EVALUATION OF A POTENTIAL WELL FIELD NEAR CHURCH ROCK AS A WATER SUPPLY FOR GALLUP, NEW MEXICO

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16. Abstracts

A digital model is used to evaluate the Westwater Canyon Member of the Morrison Formation near Church Rock, N. Mex. as the source for a potential well field to supply water to Gallup, N. Mex. The estimated values of the aquifer parameters are transmissivity, 300 feet squared per day; coefficient of confined storage, 0.0002; coefficient of unconfined storage, 0.10; and leakance, 10^{-7} per day. The model indicated that the ability of the potential well field to meet the projected needs of the city of Gallup depends on the future withdrawals of water from uranium mines in the area.

17. Key Words and Document Analysis. 17a. Descriptors

*Ground Water, *Water Supply, *Model Studies, *Mathematical Models.

17b. Identifiers/Open-Ended Terms

*San Juan Basin, *Morrison Formation, *Westwater Canyon Member, *Gallup, New Mexico.

17c. COSATI Field/Group

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PRELIMINARY ESTIMATES OF EFFECTS OF URANIUM-MINE DEWATERING ON WATER LEVELS, SAN JUAN BASIN

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Abstract

Most of the uranium mines in northwestern New Mexico will withdraw water from the Morrison Formation in the course of mining operations. Using three levels of projected uranium mining, a digital model was used to estimate approximate dewatering rates, effects on water levels in the Morrison Formation, and effects on streams to the year 2000. All effects are superimposed on other likely developments of ground water from the Morrison Formation. Planned or announced mines, a maximum of 33 by 1985, would produce 570,000 acre ft (7×10^8 m^3) of water by 2000. The dewatering rate would be about 36 ft^3/s (1 m^3/s) in about 1985, with drawdowns of 2,000 ft (600 m) or more expected near the deepest mines. By 2000, a projected medium range of development of 72 mines would produce about 1,300,000 acre ft (16×10^8 m^3) of water, and the dewatering rate would be about 90 ft^3/s (2.6 m^3/s). Drawdowns of 4,000 ft (1,200 m) or more might be expected near the deepest mines. By 2000, a maximum projected development of 105 mines would probably produce about 2,030,000 acre ft (25×10^8 m^3) of water, and the dewatering rate would be about 117 ft^3/s (3.3 m^3/s). By 2000, dewatering of uranium mines and other ground-water developments may reduce flow in the San Juan River by 0.04 ft^3/s (0.001 m^3/s), and flow toward the Rio Grande valley may be reduced by 0.5 ft^3/s (0.015 m^3/s). The peak effect on flow to streams would not occur until long after the year 2000.

Introduction

Purpose and scope

The development of uranium resources from subsurface mines in northwestern New Mexico will result in the production of large quantities of water from the Morrison Formation, the major ore-producing unit and an important aquifer in the area of development. Mine dewatering will cause extensive water-level declines and will reduce the ground-water flow toward the San Juan River and Rio Grande valley (fig. 1).

In anticipation of major increases in ground-water pumping that will result from the development of energy resources, the U.S. Geological Survey (USGS), New Mexico Bureau of Mines and Mineral Resources, and New Mexico State Engineer began a cooperative study in 1974 to evaluate the ground-water resources and possible effects of ground-water development. The experience and techniques developed during that study were applicable to an evaluation of impacts on ground-water resources requested by the San Juan Basin Regional Uranium Study (SJBRUS) Task Force.

This evaluation was requested by SJBRUS Task Force in order to estimate: 1) quantities of water that might be produced from uranium mines in the Morrison Formation, 2) changes in water levels in the Morrison Formation resulting from mine dewatering, and 3) effects of dewatering on surface flows.

The effects of uranium mining were evaluated for three projected levels of development: 1) no additional mines included beyond the 33 that are currently operating or planned, 2) a medium-range projection including 72 mines, and 3) a high projection including 105 mines. The predicted effects of these projected levels of development were to be superimposed on other likely water withdrawals for such uses as coal production and municipal supply. Mine locations for the three projections were determined by SJBRUS.

This report presents the results of a preliminary digital model evaluation developed by the USGS. This model was constructed using the best available values for hydraulic properties but also contains many untested simplifying assumptions. The model has not been calibrated or tested for sensitivity to assumptions about the hydrogeologic system, and the results presented should be considered engineering estimates giving only the rough magnitude of effects that may result from uranium development in the basin. A more rigorous model of the hydrologic system was not attempted because of the immediate need for these estimates.

Study area

The study area (fig. 1) coincides approximately with the extent of the Morrison Formation in northwestern New Mexico and southwestern Colorado. Most of the area lies within the San Juan structural basin as defined by Kelley (1951). Major physiographic features in or near this area include the San Juan and La Plata Mountains in Colorado, the Chuska Mountains near the New Mexico-Arizona border, the Zuni Mountains at the south side of the study area, and the Rio Grande valley and Sierra Nacimiento on the east side of the study area. The San Juan, Animas, La Plata, and Mancos Rivers flow perennially into New Mexico from Colorado. Other major drainages, including the Chaco River, Canyon Largo, Puerco River, Rio San Jose, and Rio Puerco, drain large areas but are characterized by ephemeral flow.

Much of the annual precipitation comes during short but frequently intense convective thundershowers. At lower elevations, such as the area drained by the Chaco River, the annual precipitation rarely exceeds 8 inches (20 cm). The uplands, particularly the San Juan and La Plata Mountains in Colorado where annual precipitation exceeds 30 inches (76 cm) in some places, are the source for most surface water in the basin. Much of the recharge to aquifers also occurs in the upland areas.

Population centers include Durango and Cortez in Colorado and Farmington, Shiprock, Gallup, and Grants in New Mexico. Major population increases are expected as a result of energy and related developments. Major energy developments currently in operation include oil and natural-gas production, coal mining, coal-fired power production, and uranium mining. The Navajo Irrigation Project also contributes significantly to the economic growth of the area. Although none of these except the uranium mines are presently removing significant amounts of water from the Morrison Formation, additional demand for ground water is anticipated, particularly for use in coal mining and power production.

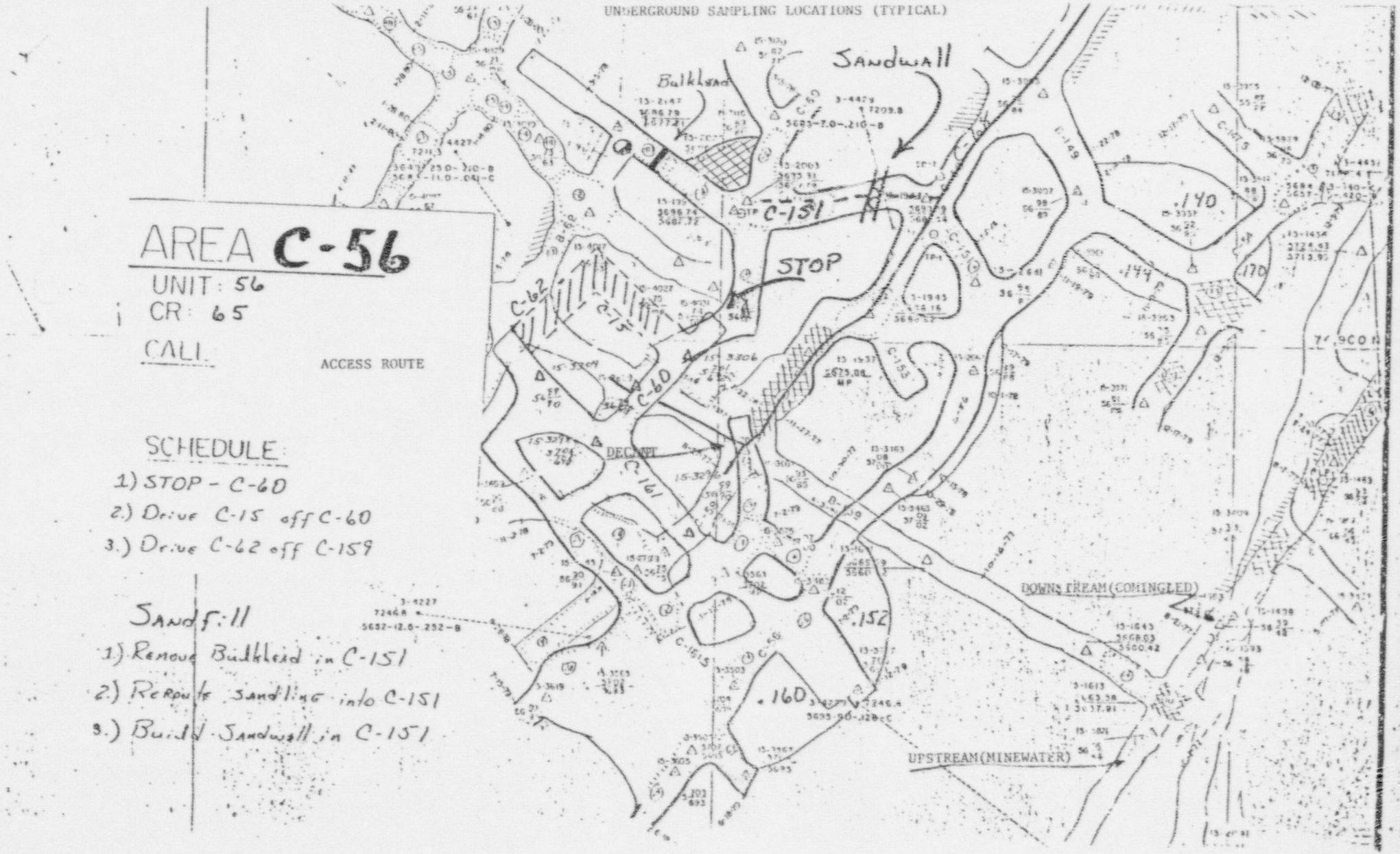
Ground water in the Morrison Formation

The Morrison Formation (Jurassic) includes three members throughout most of the study area. In ascending order, these are: the Recapture Member, Westwater Canyon Member, and Brushy Basin Member. In the northwest part of the area near Four Corners, a fourth member—the Salt Wash Member—underlies the Recapture Member.

[4] The following table sets forth a number of commonplace and customarily accepted risks of premature death:

Cause	Individual risk/year
motor vehicle - Total	1/4,500
(1975) - Pedestrian	1/25,000
home accidents (1975)	1/83 000
air travel - one transcontinental flight/yr	1/330,000
accidental poisoning - solids and liquids	1/170,000
accidental poisoning - gases and liquids	1/140,000
inhalation and ingestion of objects	1/71,000
electrocution	1/200,000
falls	1/13,000
air pollution (sulphates)	1/6,700
(benso(a)pyrene)	1/33,000
vaccination for small pox (per occasion)	1/330,000
living for one year downstream of a dam	1/20,000
bicycling	1/100,000
drowning (from recreational activities)	1/53,000
government employment	1/9,100
agricultural employment	1/1,700
truck driving employment	1/2,000
alcohol	1/20,000
smoker	1/300
person in room with smoker	1/100,000
one pint of milk per day (aflatoxin)	1/100,000

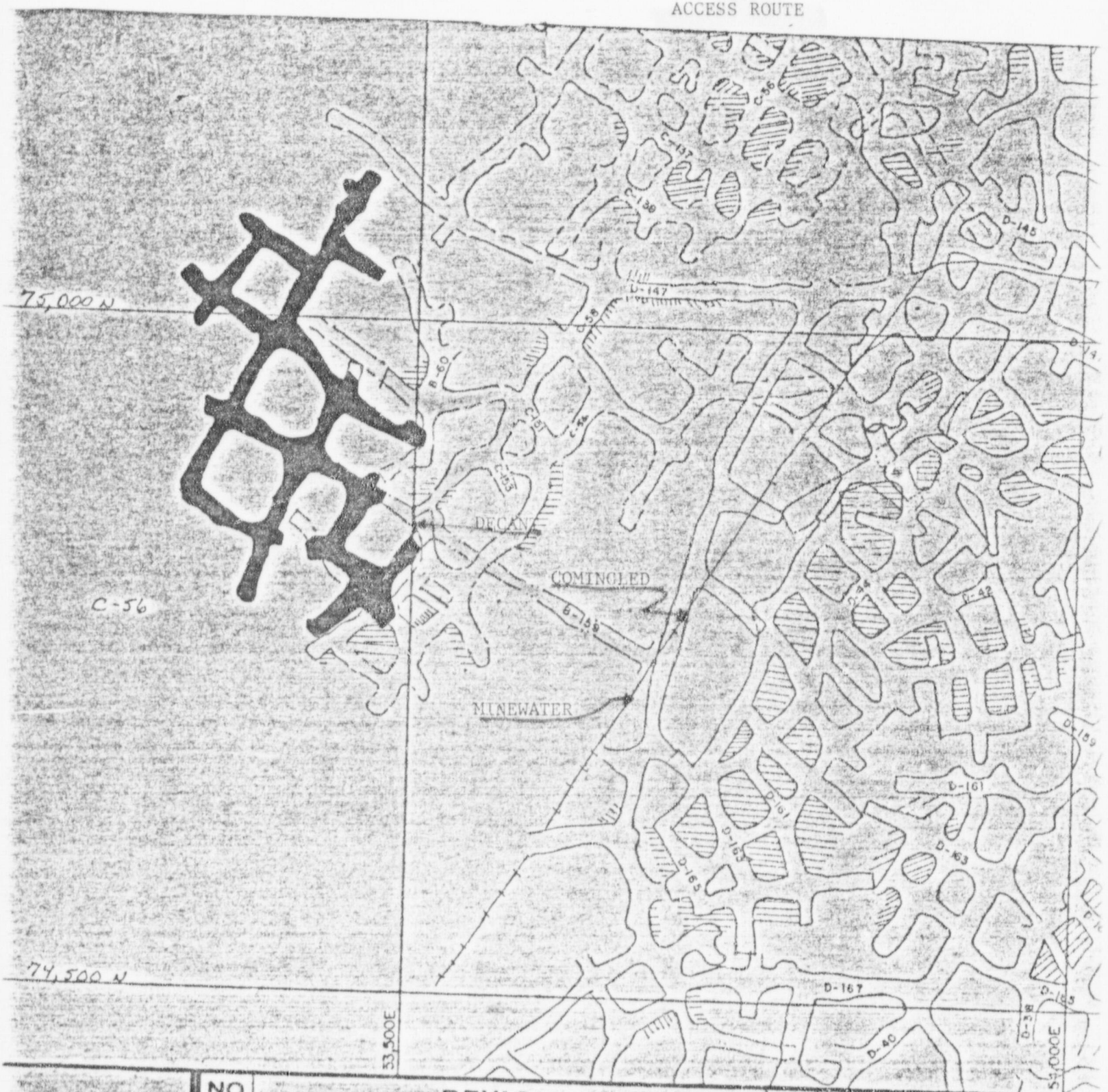
Source: OSHA Testimony of Professor Richard Wilson reprinted in Hutt, Unresolved Issues in the Conflict Between Individual Freedom and Government Control of Food Safety, 33 FD&C L.J. 558, 564-66 & 568 (1978).


UNDERGROUND SAMPLING LOCATIONS (TYPICAL)
AREA C-56
UNIT: 56
CR: 65
CALI
ACCESS ROUTE
SCHEDULE:
1) STOP - C-60
2.) Drive C-15 off C-60
3.) Drive C-62 off C-159
SANDWALL
1) Remove Bulkhead in C-151
2.) Reroute Sandfill into C-151
3.) Build Sandwall in C-151
Bulkhead
SANDWALL
STOP
C-151
C-62
C-15
C-60
C-159
C-161
C-153
DECANT
.140
.144
.170
.152
.160
DOWNSTREAM (COMINGLED)
UPSTREAM (MINEWATER)

UNDERGROUND SAMPLING LOCATIONS (TYPICAL)

FTS SANDFILLED

ACCESS ROUTE



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