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Mine file
S.C. Linner

GENWAL COAL COMPANY

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January 31, 1986

Mr. Lowell Braxton
Department of Natural Resources
Division of Oil, Gas and Mining
355 W. North Temple
3 Triad Center
Suite 350
Salt Lake City, Utah 84180-1203

ACT/015/032
#2, #7 & #9

Re: Groundwater Monitoring Plan

Dear Mr. Braxton,

Please find enclosed for your review and approval the groundwater monitoring plan at the Crandall Canyon Mine. This monitoring plan has been incorporated into the mid-term review, however in order to satisfy an outstanding NOV I thought I better address this issue with a separate cover letter. I have recently discussed this issue with Dave Cline and Rick Summers concerning further monitoring and have incorporated their comments in the final copy of the midterm review.

If you have any further questions or comments please feel free to contact me at 637-7383. Thank you.

Sincerely yours,

Andrew C. King

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GROUNDWATER MONITORING PLAN FOR THE CRANDALL CANYON MINE, GENWAL COAL COMPANY

As noted in Section 7.1.4 of the Tract 1 Permit Application Package, only one spring was found during the June 1985 seep and spring survey within the area of potential subsidence with a flow rate of at least on gallon per minute. This spring (SP-30, see Figure 7-2) occurs as diffuse seepage from the Blackhawk Formation above the mine portals and is collected in a pipe to avoid problems at the portal face. This spring is located above the Tract 1 lease area and will not be affected by mining in Tract 2. All major springs (flows of at least five gallons per minute) found during the June 1985 survey were located outside of the area of potential subsidence.

Groundwater monitoring for the Crandall Canyon Mine area will consist of collecting water quality and quantity data from six springs as well as points of significant inflow to the underground workings. SP-30 and SP-36 will be monitored to determine potential impacts in the immediate vicinity of the mine. SP-30 was chosen because it is the only spring within the area of potential subsidence that had a flow rate of at least one gallon per minute during the June 1985 inventory. SP-36 was chosen because it issues adjacent to the area of potential subsidence and had a flow rate during the June 1985 inventory that was of sufficient magnitude (two gallons per minute) to suggest some permanence.

SP-58 will be monitored as an indicator of long-term changes in groundwater issuing from the Blackhawk Formation in an area that will not be affected by mining operations. The magnitude of these changes will be useful when interpreting changes at SP-30 and SP-36.

SP-47 will be monitored since a water right has been filed on this spring by the U.S. Forest Service (see ection 7.1.3.1 of the Tract 1 PAP). Springs SP-19 and SP-22 will be monitored as an indication of the water supply in the upper reaches of Blind Canyon.

Four samples will be collected from the monitored springs annually. With the exception of SP-30, each spring will be monitored at monthly increments during the accessible portion of the year (generally June through September). These samples will be collected as close as possible to the point of issuance of the springs. Samples will be analyzed according to the list of parameters in Table 7-3. Every fifth year (1985, 1990, etc.), samples collected during the low-flow period of the year (the final sample of the year) will be analyzed according to the list

of parameters contained in Table 7-4 (as requested in guidelines from DOGM).

Since SP-30 is collected in a pipe to bypass the portal area, its discharge point is accessible year-round. Hence, this spring will be monitored at the point of pipe discharge quarterly (normally in January, April, July, and October) and analyzed according to Table 7-3. Every fifth year, the sample collected during the low-flow period (normally October) will be analyzed according to Table 7-4.

On a quarterly basis (normally in January, April, July, and October), an inventory will be conducted of the active portion of the mine to identify the location and geologic occurrence of mine inflows that exceed three gallons per minute. In consultation with DOGM, certain of these inflows (if they occur) will be selected for continued monitoring. Currently, only one such inflow exists, flowing from the roof of the mine from an exploratory hole (DH-2) that was vertically-drilled from within the Tract 1 area at the location shown on Plate 6-1 of the Tract 1 PAP. This hole is capped and is allowed to flow only when needed to collect water-quality data.

After selection of the inflow points to be monitored, data will be collected on a quarterly basis and analyzed according to Table 7-3. Every fifth year, samples collected during the low-flow period (normally October) will be analyzed according to Table 7-4.

Groundwater monitoring data collected during a calendar year will be summarized and submitted to DOGM on and annualbasis. Included in the annual report will be an analysis of the mine working water balance, accounting for mine inflows, outflows, consumptive uses, and sump storage.

Table 7-3. Abbreviated groundwater analysis list.

Field Measurements:
Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)
Laboratory Measurements:
Total dissolved solids
Total hardness (as $CaCO_3$)
Bicarbonate (as HCO_3)
Carbonate (as CO_3)
Calcium (as Ca)
Chloride (as Cl)
Dissolved iron (as Fe)
Magnesium (as Mg)
Manganese (as Mn)
Potassium (as K)
Sodium (as Na)
Sulfate (as SO_4)

Table 7-4. Extended groundwater analysis list.

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)

Laboratory Measurements:

Total dissolved solids
Total hardness (as $CaCO_3$)
Aluminum (as Al)
Arsenic (as As)
Barium (as Ba)

Bicarbonate (as HCO_3)
Boron (as B)
Carbonate (as CO_3)
Cadmium (as Cd)
Calcium (as Ca)

Chloride (as Cl)
Chromium (as Cr)
Copper (as Cu)
Fluoride (as F)
Dissolved iron (as F)

Lead (as Pb)
Magnesium (as Mg)
Manganese (as Mn)
Mercury (as Hg)
Molybdenum (as Mo)

Nickel (as Ni)
Nitrogen-Ammonia (as NH_3)
Nitrite (as NO_2)
Nitrate (as NO_3)
Potassium (as K)

Phosphate (as PO_4)
Selenium (as Se)
Sodium (as Na)
Sulfate (as SO_4)
Sulfide (as S)
Zinc (as Zn)

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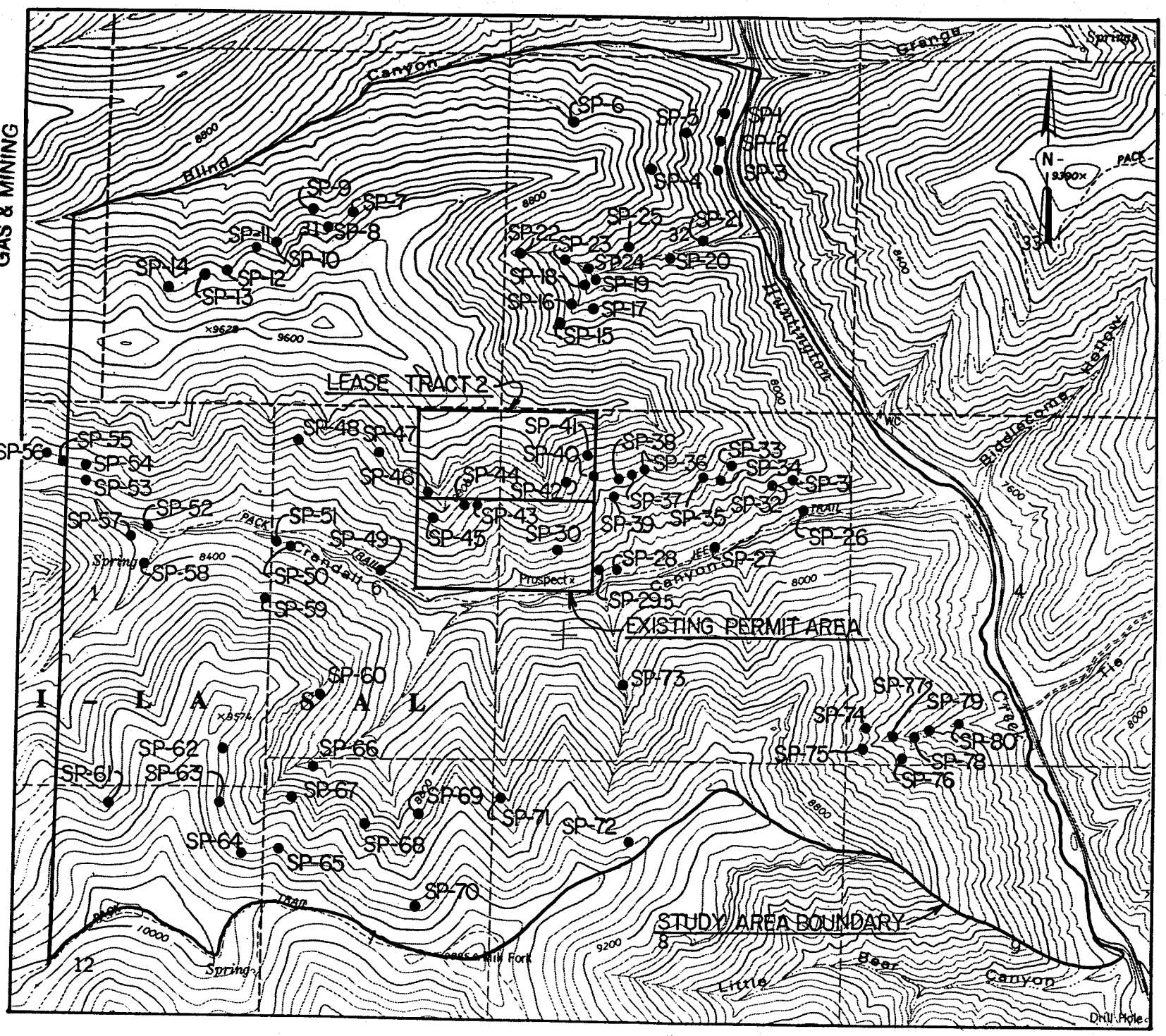

Figure 7-2. Locations of seeps and springs in the Crandall Canyon area.