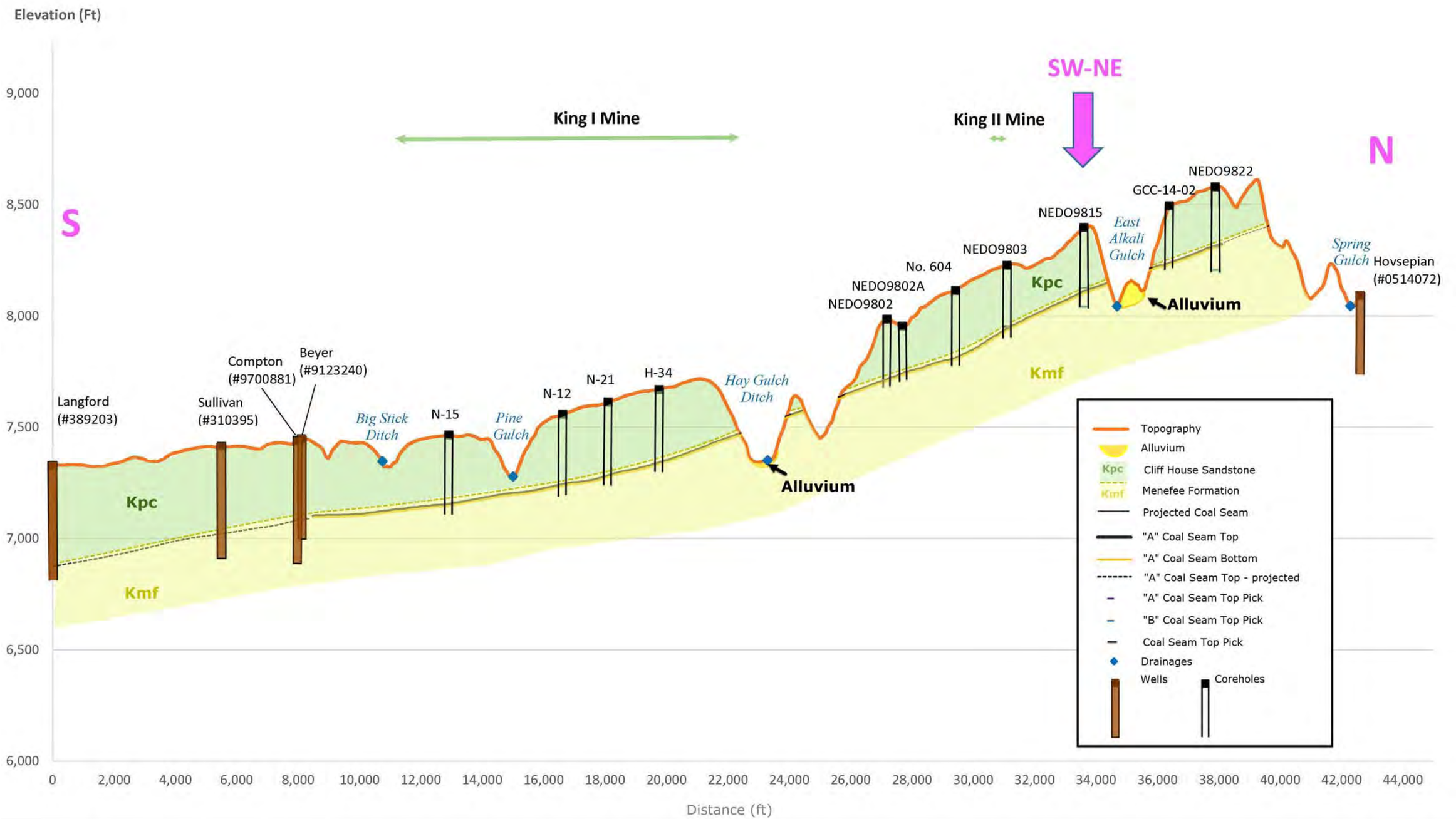


Figure 4-5: North-South Geologic Cross Section

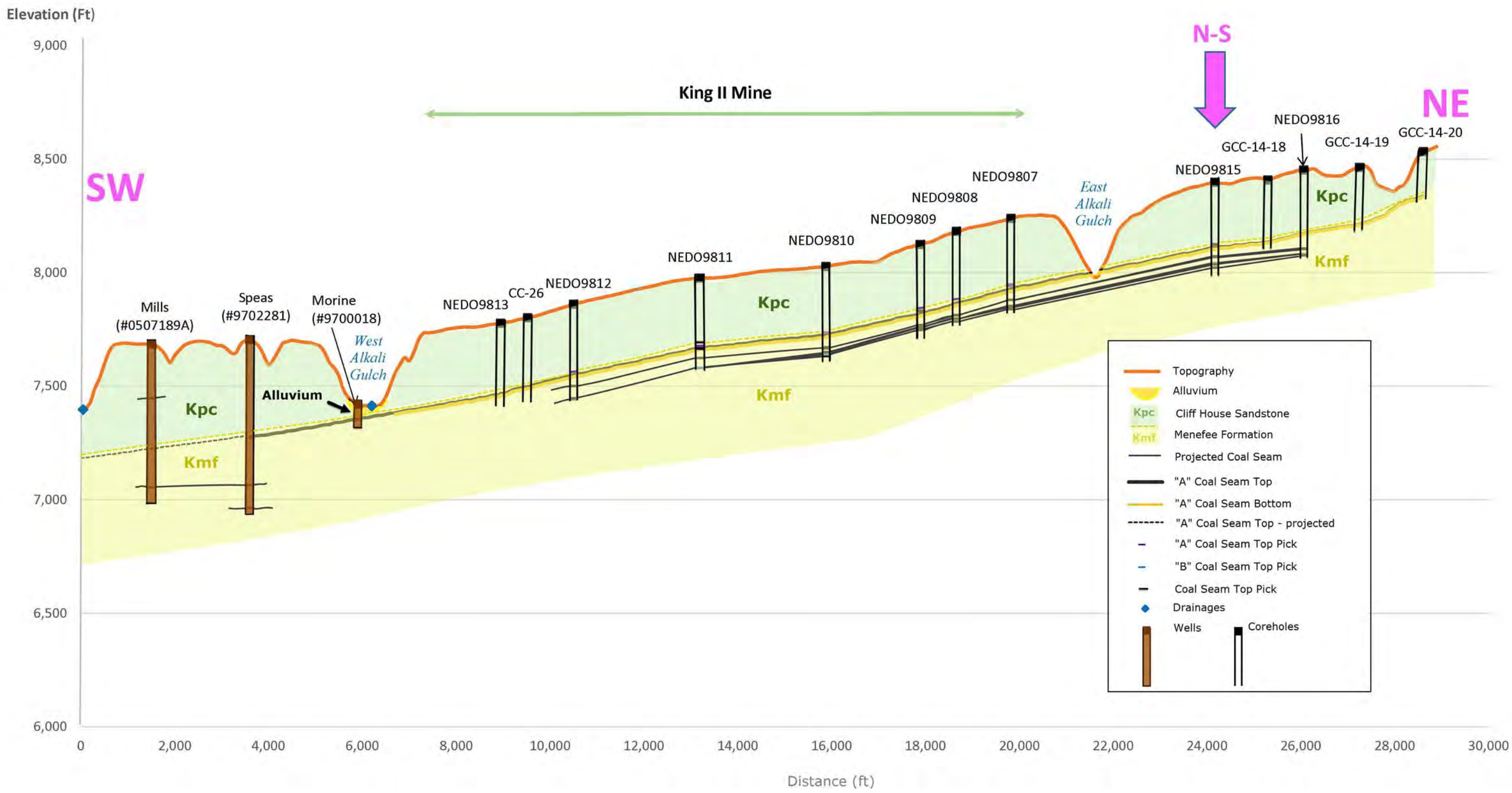
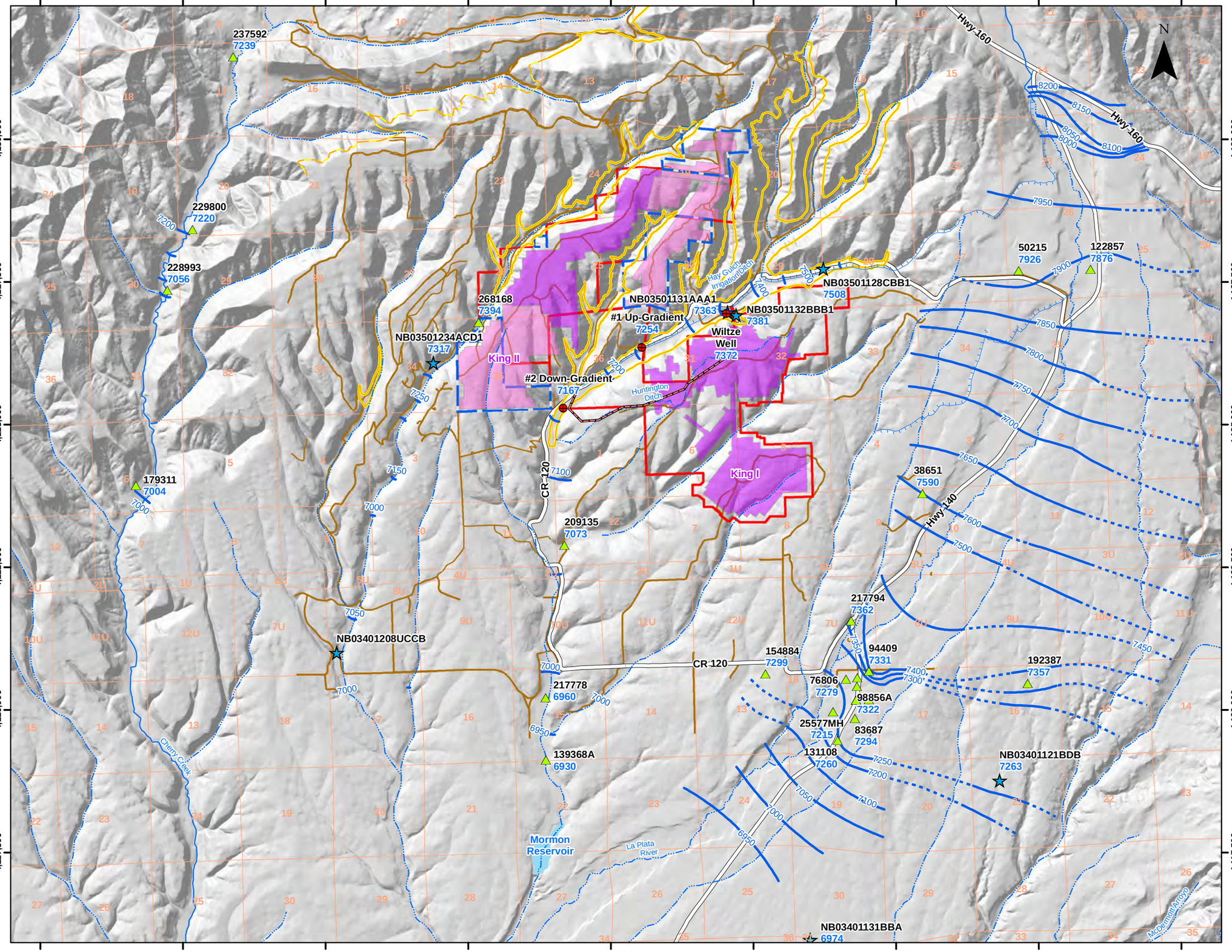


Figure 4-6: Northeast-Southwest Geologic Cross Section



GCC Compliance Monitoring Well
Alluvial Wells
Domestic Alluvial Water Levels (USGS)
"A" Coal Seam Outcrop
"A" Coal Seam Outcrop - Projected
Canal Ditch
Intermittent Stream
Perennial Stream
Alluvial GW Contour - 50' Interval
Alluvial GW Contour (Projected)
Huntington Pipeline
Main Roads
Minor Roads
Water Body
Section
GCC Permit Boundary
Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Existing
Proposed

Data Source:
GCC, NED, NHD
Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 1 mile

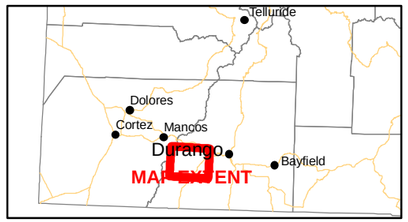


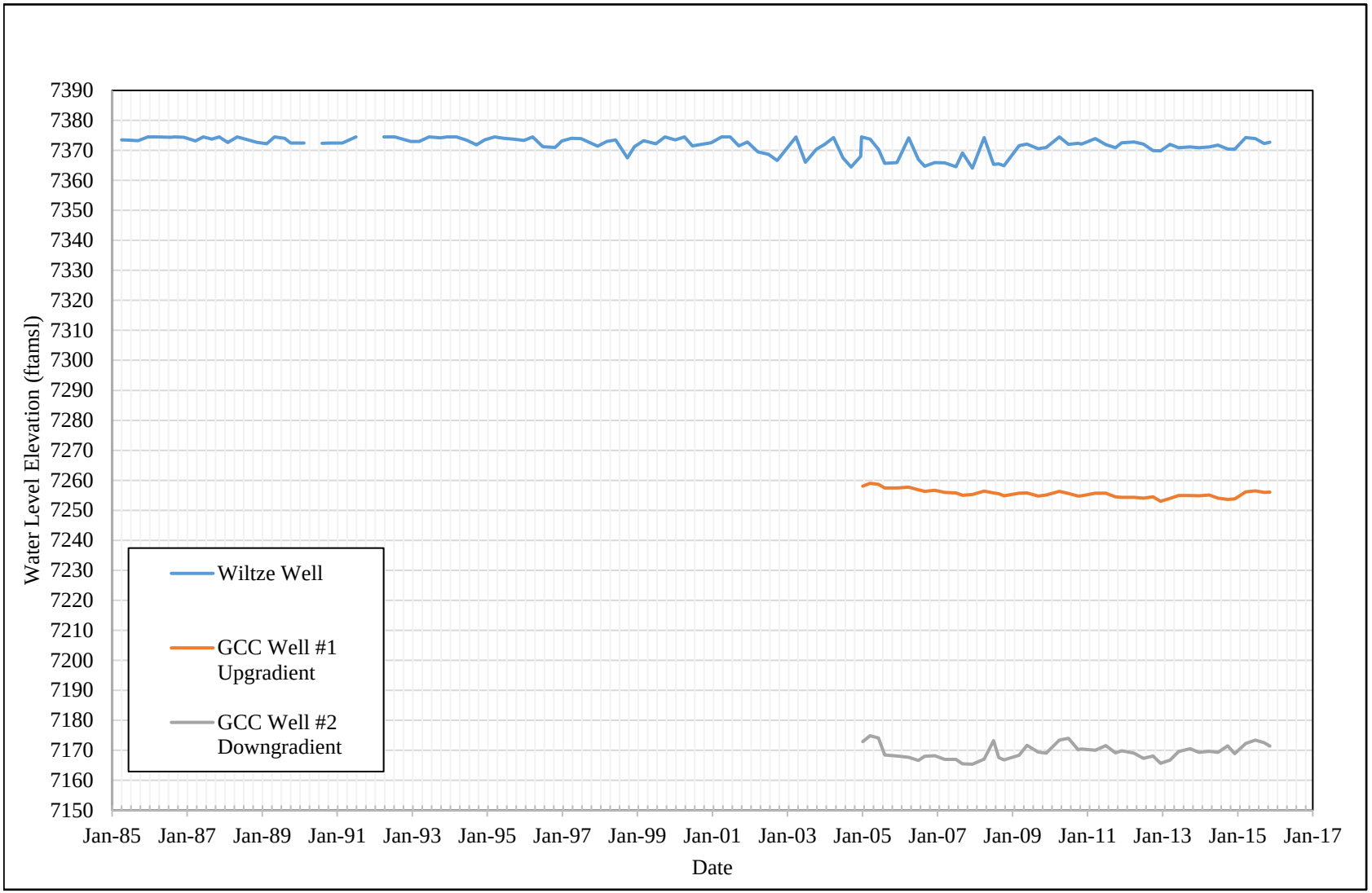
FIGURE 4-7

Alluvial Groundwater Contour Map

DATE: 1/30/2016	BY: MK	CHECKED: LJB

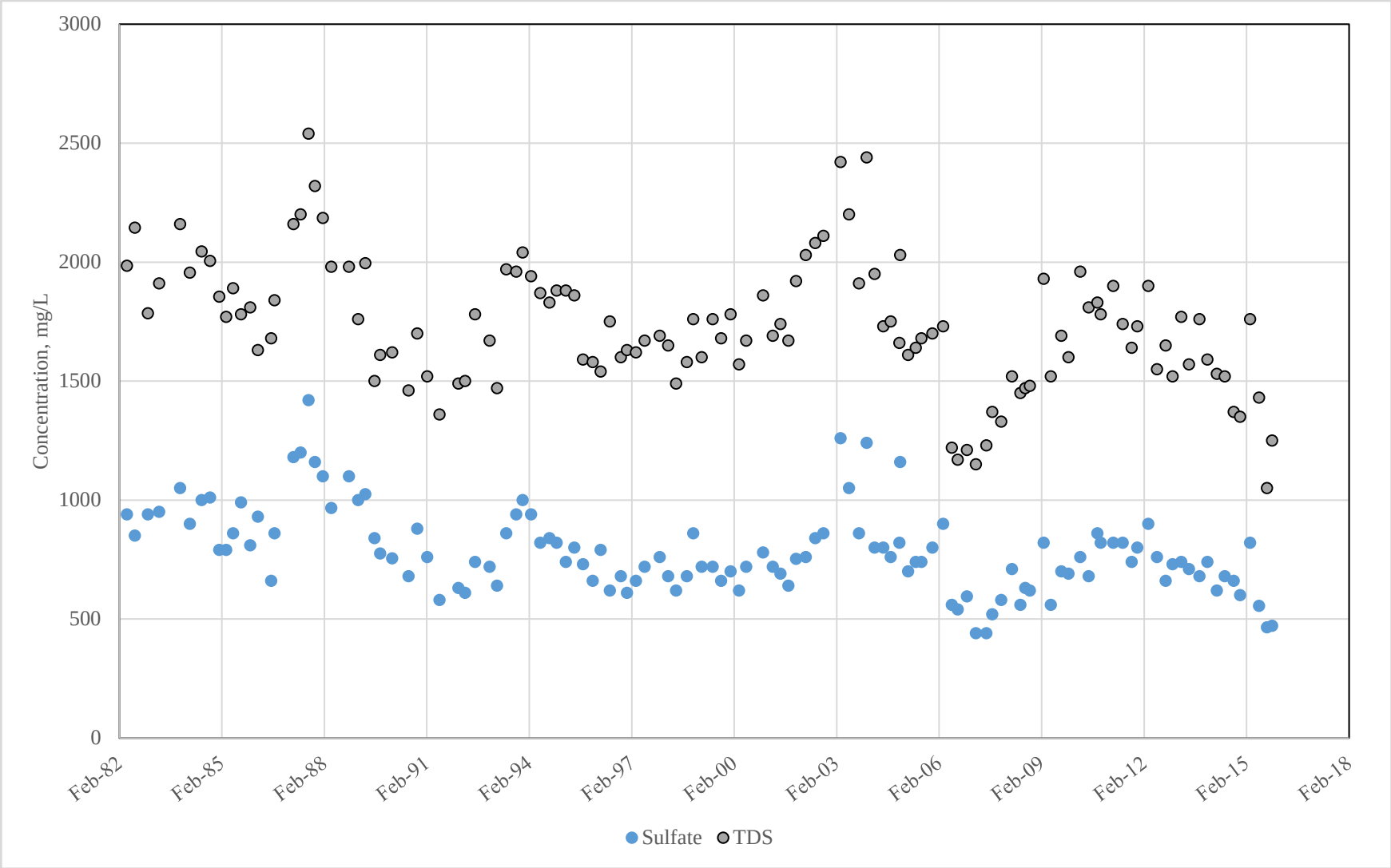
RESOURCE HYDROGEOLOGIC SERVICES

KingMine_Potentiometric.mxd



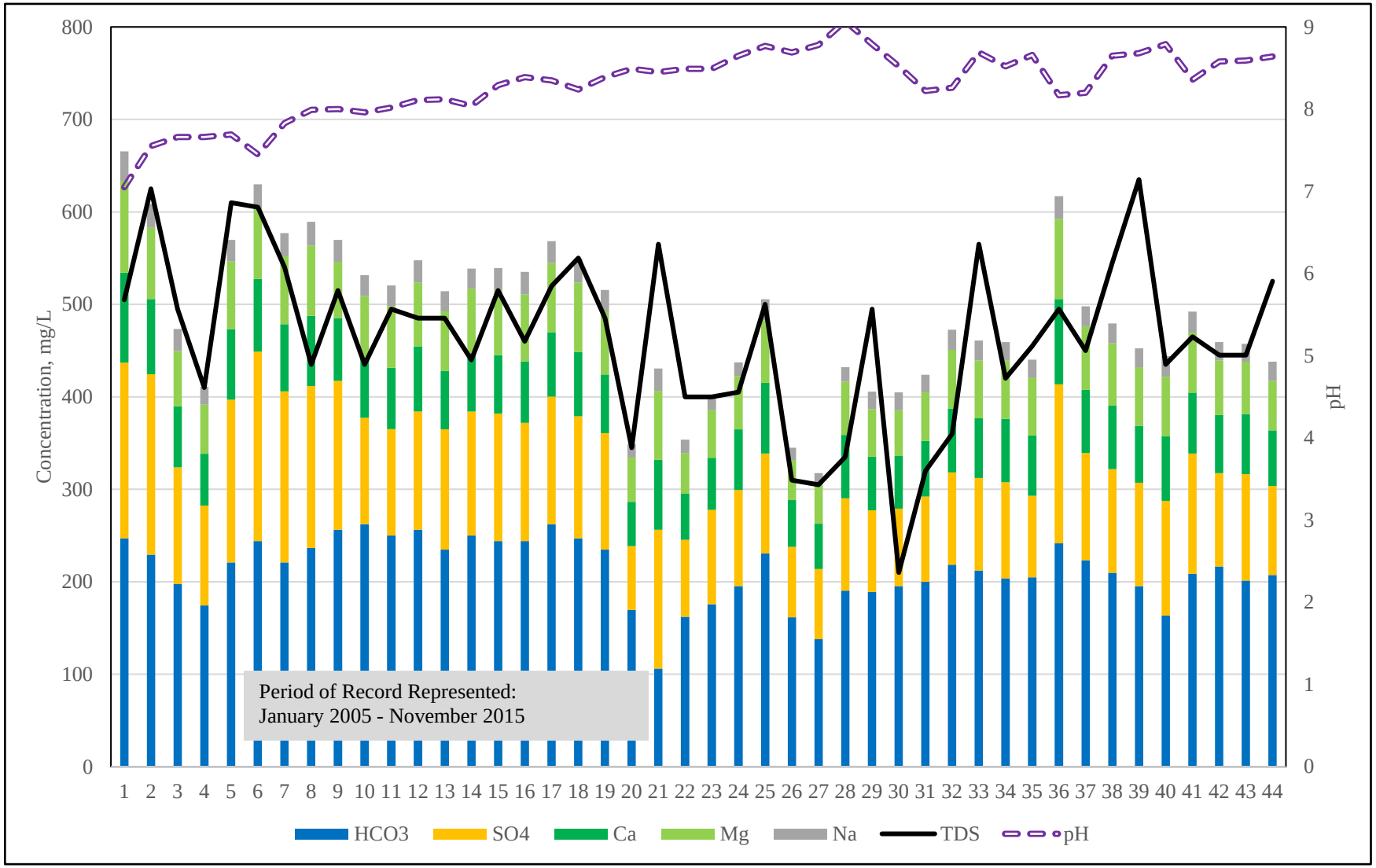
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-8: Hay Gulch Alluvial Groundwater Hydrograph for the GCC Compliance Monitoring Wells over the Entire Period of Record.



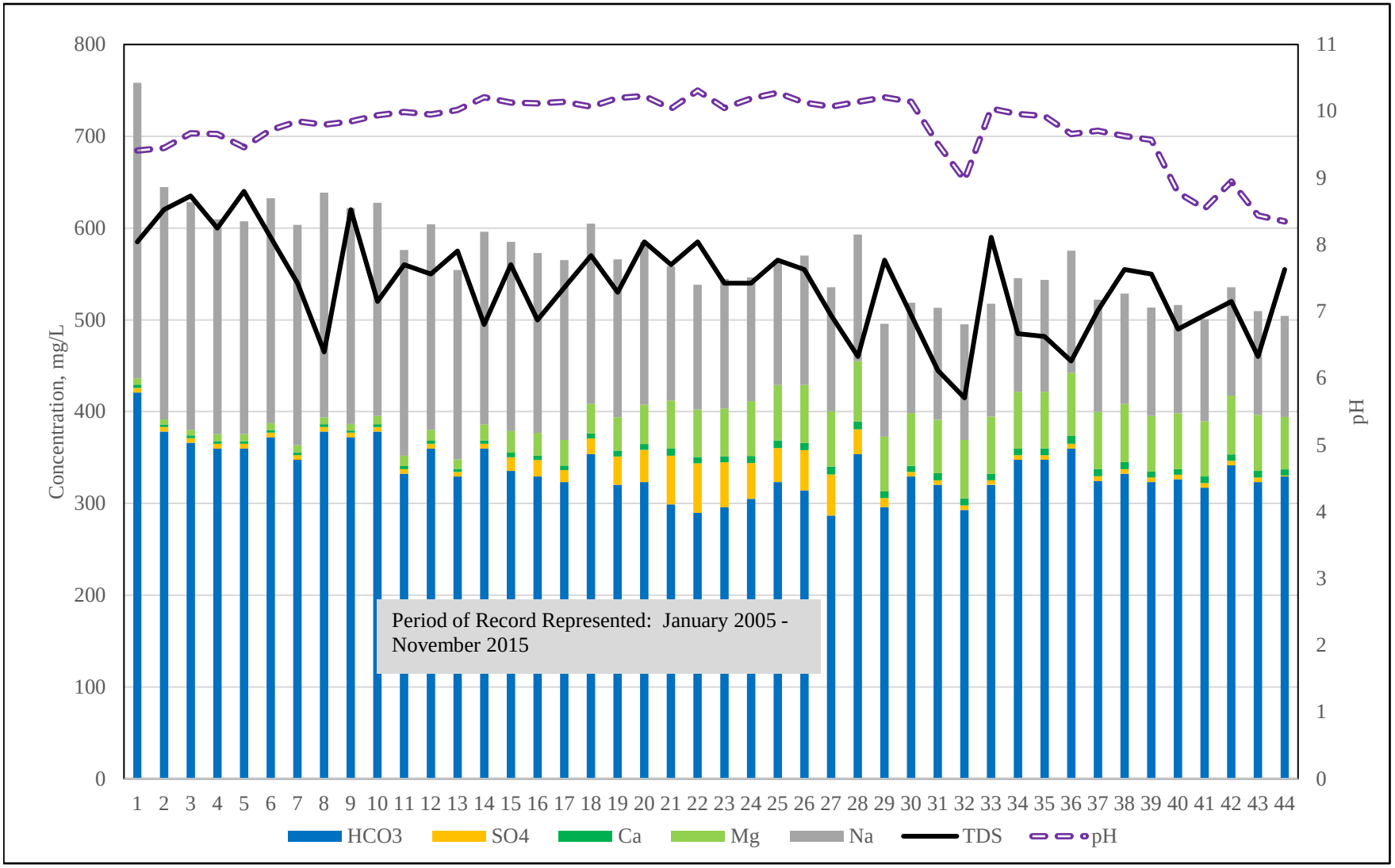
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-9: TDS and sulfate in the Wiltze well, 1982 through 2015.



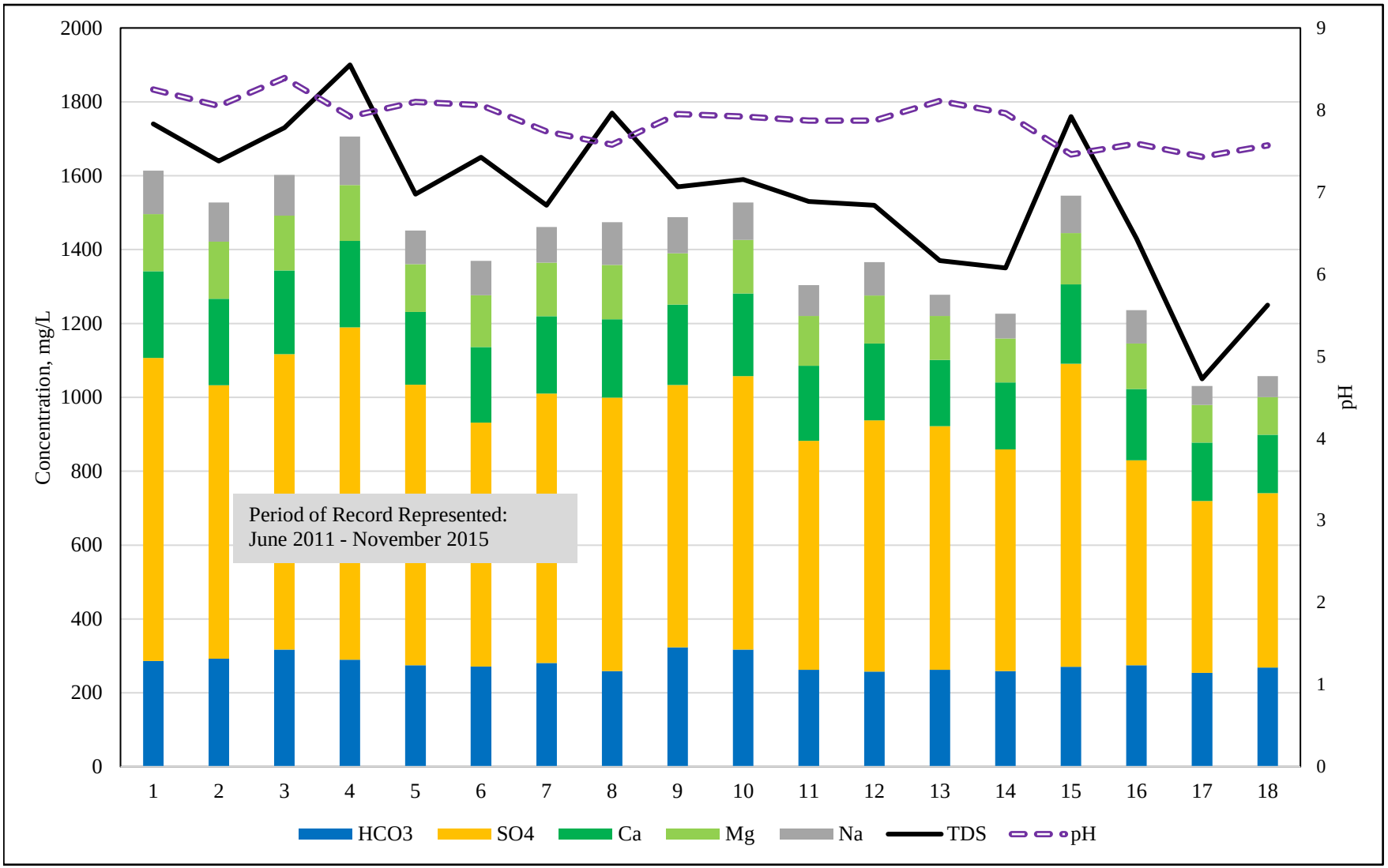
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-10: Major ions, TDS and pH in GCC Well #2 Downgradient.



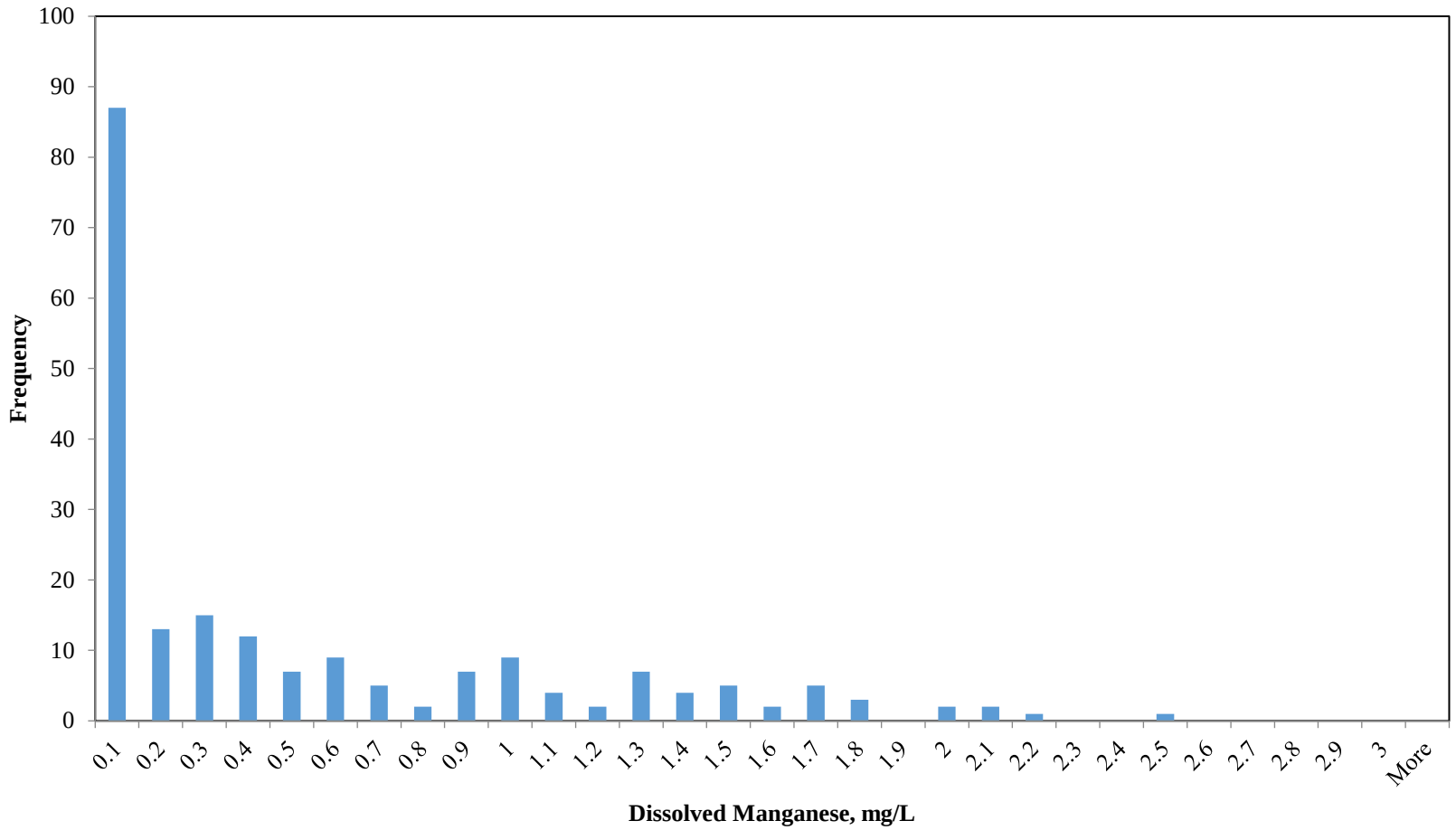
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-11: Major ions, TDS and pH in GCC Well #1 Upgradient, between King I and King II surface facilities.



RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-12: Major ions, TDS and pH in (pumped) Wiltze well near King I surface facilities.



RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-13: Distribution of dissolved manganese concentrations reported in all three GCC compliance wells, Hay Gulch alluvium.

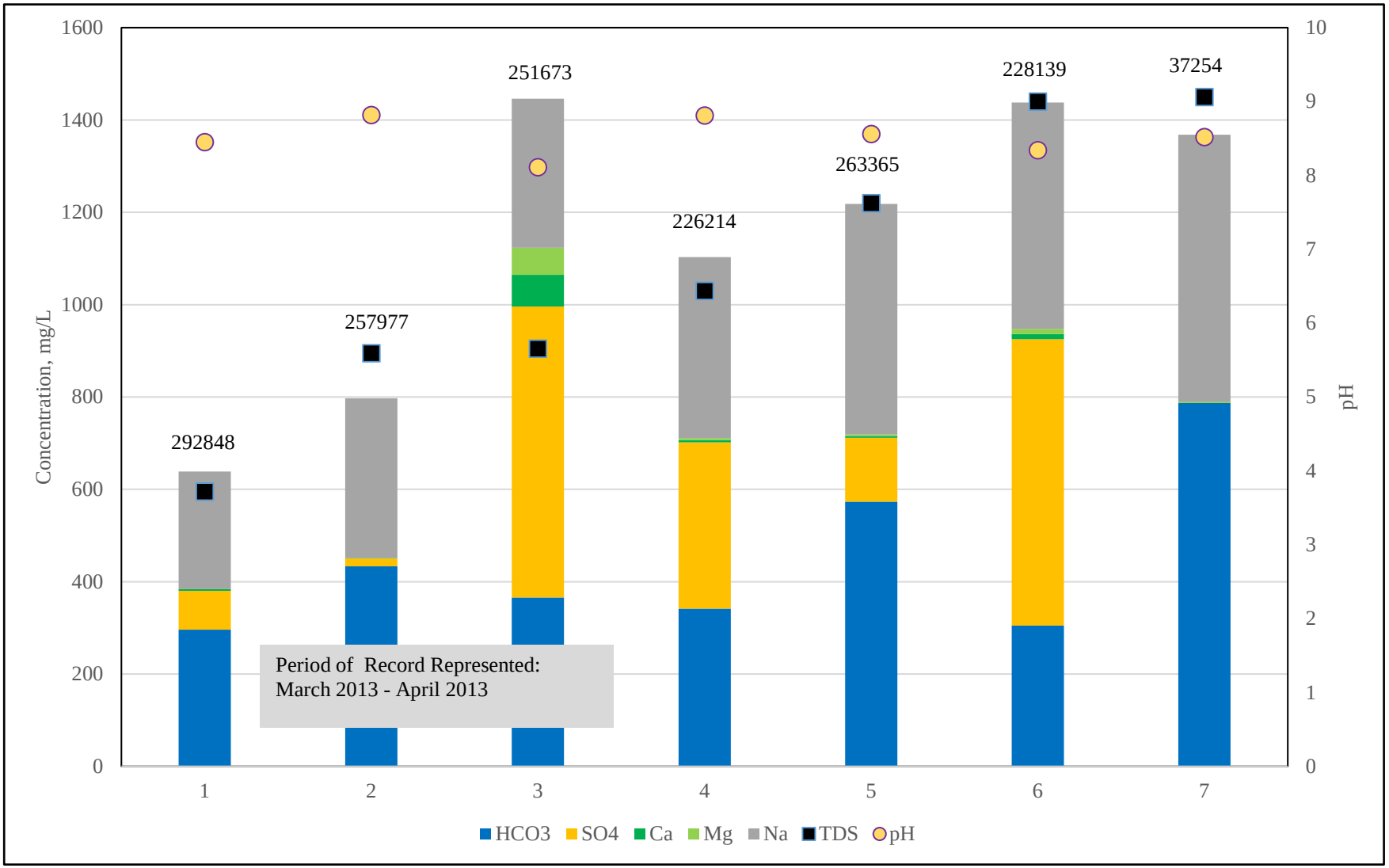
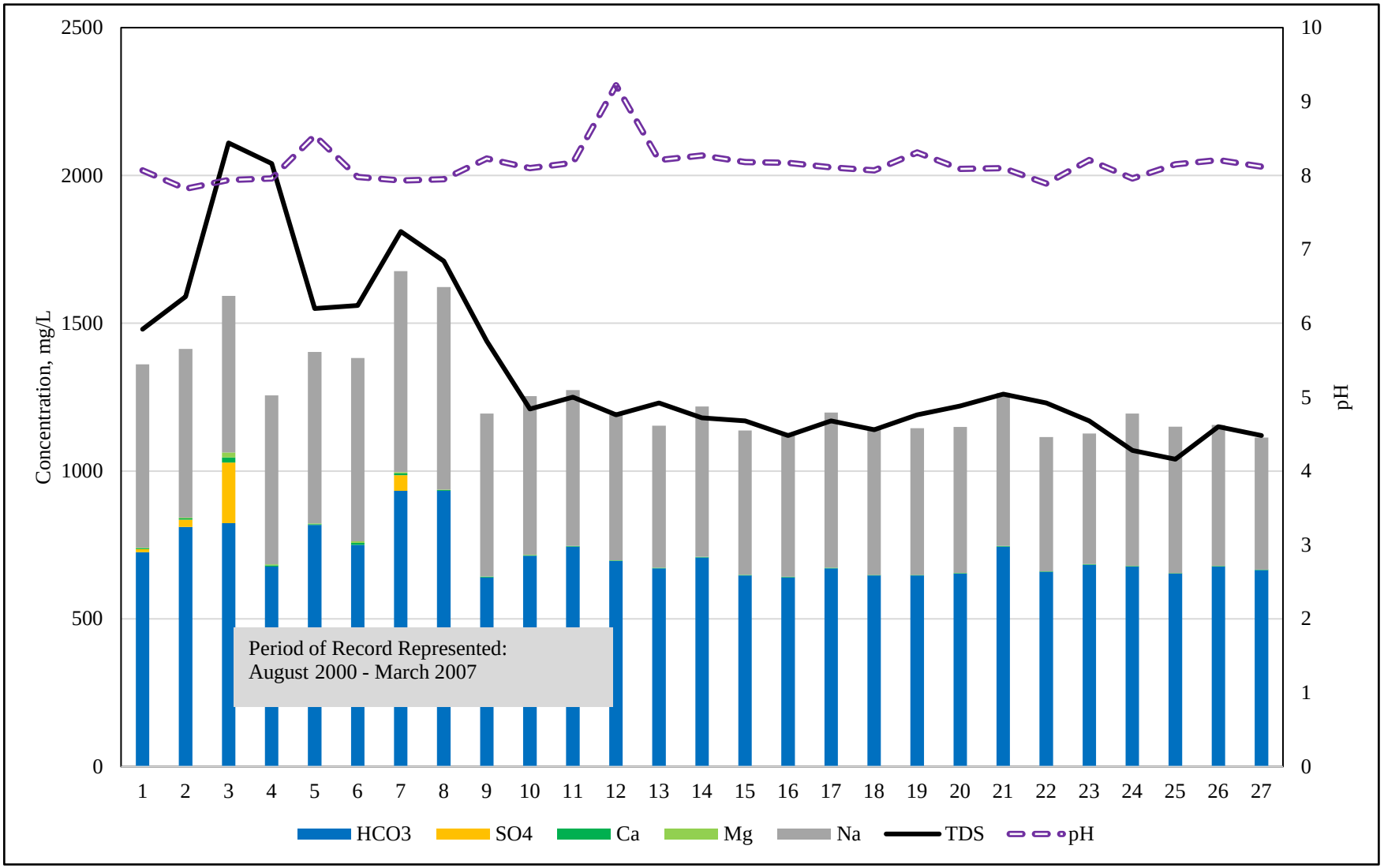
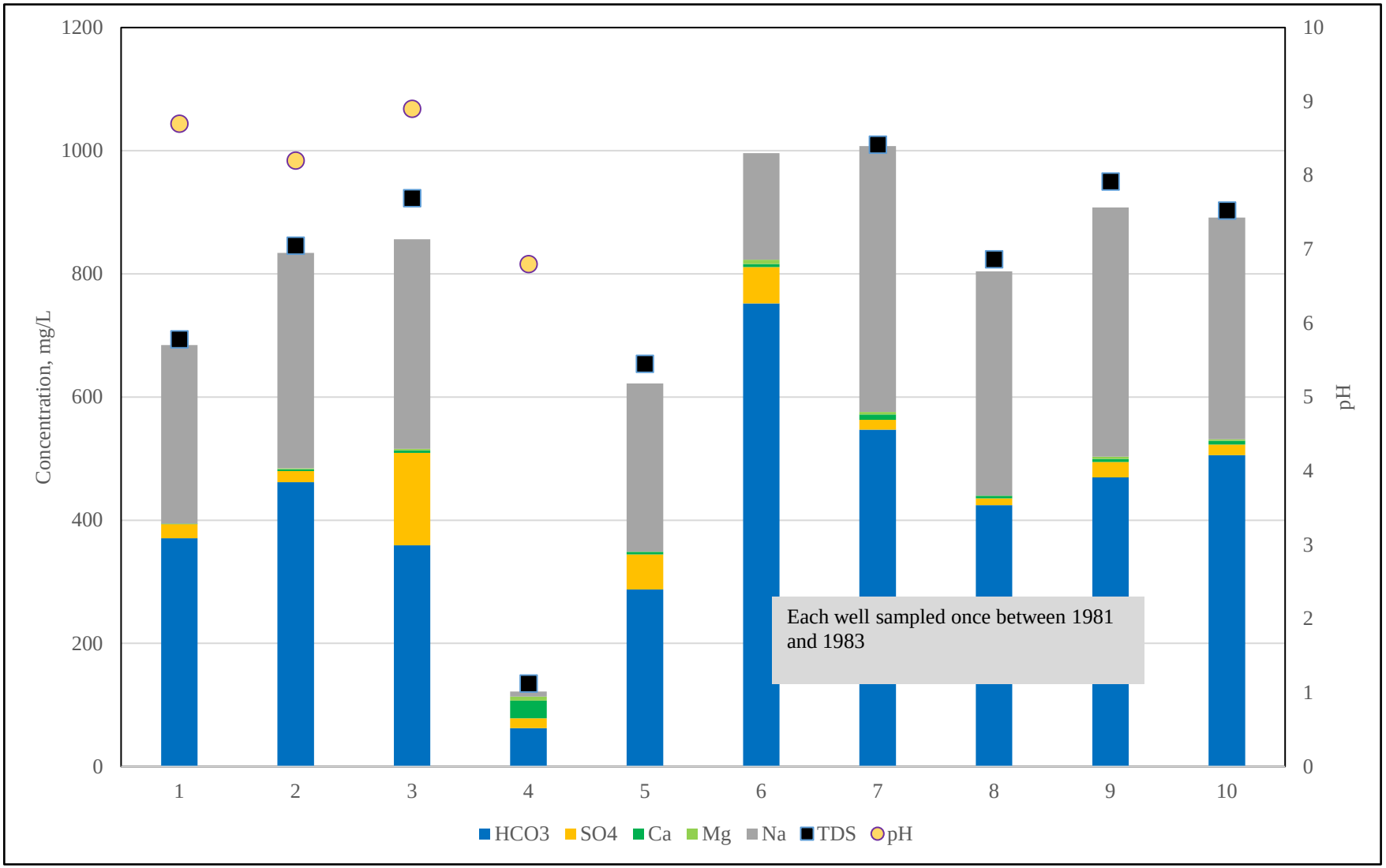


Figure 4-14: Major ions, TDS and pH in seven domestic wells completed in bedrock aquifers, Vista del Oro, 2013.



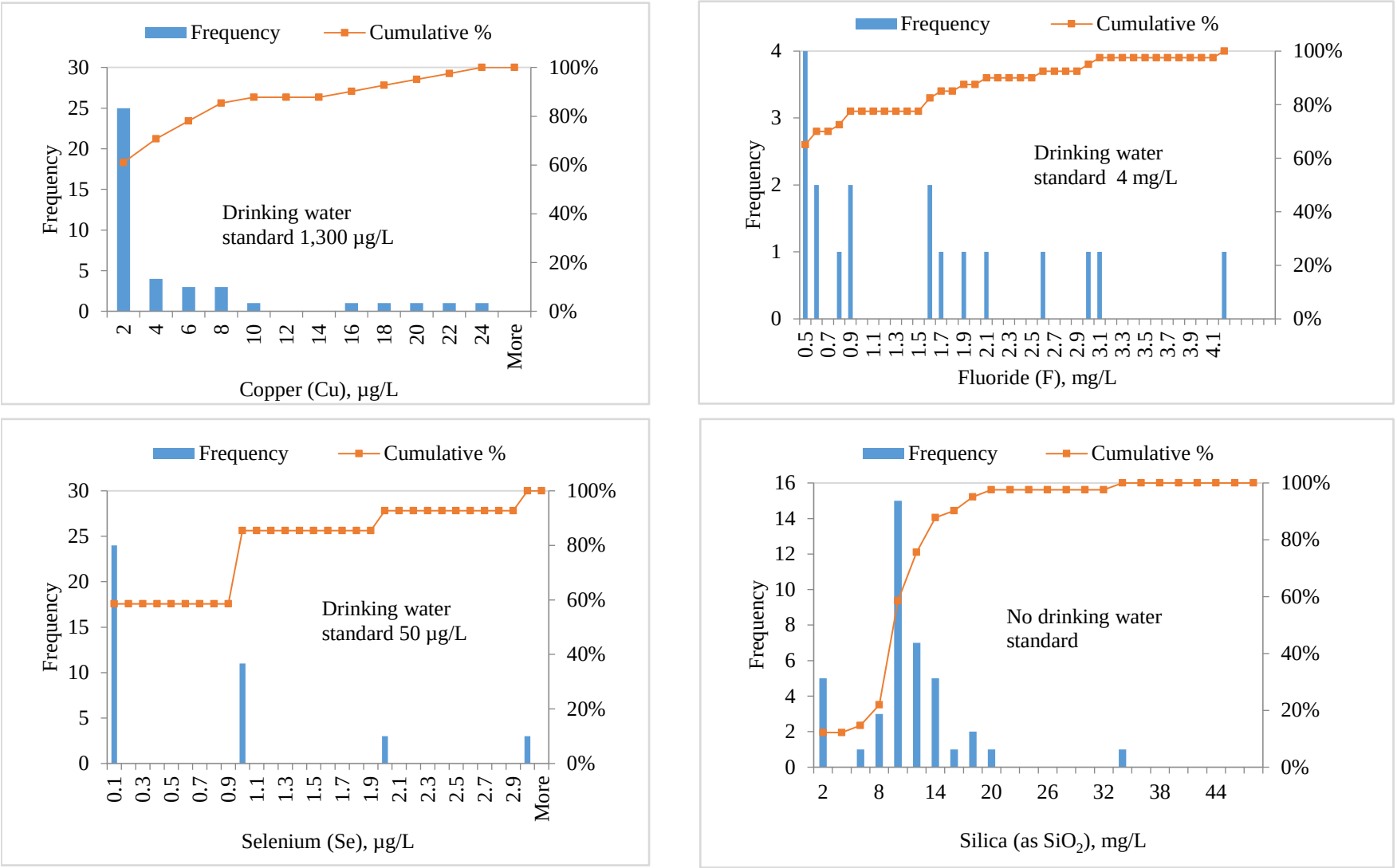
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-15: Major ions, TDS and pH in Haugen well, completed in bedrock aquifer.



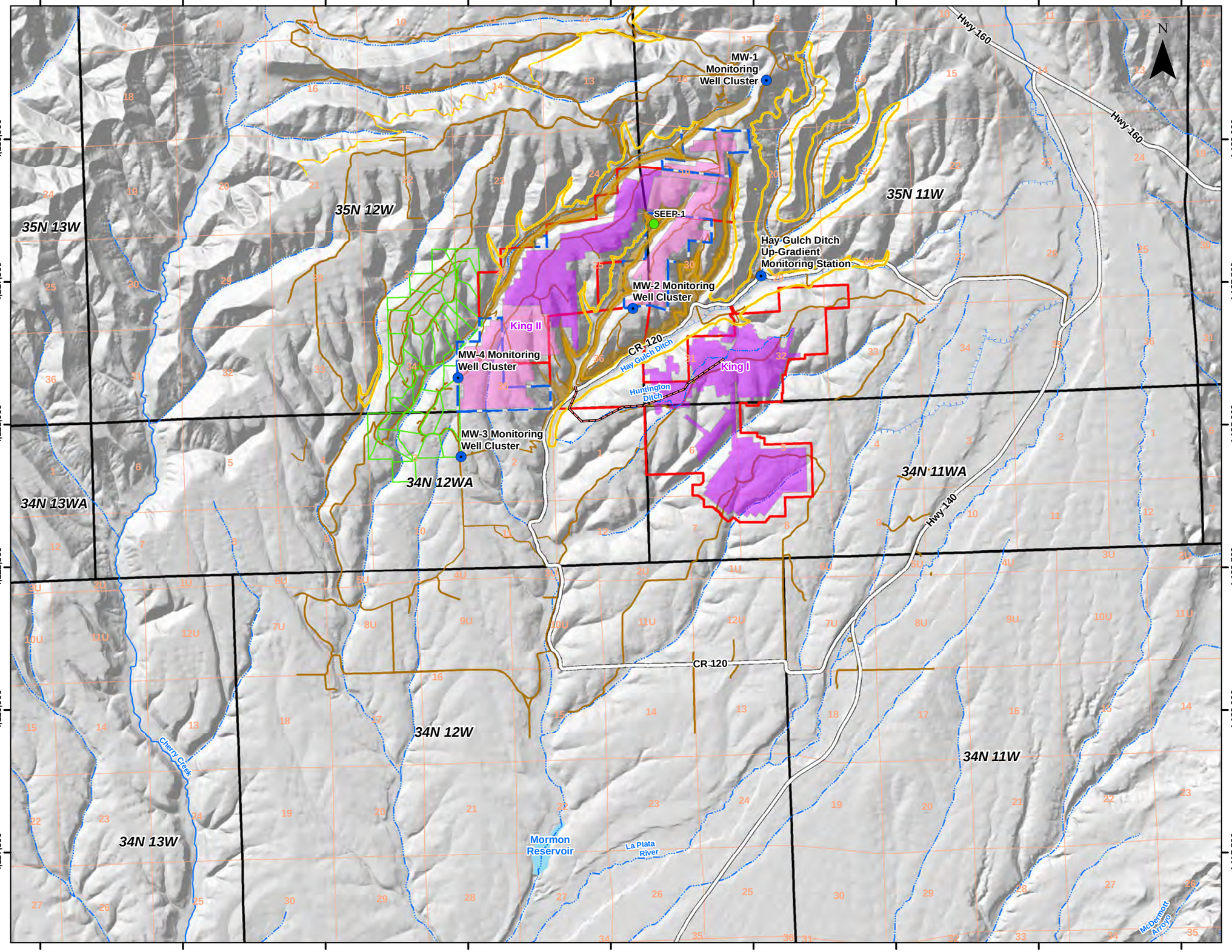
RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-16: Major ions, TDS and pH in wells sampled by USGS (NBO wells) in the study area.



RESOURCE HYDROGEOLOGIC SERVICES

Figure 4-17: Trace elements in NBO sample analyses.



- Proposed Monitoring Well Cluster
- Seep
- "A" Coal Seam Outcrop
- "A" Coal Seam Outcrop - Projected
- Huntington Pipeline
- Main Roads
- Minor Roads
- Canal Ditch
- Intermittent Stream
- Perennial Stream
- Vista del Oro Subdivision
- Spring and Seep Area
- Township
- Section
- Water Body
- GCC Permit Boundary
- Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

- Existing
- Proposed

Data Source:
GCC, NED, NHD

Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 1 mile

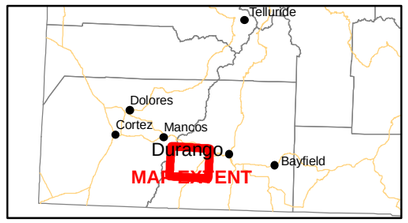


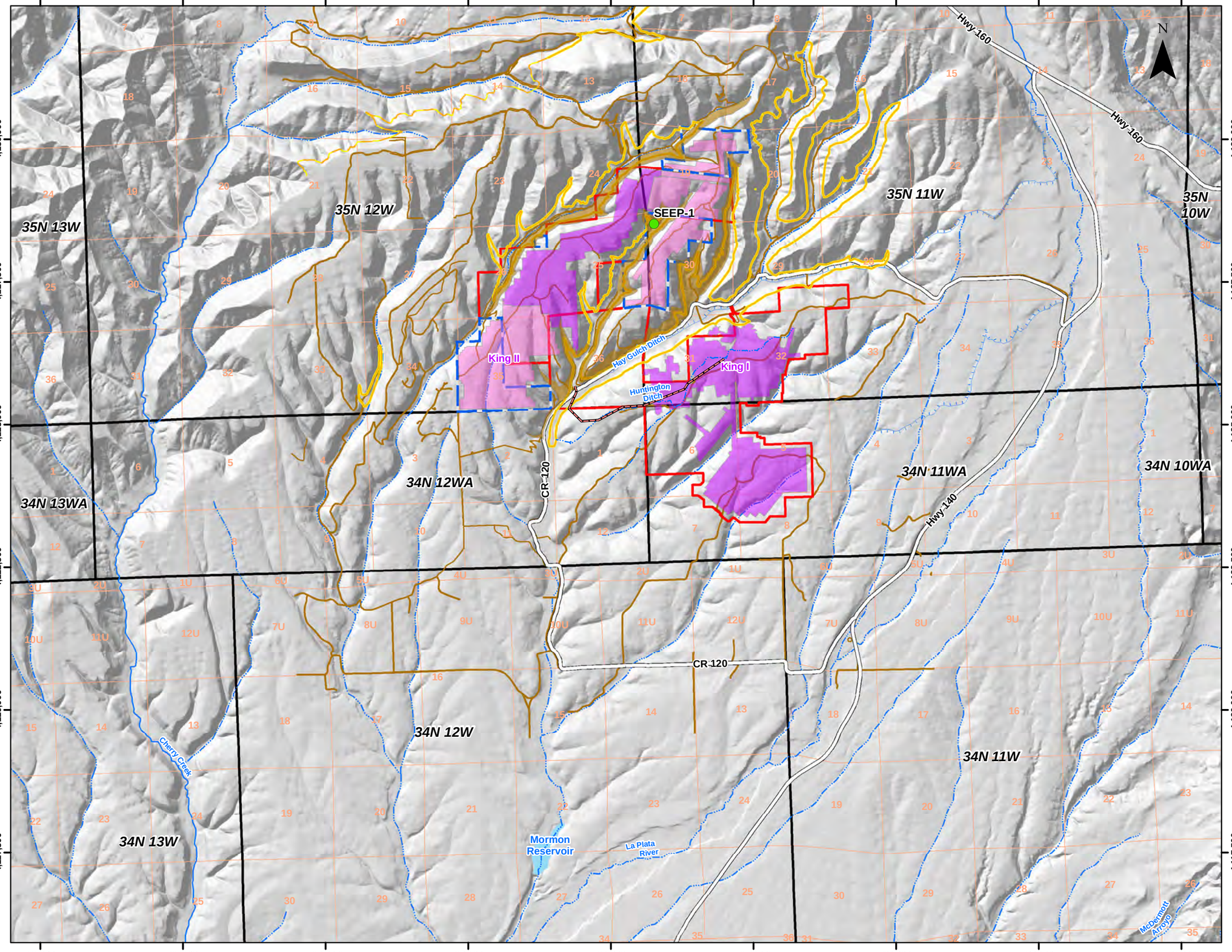
FIGURE 5-1

New Hydrologic Monitoring Locations

DATE: 1/31/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

KingMine_ProposedWells.mxd



Seep
"A" Coal Seam Outcrop
"A" Coal Seam Outcrop - Projected
Huntington Pipeline
Main Roads
Minor Roads
Canal Ditch
Intermittent Stream
Perennial Stream
Spring and Seep Area
Township
Section
Water Body
GCC Permit Boundary
Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Existing
Proposed

Data Source:
GCC, NED, NHD
Water-Resouces Investigations Report 85-4125, USGS.

Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 1 mile

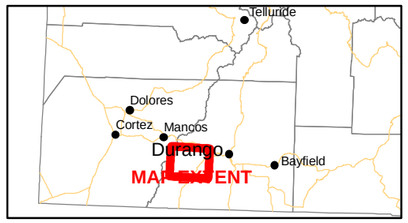


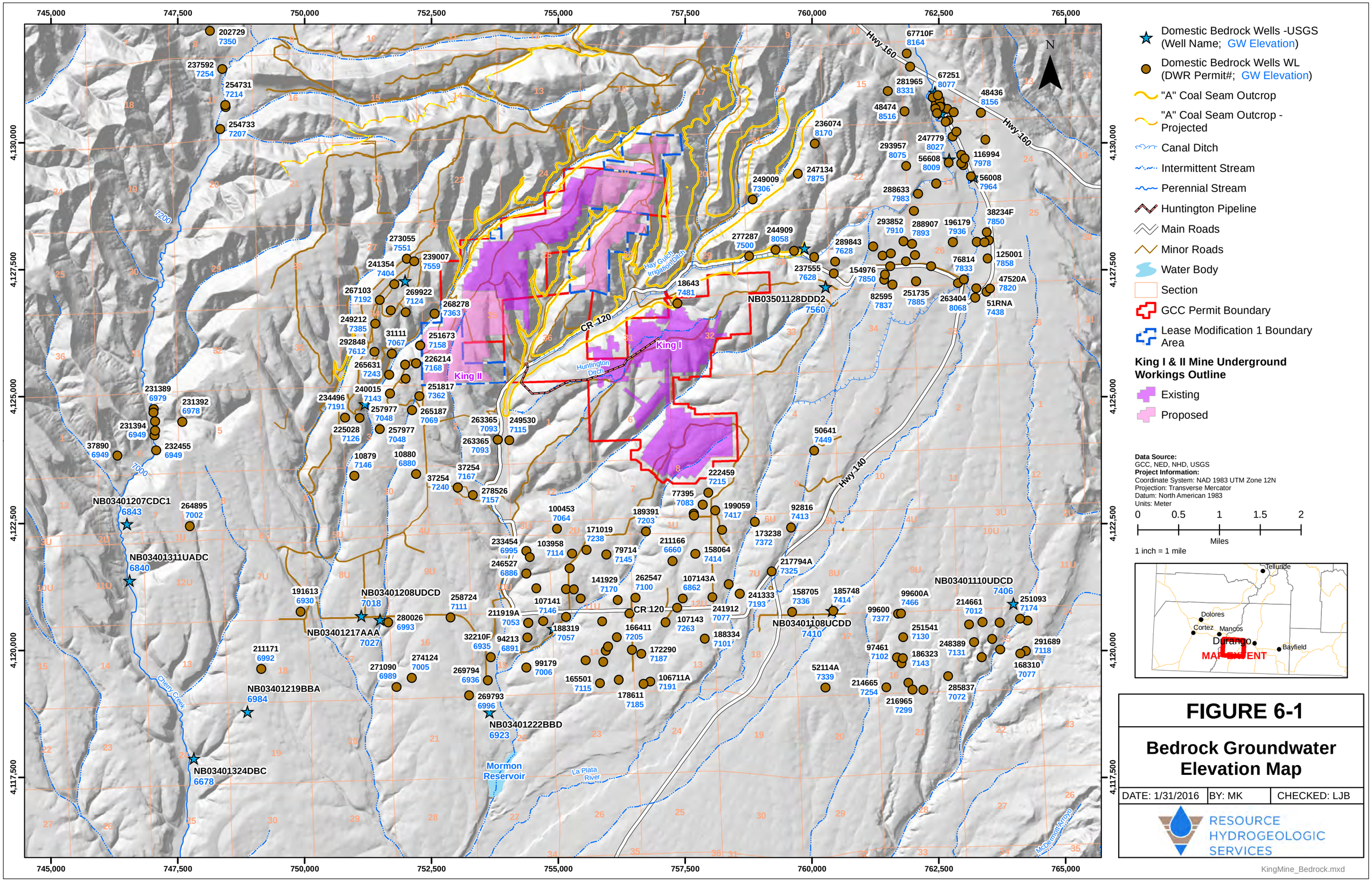
FIGURE 5-2

Spring and Seep Survey Area

DATE: 1/31/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

KingMine_SpringSeepSurvery.mxd



Domestic Bedrock Wells -USGS (Well Name; GW Elevation)

Domestic Bedrock Wells WL (DWR Permit#; GW Elevation)

"A" Coal Seam Outcrop

"A" Coal Seam Outcrop - Projected

Canal Ditch

Intermittent Stream

Perennial Stream

Huntington Pipeline

Main Roads

Minor Roads

Water Body

Section

GCC Permit Boundary

Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Existing

Proposed

Data Source:
GCC, NED, NHD, USGS
Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles

1 inch = 1 mile

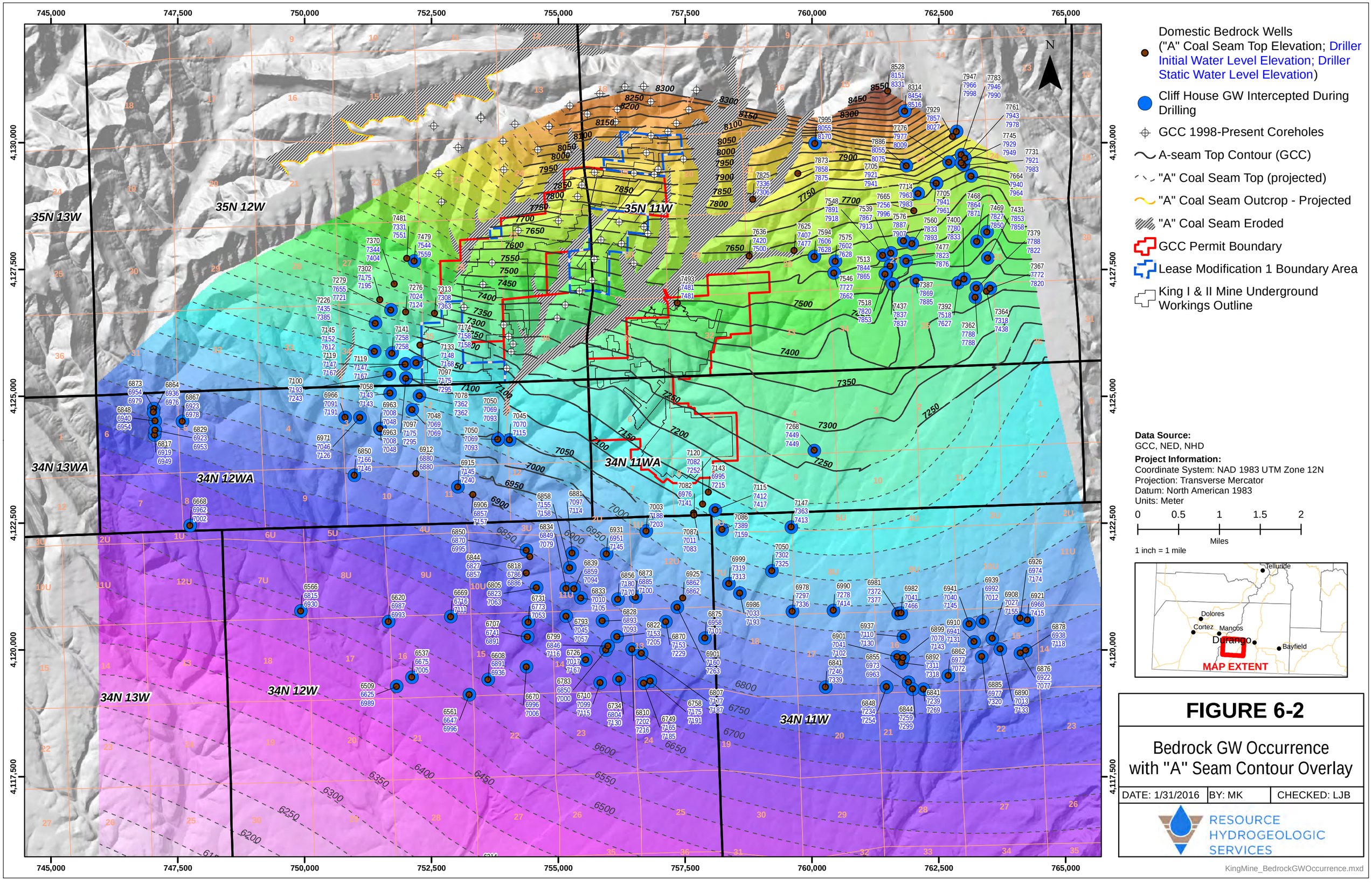
FIGURE 6-1

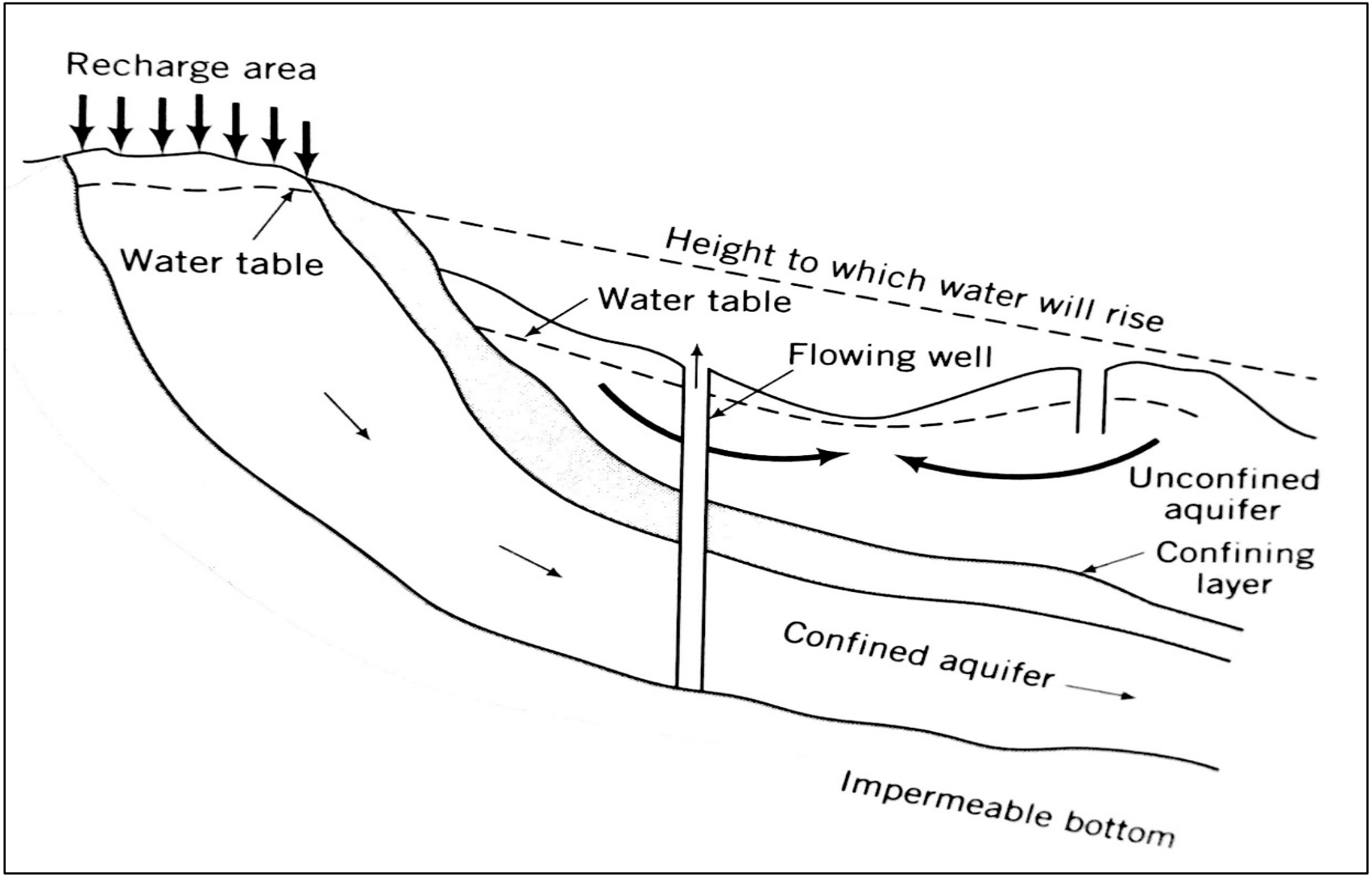
Bedrock Groundwater Elevation Map

DATE: 1/31/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

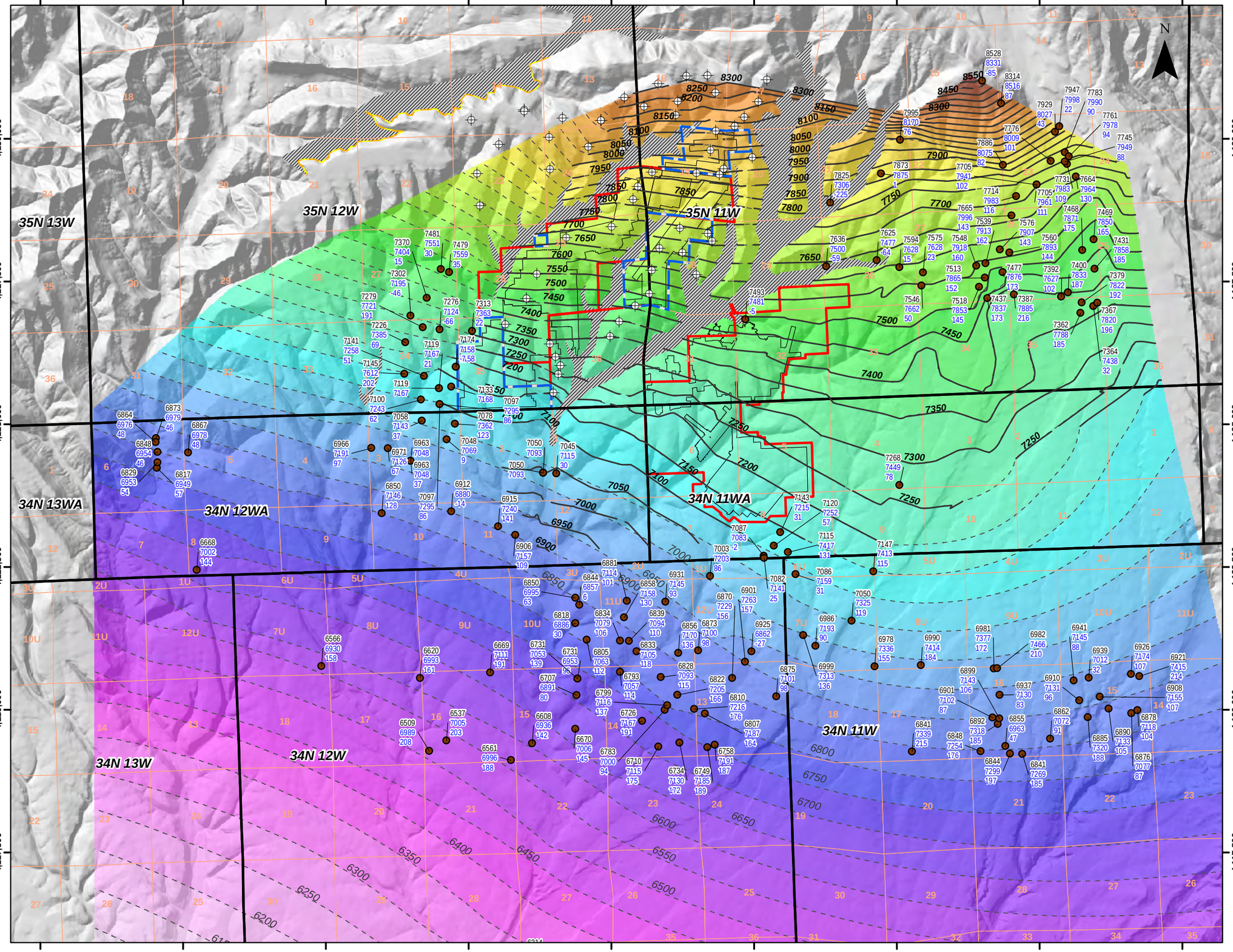
KingMine_Bedrock.mxd


745,000
747,500
750,000
752,500
755,000
757,500
760,000
762,500
765,000
4,130,000
4,127,500
4,125,000
4,122,500
4,120,000
4,117,500
N
35N 13W
35N 12W
35N 11W
34N 13WA
34N 12WA
34N 11WA
34N 13W
34N 12W
34N 11W
Domestic Bedrock Wells ("A" Coal Seam Top Elevation; Driller Initial Water Level Elevation; Driller Static Water Level Elevation)
Cliff House GW Intercepted During Drilling
GCC 1998-Present Coreholes
A-seam Top Contour (GCC)
"A" Coal Seam Top (projected)
"A" Coal Seam Outcrop - Projected
"A" Coal Seam Eroded
GCC Permit Boundary
Lease Modification 1 Boundary Area
King I & II Mine Underground Workings Outline
Data Source:
GCC, NED, NHD
Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
0 0.5 1 1.5 2
Miles
1 inch = 1 mile
Telluride
Dolores
Cortez
Mancos
Durango
Bayfield
MAP EXTENT
FIGURE 6-2
Bedrock GW Occurrence with "A" Seam Contour Overlay
DATE: 1/31/2016
BY: MK
CHECKED: LJB
RESOURCE HYDROGEOLOGIC SERVICES
KingMine_BedrockGWOccurrence.mxd



RESOURCE HYDROGEOLOGIC SERVICES

Figure 6-3: Schematic cross section cartoon illustrating difference between confined and unconfined aquifer (from: Domenico and Schwartz, 1990).



Domestic Bedrock Wells (A-Seam; Static Water Level; Hydrostatic Confined Pressure, PSI)

GCC 1998-Present Coreholes

A-seam Top Contour (GCC)

"A" Coal Seam Top (projected)

"A" Coal Seam Outcrop - Projected

"A" Coal Seam Eroded

GCC Permit Boundary

Lease Modification 1 Boundary Area

King I & II Mine Underground Workings Outline

Data Source:
GCC, NED, NHD
USDA - Aerial Imagery (2015)

Project Information:
Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.5 1 1.5 2
Miles
1 inch = 1 mile

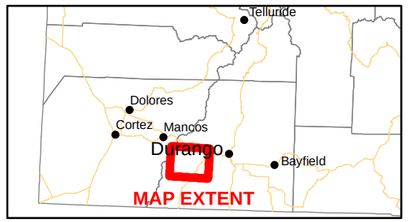


FIGURE 6-4

Bedrock Wells Confined Pressure

DATE: 1/31/2016	BY: MK	CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

KingMine_HydrostaticConfinedPressure.mxd

Proposed Decision
and
Findings of Compliance
for the

King Coal and King II Mines

Permit
C-81-035

Permit Revision No. 8

Colorado Division of Minerals and Geology
Ronald W. Cattany, Director

Prepared by

Tom Kaldenbach
Environmental Protection Specialist

June 15, 2006

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Section B

The following findings and specific approvals are required by Rule 4:

I. Roads - Rule 4.03

A. Haul Roads

1. The applicant has provided relevant information concerning the pre-1995 constructed haul road that shows the road meets the performance standards of Rule 4.03.1. The applicant has provided a design of the haul road proposed for the King II Mine that indicates this road will meet the performance standards of Rule 4.03.1.

2. The Division proposes to approve the retention of the haul road at the King Coal Mine depicted on Map No. C-4 because it is compatible with the approved post-mining land use, and a request for its retention was submitted by the landowner. (4.03.l(l)(f)(i)).

B. Access Roads

1. The landowner has requested the retention of the access road at the King Coal Mine depicted on Map No. C-4. Its retention is compatible with the approved postmining and historic land use of agriculture (ranching). Therefore the Division proposes to approve retention of the access road. (4.03.2(l)(f)).

II. Support Facilities - Rule 4.04

Information on mine support facilities is found in Section 2.05.3 of the permit and are depicted on Maps C-4 and King II-007. The landowner has requested in writing that some of the buildings at the King Coal Mine remain after reclamation to support his agriculture operation. A summary is found in the Summary Section of this document under "Description of Operations and Reclamation Plan". Proposed mine support facilities have been designed to prevent damage to fish, wildlife, and property, and to control and minimize air and water pollution; therefore, the Division proposes to approve the proposed construction of facilities. No support facilities are proposed for permanent retention at the King II Mine.

III. Hydrologic Balance - Rule 4.05

A. With the exception of the Small Area Exemptions listed below, all disturbed area drainage will pass through one of three sediment ponds. Discharges from these ponds will be monitored to verify compliance with water quality standard and effluent limitations (4.05.2(2)).

1. The Division proposes to grant exemptions from use of sediment ponds in two small areas for the following reasons: each area is relatively small, ponds and treatment facilities are not necessary for the drainage to meet the effluent limitations of Rule 4.05.2 and applicable State and Federal water quality standards for receiving streams, and there will be no mixing of surface drainage with a discharge from underground workings. The small areas to be exempted are: a) the area at the King Coal Mine that extends from the mine entrance gate to the east pond next to the haul road, and b) the segment of the haul road at the King II Mine that extends from the entrance gate to the sediment pond. (4.05.2(3)(b)(i)).

B. Diversions and Conveyance of Overland Flow

All diversions within the permit area are designed and constructed in accordance with Rule 4.05.3. Designs are discussed in Section 2.05.3 and in Appendices 8 and 11 in the permit application.

C. Stream Channel Diversions

1. The Division proposes to approve the permanent diversion of an intermittent stream draining less than one square mile, which flows along the north side of the coal waste pile at the King Coal Mine. The Division also proposes to approve the temporary diversions of two ephemeral streams at the King II Mine. One stream, west of the proposed mine portal area drains less than one square mile. The other stream is Cochrane Canyon, located east of the proposed portal area, and drains more than one square mile. This decision to approve the diversions is based on a finding that the proposed diversions meet the requirements of 4.05.18 and 4.05.4, applicable local, State, and Federal statutes and regulations and that the diversions are designed to safeguard public safety and to minimize adverse impacts to the hydrologic balance. (4.05.4(1) and (4)).

2. Channel lining structures, flow dissipators, and artificial channel roughness structures are proposed for use to control erosion. These means are proposed to be approved by the Division since they are necessary to control erosion, they are stable and will require minimal maintenance. (4.05.4(2)(a)).

D. Sedimentation Ponds

Design criteria and specifications have previously been approved for use in the two sediment ponds at the King Coal Mine. The Division proposes to approve for use design criteria and specifications for a sediment pond at the King II Mine. This decision is based on a thorough analytical demonstration by a qualified professional engineer that the resulting sediment pond will be as environmentally sound and structurally stable taking into consideration physical, climatological, and other characteristics of the site. (4.05.6(11)).

E. Impoundments

Impoundments are not proposed at this time.

F. Ground and Surface Water Monitoring

1. The applicant will conduct monitoring of ground water in a manner approved by the Division. The ground water monitoring plan is as follows: (4.05.13(1)).

   Ground water is monitored in two alluvial wells in Hay Gulch downgradient from the King Coal Mine and downgradient from the King II Mine. Section 2.04.7 and 2.05.6 of the permit application require both alluvial wells to be monitored for the following parameters on a quarterly basis:

   Table 1

Depth-To-Water (ft.)	Magnesium
pH	Sulfate
Temperature (°C)	Iron
Conductivity	Sodium
Total Dissolved Solids	Bicarbonate
Calcium	

   Historical observations indicate the producing coal seam and its overburden have been essentially dry at the King Coal Mine. In 1986, however, mining encountered ground water resulting in this water being pumped to the surface and discharged to the west sediment pond. It is hypothesized mining dewatered an overlying perched aquifer. It is possible, however, that some inflow from the Pine Gulch drainage may have occurred.

2. The applicant will monitor surface water in a manner approved by the Division. The monitoring plan was submitted under 2.05.6(3)(b)(iv) and includes the following: (4.05.13(2)).

   Surface water monitoring is limited to NPDES discharges, as no surface streams with regular flows occur in the permit area. Required monitoring of the irrigation water from the La Plata River ended in the fall of 1998.

E. Impoundments

Impoundments are not proposed at this time.

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   Table 1

Depth-To-Water (ft.)	Magnesium
pH	Sulfate
Temperature (°C)	Iron
Conductivity	Sodium
Total Dissolved Solids	Bicarbonate
Calcium	

   Historical observations indicate the producing coal seam and its overburden have been essentially dry at the King Coal Mine. In 1986, however, mining encountered ground water resulting in this water being pumped to the surface and discharged to the west sediment pond. It is hypothesized mining dewatered an overlying perched aquifer. It is possible, however, that some inflow from the Pine Gulch drainage may have occurred.

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   Surface water monitoring is limited to NPDES discharges, as no surface streams with regular flows occur in the permit area. Required monitoring of the irrigation water from the La Plata River ended in the fall of 1998.

G. Transfer of Wells

At the conclusion of mining, the two wells used in the operation will be transferred back to the owners at the written request of the surface owners (4.05.14).

H. Discharge of Water into an Underground Mine

No surface water will be discharged into the underground mine workings (4.05.15).

I. Probable Hydrologic Consequences

Ground Water Effects

The ground water-bearing units having the greatest potential to be affected by mining at the King Coal and King II Mines are the Hay Gulch alluvium, the Menefee Formation, and the Cliffhouse Sandstone. (The Point Lookout Sandstone is well beyond the area of influence of the mines because it is approximately 250 feet stratigraphically below the workings. The Point Lookout has been monitored since late 2000 in the Haugen well about 5000 ft. down-dip from the workings. Monitoring data show no impacts from mining at King Coal.).

Hay Gulch Alluvium - The mine will not discharge enough water to the Hay Gulch alluvium to impact the alluvium. The Hay Gulch alluvium has been monitored in the Wiltze well, downstream from the west sediment pond at the King Coal Mine. Monitoring data indicate no mining impacts to this unit. The King II Mine will also monitor alluvial water quality in a down-gradient well.

Cliffhouse Sandstone - It appears unlikely that the King Coal and King II Mines will fill with water after mining is finished. With the exception of one inflow event, the mine workings of the King Coal Mine have been dry. Both mines appear to underlie the updip, unsaturated portion of the Cliffhouse Sandstone. Impermeable shale and siltstone of the Menefee Formation underlie the workings, and also are unlikely inflow sources for the workings. If the King Coal Mine or King II Mine workings were to eventually fill with water, it seems unlikely the water could be transmitted from the workings to the Cliffhouse Sandstone through intergranular porosity in roof rock of the workings because the roof rock is composed of shale, which probably is impermeable to water. (Drill hole sample logs in Appendix 4 of the permit show the Upper Coal Seam of the Menefee Formation, the seam mined at the King Coal Mine, is bounded above and below by shale.) Subsidence fractures in the roof rock, however, could provide a conduit of flow for water from the workings to the overlying Cliffhouse. Therefore, if the workings fill with water, and subsidence fractures convey that water to the Cliffhouse Sandstone, then impacts could possibly occur to the water quality in the Cliffhouse Sandstone aquifer down-dip from the workings, if mine water is lower quality than ambient ground water. Significant flow from the workings to the Cliffhouse through subsidence fractures is unlikely, however, because head in the overlying (higher elevation) Cliffhouse would be

greater than the head exerted by the mine water. The State Engineer's records show two wells have been completed in the Cliffhouse Sandstone approximately one mile downgradient from the King Coal Mine workings (the V. Paulek and G. Paulek wells).

Menefee Formation – Like the Cliffhouse Sandstone, mining impacts to the Menefee Formation are improbable because it is unlikely the workings of the King Coal and King II Mines will fill with water.

Ground water points of compliance are not warranted for the Hay Gulch alluvium, the Menefee Formation, the Cliffhouse Sandstone, or the Point Lookout Sandstone because, as explained above, the King Coal and King II Mines lack the potential to negatively impact these units.

Surface Water Effects

With the exception of two small area exemptions, all runoff from the disturbed area at the mine site will be routed through sediment ponds. Effects of mining on this water will involve changes in the magnitude and duration of runoff and changes in water quality.

The effects on water quantity are expected to be minimal. A decrease in permeability due to the construction or roads and buildings can be expected to cause an increase in runoff amounts. The rate of runoff will increase over natural conditions because of the increased efficiency of conveyance channels. However, these effects are moderated by the detention of runoff in the pond and subsequent evaporation of pond water. In general, only slight changes in the hydrologic balance of surface water are expected due to the underground mining operations proposed at the King Coal Mine.

Changes in water quality can be expected to occur as a result of mining. Increases in erosion rates are expected from the disturbance of soils and vegetation, however, these are compensated by deposition of sediment in the sediment ponds. An increase in total dissolved solids (TDS) may occur from well water pumped and used for dust suppression and other operational use. Evaporation of water standing in the ponds may also cause an increase in TDS, although the increase above background concentrations (1500-2000 mg/1) is not expected to be large.

The Division has determined that probable hydrologic effects on surface water identified above will not preclude use of the water below the point of discharge from the mine. This conclusion is based on the small and infrequent flows relative to the large amount of dilution available in receiving waters. The quality of surface water is limited on site and the treatment systems should act to mitigate any adverse effects on surface water.

Protection of Hydrologic Balance

Pursuant to Rule 2.07.6(2)(c), the Division has assessed the probable hydrologic impacts to ground water and surface water at the King Coal and King II Mines. The Division finds that the mine operations have been designed to prevent material damage the hydrologic balance outside the permit area.

IV. Topsoil

The baseline soil inventories for the King Coal and King II Mines are presented in Section 2.04.9 of the permit application. Topsoil replacement is described in Section 2.05.4. Baseline surveying of soils was not performed in the King Coal Mine facilities area due to previous disturbances. Instead, a survey by the Soil Conservation Service was performed for adjacent, undisturbed areas. This survey identified three soil mapping units as described in Section 2.04.9 and depicted on Map C-6. Map King II-006 shows nine soil mapping units identified on the King II Mine. Approximately 1.5 acres are to be disturbed at the King Coal Mine as a topsoil borrow area at the end of the life of the mine.

The owner of the land in the surface facilities area of the King Coal Mine has allowed access and rights for a topsoil borrow area shown on Map C-4 to be used for reclamation purposes. Topsoil and suitable growth medium have been analyzed and the results are provided in Appendix 9 of the King Coal Mine permit volume and Appendix 6 of the King II Mine permit volume.

V. Sealing of Drilled Holes and Underground Openings

Information pertaining to the sealing of drill holes and portal and ventilation openings is presented in Section 2.05 of the permit application.

All portal and ventilation entries will be permanently sealed by backfilling each opening with underground development waste, common fill, and sediment from the two sediment ponds for a distance of 50 feet from the entrance. Once backfilling its completed, each entry will be collapsed with explosives. NKC has adequately demonstrated that sufficient quantities of fill material exist on site to complete both portal and mine bench backfilling activities.

A single drill hole currently exists at the mine site in Hay Gulch and is used as a water well. The landowner has requested that this well remain open following permanent cessation of operation. The Division previously agreed with this request and hereby reaffirms this previous approval. Therefore, the drill hole is not required to be sealed. (4.07).

VI. Use of Explosives

NKC does not store or use explosives; therefore, the requirements of this section are not applicable. (4.08).

Waste Bank Design
Summary Report

(1997 Waste Bank Enlargement Project)

National King Coal Mine
No. C-81-035
Durango, Colorado

prepared by;

Don R. May, P.E.
735 East 7th Avenue
Durango, CO 81301

November 1993
revised July 1997
revised November 1997
revised December 1997

COLORADO REGISTERED
DON R. MAY
23655
1/3/97
PROFESSIONAL ENGINEER

1. General Plan and Scope

This document combines all previous reports on the waste pile into one report. Detailed documentation is not included herein. Please refer to the original reports for complete documentation and other details. The previous reports are titled Waste Bank Design, Technical Revision 1, April 1991 and Waste Bank Design Technical Revision, September 1991.

According to stipulation No. 07 issued by the Division of Minerals and Geology of the State of Colorado, the design of the permanent coal waste bank at National King Coal Mine must satisfy the requirements stated in mine regulations 2.05(8), 2.50(9), 2.05(10), 4.10 and 4.11. This document attempts to address these regulations in a manner appropriate to the scale and scope of the National King Coal mine site.

The coal refuse will be mine waste rock extracted over the life of the mine. The material is composed of dense, medium grained sandstone with occasional shale and carbonaceous shale partings. With the addition of the proposed wash plant the production of waste rock will increase with an estimated ultimate volume of one million cubic yards.

The waste bank will be a valley fill type pile located in the east drainage. The existing coal waste bank, approximately 25,000 cubic yards, will be modified to meet the design specifications stated in this report and will be incorporated into the permanent structure.

A limit equilibrium static analysis was performed using effective stresses to assure long term stability of the bank. The face of the bank will have a surface slope of 2.5:1 or less. The east side drainage will diverted around the pile on the north side and will be tied into the clear water diversion system. An intercept channel will be constructed on the south side of the bank to collect contaminated runoff from the pile and runoff from adjacent areas and route it to the sedimentation ponds. An underdrain system will be constructed beneath fill and will also drain into the ponds.

The mine is located in a geologically stable area that rates low in seismic activity. Because the waste bank lies below the mining levels, there will be no subsidence effect.

2. Detailed Design

Waste Material Properties

As stated, the coal refuse is mine waste rock composed of dense, medium-grained sandstones. This material comes from the Menefee Formation, Mesa Verde Group, Upper Cretaceous age. The sandstone is a quartz sandstone with

calcareous to slightly ferruginous cement and minor argillaceous and carbonaceous shale partings. Based on analysis of material removed from the mine the following particle size distribution was obtained.

Size Distribution	
Material above 6"	20% by weight
Material above 4"	30% by weight
Material above 2"	30% by weight
Material above #4 mesh*	10% by weight
Material above #10 mesh*	5% by weight
Material above #40 mesh*	< 5% by weight
Material above #200 mesh*	<5% by weight

*U.S. Series equivalent screen size
This information was provided by National King Coal

The following table summarized material properties for the waste rock.

Material Strength
Approx. dry density = 86 pcf
Maximum dry density = 91 pcf
Optimum moisture content = 12.0%
Internal angle of friction = 32°
Cohesion = 2.8 psi
Relative toughness = 1.5
Ft-lb/ft^2 of fracture = 312.4
Compressive strength, 9500 psi (no partings)
Compactive 12.5%
Compressive strength, 8400 psi (partings)
This data was supplied by King Coal

Coal Waste Pile Configuration

The criteria used in designing the waste pile were 1) to be structurally stable, 2) provide 1,000,000 cubic yards of storage volume and 3) to provide adequate surface and subsurface drainage. Please refer to design drawing sheets 1 and 2 for details.

The waste pile will begin at the toe of the existing waste bank, across the access road from the coal storage pile and extend up valley about 1600 ft. The waste pile will have a front face slope of 2.5:1, extend across the valley from side to side and have a maximum thickness of 200 ft at the top of the front face. It will slope upvalley at 1% and will have a cross slope of 2% with the high side on the north.

Waste rock will be transported to the top of the pile via conveyor and will be spread with heavy equipment that will access the top of the pile from existing roads leading to the top of the mesa from the northeast. A constructed road that traverses the pile and the north hillside and terminates on the top of the waste pile will provide access for light duty vehicles. The road will initially be constructed as shown up to the point where it attains its highest elevation on the north hillside. Then it will gradually drop back down toward the valley floor as it heads east, upvalley. As the pile volume increases in elevation it will progressively cover this portion of the road until the maximum volume is reached and the road will appear as shown on the plans. This will give continuous access as the pile grows with time.

Stability Analysis

A limit equilibrium analysis for plane surfaces was used to assess the stability of the design configuration. The analysis is appropriate for simple geometries with plane failure surfaces. Because of the very shallow depth to bedrock a circular failure plane is unlikely and a plane failure surface parallel to the bedrock is expected. Static equilibrium equations were derived for the specific geometry occurring at this site.

The limit equilibrium stability analysis is dependent on three soil properties: effective cohesion, effective friction angle and the unit weight of the material. To determine field estimates of these properties, soil samples and testing were completed by Lambert and Associates, Inc. (Consulting Geotechnical Engineers and Material Testing). A hollow stem auger was used to drill through the entire thickness of the existing pile. Samples were extracted at various depths and used to estimate the soil properties.

Direct shear tests were performed to determine the effective cohesion and friction angle. The result of these tests covered an exceptionally wide range and thus a triaxial shear test was performed to confirm the appropriate values. The unit weight of the material was determined during compaction tests. Test results are reported in the properties table shown above.

Safety factors computed using these parameters were from 1.5 to 2. The analyses included pore water effects, which lowers the safety factor resulting in a conservative estimate. The required safety factor must be equal to or greater than 1.5.

Construction

The waste pile will be constructed in stages, progressively extending up the drainage as needed. Prior to development of a new stage, the topsoil will be removed and stockpiled. All vegetation will be removed prior to stripping of the topsoil.

The mine waste material shall be put in place in lifts that optimally should be between 12-18 inches and in no case shall exceed 24 inches. The density of each lift should meet state regulations, which require that waste material be compacted to at least 90% of the maximum dry density.

A Proctor Test was run on soil samples from the existing waste pile to determine the maximum dry density and the optimum moisture content of that material. The tests conformed to the required AASHTO T99-74 standard procedure. The maximum dry density was 91.0 pcf and the optimum moisture content was12%.

Ongoing Density Measurements:

As construction of the pile progresses, periodic density measurements of the compacted fill material shall be performed. The following guidelines should be used.

1. The density of all waste material placed on the pile shall be at least 90% of the maximum dry density.
2. A Standard Proctor Test (AASHTO T99-74) shall be performed near the beginning of construction to establish baseline parameters. Subsequent test can be performed using a nuclear density gage.
3. A random test shall be performed during each of the first five years of construction and at least every other year after that.
4. If at any point during the construction of the waste pile, the consistency of the waste material changes, another Standard Proctor Test shall be performed to verify the validity of the current baseline parameters.
5. If the results of a random density test fail to meet the required 90% compaction one or more follow up tests shall be performed until the site engineer is confident that compaction standards are being met.
6. The site engineer shall determine the number of measurements and location of tests. Both of these will vary as the waste pile increases in size.

Topsoil and Fill Cover Material:

Final reclamation of the waste pile requires that there be 3.5 feet of cover and 6 inches of topsoil on top of the waste pile. The fill material may consist of naturally occurring soil and rock removed from the site and stockpiled in preparation of placement of waste fill. All vegetative material should be removed prior to stockpiling the cover material. Material appropriate for topsoil should be kept in a separate pile. Cover material stockpiles should be located near the five, ten and fifteen year estimated elevations of the waste pile (or at other logical intervals which will reduce the transport cost during fill placement).

The unit weight and composition (percent topsoil, rock, other soil etc.) of cover material should be periodically estimated during the clearing process. This

can be accomplished using the mine scales and the known volume of a front end loader bucket. This information can then be used in establishing the bond estimate. In addition to the physical properties, a chemical analysis of the topsoil must be performed to determine the quantity of fertilizer that will be needed to assure successful growth of vegetation during final reclamation.

Five Year Waste Pile

A revised estimate of 5000 cubic yards of waste rock production annually was used in estimating the elevation of the 5-year waste pile. Beginning with the existing waste rock volume, approximately 25,000 cubic yards, and adding the annual increment, results in a required 5-year volume of 50,000 cubic yards. This corresponds to a pile height of 75 feet (elevation 7490). The boundary of the 5-year pile is shown on the accompanying design drawing. In addition, the volume of cover material (fill and topsoil) for the 5-year pile was estimated at 7000 cubic yards. Of this, the mine operator estimated that they currently have enough cover stockpiled to accommodate the existing pile (about 4800 cubic yards of cover). A location for the 5-year cover storage pile (7000 cubic yards) is shown on the plan drawing.

Drainage Features

Enlargement of the waste pile will require modification of the drainage intercept ditches on both the north and south side of the pile. In addition the sedimentation ponds will be altered to accommodate the increased contaminated runoff volumes. All ditches and pipes are sized for the 100 year event and the ponds for the 10 year event. Please refer to the drainage report (revised July 1997), and the accompanying design drawings for details.

The Eastside drainage channel will be moved from its existing location, to the north against the natural hill slope. As the waste bank increases in elevation the ditch will move up the hillside. At the top of the sloping pile faced the channel will intersect an armored channel that will flow down the front face of the waste pile. These two ditches will route uncontaminated water to the clear water diversion system.

A similar set of intercept ditches on the south side of the pile will collect contaminated runoff from the pile and some clear water from the adjacent hillside and route it to the sedimentation ponds. Please refer to the design drawings and the drainage report for details.

Underdrain

An underdrain system for the waste pile is required by the regulations. The purpose is to intercept water which originates either form precipitation infiltration through the waste pile surface or from the interception of groundwater at the pile-

ground interface. Sizing of the underdrain should consider both of these water sources. No detailed guidelines for determining the size are provided by the state. The following factors were used in setting the underdrain size.

Groundwater:

Two observation wells were augered to determine if the groundwater table was near the surface in the area of the proposed waste pile. The first well was located just upvalley of the top of the 2.5:1 slope on the face of the pile. It was centered in the valley. The boring log showed that the top 22 feet of natural material consists of silty and slightly sandy clay with some gravel. Water was encountered at a depth of 20 ft. and bedrock at 22 ft. The second boring was located approximately 600 ft. upvalley of the first. The top 22 ft consisted of the same material as in the first bore. From 22 ft. to 36 ft. the material is siltstone and sandstone. No water was encountered. The total depth was 36 feet.

In addition to the augering, a detailed search of both sides of the drainage from bottom to top was completed for signs of seeps, springs or other indications of groundwater at the surface. None was found. This supports historic observations from routine inspections made over the last several years. Based on these results it is concluded that groundwater does not significantly contribute to the water within the waste bank.

Underdrain Size:

Precipitation falling directly on the pile and snowmelt are the primary sources of water reaching the pile. A portion of this water will infiltrate the surface and make its way either to 1) the natural ground-waste pile interface where it will continue to move down to the groundwater table or 2) it will move to the underdrain located at the bottom and center of the waste pile. The underdrain should be sized to adequately transport this latter portion out of the waste pile.

The size of the underdrain was estimated based on a rough approximation of the hydraulic routing of water through the pile. The next table shows the geometric, hydraulic and hydrologic parameters used in the analysis.

The first component is the design precipitation. NOAA climatologic data for Durango were reviewed and the maximum monthly total for each month was selected from the 97 years of record. These were averaged over the 12 months to get a maximum average monthly value of 6.38 inches. This depth was spread out over 15 days instead of 31 to reflect the discontinuous nature of local rainfall. The resulting rate was used as the precipitation input for all drain sizing estimates.

The waste pile was divided into five equal zones along its length. Routing of the infiltrated precipitation through each zone was approximated based on the geometry of that zone. Once the flow moves vertically through the zone it enters the drain. Note that the hydraulic conductivity of the gravel used to fill the drain is

100 to 1000 time larger than that of the waste material. This indicates that the water will move much faster through the drain than through the pile. Because of this fact and the relative steep slope of the valley floor (drain slope) compared to the pile surface, each zone drains approximately independently, in time, of the others. This is the routing effect and means that only a portion of the pile will be contributing flow to the drain during any given time interval of the design event.

Physical Properties						
geometry	valley slope = 0.1265					
	pile face slope = 0.4000					
	pile top slope = 0.0100					
	pile length = 1600 ft					
	Average pile dimensions for five equal length segments (ft) (bottom of pile upvalley to top of pile →)					
	length	320	320	320	320	320
	width	320	500	420	380	200
	thickness	44	131	102	65	27
hydraulic	hydraulic conductivity, K					
	gravel (drain fill) material					
	range of Ku = 0.0010 ft/s to 0.1024 ft/s					
	average Ku = 0.0132 ft/s					
	waste rock material					
	Kw = 1.086×10^{-5} ft/s					
hydrologic	gross infiltration rate = 50% of long term precipitation					
	precipitation - mean max. month = 6.38 in. (period of record)					

note: hydraulic conductivities and the infiltration are coarse estimates based on reported text book values for similar materials.

After balancing the estimated inflow to the drain with the flow capacity of the drain and adding a safety factor a size was estimated. It is reasonable to assume that the drain size should decrease as you move upvalley and have less volume and surface area contributing to it.

The lower portion (approximately 400 ft.) will be serviced by the existing drain constructed for the original waste pile. The new drain was designed in three sections of 400 feet.

Underdrain Size		
Reach	Length (ft. bottom to top)	Drain size (width x depth in ft)
1	0 to 400	existing 3x3, square
2	400 to 800	7x4, rectangular
3	800 to 1200	5x4, rectangular
4	1200 to 1600	3x3, rectangular

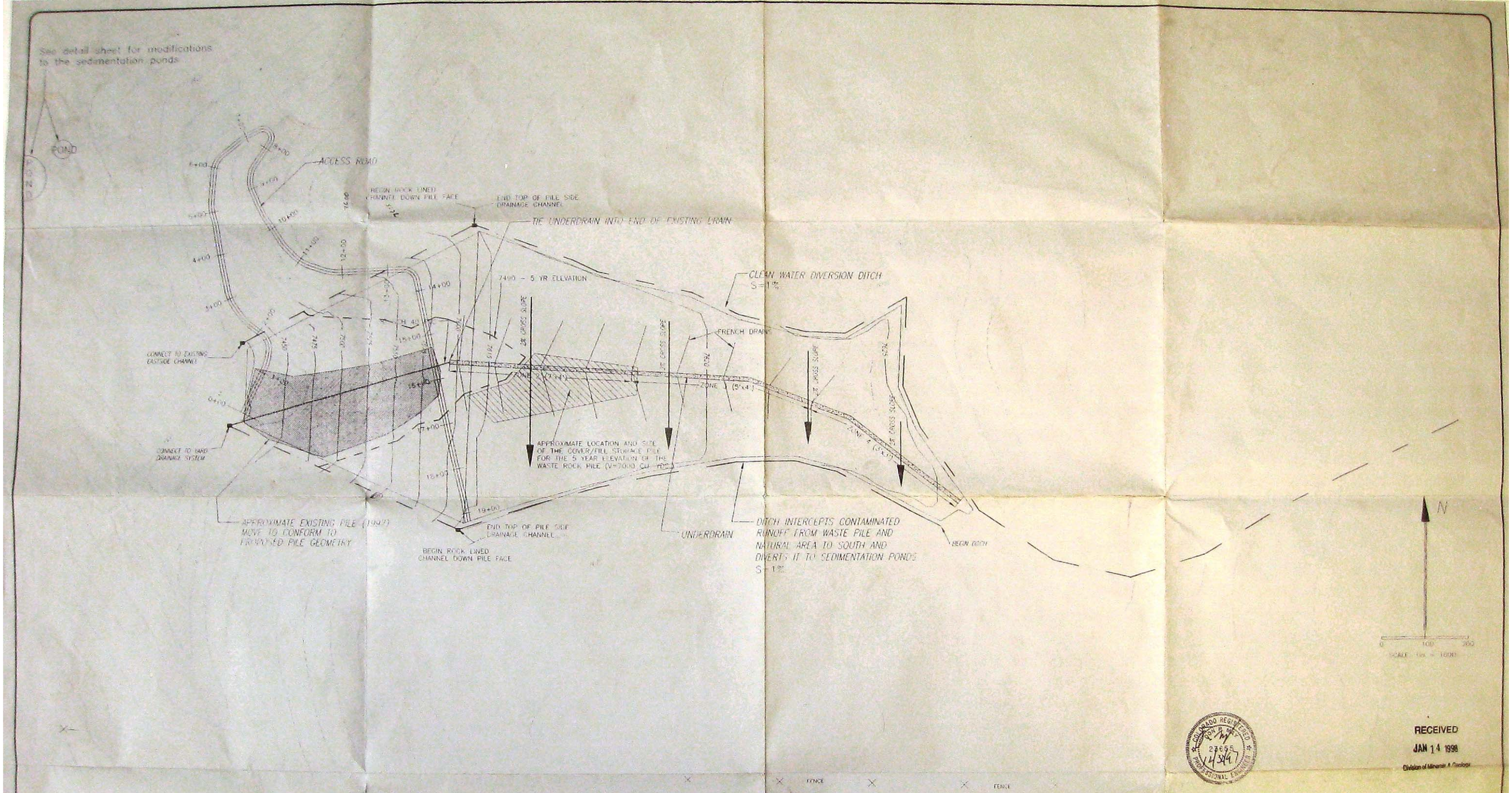
The new portion of the drain should be connected to the existing drain at its terminus. Because the existing drain is not sized to handle all flow generated above it an 8" drain pipe (schedule 40 pvc in bedding) should be connected at

this junction to help transport flow to the yard (sediment ponds) and away from the pile. See the design drawings for details.

In addition to the main, central drain it is recommended that French drains be constructed on both sides at 100-foot intervals for the 800 ft of reaches 2 and 3. These French drains should consist of 4" perforated pipe centered in a bedding zone 24" x 24", trenched into the natural surface. The bedding should be a well graded gravel with a maximum rock size of ¾ ". The finger drains should extend through the side of the underdrain filter liner and into the drain. Laterally they should extend across the valley floor to the breakpoint in the slope with the valley side walls.

If at anytime during salvaging of topsoil or any other construction activity, a spring or seep is encountered, an additional lateral French drain shall be installed from the seep to the underdrain. It shall be constructed as described above.

The underdrain is wrapped in a porous filter cloth (designed to allow water to enter but keep out fine sediment) and filled with rock. No more than 10% of the rock may be less than 12" in size and no single rock may be larger than 25% of the depth of the drain. Flow from the drain will enter the lower intercept channel and subsequently be diverted to the ponds for settling.



PLAN VIEW OF MINE WASTE PILE

LIST OF PROPOSED FEATURES

1. WASTE PILE
2. CLEAR WATER DIVERSION DITCH (NORTH SIDE)
3. CLEAR WATER LINED DITCH DOWN NORTH FACE OF PILE
4. CONTAMIN. WATER INTERCEPT DITCH (SOUTH SIDE)
5. CONTAMIN., LINED DITCH DOWN SOUTH FACE OF PILE
6. UNDERDRAIN
7. ACCESS ROAD
8. MODIFICATIONS TO PONDS: CONNECTOR PIPE, LOW OUTLETS, SPILLWAYS

WASTE PILE GEOMETRY

PILE VOLUME = 1,022,000 CUBIC YARDS
FACE SLOPE: 2.5:1
FACE HEIGHT = 200 FT
TOP OF PILE SLOPE = 1%
TOP OF PILE CROSS SLOPE = 2%
FACE TOE ELEV = 7415 FT
FACE TOP ELEV = 7615 FT
TOP END OF PILE ELEV = 7626 FT

PLACEMENT OF FILL

1. THE WASTE PILE WILL BE CONSTRUCTED IN STAGES EXTENDING UPVALLEY AS NEEDED.
2. REMOVE AND STOCKPILE ALL TOPSOIL PRIOR TO DEVELOPMENT OF A NEW STAGE.
3. MINE WASTE SHALL BE PLACED IN LIFTS NOT TO EXCEED 12" - 15"
4. EACH LIFT SHALL BE COMPACTED TO 90% OF THE MAXIMUM DRY DENSITY OF 91.0 PCF, OPTIMUM MOISTURE CONTENT OF 12%.

COLORADO REGISTERED PROFESSIONAL ENGINEER DON R. MAY 27665 12/30/97

RECEIVED
JAN 14 1998
Division of Minerals & Geology

NATIONAL KING COAL MINE
MINE WASTE PILE DESIGN

HESPERUS, COLORADO

PLAN LAYOUT | Map King I-014

NATIONAL KING COAL MINE
1424 CR 120
HESPERUS CO

ENGINEER(S):
DON R. MAY P.E. 970-385-7504

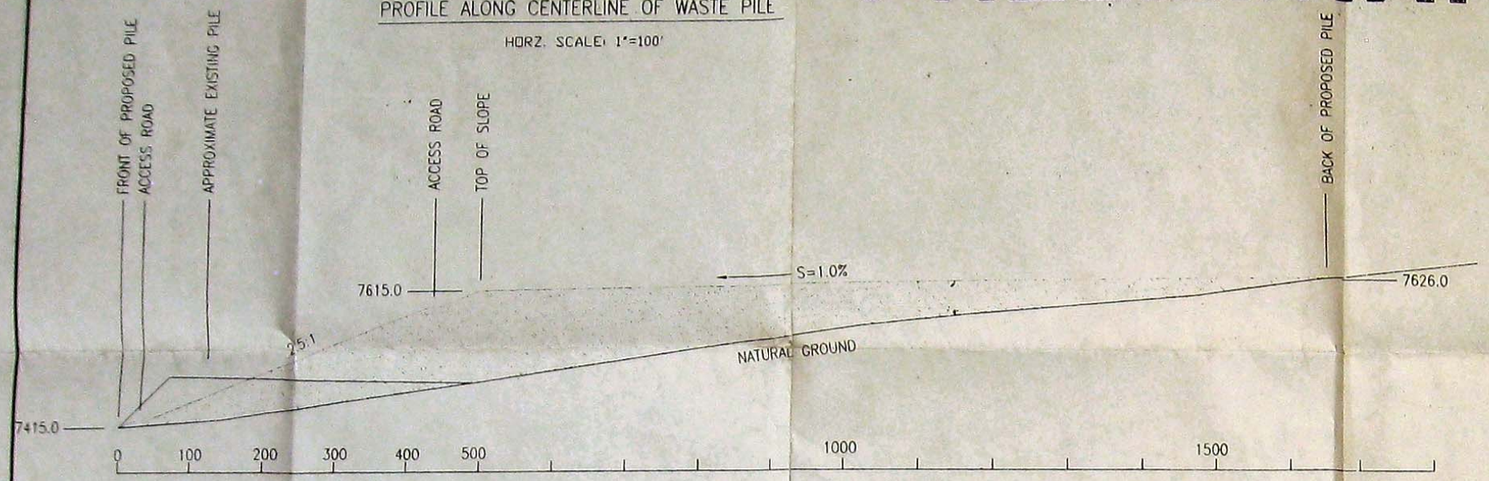
PREPARED FOR: COLORADO STATE DIVISION OF MINERALS AND GEOLOGY

SCALE 1" = 100' | DATE 12/30/97 | SHEET 1

PRELIMINARY

PROFILE ALONG CENTERLINE OF WASTE PILE

HORZ. SCALE: 1"=100'

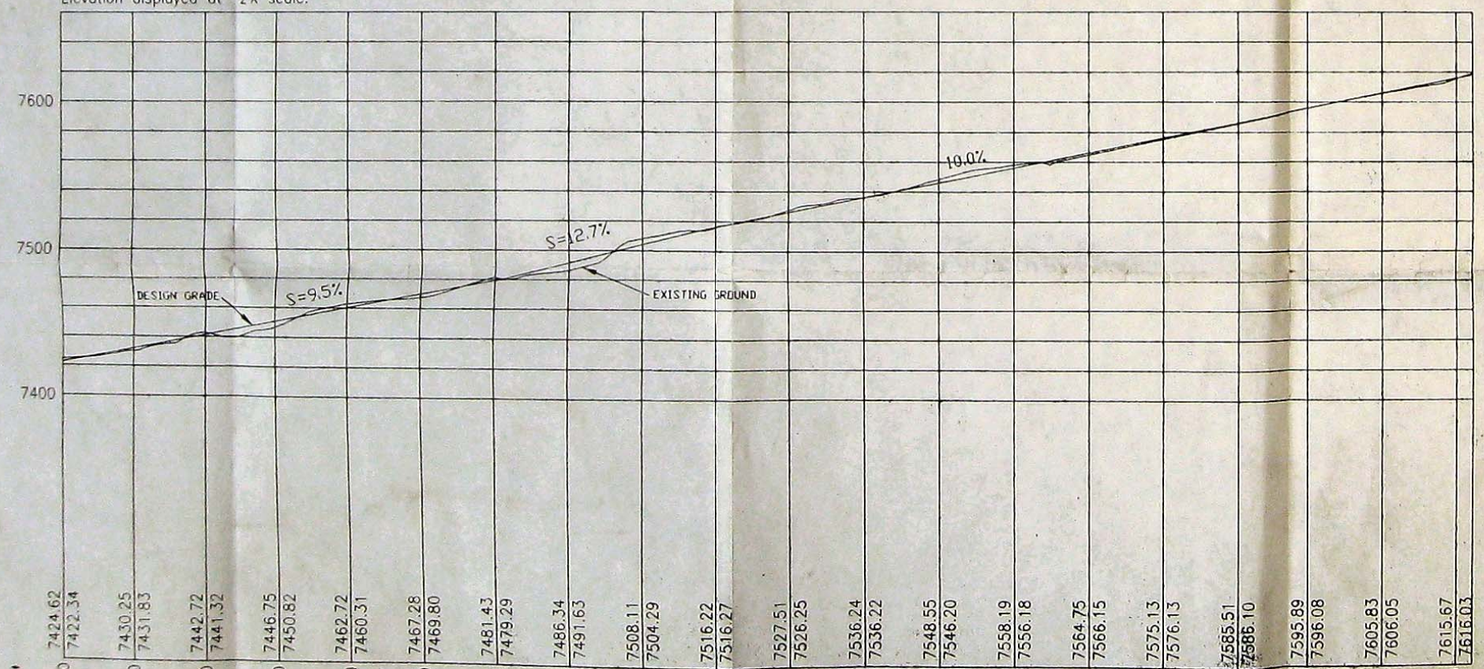


PROFILE ALONG ACCESS ROAD

ALIGNMENT: A ACCESS ROAD

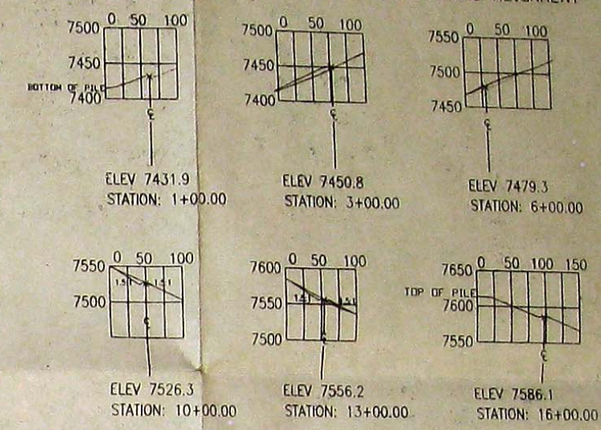
Elevation displayed at 2X scale.

HORIZONTAL 1"=100'
VERTICAL 1"= 50'

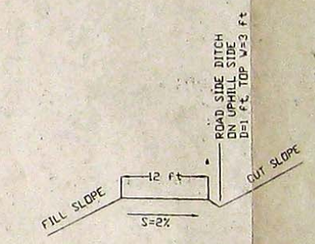


0+00.00	7424.62	7422.34
1+00.00	7430.25	7431.83
2+00.00	7442.72	7441.32
3+00.00	7446.75	7450.82
4+00.00	7462.72	7460.31
5+00.00	7467.28	7469.80
6+00.00	7481.43	7479.29
7+00.00	7486.34	7491.63
8+00.00	7508.11	7504.29
9+00.00	7516.22	7516.27
10+00.00	7527.51	7526.25
11+00.00	7536.24	7536.22
12+00.00	7548.55	7546.20
13+00.00	7558.19	7556.18
14+00.00	7564.75	7566.15
15+00.00	7575.13	7576.13
16+00.00	7585.51	7586.10
17+00.00	7595.89	7596.08
18+00.00	7605.83	7606.05
19+00.00	7615.67	7616.03
19+22.17	7619.16	7618.24

SELECTED CROSS SECTIONS ALONG ACCESS ROAD ALIGNMENT

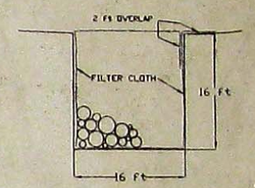


TYPICAL ROAD SECTION



DETAIL OF WASTE PILE UNDERDRAIN

(ROCK FILLED TRENCH)

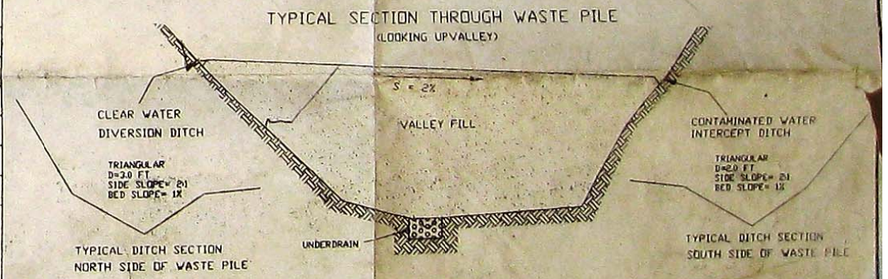


REQUIREMENTS FOR ROCK FILL

1. NO MORE THAN 10% OF THE ROCK MAY BE LESS THAN 12 INCHES IN SIZE.
2. NO SINGLE ROCK MAY BE LARGER THAN 25% OF THE WIDTH OR 4 FEET.
3. THE ROCK SHOULD BE PLACED SO THAT IT IS WELL GRADED WITH NO LARGE VOID SPACES.
4. ROCK SHALL CONSIST OF NON-DEGRADABLE, NON-ACIDIC OR TOXIC FORMING ROCK. IT SHOULD NOT SLAKE IN WATER AND SHOULD BE FREE OF COAL AND CLAY.

TYPICAL SECTION THROUGH WASTE PILE

(LOOKING UPVALLEY)



NATIONAL KING COAL MINE
MINE WASTE PILE DESIGN

HESPERUS, COLORADO

DETAIL SHEET

NATIONAL KING COAL MINE 4424 CR 120 HESPERUS, CO	ENGINEERING: DON R MAY P.E. 970-385-7534
PREPARED FOR: COLORADO STATE DIVISION OF MINERALS AND GEOLOGY	MAP KING I-015
SCALE AS SHOWN	DATE: 7/1/97 SHEET: 2

999

STATE OF COLORADO

DIVISION OF MINERALS AND GEOLOGY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

DEPARTMENT OF NATURAL RESOURCES

Roy Romer
Governor

James S. Lochhead
Executive Director

Michael B. Long
Division Director

February 9, 1998

Tom Bird
National King Coal, LLC
4424 County Road 120
Hesperus, CO 81326

Re: King Coal Mine (Permit No. C-81-035)
Proposed Decision - Technical Revision No. 8
Expansion of Current Coal Waste Pile

Dear Mr. Bird:

Enclosed you will find the Division of Minerals and Geology's Proposed Decision for Technical Revision No. 8 at the King Coal Mine. Notice of the proposed decision will be published in the *Durango Herald* as soon as possible. The first publication will initiate the ten (10) day public comment period for the Division's decision.

Documentation must be submitted to the Division demonstrating that a copy of the approved revision application was sent to the Office of Surface Mining and the Bureau of Land Management. The material should be sent within 15 days of final approval.

Please refer to the Performance Bond heading on the enclosed proposed decision form. If the amount of "Bond Held" equals or exceeds the "Revised Liability", you need not submit additional bond. However, if the "Revised Liability" exceeds the "Bond Held", please submit additional bond or rider to your existing bond that equals or exceeds the "Revised Liability". The revision will not be final until the bond is approved by the Division.

If you have any questions, please contact me.

Sincerely,

Larry Rostler for

Harry B. Ranney
Environmental Protection Specialist

HBR/JRC

Enclosure

cc: Lawrence Kline, Office of Surface Mining, with enclosures

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COLORADO DIVISION OF MINERALS AND GEOLOGY
1313 Sherman Street, Room 215, Denver, Colorado 80203, (303) 866-3567

COAL MINING PERMIT - TECHNICAL REVISION DECISION

King Coal Mine, National King Coal, LLC
Permit No. C-81-035

The Division of Minerals and Geology has proposed the decision stated below. Provided there are no objections, the decision will become effective upon the termination of the ten (10) day public comment period, in accordance with Rule 2.08.4(6)(b)(ii).

Technical Revision No. 8 — Decision: approve

Submittal Date: August 23, 1997 — Decision Date: February 6, 1998

Description of Revision: Expansion of Current Coal Waste Pile

REVISED INFORMATION

APPLICATION PAGES

Appendix 7 & 8

MAPS/EXHIBITS

C-4 & Waste Pile Design

CHANGE IN ACREAGE		REVISED TOTAL ACREAGE		PERFORMANCE BOND	
Disturbed:	0.0	Disturbed:	11.0	Prior Liability:	$81,856.00
Affected:	0.0	Affected:	1,154.0	Change in Liability:	$30,000.00
Permit:	0.0	Permit:	1,154.0	Revised Liability	$111,856.00
State:	0.0	State:	80.0	Bond Held	$80,000.00
Federal:	0.0	Federal:	593.0		
Private:	0.0	Private:	829.0		

DIVISION OF MINERALS AND GEOLOGY

Larry P. Rautter
Authorized Representative

Date: 2-6-98

M:\OSS\RC\TEMP\CTR09035.HBR

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
UNCOMPAHGRE FIELD OFFICE
2505 SOUTH TOWNSEND
MONTROSE, COLORADO 81401

In Reply Refer To:
CO-150
3425
COC 62920
Coal

June 20, 2000

Memorandum

To: Solid Minerals Team (CO-933 (KP))

From: Uncompahgre Field Office Manager

Subject: Combined Geologic and Engineering and Maximum Economic Recovery Report and Tract Delineation Report - Coal Lease Application for Coal Lease COC 62920 - National King Coal, LLC (NKC).

In response to the memo from Karen Purvis of the Solid Minerals Team, which, *in part*, requested that we:

1. Prepare the GER and MER reports, and;
2. Prepare the Tract Delineation report

We have enclosed the reports. If you have any questions regarding either report, please contact Desty Dyer at (970) 240-5302

If you have any questions regarding the EA please call Ilyse Auringer at (970) 385-1359.

Enclosure

Jamie B. Ferguson Acting

CC Ilyse Auringer, BLM staff chief, DFO
✓ Trent Peterson, manager, NKC - King Mine

Combined
Geologic and Engineering Report (GER)

and

Maximum Economic Recovery Report (MER)

for

East Alkali Tract Lease by Application (COC 62920)

applied for by

National King Coal, LLC (NKC)

T. 35 N., R. 11 W., N.M.P.M.
T. 35 N., R. 12 W., N.M.P.M.

by
Desty Dyer
Mining Engineer

June 20, 2000

GER / MER REPORT - EAST ALKALI TRACT LEASE APPLICATION - NKC

LOCATION

The legal description for the lease tract is as follows:

T. 35 N., R. 11 W., N.M.P.M.
Sec. 19, lots 4, 5, E2SW4, & SE4.
T. 35 N., R. 12 W., N.M.P.M.
Sec. 24 - lots 1, 2, and SW4SE4.
Sec. 25 - lots 1, 2, W2NE4, and W2.
Sec. 26 - SE4NE4, E2SE4, SW4SE4.
Sec. 35 - NE4, N2SE4.

Area for the East Alkali tract totals approximately 1,304.51 acres. Note: The East Alkali lease tract will be referred to hereafter as the A.T.

The A.T. is located in La Plata County, Colorado, 6 miles southwest of Hesperus on the north side of county road 120 (Hay Gulch) off of highway 160. The A.T. is a virgin tract of federal coal which is adjacent to state and fee reserves. Portal access to the A.T. would likely be from new surface facilities on a state coal lease to the south southeast of the A.T. This property is north northwest of the current King Coal mine across Hay Gulch.

LEASE STATUS

COC 62920 covers the A.T. and is in application, pending the NEPA process. It is bounded by coal outcrop on the northwest and southeast side, state coal on the south southeast, and thin federal coal on the northeast.

NKC also holds the following leases:

COC 57200 - LMU comprised of federal leases P-058300, C-29125, and COC49465; fee leases Dunn-Ute, Poor Daughters, and Huntington; and, Colorado lease C-607.

P-058300 - Original and current portal access exists on this lease that, except for chain pillars in the mains, is mined out. The lease is bounded by coal outcrop, fee coal, and federal leases; therefore, it is not a candidate for modification.

C-29125 - Borders P-058300 on the south, and has had the 160 acre modification limit applied. It contains approximately 137,400 tons of recoverable reserves including all the modifications.

COC 49465 - Borders C-29125 on the west, Huntington on the north, and has had the 160 acre modification limit applied (which extends coal holdings to the south, bordering Huntington's east side and the C-29125 modification's west side). It contains approximately 645,600 tons of recoverable reserves.

COC 60941 - Borders COC 49465 on the south and Huntington on the west and south. It has had the 160 acre modification limit applied (NKC's southern most coal holdings). It contains approximately 900,000 tons of recoverable reserves.

STRATIGRAPHY

GENERAL - The A.T. is located in the Red Mesa area of the Durango Coal Field in the Colorado Plateau between the San Juan Mountains on the North and the San Juan Basin on the

South. The general area is made up of sandstone mesas, canyons, and dry gulches. The area tilts 2 to 3+ degrees southward and the surface ranges from 7,300 to 8,200 ft. elevation. The geologic formations include the Mesaverde Group of the upper Cretaceous Age. In the mine area the Upper Mesaverde consists of (in descending order) the capping Cliff House sandstone, the coal bearing Menefee Formation, and the basal Point Lookout sandstone.

COAL BEDS - The coal bearing Menefee formation is of non-marine sedimentary deposits of sandstone, shale, and coal. The formation is about 300 ft. thick. There are two coal beds that get thicker than 4' in the Menefee formation. The King Mine is located in the top (No. 1) coal bed about 20 ft. below the base of the Cliff House sandstone. This coal seam ranges from 4.5 to 7 ft. thick. Coal bed No. 2 lies 50 to 90 feet below bed No. 1 and varies from 4 to 9 ft. thick, but is thinner on the average and has rock partings; factors which present it as unmineable. Other seams existing below coal bed No. 2 have not proven to get thicker than 3', and are not currently considered mineable.

The Upper Menefee seam is overlain by thinly laminated shales with some sandstone lenses and is underlain by hard sandy shales. The overburden ranges from 0 feet on outcrop to just over 400 ft. There are minor rolls and faults which have been encountered during mining but no major geologic structural barriers prevent mining. Panels have been abandoned due to the following:

1. Coal thinning to consistently less than 4 ft (as occurred in the W side of the workings at about the N-S boundary of federal lease COC49465 and state lease C-607, in the north side of both the Huntington fee and COC 60941 lease).

   Note: The use of "low profile" shuttle cars allows the mining of the seam down to about 44 inches; however, if that is the average coal thickness, then lower areas require cutting rock out of the roof or floor and this adds ash to the product which is not allowable in the market. *Coal thickness in the A.T. area should average about 6.7' and not be less than 5.0', according to known drill hole data.*

2. Poor roof conditions (caused by weak, thinly laminated shales) that made roof control too difficult to maintain safely (as encountered on federal lease C-29125 and on the Huntington fee lease).

   Note: Poor roof conditions can be tolerated by taking somewhat shorter cuts and bolting the roof as immediately as is practical, but if the conditions continue to persist across a panel the safety of the roof support may still be in question and the production rate becomes too uneconomical to allow further operations.

3. Sulphur content becoming greater than 1.0% (as occurred widely in the Poor Daughters and Kambe fee leases at the NE and E side of the workings, and in some areas of the Huntington fee lease and modification areas of the C-29125 and COC 49465 especially under or near the vicinity of Pine Gulch).

   Note: If low sulphur coal is being mined in large quantities in a pillar section it can be mixed with higher sulphur coal from another section, but this option allows for only a small portion of higher sulphur coal to be mined; otherwise, sulphur content at greater than 1% renders the seam unmineable. The A.T. is not expected to yield a product over 1% sulphur.

COAL QUALITY - The coal is ranked high-volatile B. Analysis of the ash and sulphur content of the No. 1 (Upper Menefee) seam based on drill hole data is as follows:

Ash 7.78 % Sulphur 0.68% Water 5.60% BTU 12,769

Ash increases when roof slabs dilute coal during initial excavation. Roof pans are installed with 4 to 5 six ft. bolts. The pans run perpendicular to the entries on a 4 ft. interval to prevent secondary slabs from diluting the coal mined. The roof has become so thinly laminated in some areas that it will fall out in an intersection to the end of the bolts. In some cases secondary bolting has been successful in supporting the caved area; however, where the problem is extended across a panel, mining has been terminated. Run of mine coal quality can be poor (high ash) due to a portion of the near roof falling promptly as the coal seam is mined or before it can be bolted. The thickness falling is normally several inches of shale. Previous to the purchase and use of low profile equipment, areas of less than 5 ft. of coal had to have rock bottom graded out after the mining and bolting cycles were completed to allow room for equipment. This procedure introduced extra time and labor burdens which could not consistently be carried at a profit. Use of a wash plant are tentatively part of surface facility plans, but are not considered a requirement to produce a marketable product.

Reserves in the A.T. are expected to meet compliance coal standards for sulfur and ash content for their market (ash<10% and sul<1%), NKC has encountered higher sulphur in reserves accessed by their King Coal mine, but that is not expected on the A.T.

MINING FACTORS

METHOD CONSTRAINTS - Geologic constraints relating to coal depth and thickness within the A.T., and economic constraints for the applicant dictate that the underground room and pillar mining method be employed to extract the coal from the A.T. The amount of overburden on the A.T. varies from 0 ft. to 300 ft. (generally getting deeper from outcrop on the east, south, and west side to the center and to the north) and averages about 150 ft. This overburden necessitates underground mining and since NKC already owns continuous miners and shuttle cars, they would employ them to mine the coal reserves. The single geologic constraint which would prevent consideration of the use of the longwall method of mining is the thickness of the coal which in turn determines the available reserves per acre. To break even on investment in longwall equipment would take 4K to 5K acres of additional known reserve. A vast amount of new reserves would have to be proven and rights to mine obtained before the capitol investment for longwall equipment could be justified. Even if reserves were available to justify longwall equipment, the facilities available for shipping the product would not currently handle a longwall production rate.

PRODUCTION FACTORS

CURRENT- Short Term Schedule - Production to meet the market demand could be supplied by two spare and one active development section operating on 10 hrs/shifts, 2shift/day, 5 day/week schedule (totaling 520 operating shifts/yr.).

Production Data - The current operation mines entirely within the Upper Menefee coal seam just south of the A.T. NKC successfully mines coal using continuous miners to develop panels of 7 entries with crosscuts on 75 ft. centers, and pulls pillars on retreat yielding a total of 60%

to 65% recovery of an average 5.3 ft. thick coal. The current mine is capable of producing up to 300,000 tons/year, and maximum annual federal production to date was 262,481 tons which occurred in 1998. The total mine production that year was 283,211 tons. The 2000 production rate after the first quarter indicates the total production for the mine would be about 160,000 tons/year. The ideal yearly production for NKC would be 300,000 tons per year in order to meet financial cash flow demands for the operation.

Mining Equipment - The following is a list of major equipment currently used by NKC and is typical for use in an underground room and pillar operation:

Continuous Miners	3	Roof Bolters	3
Shuttle Cars	7	Utility Loader	2
Lube Truck	1	Utility mantrips	6
Utility Hauler	1	Belt Drives	7
Main Mine Fan	1	Utility Scoop	2

Life of Mine - The recoverable reserves currently available to the King Coal mine operation include 1.6 M tons of federal coal and 0.3 M tons of fee coal which total about 1.9 million tons and would provide about 6.3 years of life at the 300 tpy production rate.

Manpower - The current manpower level averages about 36 - 61. A recent layoff has reduced the manpower to the lower level but this is considered to be a temporary situation, awaiting greater market demand for the coal.

PROJECTED with A.T.- Short Term Schedule - NKC management intends to increase the production schedule by activating a second shift and a second and possibly third section. This schedule with 3 available sections would continue to be employed as long as market demand for the coal remained stable. Lease and Permit agreements would be obtained in order to allow for new surface facility construction and initial underground development would be implemented before mine-out of the current King Coal mine.

Production Data - The operation would remain within the Upper Menefee coal seam. Panel geometry and recovery would remain the same while management would strive to achieve and maintain the 300,000 tpy production rate.

Mining Equipment - There would be no change.

Life of Mine - The A.T. would add about 23.5 years to the life of NKC's mining operations at the projected 300K ton per year production rate. Actual years of operations on the A.T. could last over an extended time since coal production from the King Coal mine logical mining unit (LMU - with fee and federal lease reserves) could be realized in conjunction with production from the A.T. at the end of the life of mine of the King Coal mine. Mining in the A.T. and in the adjacent LMU and leases could take approximately 30 years (Mine Life). It is likely that the A.T. itself would be mostly mined-out about 25 years after being entered.

Manpower - The manpower requirements would remain the same.

SURFACE FACILITIES

The current surface coal handling facilities of NKC's King mine located in Hay Gulch would be abandoned and reclaimed upon production from the A.T. becoming the sole source of coal for the

market. Before the end of the life of the King Coal mine new surface facilities would be constructed to serve the mine accessing the A.T.

TRANSPORTATION

As the surface facilities are constructed for the new mine serving the A.T., so would the transportation infrastructure to serve the mining needs of the new operation. A conveyor belt system would be put in place from the tipple to the working area underground. This system could be extended to working faces in the A.T. throughout the life of the new mine. Conveyor belt drive motors, hardware, and belting that is still in good shape could be removed from the King Coal mine and used in the new mine.

ESTIMATED RECOVERY

The Upper Menefee seam recovery within the A.T. should approximate the current recovery of existing mining operations demonstrated to be 67% in the active federal lease. The existence of high ash on the southwest side of the A.T. could render 230 acres either unmineable or just partially recoverable. BLM calculates a recoverable reserve for the A.T. to be **7.05 M tons** (5,209 tons per total tract acre).

POTENTIAL MARKETS

The current King mine primarily supplies coal for heat energy used in the production of cement and domestic electric utilities. A small amount of coal is also shipped to Japan for burning in electric power plants. The narrow-gauge tourist trains in Durango, CO and Chama, NM and domestic use also are supplied by coal from the King mine. A new mine extracting coal from the A.T. would be expected to supply similar market destinations as shown below:

1. Cement Production	80-85%
2. Electric Utilities (APS)	12-15%
5. Domestic	3 - 4%
4. Train	1 - 2%
5. Spot Buys	1 - 3%

MAXIMUM ECONOMIC RECOVERY DETERMINATION

The area NKC applied for was reviewed by BLM and it has been determined that this tract is the most efficient and reasonable area to lease given the current available data from drill holes. Although larger coal companies have reviewed data on coal deposits in the area, none of them have deemed the resource either substantial or valuable enough for them to initiate new surface and underground facilities without already having a sales history with established contracts for the local coal in the potential markets.

It has been determined by BLM that Maximum Economic Recovery (MER) of the A.T. federal lease application can be achieved by underground mining using the room and pillar method of mining as described above.

East Alkali Tract - COC62920

Tract Delineation Report

Prepared by:

Desty Dyer, Mining Engineer
Uncompahgre Field Office
June 20, 2000

Reviewed by:

Matt McColm, Mining Engineer
Colorado State Office

I. General Location. The East Alkali Tract is located in La Plata county in the state of Colorado, on the north side of county road 120 in Hay Gulch approximately 6 miles southwest of the town of Hesperus off of highway 160. The location of the tract is shown on Figure 1. Attachment 1 contains a legal description of the tract.

II. Background and History. The East Alkali Tract (A. T.) has been delineated in response to a competitive lease application filed on April 9, 1999, by National King Coal, LLC (NKC). The A.T. is a virgin tract of federal coal which is adjacent to state and fee reserves. The surface is primarily fee, owned by the Ute Mountain Ute tribe, with approximately 40 acres being public land managed by BLM. Portal access to the A.T. would likely be from new surface facilities on a state coal lease to the south of the A.T. This property is north northwest of the current King Coal mine across Hay Gulch.

The current workings in the King mine have shown that coal production can be realized from the upper Menefee seam in the general area of the A. T. There is outcrop and drill hole data from old studies in and around the A. T. that give indication of coal that is mineable within the tract. Although there are two seams present (upper and lower Menefee) the upper seam is the only seam thick enough to be considered mineable.

The mineable reserves in the A. T. are bounded by coal outcrop on the northwest and southeast side, state coal on the south southeast, and thin federal coal on the northeast. Lease/Reserve status for NKC is as follows:

COC 62920 covers the A.T. and is in application, pending the NEPA process.

NKC also holds the following leases:

COC 57200 - LMU comprised of federal leases P-058300, C-29125, and COC49465; fee leases Dunn-Ute, Poor Daughters, and Huntington; and, Colorado lease C-607.

P-058300 - Original and current portal access exists on this lease that, except for chain pillars in the mains, is mined out. The lease is bounded by coal outcrop, fee coal, and federal leases; therefore, it is not a candidate for modification.

C-29125 - Borders P-058300 on the south, and has had the 160 acre modification limit applied. It contains approximately 137,400 tons of recoverable reserves including all the modifications.

COC 49465 - Borders C-29125 on the west, Huntington on the north, and has had the 160 acre modification limit applied (which extends coal holdings to the south, bordering Huntington's east side and the C-29125 modification's west side). It contains approximately 645,600 tons of recoverable reserves.

COC 60941 - Borders COC 49465 on the south and Huntington on the west and south. It has had the 160 acre modification limit applied (NKC's southern most coal holdings). It contains approximately 900,000 tons of recoverable reserves.

Fee Leases (Huntington and Tipotch) - Totals approximately 233 acres containing about 300,000 tons of coal reserves.

The block of leased coal currently controlled by NKC supports the King Mine. The current mine is capable of producing up to 300,000 tons/year, and maximum annual federal production to date was 262,481 tons which occurred in 1998. The total mine production that year was 283,211 tons. The 2000 production rate after the first quarter indicates the total production for the mine would be about 160,000 tons/year. The ideal yearly production for NKC would be 300,000 tons per year in order to meet financial cash flow demands for the operation. Total remaining reserves are approximately 2.2 M tons and could provide about 7 years of production at the 300,000 ton per year rate.

III. General Description. The A.T. is located in the Red Mesa area of the Durango Coal Field in the Colorado Plateau between the San Juan Mountains on the North and the San Juan Basin on the South. The general area is made up of sandstone mesas, canyons, and dry gulches. The area tilts 2 to 3+ degrees southward and the surface ranges from 7,300 to 8,200 ft. elevation. The geologic formations includes the Mesaverde Group of the upper Cretaceous Age. In the mine area the Upper Mesaverde consists of (in descending order) the capping Cliff House sandstone, the coal bearing Menefee Formation, and the basal Point Lookout sandstone.

Access to this tract of federal coal is not limited, but NKC has tentative plans to build new surface and portal facilities on a state lease adjacent to the A. T. on the southwest side. The 300 foot overburden limit lies in the northeast end of the tract and is not a limitation to mining. The outcrop surrounds the tract except for the southwest and northeast portion. The northeast boundary was determined by thinning (unmineable) coal.

Opportunities to enhance the competitiveness of the tract during tract delineation rely on the economic value of the recoverable reserves. That value is not likely high enough for a competitive bid since such a competitor would have to establish market sales for the coal which NKC already satisfies. NKC has been operating under a granted royalty rate reduction on the federal and fee coal they lease, indicating there is little or no financial margin for an outside competitor to establish a new operation on top of a high bid.

The coal outcrops in several locations along the west and east sides of the tract. The surface topography of the tract varies in elevation from about 7,300 ft. along the south boundary to just over 8,200 ft. near the north boundary. Figure 1 shows the relationship of the tract to the features described. The tract is not likely to have competitive interest in the climate of the current coal market. If the reserves are not recovered as part of the NKC mining operation as a result of their application and successful bid, the coal reserve would be available for future generations, with a modest chance that it may represent a bypass of coal resource. Leasing to NKC would enhance recovery for the combination of the existing fee and federal leases and the applied for tract by virtue of the overall geologic and structural layout of the available coal resource to be mined and with respect to encouraging NKC's efficient and logical transition to a new mine from the existing mine.

The tract has been delineated to include all recoverable coal reserves in the upper menefee seam lying between the state lease on the southwest, outcrops on the west and east, and thin coal on the north. The original competitive lease application submitted by the NKC identified an area of

approximately 1,304 acres more or less, and this is the tract description with which BLM agrees.

The tract as delineated contains only federal coal. The surface estate is mostly private land held in fee by the Ute Mountain Ute tribe. There are about 40 acres of BLM managed surface in the southernmost extent of the tract.

IV. Geologic Data.

Stratigraphy. The A. T. is underlain by the Upper Mesaverde Group, and consists of (in descending order) the capping Cliff House sandstone, the coal bearing Menefee Formation, and the basal Point Lookout sandstone. The A. T. has overlying alluvial deposits.

The coal bearing Menefee Formation is of non-marine sedimentary deposits of sandstone, shale, and coal. The formation is about 300 ft. thick. The King Coal Mine is located in the top (No. 1) coal bed about 20 ft. below the base of the Cliff House sandstone. This coal seam ranges from 4.5 to 7.5 ft. thick. Coal bed No. 2 lies 50 to 90 feet below bed No. 1 and varies from 2 to 9 ft. thick, but is thinner on the average and has rock partings. Coal bed No. 3 lies about 30 ft. above the Point Lookout sandstone and varies from 3 to 7 ft. thick, and is also thinner on average.

The Upper Menefee seam is overlain by thinly laminated shales with some sandstone lenses and is underlain by hard sandy shales.

Structural Setting. The tract is located in the Red Mesa area of the Durango Coal Field in the Colorado Plateau between the San Juan Mountains on the North and the San Juan Basin on the South. The general area is made up of sandstone mesas, canyons, and dry gulches. The area tilts 2 to 3 degrees southwest and the surface ranges from 7,300 to 8,200 ft. elevation.

Structural Geology and Geologic Hazards. There are minor rolls and faults which have been encountered during mining in the seam south of the A. T. that appear to be in conjunction with drainages on the surface. In several locations high sulphur, thinning coal, and/or poor roof conditions have resulted in slower development or even the abandonment of mining.

V. Coal Data In general, coal in the Hesperus-Red Mesa field is ranked high-volatile C and B. The upper menefee seam consistently produces high-volatile B.

Coal Quality Analysis of the ash and sulphur content of the No. 1 (Upper Menefee) seam based on drill hole core samples is as follows:

Ash 7.78 % Sulphur 0.68% Water 5.60% BTU 12,769

The ash and sulphur content implied by these analysis suggests a slightly better product than is sold from the current King Mine workings. Ash increases when roof slabs dilute coal during initial excavation. Roof control practices generally prevent this type of dilution. An on-site ash analyzing lab is employed by NKC to ensure that dilution is not creating ash influx greater than acceptable market limits.

Coal Quantity The following coal quantity determinations were calculated by BLM's mining engineer (Uncompahgre Field Office) in February 2000, as part of BLM's Tract Delineation report for the A. T. application. The results show recoverable reserves tabulated for the applied for portion of the tract.

Tract Area	Acres	TONS		
		In-place	Mineable	Recoverable
East Alkali	1,353	12,957,000	11,748,000	7,049,000

Narrative Description of Calculation Data & Methods The tract acres were broken down according to the original application description. Those areas were further broken down by coal thickness, outcrop burn, lease boundary buffer, and ash. The coal thickness in the applied for area averages 6.7' thick with coal in the northeastern portion going down to 4.5' thick or less and considered unmineable. High ash appears in the southwestern portion, and where it was over 11% ash the coal was considered unmineable. Within each mineable unit recovery was considered to be 60% (which is likely, even considering a property that has no proven recovery rate).

Estimated Recoverable Reserves As tabulated above, the estimated recoverable reserves in the applied for acres is **7,049,000** tons.

VI. Mining Considerations

Surface Facilities NKC would construct new coal handling surface facilities to serve their planned mining operation on the A. T. The facilities would most likely be located on an adjacent state lease to the southwest. The facilities would be built toward the end of the life-of-mine of the King Mine as a transition to mining on the A. T. became necessary due to exhaustion of reserves in the King Mine. The current surface coal handling facilities of NKC's King mine located in Hay Gulch would be abandoned and reclaimed upon production from the A.T. becoming the sole source of coal for the market.

If the tract were not acquired by NKC it is possible that the coal could be accessed by a different mining company. Any other company would not only be starting out with the capital investment involved in building new surface facilities, but would be having to establish a market for the coal, presumably besides that which NKC would be satisfying with coal from the King Mine. As mentioned above, there is a minimal possibility for competitive bidding. Either way, development of the tract demands new surface facilities.

Mining Method, Mine Life Geologic and economic constraints dictate that the underground room and pillar mining method be employed to extract the coal from the tract. The amount of overburden ranges from 0 to 300 ft. which necessitates underground mining and since NKC already owns continuous miner equipment they would employ it to mine the coal reserves. There are no *geologic*

constraints which would prevent consideration of the use of the longwall method of mining sometime in the future; however the investment for the equipment and the ability to ship longwall production quantities eliminates it as a current consideration.

The current operation in the upper menefee seam coal adjacent to the tract successfully mines coal using continuous miners to develop panels which are mined by the retreating pillar robbing method of mining.

The period of mining on the A. T. would be 20 to 25 years total, but could last over an extended time since coal production from the King Mine on its federal LMU and federal leases could be realized in conjunction with production from the A. T. Mining in the A. T. and in the adjacent LMU and leases could take approximately 30 years, but it is likely that the A. T. itself will be mostly mined out in 25 years.

Mining Equipment The following is a list of major equipment currently used by NKC and is typical for use in an underground room and pillar operation:

Continuous Miners	3	Roof Bolters	3
Shuttle Cars	7	Utility Loader	2
Lube Truck	1	Utility Mantrips	6
Utility Hauler	1	Belt Drives	7
200hp Main Mine Fan	1	Utility Scoop	2

Employment Requirements Production on the tract could proceed without a rise in employment requirements if NKC were the successful bidder. The life of the NKC mining operation would have been extended, however, which could allow for an extended period of employment for the existing office, surface, and underground employees. Current employment level is approximately 36 but at full production could approach 60 employees.

In the unlikely event that NKC is not the successful bidder, the successful bidder would be in a position of having to establish the new surface and underground facilities, and obtain the contracts now being filled by NKC. Another option would be to sub-lease the tract to NKC. (Also see ¶ 3, page 3 under General Description above). Employment levels would stay about the same, and could include many of the same personnel.

Attachment 1. - Legal Description of the A. T.

T. 35 N., R. 11 W. & T. 35 N. R. 12 W., New Mexico Principal Meridian, La Plata County, Colorado.

T. 35 N., R. 11 W., N.M.P.M.
Sec. 19, lots 4, 5, E2SW4, & SE4.

T. 35 N., R. 12 W., N.M.P.M.
Sec. 24 - lots 1, 2, and SW4SE4.
Sec. 25 - lots 1, 2, W2NE4, and W2.
Sec. 26 - SE4NE4, E2SE4, SW4SE4.
Sec. 35 - NE4, N2SE4.

Area for the A. T. totals approximately 1,304.51 acres.

Attachment 2. - Bibliography

1949, Geology and Coal Resources of the Durango Area, LaPlata and Montezuma Counties, Colorado: USGS Oil and Gas Investigations Preliminary Map 109, 2 Sheets, Zapp, A. D.

1981, Paleontological Inventory and Assessment of the Durango and Cortez Known Recoverable Coal Resource Areas: BLM Contract, 63 pages.

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1997 and 1999 National King Coal, LLC, Royalty Rate Reduction Application (with references to economic data).

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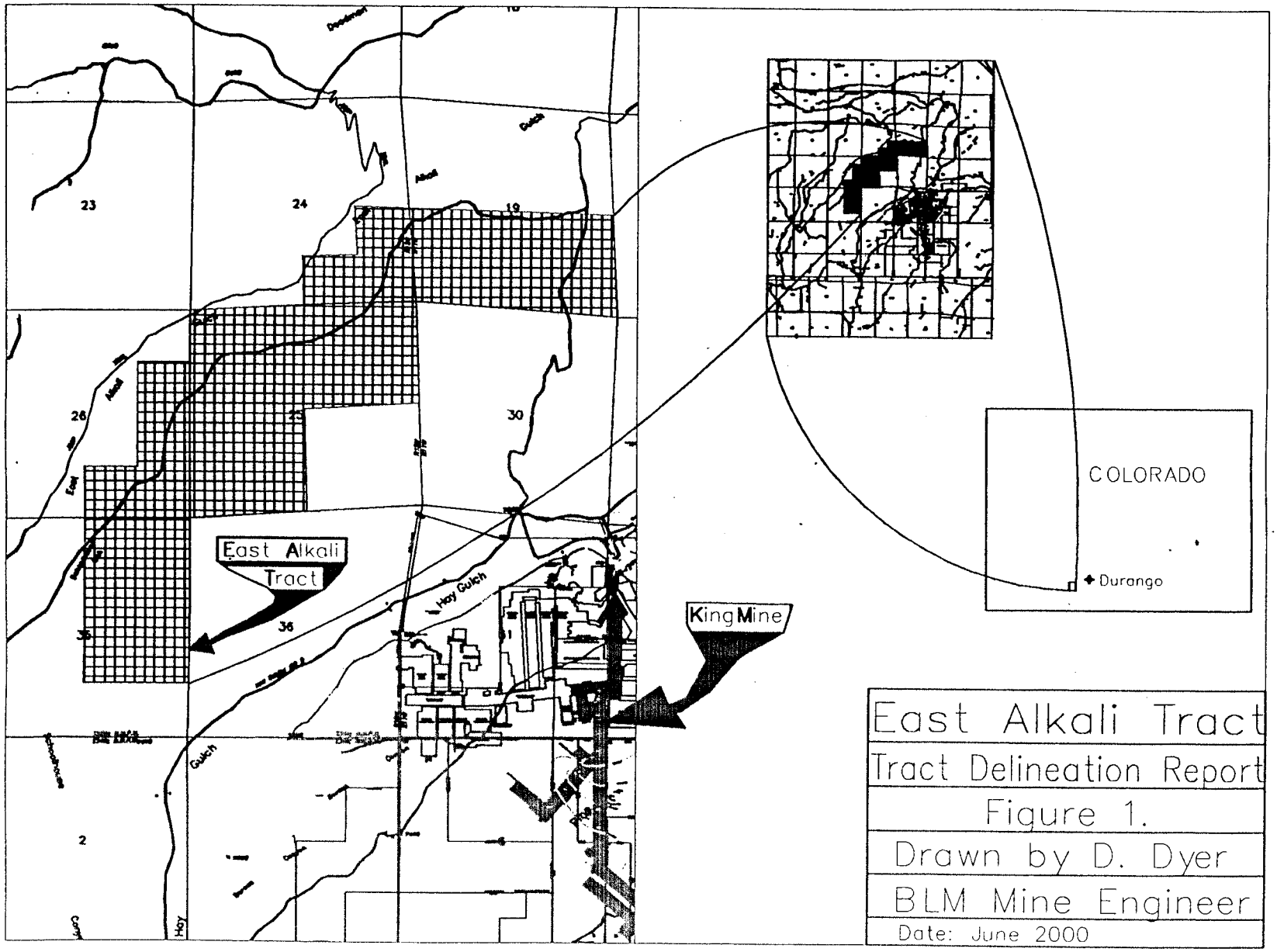

East Alkali Tract

Tract Delineation Report

Figure 1.

Drawn by D. Dyer

BLM Mine Engineer

Date: June 2000