WATER QUALITY PROBLEMS IN THE ALBUQUERQUE SOUTH VALLEY

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Albuquerque overlies one of the most precious fresh water aquifers in New Mexico. Approximately 300 vertical feet of the Rio Grande Valley-fill strata are saturated with high quality water. This ground water constitutes the city's sole source of drinking water. The resource, however, is highly vulnerable to pollution due to permeable soils and a shallow water table. While only a small fraction of the ground water has been contaminated to date, recent trends suggest that the nature and extent of contamination may become more severe in the next decade, due to increased industrialization and population growth.

DESCRIPTION OF THE SOUTH VALLEY

The Albuquerque South Valley is situated within the Albuquerque-Belen geologic basin. The basin is located in central New Mexico and is approximately 100 miles long and 25 to 40 miles wide. The basin is bounded by mountains to the east and is drained to the south by the Rio Grande and its major tributaries.

As used in this paper, the South Valley is located partly within and adjacent to the city of Albuquerque and is an area of about 50 square miles. It is bounded on the north by Central Avenue, on the east by Interstate 25, and on the south by the Isleta Pueblo grant boundary. The western boundary of the study area extends approximately 1 mile west of Coors Boulevard (see Figure 1).

The Rio Grande is the only perennial stream in the study area. It flows from north to south through the middle of the South Valley. The alluvial flood plain along the river generally extends two to three miles west of the river and one-fourth to one mile east of the river.

Approximately 54,000 people reside in the South Valley, according to 1980 census data. Nearly 39,000 of these reside in the unincorporated areas of the study area. The northern portion of the South Valley is urban and is supplied with water and sewage utilities by the city of Albuquerque. The southern part is rural; water for domestic use generally is obtained from wells that are less than 300 feet in depth and on-site sewage disposal is utilized. The far southeastern area is largely agricultural and relatively few

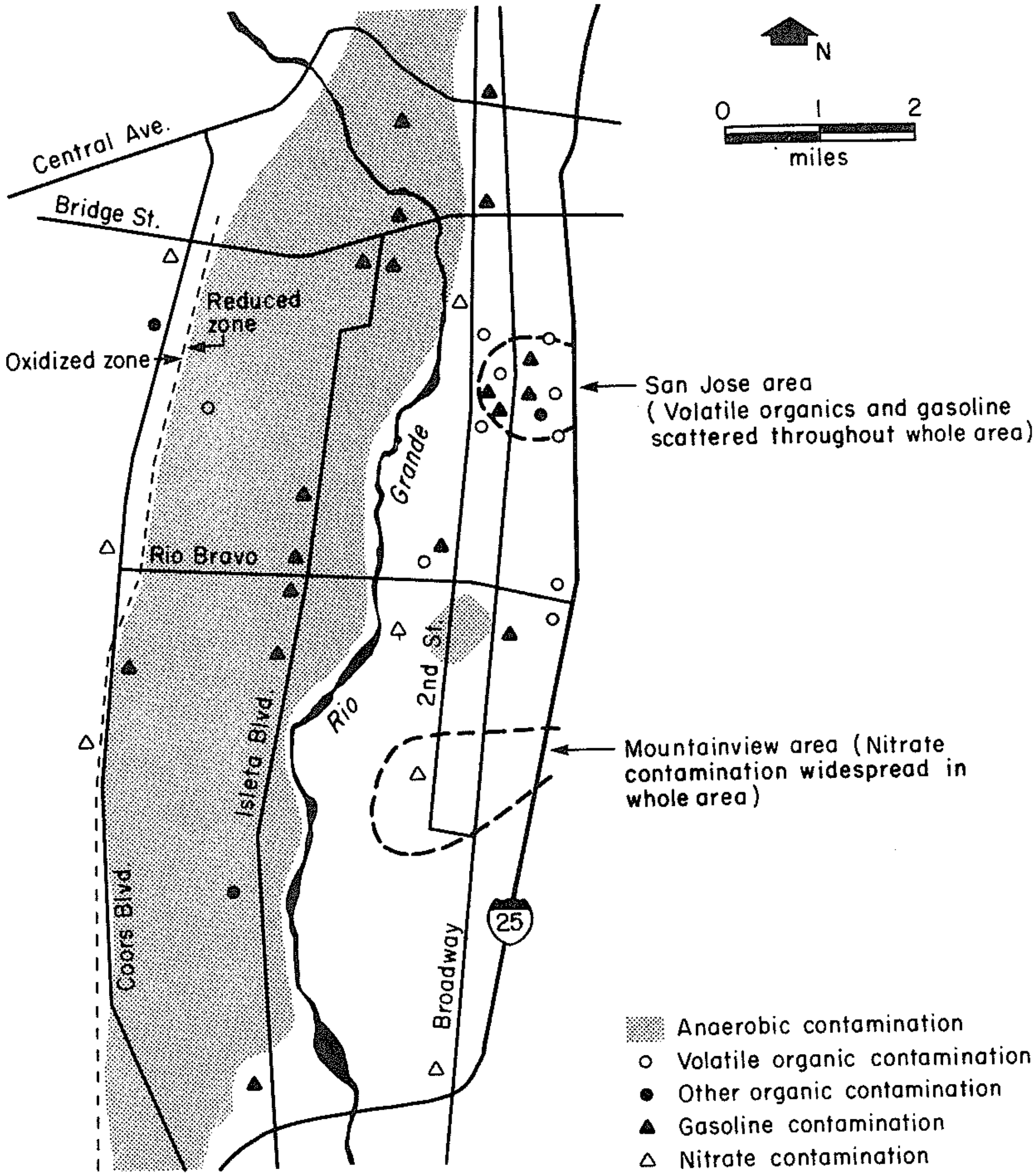

Figure 1. Ground Water Contamination in the Albuquerque South Valley

wells have been drilled. The inner valley within the study area is dissected with canals and drains. The network allows water to be routed throughout urban and rural areas for agricultural use, flood control, and to prevent waterlogging of low-lying land.

POTENTIAL CONTAMINATION SOURCES

In the South Valley, the top three sources of ground water contamination (at least in volume) are agriculture, septic tanks and petroleum product storage facilities.

Agriculture/Evapotranspiration

Irrigation canals have diverted water from the Rio Grande for hundreds of years. Percolating irrigation water caused ground water levels in many valley areas to rise and be more vulnerable to evaporation directly from the soil surface and to transpiration from living plants whose roots tap the ground water. These processes, collectively termed evapotranspiration (ET), cause a gradual build up of salinity in the ground water and form alkali deposits on the soil surface.

In 1919, about 28% of the valley floor was covered by salt grass and alkali or was swampland (Bloodgood, 1930). The Middle Rio Grande Conservancy District designed and constructed drains in the early 1930s to control the waterlogging of irrigated fields. The drains lowered the water table and the croplands were reclaimed.

There are two mechanisms related to irrigated agriculture and evapotranspiration that degrade ground water quality: (1) gradual increase of salinity as relatively pure water evaporates and (2) leaching of alkali deposits as croplands are flushed. Excessive application of irrigation water provides for evapotranspiration and a subsequent increase in the salinity of the shallow ground water once the residual irrigation water percolates downward.

Septic Tanks

About 55% of all housing units in the South Valley dispose of their wastewater using on-site wastewater treatment and disposal systems. There are approximately 9,000 septic tanks/cesspools in use in the area, based on 1980 census data and city and county records. They collectively discharge about 1.4 million gallons of wastewater into the ground daily.

Severe ground water pollution problems can result from the cumulative effects of high density development, improperly treated septic tank effluent, and use of septic tanks in poorly suited areas. In the South Valley, there are several significant existing or potential ground water concerns associated with the use of septic tanks and cesspools.

These include contamination with nitrate and pathogens, and the creation of anaerobic (oxygen deficient) ground water conditions that result in undesirably large concentrations of iron and manganese. The anaerobic conditions occur as a result of biological decomposition of high concentrations of organic material (sewage).

Petroleum Product Storage

Discharges of petroleum contaminants in the South Valley include those resulting from leaking underground storage tanks, accidental spills of liquid products, and the periodic disposal of aqueous contaminants such as tank-bottom water and hydrostatic pipeline-test water. At present, no reliable estimates of total waste volumes of contaminants can be made.

Petroleum products like gasoline, jet fuel, and diesel are complex mixtures of hundreds of organic compounds, many of potential public health concern. Benzenes, 1,2-dichloroethane (EDC), ethylene dibromide (EDB), and polynuclear aromatic hydrocarbons (PAHs) are of primary water quality concern. Elements such as lead, iron, and manganese also may be of concern depending upon site conditions.

CONTAMINATION OF SOUTH VALLEY GROUND WATER

A long history of human activity in a shallow water table zone has left the Albuquerque valley with ground water contamination dating back to at least 1927. Ground water contamination of the Rio Grande Valley-fill aquifer today is typically limited to the upper 200 feet of the aquifer. Deeper waters are generally uncontaminated and are of exceptionally high quality to depths exceeding 3,000 feet.

The contamination in the shallower parts of the aquifer is of utmost concern for two reasons: (1) more than 8,000 households are totally dependent on shallow wells for water supply; and (2) there exists a potential for contamination in the shallower parts of the aquifer to be drawn to deeper zones, ultimately jeopardizing deep municipal and industrial supply wells.

Anaerobic Contamination

Ground water contamination has been documented in virtually every section of the South Valley, as shown in Figure 1. The most common type of contamination in the South Valley is an extensive taste and odor problem involving non-hazardous but elevated levels of salinity, hardness, iron, and manganese in shallow private well waters. Most of these contaminants are ubiquitous within the zone shown as "Anaerobic Contamination".

The manganese and iron problems exist throughout the inner valley except in the largely undeveloped farming areas in the southeast, where residential lot sizes typically are larger than 5 acres (see Figure 2). The elevated levels of manganese and iron appear to be principally attributable to septic tank and cesspool wastewater discharges (Gallaher et al., 1987).

Of much greater public health concern, however, are the presence of several localized contamination problems with nitrate, gasoline, and volatile organic compounds (VOC) such as cleaning solvents. Nitrate and VOC contamination can be insidious in that noticeable tastes and odors are not present until the degree of contamination greatly exceeds health standards.

<u>Petroleum Product Contamination</u>

At least 20 incidents of ground water contamination by petroleum products have been documented by the Environmental Improvement Division from 1970 to 1985 (see Figure 3). A concentration of petroleum contamination occurs in the San Jose area and is associated with the industrial and bulk terminal facilities along 2nd St. and Broadway. Contamination from leaking underground gasoline storage tanks occurs along virtually all of the major streets within the valley. The largest number of the cases are situated along Isleta Boulevard, formerly the major north-south highway through the valley. Most of the petroleum contamination sites are limited in areal extent to a few acres.

<u>West of Coors Boulevard</u>

Relatively isolated cases of nitrate contamination by septic tanks have been observed in a large zone situated generally west of Coors Boulevard. Of fifty wells sampled in this area by the EID, four (8%) had nitrate-nitrogen concentrations greater than the recommended health limit of 10 mg/l (milligrams per liter), and sixteen (32%) exceeded 5 mg/l. Wells with elevated nitrate concentrations are located throughout the zone west of Coors Boulevard, but in all cases are situated in close proximity (less than 500 feet) to large capacity septic tanks.

<u>Mountainview and San Jose Areas</u>

The most severe ground water pollution in the South Valley exists in the Mountainview and San Jose areas shown in Figure 1. Within both areas, wells have been taken out of service due to threats to public health. The respective boundaries of contamination have not been fully determined, but available information indicates that each zone of contamination encompasses an area of at least one to two square miles.

The dangerously large nitrate concentrations detected in Mountainview ground water rank with some of the highest in the United States. Nitrate concentrations at least 50

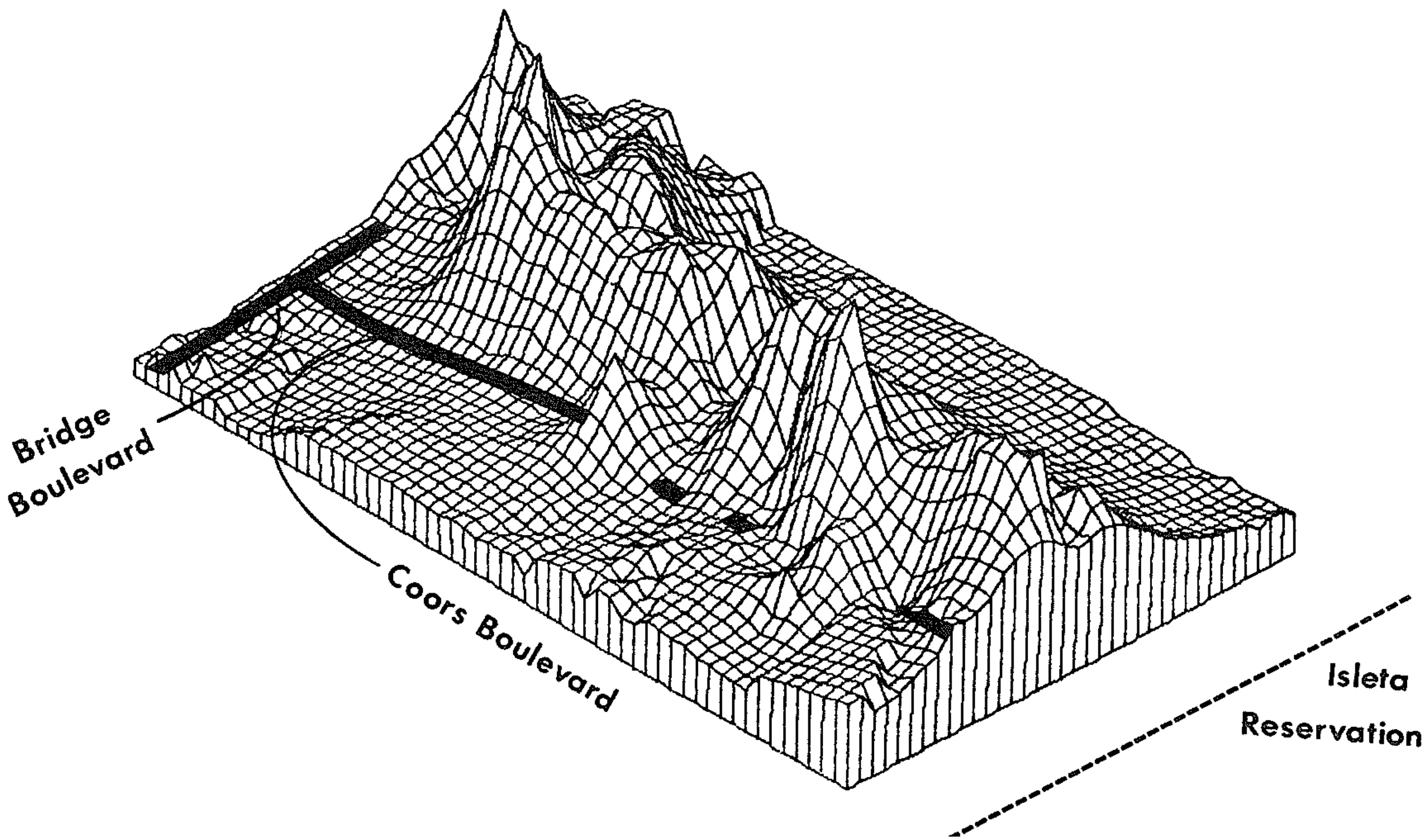

Figure 2. Three-dimensional Perspective of Manganese Concentrations in the South Valley. The "peaks" represent the largest concentrations. View is to the northeast. The widest lines depict the approximate paths of major streets.

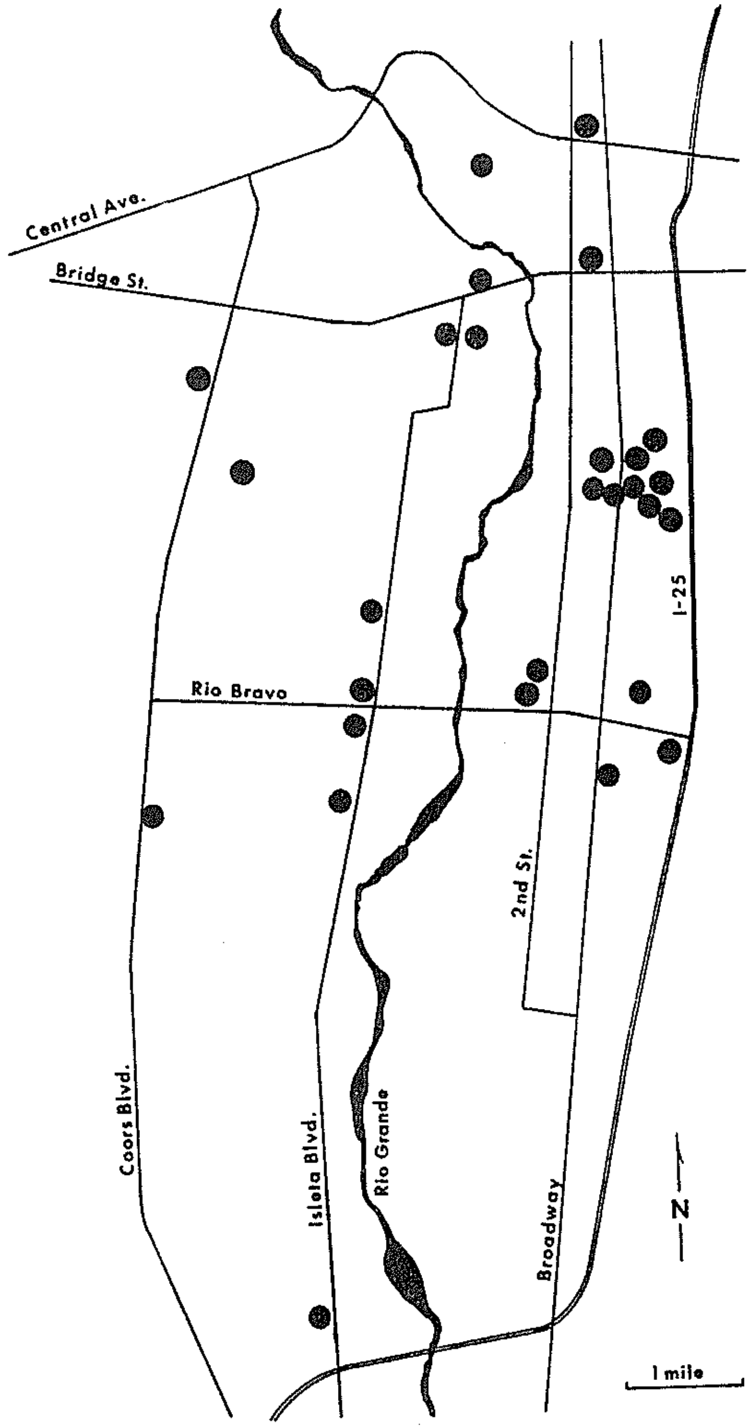

Figure 3. Hydrocarbon Incidents Impacting Ground Water

times higher than drinking water limits have been detected. The specific source of the problem has yet to be determined, though the contamination was first documented in 1961.

A review of available chemical and hydrological information by Gallaher et al. (1987) leads to the conclusion that ground water contamination at Mountainview was probably caused by the discharge of nitrate-rich salts within the Tijeras Arroyo drainage. Such salts are widely used in munitions, explosives pyrotechnics, and commercial fertilizers.

While the possibility exists that other sources may have contributed to the nitrate problem, there is sufficient cause to warrant expanded investigation into the possible relationship between explosives disposal and the Mountainview nitrate contamination. Further work in this area is planned for 1988 by state and federal agencies.

The San Jose area is located within an industrial and residential area in the northeast portion of the South Valley. It has been designated as the state's highest priority "Superfund" site because of the presence of hazardous substances, particularly in the ground water near the city's San Jose well field. Within the site, there are six known or suspected contaminant sources. Figure 4 overviews the general conditions of the site.

Ground water contamination was first generally suspected in 1978 when tastes and odors were noted in a private well near a chemical handling facility. Subsequent sampling showed certain volatile organic compounds were present in two municipal wells. These wells were subsequently taken out of operation by the city of Albuquerque. To date, at least six private, industrial, or municipal supply wells have been impacted by the contamination and subsequently shut down.

Since 1983, the U.S. Environmental Protection Agency (EPA) has directed a remedial investigation at the San Jose area under the auspices of the federal "Superfund" program. Preliminary investigations at the site indicate that ground water contamination exists as deep as 170 feet below the top of the aquifer (200 feet below the land surface), and may encompass an area greater than one square mile. The degree of contamination varies considerably with location but generally decreases with depth (EPA, 1985).

The upper 50 to 60 feet of the aquifer contains aromatic hydrocarbons and chlorinated solvents in concentrations typically less than 40 and 700 parts per billion (ppb), respectively. Maximum detected concentrations, however, are considerably higher (e.g. 55,000 ppb of total hydrocarbons; McQuillan et al., 1982).

Additional field investigations are required to determine if there is or has been any source of soil and/or ground water contamination at any facility within the San Jose area. Possible sources include petroleum handling facilities, solvent handling facilities, flood

This area is complex in terms of both hydrogeology and potential sources or organic contaminants. The direction of ground-water flow appears to have been reversed due to heavy pumpage. At least three of the numerous potential contaminant sources have impacted ground-water quality.

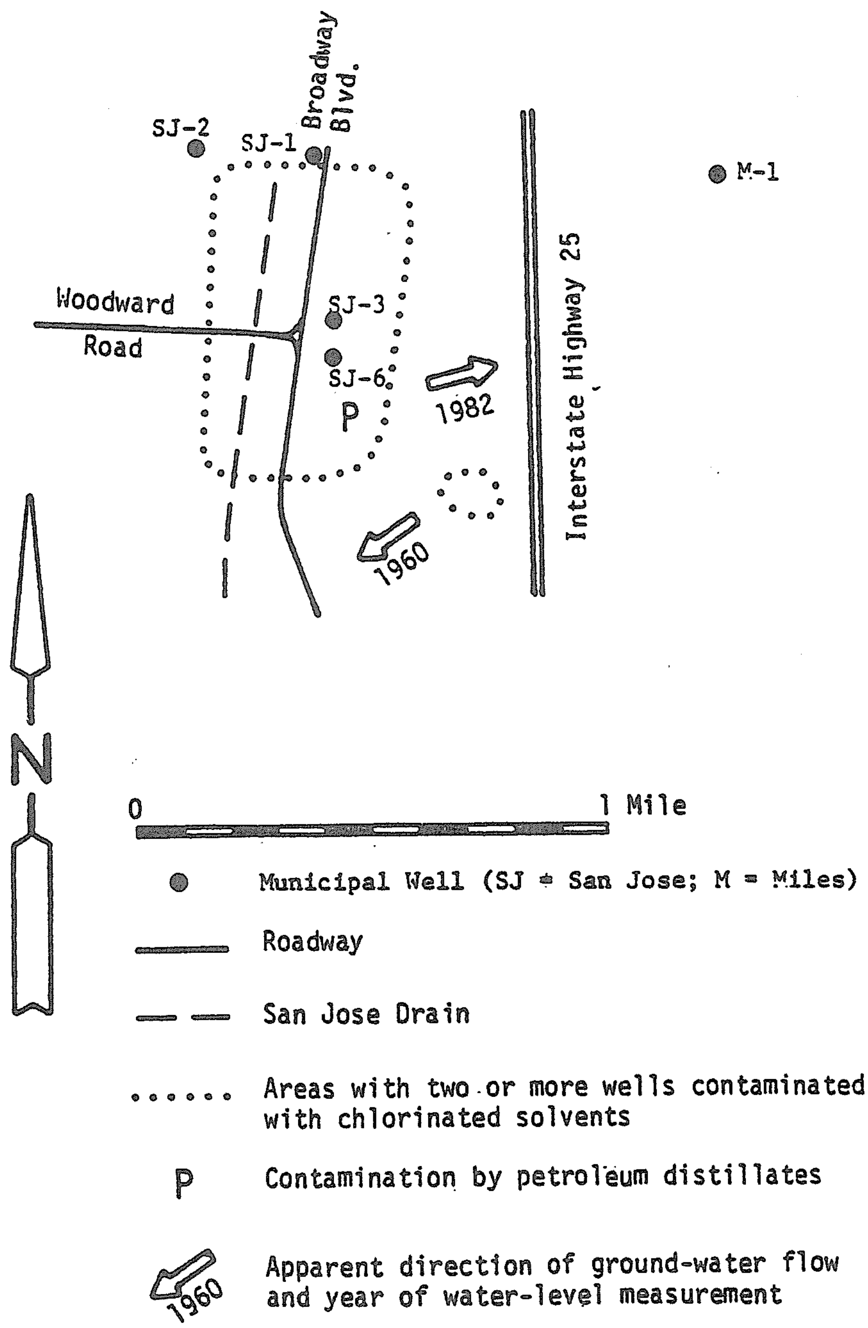

Figure 4. San Jose Area of the Albuquerque South Valley

diversion channels, and municipal sewer lines if leakage from these facilities occurs. As concluded by McQuillan et al. (1982), there appears to be multiple sources which have contributed to the problem.

DISCUSSION AND CONCLUSIONS

For most South Valley residents, there is currently little potential health risk associated with drinking private well water. Severe taste and odor problems are widespread in the inner valley but, on balance, are not hazardous to public health. Potential health hazards caused by nitrate, gasoline, and volatile organics are generally restricted to discrete areas. Epidemiologic studies conducted between 1985 and 1987 indicate that the rates of diarrheal illness, cancer, and childhood leukemia in the South Valley are not significantly different than in other parts of Albuquerque, Bernalillo County, or New Mexico (Gallaher et al., 1987).

Due to increased industrialization and population growth, however, the extent of health-threatening contamination cases will inevitably increase in the next decade. Experience gained indicates that in the inner valley the ground water is exceedingly vulnerable to contamination from spills or wastewater discharges at the land surface. Moreover, it appears that contaminants in the shallow ground water zones are being drawn to greater depths by the pumping of deep wells. This vertical migration presents a long-term threat to all deep wells including those used by the city of Albuquerque.

Development and aggressive enforcement of ground water protection based zoning measures by local governments would greatly minimize this long-term risk. In the light of the demonstrated vulnerability of aquifers to contamination, industrial development in the inner valley may conflict with the goal of protecting municipal and private water supplies. High risk activities should be located, when possible, in areas outside of the valley where the depth to ground water is greater than 300 feet.

REFERENCES

Bloodgood, D.W. 1930. The Ground Water of the Middle Rio Grand Valley and its Relation to Drainage. New Mexico State College, Agricultural Experiment Station, Bulletin 1984, p. 306.

Gallaher, B.M., McQuillan, D.M., Chavez, L.D., Hull, H.F. and Eidson, M. 1987. Ground-Water Quality and Public Health Albuquerque South Valley. New Mexico Health and Environment Department. EID/GWH/87-1, p. 240.

McQuillan, D.M., Oppenheimer, S.J. and Meyerhein, R.F. 1982. Organic Ground-Water Pollutants in the South Valley of Albuquerque, New Mexico. New Mexico Health and Environment Department. p 47.

U.S. Environmental Protection Agency, 1985. Draft Technical Report, Offsite Remedial Investigation, South Valley Site, Albuquerque, New Mexico. Contract No. 53-6111.0, 2 vols.