UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

# A PRELIMINARY EVALUATION OF THE GEOHYDROLOGY AND WATER QUALITY OF THE GREENACRES LANDFILL AREA, SPOKANE COUNTY, WASHINGTON

By W. E. Lum II, G. L. Turney, and R. C. Alvord

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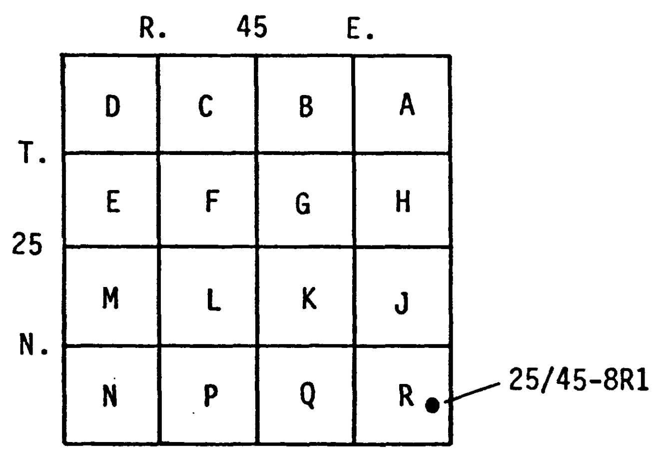
## WELL-NUMBERING SYSTEM

In this report wells are designated by symbols that indicate their location according to the rectangular-grid system for subdivision of public land. For example, in the symbol 25/45-8R1, the part before the hyphen indicates successively the township and range (T.25 N., R.45 E.) north and east of the baseline and Willamette meridian. Because all townships mentioned in this report are north of the baseline and east of the Willamette meridian, the letters "N" and "E" are omitted in the text. This well would be referred to as 25N/45E-08R01 in table 1 and 25/45E-08R01 in table 2. The first number after the hyphen indicates the section (8) in which the well is located; the letter denotes the 40-acre subdivision of the section according to the following diagram. The last number is the serial number of the well in the 40-acre subdivision. Thus, well 25/45-8R1 is in the SE¼SE¼ sec. 8, T.25 N., R.45 E., and is the first well in that tract to be recorded.




Section 8

## CONVERSION FACTORS, INCH-POUND TO METRIC

| Multiply inch-pound units | By | To obtain SI units |
|---|---|---|
| inch (in.) | 25.4 | millimeter (mm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |
| gallon per minute (gal/min) | 0.06308 | liters per second (L/s) |
| cubic foot per second ($ft^3/s$) | 0.02832 | cubic meter per second ($m^3/s$) |
| micromho per centimeter at 25° Celsius (umhos/cm at 25°C) | 1.0000 | microsiemen per centimeter at 25° Celsius (uS/cm at 25°C) |

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), use the following equation: $°C = 5/9\ (°F - 32)$

# A PRELIMINARY EVALUATION OF THE GEOHYDROLOGY AND WATER QUALITY OF THE GREENACRES LANDFILL AREA, SPOKANE COUNTY, WASHINGTON

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## ABSTRACT

The Greenacres landfill, located about 11 miles east of the city of Spokane, Washington, was used for the disposal of waste from 1951 to 1972. Materials in the landfill include household and industrial waste materials, and various hazardous wastes. In 1983 the landfill was designated by the U.S. Environmental Protection Agency as a "Superfund" site. The purposes of this investigation were to gather, describe, and interpret all the existing data concerning the hydrology and ground-water quality of the area surrounding the landfill, and to identify any additional data needed to describe the hydrology of the area.

The quantity of water flowing through the landfill as a result of precipitation on the landfill and in the drainage basin above the landfill probably ranges from 21,000 to 85,000 gallons per day. This water movement may be creating a leachate and transporting some of the wastes out of the landfill. If this is occurring, the leachate would flow into the Spokane aquifer, which underlies the lowest part of the landfill. A solute-transport model that simulates movement of conservative chemicals in the Spokane aquifer suggests that if leachate entered the aquifer it could form a contaminant plume extending west of the landfill. The plume would encompass an area where ground water provides most of the water used for municipal, industrial, irrigation, and domestic purposes.

Water-quality analyses of water from numerous wells in the area which are open to the Spokane aquifer are available, but well 25/45-16K1 is the only well where ground-water contamination was consistently apparent. This well is only 500 feet from the landfill. Contamination of water in this well was indicated by high concentrations of dissolved mineral constituents and several organic compounds, including trans-dichloroethene in concentrations ranging from 115 to 392 micrograms per liter. Available data are insufficient to completely interpret the ground-water flow system near this well and the source of the contamination cannot be determined conclusively.

While the existing data are adequate to provide background information, more data are needed to (1) determine the source of contamination in well 25/45-16K1, (2) determine ground-water flow in the Spokane aquifer near well 25/45-16K1, and (3) determine the extent of contamination in the Spokane aquifer. The degree of the influence of the landfill on the Spokane aquifer cannot be determined with existing data. Additional data acquired through the installation and monitoring of test wells for both water levels and specific chemical constituents will help answer these questions.

# INTRODUCTION

Among the many environmental issues facing the Nation and the people of the State of Washington, the safe disposal of waste materials is one of the most serious. Recent publicity about surface- and ground-water contamination problems in parts of Washington has brought the subject of waste-material disposal to the attention of the general public. Ten hazardous-waste sites in Washington, most of which are active or former waste-disposal areas, were identified in 1982 by the U.S. Environmental Protection Agency (EPA) to be included under the "Superfund" program. A 1983 update of the 1982 "Superfund" list added 4 new sites to the original list of 10; Greenacres landfill was one of those added. These sites may require some type of remedial action to deal with their actual, or potential, contamination of the environment. In addition, the Washington State Department of Ecology (WDOE) has identified more than 400 sites where it is believed that ongoing or previous disposal of wastes have caused, or may cause, damage to the environment (M. Ruef, WDOE, oral commun., May 15, 1984). Other undetected occurrences of surface- and ground-water contamination probably occur in the State.

This study is part of a cooperative program between the WDOE and the U.S. Geological Survey to make a preliminary assessment of the hydrologic setting, including surface- and ground-water quality where appropriate, of selected landfill sites within Washington. This report describes the hydrologic setting and ground-water quality with respect to the Greenacres landfill in Spokane County, Washington (fig. 1).

## Purpose and Scope

The objectives of this report are to describe to the extent available data allow, 1) the geohydrologic setting in the immediate vicinity of the Greenacres landfill, 2) the presence or absence of ground-water contamination attributable to the landfill, and 3) what additional data, if any, are necessary to adequately determine the above. No additional field or laboratory data were collected during the course of this study.

Data from various Federal, State and local agencies, and private consultants were assembled to provide a data base for the study. These data were reviewed and those that are applicable to the objectives of this study are included in the report.

Surface-water quality was not considered in this study since no surface-water drainage systems are believed to be close enough to the landfill to be adversely affected by it.

## Data Sources

In addition to published reports of the Geological Survey, numerous other Federal, State, and local agencies provided both unpublished data and copies of reports that were written by private consulting firms under contract to those agencies. The materials collected are stored in the Tacoma Office of the U.S. Geological Survey Water Resources Division. Sources of data and reports included:

City of Spokane
U.S. Environmental Protection Agency
Washington State Department of Ecology—Eastern Regional Office
—Office of Water Programs
Spokane County Health District
Washington State Department of Social and Health Services (DSHS)
—Division of Health
Spokane County Engineer's Office (SCEO)
Spokane County Office of County Utilities
Consolidated Irrigation District
Washington State University—Water Research Center
U.S. Department of Agriculture
Washington State Department of Natural Resources

The reports of the Geological Survey and other agencies are all listed in the Selected References section at the end of this report.

Information on geology and hydrology of the area came primarily from published reports including Bolke and Vaccaro (1979 and 1981), Drost and Seitz (1978), Esvelt (1978), and Vaccaro and Bolke (1983). Sources of ground-water quality data included published and unpublished data of the Geological Survey and mostly unpublished data from the files of the Environmental Protection Agency, Washington State Department of Ecology, Washington State Department of Social and Health Services, and Spokane County Engineer's Office.

## Description of the Area

The Greenacres landfill (figs. 1 and 4) is located about 11 miles east of the city of Spokane, Wash., and about 3.5 miles west of the Washington-Idaho State line. The landfill is emplaced near the mouth of a stream-cut valley that is a side-hill tributary to the Spokane Valley. The landfill is 50 to 250 feet above the Spokane Valley floor and covers an area about 0.4 mile long and 0.1 mile wide. It is up to 50 feet thick in some places. There are no observed (July 1984) perennial or intermittent surface-water runoff channels from the landfill or from the drainage basin containing the landfill (drainage area 0.36 $mi^2$); any surface-water runoff from in this area, however, would be tributary to the Spokane River.

Near the landfill the Spokane Valley is relatively flat, and ranges in width from 3 to 8 miles. North and south boundaries of the Spokane Valley coincide with the contact between the unconsolidated materials that make up the Spokane aquifer and the consolidated rock of the valley sides. The elevation of the valley floor near the landfill is about 2,000 to 2,100 feet above sea level and the uplands that border the north and south edges of the valley range up to nearly 6,000 feet. Within 3 miles of the landfill, land is used for agriculture, rural and urban single- and multiple-family residences, commercial purposes, and industrial parks. Population in the area that includes the Spokane valley, from west of Spokane to just east of the Washington-Idaho State line (fig. 4; 135 $mi^2$) is nearly 200,000 (Bolke and Vaccaro, 1981).

The Spokane (or Spokane Valley-Rathdrum Prairie) aquifer (Drost and Seitz, 1978) provides most of the water for municipal, industrial, and agricultural purposes in this general area. This aquifer has been designated a "Sole Source Aquifer" by the U.S. Environmental Protection Agency (Drost and Seitz, 1978 and Esvelt, 1978).

## History of the Landfill

The landfill was opened in about 1951, and until 1965 was operated as an open dump on private land. Wastes were commonly burned and were not covered, unlike current practice in sanitary-landfill operations. During this time industrial, as well as household wastes, were commonly dumped.

Land containing the landfill was purchased by Spokane County in 1965, and between 1965 and 1968 the Spokane County Engineer's Office administered the site; the day-to-day operations of the landfill were directed by a contractor. In 1968 the site was converted to "sanitary landfill" practices and wastes were covered daily with locally obtained soil and overburden materials. Industrial wastes, pesticides, and other unknown chemical wastes reportedly continued to be emplaced in the landfill from 1965 to 1972. Some additional land surrounding the landfill was leased during this time and overburden materials were removed from those areas (see fig. 1) to cover the wastes.

The landfill officially closed on March 31, 1972. Shortly thereafter the land was sold to a private party (J. A. Legat, Spokane County Office of County Utilities, written commun., July 13, 1984).

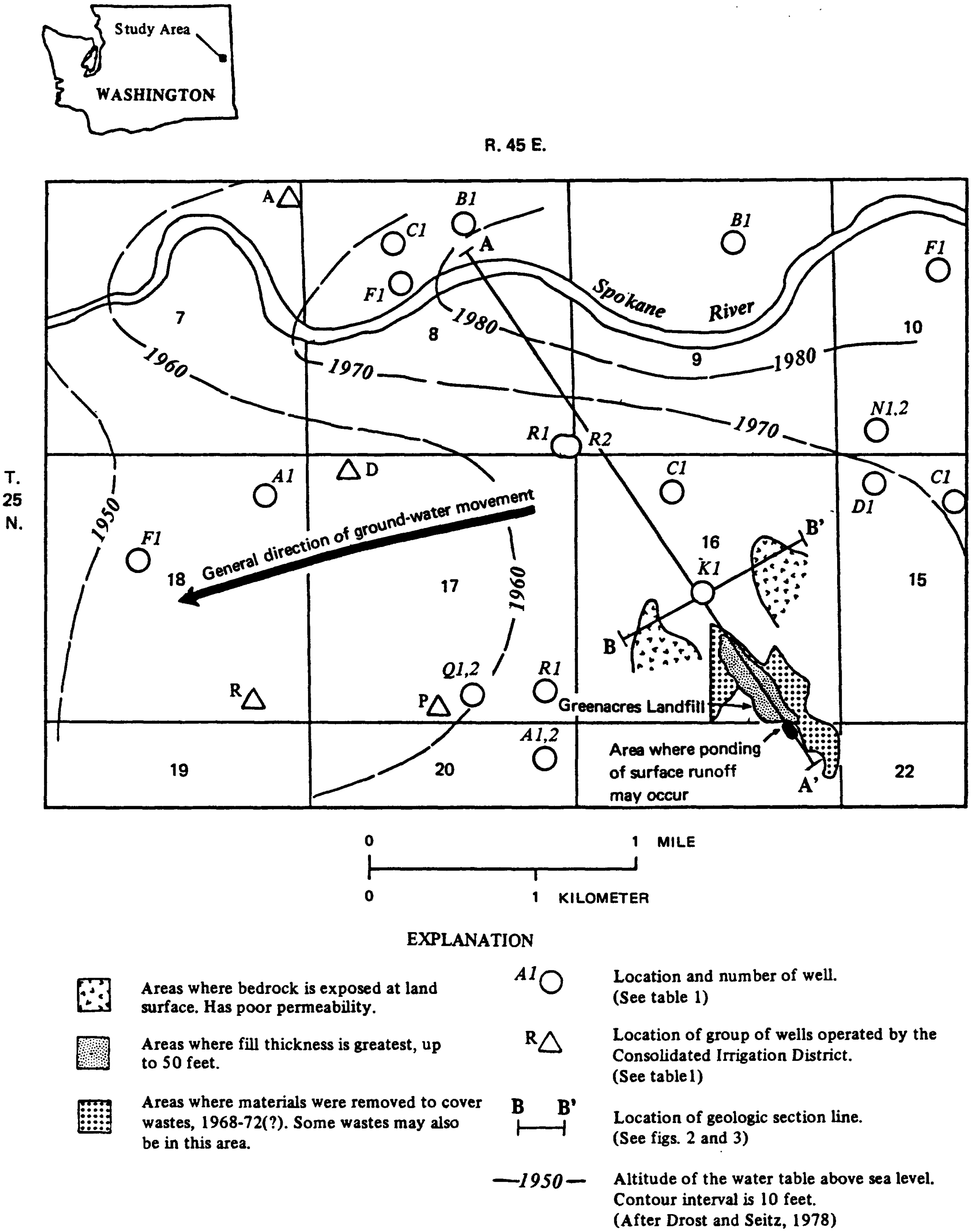


FIGURE 1.--Location of the Greenacres landfill and certain adjacent areas.

## GEOHYDROLOGIC SETTING

### Geology

The valley in which the landfill lies is cut into consolidated Precambrian and Tertiary rocks, referred to in this report as "bedrock" (figs. 1, 2, and 3). The lower (or northern) part of the landfill lies on unconsolidated Quaternary deposits which are known as the Spokane aquifer (after Drost and Seitz, 1978). The Spokane aquifer is composed predominantly of glaciofluvial deposits which extend from Pend Oreille Lake, Idaho, to Long Lake, Wash., and cover an area of about 350 $mi^2$ (Drost and Seitz, 1978). According to Piper and LaRocque (1944, p. 87)...

> "The Spokane Valley and contiguous lowland plains are underlain, commonly at a depth of several hundred feet, by an impervious rock floor***" [the bedrock],"***part of a pre-Wisconsin valley system that presumably discharged westward by way of the Spokane Valley. The pattern of the pre-Wisconsin valleys is not known precisely, but apparently the Spokane Valley trough received the drainage from an extensive area to the east and northeast, an area much more extensive than that now drained by the Spokane River. The pre-Wisconsin valleys are filled to a depth of several hundred feet by glacial outwash***" [the Spokane aquifer] "***that has an extraordinarily large capacity to transmit ground water."

The Spokane aquifer deposits consist mostly of sand and gravel, fine to coarse, and are poorly to moderately sorted, having scattered cobbles and boulders. Some beds are composed almost exclusively of cobbles and boulders as well as a few scattered clay lenses. The sand and gravel is relatively free of fine sand and silt, except in the uppermost 3 to 5 feet, where fine-grained materials fill most voids in the sand and gravel. Near Hillyard, the sediments become progressively finer grained toward the north, where the aquifer is composed predominantly of stratified sand but includes some gravel and silt and a few boulders.

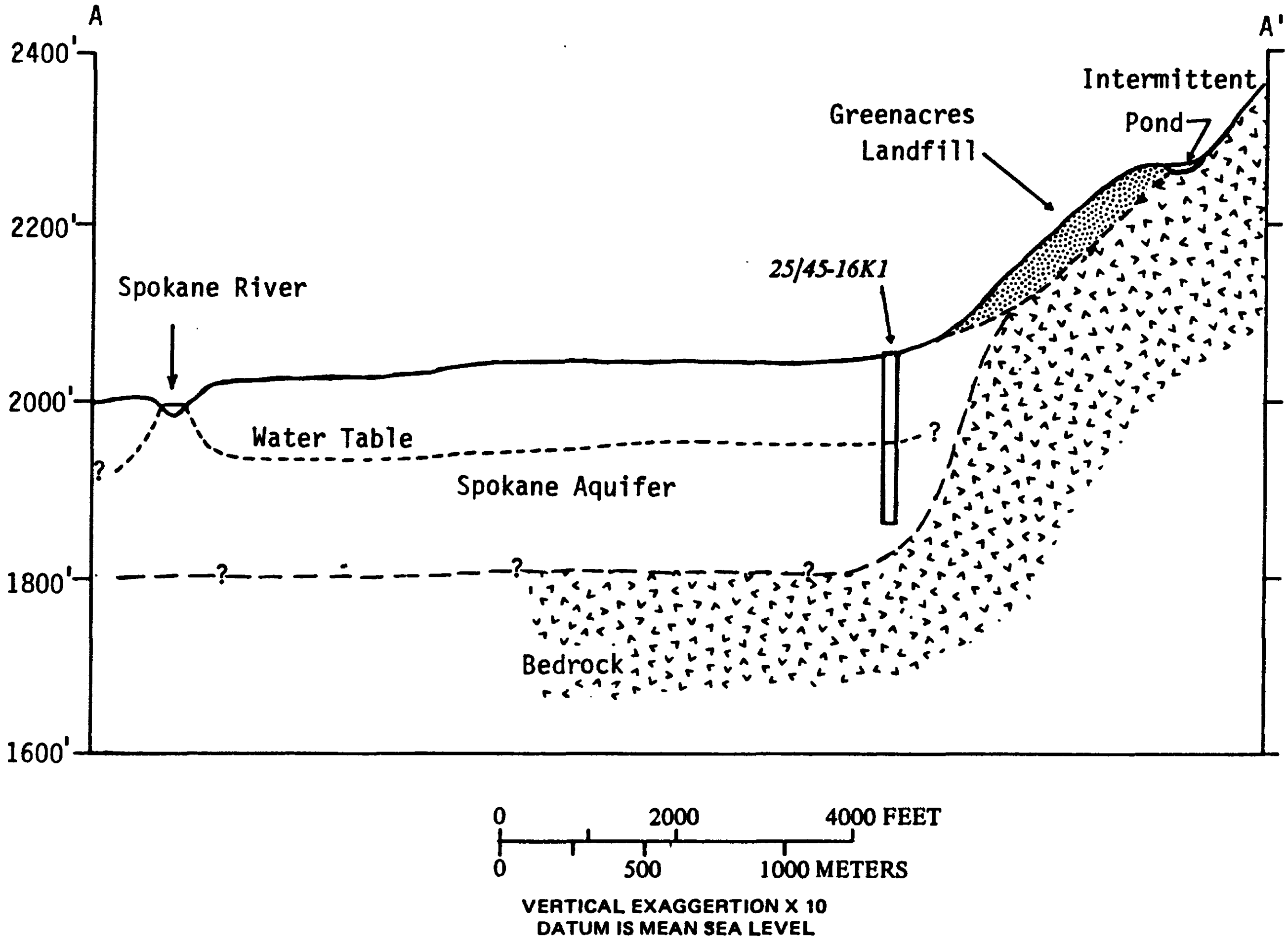


FIGURE 2.--Diagrammatic geologic section A-A'.

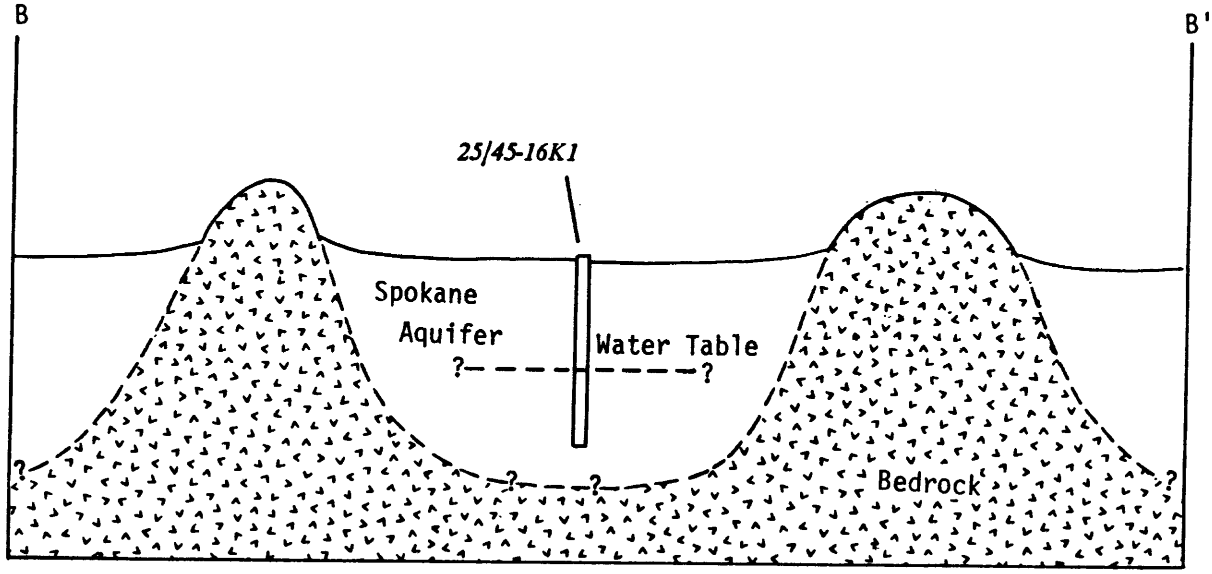


FIGURE 3.--Diagrammatic geologic section B-B'.

## Hydraulic Characteristics of the Spokane Aquifer

The Geological Survey has intermittently conducted studies of the Spokane aquifer for more than 40 years. The transmissivity of the Spokane aquifer is generally high. (Transmissivity is the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient.) Transmissivity of the aquifer, calculated from pumping tests of individual wells, ranges from less than 0.13 million $ft^2/d$ in the western end of the aquifer (near Hillyard, fig. 4) to more than 13 million $ft^2/d$ near the Washington-Idaho State line (Drost and Seitz, 1978). Bolke and Vaccaro (1981) constructed a digital-computer model to simulate ground-water flow in the Spokane aquifer (see fig. 4). Transmissivities determined during calibration of the model ranged from 0.13 million to 11 million $ft^2/d$ (Bolke and Vaccaro, 1981).

According to Drost and Seitz (1978), estimated ground-water velocities in the Spokane aquifer are also high. Using estimated values for saturated thickness (280 feet), transmissivity ($3.4 \times 10^6$ $ft^2/d$), water-table gradient (7 ft/mi), and porosity (0.25), ground-water velocity is about 64 ft/d at the State line. In an earlier study by the U.S. Army Corps of Engineers (1976), ground-water velocity was estimated to be 90.5 ft/d near the same location. Near Hillyard, using estimated values for saturated thickness (160 feet), transmissivity ($0.4 \times 10^6$ $ft^2/d$), water-table gradient (30 ft/mile), and porosity (0.30), the average ground-water velocity is 47 ft/d. In the Corps of Engineers study, the velocity was estimated to be 41.1 ft/d near the same location.

## Ground-Water Flow System in the Spokane Aquifer

Most of the ground water in the Spokane Valley enters the aquifer from the east, moves parallel to the axis of the valley (fig. 1), and leaves the aquifer many miles to the west largely as flow into the Spokane and Little Spokane Rivers (fig. 4). Near the community of Greenacres, the quantity of water flowing through the Spokane aquifer (toward the west) is in excess of 350 million gallons per day (more than 550 $ft^3/s$; Bolke and Vaccaro, 1981).

Ground water also enters the Spokane aquifer as subsurface flow from surrounding drainage basins, such as Newman Lake and Liberty Lake basins (fig. 4). Water from numerous smaller tributary valleys (such as the one containing the Greenacres landfill) also flows into the Spokane aquifer and mixes with the ground water flowing in the aquifer.

Water in the aquifer moves laterally except in areas where local discharge from or recharge to the aquifer occurs, such as near pumped wells and near the Spokane (see fig. 2) and Little Spokane Rivers. In these areas, the flow has both a lateral and a vertical component, but usually the vertical component is insignificant compared to the lateral component.

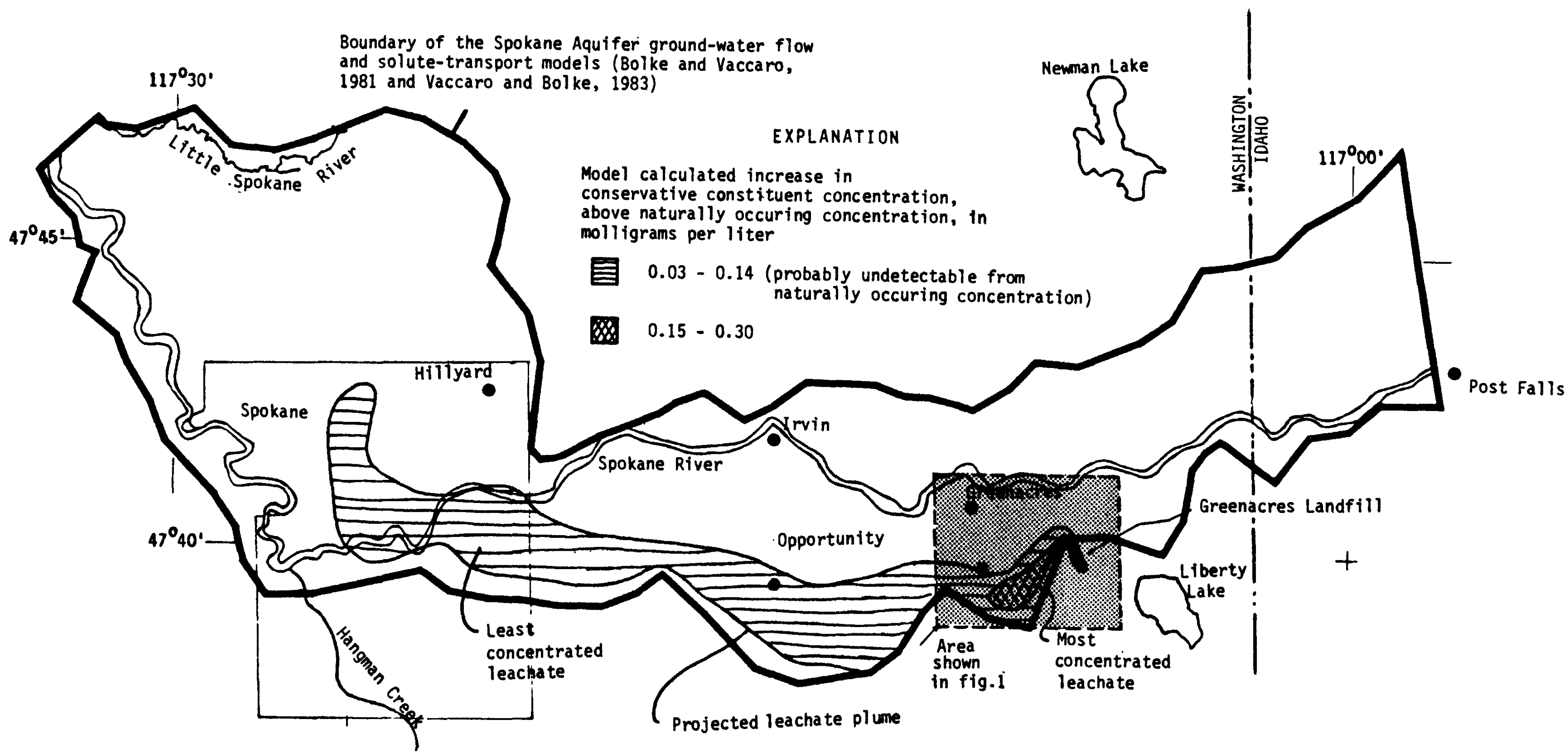


FIGURE 4.--Predicted path of leachate movement in the Spokane aquifer (J. J. Vaccaro, written commun., July 19, 1985)

## Water Movement Through the Landfill

Water is believed to move into the landfill from the nearby uplands (located to the south of the landfill) and from infiltration of a part of the precipitation that falls directly on the landfill itself. The landfill is situated on an intermittent stream and blocks a drainage area of 0.18 $mi^2$. The mean annual runoff from this area into the landfill was calculated and this value ranged from 6.3 to 25 million gallons per year. If this flow is converted to mean daily values, then somewhere between 17,000 and 70,000 gallons of water per day flows into the landfill from the uplands. This range of values was calculated using the relationship (equation 1):

$$RO = P - ET - I \quad (1)$$

where

RO = surface-water runoff available to flow to the landfill,
P = precipitation,
ET = loss of water to evaporation and transpiration by plants.
I = infiltration

Equation 1 was solved using daily precipitation (about 17 inches per year; P in eq. 1) and temperature records for the 30-year period 1949 to 1978 for Spokane, Wash. The daily rate of evapotranspiration (ET in eq. 1) was calculated by the Blaney-Criddle method. Infiltration (I in eq. 1) into the bedrock, upon which the landfill and the drainage area to the south lie (fig. 2), was assumed to be zero. During a reconnaissance of the area around the landfill (July 1984) no evidence of surface-water drainage from the landfill to the Spokane River or its tributaries was found, therefore runoff (RO in eq. 1) was assumed to be zero also. Direct evaporation from the intermittent pond (fig. 2) is considered insignificant. The range of values determined for water moving from the uplands results from the range in values determined for actual evapotranspiration. This range (9 to 15 inches per year; H.H. Bauer, USGS, written commun., July 30, 1984) results from the uncertainty of soil-moisture capacity and plant-root depth for the area. The lowest value for runoff (2 inches per year, 17,000 gal/d) was obtained assuming 3 inches per foot for moisture capacity and 3.0 feet for root depth. The highest runoff (8 inches per year, 70,000 gal/d) value was obtained assuming a moisture capacity of 1 inch/ft and a root depth of 1.5 feet.

Water is also believed to move into the landfill as a result of precipitation falling directly on the landfill. The rate of inflow from this source was determined by rearranging equation 1 to solve for infiltration.

$$I = P - ET - RO \quad (2)$$

Again, evidence suggests that no surface water moves off of the landfill and runoff in equation (2) was therefore assumed to be zero. Using the same assumptions for soil-moisture holding capacity and plant-root depth as before and considering the area of the landfill equal to 0.04 $mi^2$, the mean daily rate of infiltration into the landfill as a result of incident precipitation was determined to range between 4,000 and 15,000 gal/d.

Based on available data, the water table in the Spokane aquifer is believed to be below the landfill, but sufficient information does not exist to confirm this. Depth to the water table at the well nearest the landfill (25/45-16K1, about 500 feet north) is 105 to 110 feet. Regardless of the position of the water table, movement of water through the landfill from both the uplands and infiltration of part of the incident precipitation is between 21,000 and 85,000 gal/d on the average, probably causing leaching of waste materials. The coarse materials of the unsaturated zone above the Spokane aquifer would permit the leachate to move rapidly to the water table. This assumes that chemical or biological activity does not completely degrade the waste materials, and that the sorption capacity of the coarse materials is small relative to the loading.

## Movement of Leachate from the Landfill

Sufficient data concerning the landfill are not available to know with certainty if leachate is being formed and whether the chemical compounds involved are conservative or nonconservative. However, because water is believed to be moving through the landfill and because many other landfill studies have determined that water in contact with landfill wastes produces a leachate of degraded quality, it is reasonable to assume that a leachate is forming in the Greenacres landfill. As established previously, the leachate may then be entering the Spokane aquifer that underlies the northernmost end of the landfill (see fig. 2).

Leachate can consist of both conservative and nonconservative components, depending on the parent waste material. Conservative components are those whose concentration changes only as a result of dispersive forces. They do not undergo chemical reactions, at least within the limits of analytical detection. Nonconservative components undergo chemical reactions and their concentration can change in a variety of ways. If they are soluble in water, their rate of movement could be similar to that of conservative components, except that concentrations could change due to chemical reactions between the components, and between components and aquifer material. Sorption processes may retard the rate of, or even prohibit, movement of the component. If they are poorly soluble in water, and concentrations are sufficient, immiscible phases of nonconservative and conservative components may be expected at the top of the water table if they are less dense than water, or at the bedrock-aquifer interface if they are more dense than water. Near the source, the components that are more dense than water may be found anywhere from top to bottom of the aquifer. It is also likely that several of these mechanisms occur, to differing degrees, simultaneously. In any case, it is difficult to predict the direction and rate of movement of a leachate.

To better understand how leachate might move through the Spokane aquifer, after entering from the landfill, a steady-state solute transport model was used. This model (Vaccaro and Bolke, 1983) was designed to simulate the movement of the chloride ion, considered to act as a conservative component in the Spokane aquifer. The leachate input from the landfill, which lies just at the edge of the solute-transport model (fig. 4), was simulated by specifying a rate of water entering the model at the center of the model cell located closest to the landfill. The leachate is assumed to have a specified concentration of a conservative component dissolved in it. The mean value for all available analyses of chloride concentration in water from well 25/45-16K1 (water-quality analyses are discussed later in this report) is 38 mg/L (milligrams per liter). This value was used as an approximation of the conservative component (chloride) concentration in water that may flow from the landfill into the Spokane aquifer. The simulated rate of water moving into the aquifer was set equal to 85,000 gal/d, the maximum rate of outflow from the landfill calculated in the preceding section of this report.

Using this quantity and concentration of simulated leachate, the model indicates that the leachate would be highly diluted as it moved into the aquifer. Background chloride concentration in water from the Spokane aquifer is about 4.0 mg/L (Vaccaro and Bolke, 1983). The simulated leachate would increase the average concentration in the aquifer by about 0.15 to 0.30 mg/L in the area shown as "most concentrated leachate" in figure 4. Farther from the landfill the leachate would become even more dilute, until the increase above background concentrations would approach zero.

These predicted increases in concentrations due to the simulated leachate would be difficult to detect when considering the analytical variation of the samples. For example, the standard methodology used by the U.S. Geological Survey central laboratory to determine chloride concentration has a coefficient of variation of 16 percent at concentrations around 1.0 mg/L (U.S. Geological Survey, 1978). Samples with a true concentration of 4.0 mg/L would vary by plus or minus 1.3 mg/L at the 95-percent confidence level. This suggests that the highest increase of chloride concentration predicted by the model, 0.30 mg/L, could not be differentiated from analytical variation between water samples. It is assumed that other laboratories use similar methodologies with similar coefficients of variation and confidence levels. Thus, the leachate plume (as shown by increased chloride concentration) predicted by the model could go essentially undetected, using standard methodology and analyzing only for chloride concentration.

Different concentrations and rates of outflow could cause the model to predict other results than those discussed above. However, there are not sufficient data to determine the quantity or concentration of a leachate, or if it is moving out of the landfill. The values chosen illustrate generally what might happen to a leachate moving in the Spokane aquifer. Also, a transient solute transport model for the Spokane aquifer was constructed (Vaccaro and Bolke, 1983) but could not be calibrated. Thus, the time it would take to reach steady-state conditions for leachate movement in the aquifer cannot be calculated.

The most significant result of the simulation discussed above is that the predicted path of leachate containing conservative components passes under suburban, urban, commercial, and industrial areas where a large number of residential and municipal water-supply wells are located. It must be emphasized that the model deals with only conservative components of the plume. Nonconservative components, as previously discussed, may or may not move similarly to model predictions.

Another important factor in leachate movement away from the landfill is the geometry of the bedrock in the vicinity. The landfill, a part of the Spokane aquifer, and the contaminated well (25/45-16K1) are all situated within a horseshoe-shaped area in the bedrock (fig. 1). Regional flow patterns in the Spokane aquifer are disrupted to an unknown extent by the bedrock, and movement of leachate out of the "horseshoe" may differ by some unknown degree from the simulation discussed above.

Concentrations of conservative and nonconservative components entering the Spokane aquifer also may vary with time. Heavy precipitation or rapid snowmelt in the landfill drainage basin can result in a surge of water infiltrating and moving through the landfill. This surge of water could create leachate of high concentration and large volume; upon entering the Spokane aquifer, it would result in a high-concentration pulse of contaminants which would move in ways discussed above. Due to the high ground-water flow rate in the Spokane aquifer, high concentrations of contaminants may be detectable at a given point for only short periods of time. Ground-water sampling between these periods of high concentrations of contaminants could either miss evidence of contamination or underestimate the maximum concentrations.

## Distribution and Use of Wells in the Area

Approximately 20 domestic water-supply wells (fig. 1 and table 1) were reported to exist in the area in the early 1950's (Weigle and Mundorff, 1952). The number of currently (1984) operating domestic wells is probably greater than this due to increased population in the area, but no field investigations were conducted to determine the exact number of wells. The number of public water-supply wells in this area has increased greatly since the 1950's. In 1952 there was one public supply well operated by Bacon Irrigation District that served 41 families (Weigle and Mundorff, 1952). Currently, information indicates that at least four public supply-irrigation well clusters (three or more wells in each cluster) are present in the area shown in figure 1. These well clusters are part of a system operated by Consolidated Irrigation District that serves approximately 6,000 people.

Within the area of the projected leachate plume (fig. 4) there are numerous municipal, industrial, and irrigation wells. Based on 1977 pumpage information, the total quantity of water pumped from within the projected plume area is an average of about 18 million gal/d (Bolke and Vaccaro, 1981). About 70 percent is used for municipal water supplies and 15 percent each for industrial and agricultural purposes.

## CHEMICAL QUALITY OF GROUND WATER

Water-quality data for 16 wells are presented in tables 2A, B, C, and D. Major dissolved constituent, field-measurement, and nutrient data are available for water from most of the wells. Limited analyses for heavy metals are available for water from nine of the wells and organic-compound data are available for water from six of the wells. These are all of the known water-quality data in the study area with two exceptions. First, in a few cases, duplicate samples were taken at the same time, and similar analyses performed on both samples. Agreement between samples was very good; therefore, only one analysis is presented in the tables. Second, most of the analyses for organic compounds included more constituents than those shown. These additional compounds were primarily halogenated hydrocarbons, and in two instances a few pesticides. These additional organic compounds were not detected or were present only at detection-level concentrations and are not considered pertinent or significant to this discussion.

### Physical Characteristics and Major Dissolved Constituents

The data on physical characteristics and major dissolved constituents (table 2A) of the ground-water samples provide a good indication of the chemistry of water from several wells. Specific-conductance values generally range from 100 to 300 umhos/cm (micromhos per centimeter) and pH values are slightly basic, ranging from about 7.0 to 8.5. The water is moderately hard to hard and dissolved-solids concentrations are usually less than 150 mg/L. Calcium and magnesium are the predominant cations, and bicarbonate, represented by alkalinity, is the predominant anion.

Calcium, magnesium, alkalinity, sulfate, and chloride concentrations fluctuate considerably in water from most of the wells. For example, water from well 25/45-18R1 had concentrations of magnesium of 14, 27, and 1.9 mg/L in three consecutive months (June, July, and August 1972). Chloride concentrations in samples taken from 25/45-15R1 in October, November, and December 1971 were 4.0, 18, and 1.0 mg/L, respectively. The temporal fluctuations are probably caused by processes such as dispersion and mixing of constituent loads, differences in chemistry of water entering the aquifer, and water-level fluctuation. Analytical and sampling inconsistencies may also account for some of the fluctuations observed.

Indications of ground-water contamination near the landfill were observed in analyses from well 25/45-16K1. The water sampled from this well during the period 1973 to 1983 had specific-conductance values ranging from 620 to 1,150 umhos/cm and dissolved-solids concentrations were between 445 and 674 mg/L. Calcium, magnesium, alkalinity, and chloride concentrations from 1983 samples were 5 to 10 times higher than water from surrounding wells. Sodium, potassium, sulfate, and fluoride concentrations are somewhat higher than in nearby waters, but generally less than double. Generally, the water is slightly acidic, with most pH values ranging from 6.3 to 7.3. Concentrations of calcium, magnesium, and chloride in the water of this well have generally increased from 1973 to 1983, but in the last two samples (1983) appreciably decreased concentrations of calcium and magnesium were noted.

## Nutrients

The nutrient data (table 2B) consist primarily of nitrate analyses. Nitrate concentrations are generally less than 2.0 mg/L (as nitrogen) and in no cases exceed 3.8 mg/L, which is well below the EPA drinking water regulation standard of 10 mg/L. Nitrate concentrations in water from well 25/45-16K1 are as low or lower than those in analyses from other wells, suggesting either no local nitrate contamination or reducing conditions which can convert nitrate to nitrogen. As with the major dissolved constituents, a sharp decrease in nitrate concentration is noted in the last two samplings of 1983 from this well. Few organic nitrogen and ammonia data were available and those that were are inconclusive.

## Metals

Concentrations of most metals analyzed (table 2C) were usually 10 ug/L (micrograms per liter) or less. Iron concentrations were higher, occasionally exceeding the EPA drinking water regulation standard of 300 ug/L. These higher iron concentrations occur sporadically and probably represent local conditions as opposed to the aquifer as a whole.

Water from well 25/45-16K1 had manganese concentrations of 330 and 370 ug/L on July 26 and October 24, 1983, respectively, and a mercury concentration of 4.0 ug/L on October 4, 1977, indicating likely contamination. The two manganese concentrations are rather abrupt increases from previous concentrations of 10 ug/L or less for water in this well, and all previous mercury concentrations from this well are less than 0.5 ug/L. An abrupt increase in manganese concentration, combined with an abrupt decrease in nitrate concentration implies a potential change in oxidation-reduction conditions in the aquifer. A firm determination that the ground water has changed from oxidizing to reducing is not possible based on existing data, however. Zinc concentrations from 58 to 200 ug/L in water from this well are from unknown sources.

The metal of most concern in water from other wells is mercury, with concentrations of 4.6 ug/L in water from well 25/45-18R1 and 6.1 ug/L in water from well 25/45-15R1, both on September 14, 1972. These concentrations exceed the EPA drinking water regulation standard of 2.0 ug/L. Even though well 25/45-18R1 is in the projected contaminant plume, well 25/45-15R1 is more than 1 mile upgradient of the landfill, suggesting the landfill is not related to these high mercury concentrations.

## Organic Compounds

Available water analyses for organic compounds (table 2D) are usually limited to volatile organic compounds, specifically common cleaning solvents. The primary indication of contamination from organic compounds is in samples from well 24/45-16K1. Trans-dichloroethene, present in samples from this well in concentrations from 115 to 392 ug/L, is the major organic contaminant. Tetrachloroethene and 1,2-dichloroethane are present in concentrations generally between 10 and 30 ug/L. Trichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane and 1,2-dichloropropane are present in most analyses, but usually in concentrations below 10 ug/L. Trichloromethane (chloroform) was present in low concentrations in two analyses from this well.

The organic compounds in well 24/45-16K1 occur in relatively consistent concentrations, suggesting fairly steady input into the aquifer or a very low local ground-water flow rate. It should be noted that two-carbon compounds are observed primarily; except for the two observations of trichloromethane, no other one-carbon organic compounds have been detected in this well.

The only other indication of organic contamination in the landfill area is the presence of trichloromethane in samples taken on September 15-17, 1980, from five wells (25/45-15D1, -16K1, -17D3, -17P2, and -18R1). The latter three wells are downgradient from the landfill, but the first well (25/45-15D1) is about 1 mile upgradient of the landfill. This fact casts doubt about the landfill being the source of the trichloromethane. The data themselves may be spurious, or they may represent another source of contamination. During this same period a concentration of 2.3 ug/L of 1,1,1-trichloroethane was also observed in well 25/45-18R1; however, this compound was undetected in a duplicate sample.

## Limitations of Water-Quality Data

These water samples were collected and analyzed by several different agencies. As a result, the types of constituents determined varies somewhat from one analysis to the next, even in different water samples from the same well. Differences in the total or dissolved-concentration determination of constituents also were found in some analyses and are noted in the tables. Differences in determinations of total or dissolved major anions (alkalinity, sulfate, chloride, and fluoride) and nitrate were present also, but are not considered significant.

## EVALUATION OF EXISTING DATA AND REPORTS

In general, it appears that the existing data and reports concerning the area surrounding the Greenacres landfill provide good background information on the geology, hydrology, and water chemistry. However, it is difficult to assess the impact of the landfill on ground-water quality using the existing data.

Specifically, the shortcomings of existing information include:

1) Current well distribution and available water-quality data are insufficient to clearly determine the extent and source of the contamination observed in well 25/45-16K1.

2) There are not sufficient data to firmly determine the direction and rate of subsurface water movement in the landfill, ground-water movement in the part of the Spokane aquifer that underlies the landfill, and in the Spokane aquifer in the area around well 25/45-16K1. These data are necessary to determine if the landfill is contaminating the aquifer and, if it is, where the contaminants have moved.

3) There are no adequate control samples from points upgradient of the landfill to isolate it as a pollution source.

4) Existing wells not designed for water-quality sampling do not provide the most suitable and reliable data. Typical construction techniques for water-supply wells differ greatly from modern well-construction techniques for chemical sampling. Construction techniques can affect organic compound and metal determinations because of physical and chemical reactions with the materials used. The size and location of the well's openings are also important in determining the depth of a contaminant plume.

## DESCRIPTION OF ADDITIONAL DATA NEEDED

Additional data will be required to accurately describe the potential pollution of the environment from the Greenacres landfill and to determine the environmental damage that may have occurred. Data collection activities should include:

1) Test well drilling. Exact locations of the test wells were not selected as part of this study; however, the following general guidelines are suggested. As public health is of utmost concern, test wells should be placed to determine if ground water (currently polluted or potentially polluted) is moving from the landfill toward Consolidated Irrigation District wells in 25/45-17P, which are located about 1 mile west. These wells are part of a system that supplies more than 6,000 people with domestic and irrigation water. Additional wells should be placed to define the following: 1) background water quality, 2) ground-water flow system, 3) pollutant distribution—horizontally and vertically.

   At each well site the lithology, thickness, and permeability of the materials present should be fully evaluated in order to determine how leachate moves through them.

2) Measurement of ground-water levels.

   Water-level information for the Spokane aquifer is also necessary to understand the ground-water flow system of the area. To allow interpretation of the seasonal and man-induced water-level fluctuations that probably occur in this area, water levels should be measured in selected existing wells in the area over a period of about 1 year. Water levels in newly drilled wells should be monitored for at least 18 months after the wells are completed.

3) Collection of ground-water quality samples.

   Test wells should be sampled for a specific set of chemical constituents that are considered indicators of pollution in this particular case. The indicators include (but are not limited to):

| | |
|---|---|
| Temperature | 1,1-Dichloroethane |
| Specific conductance | 1,2-Dichloroethane |
| pH | 1,1,1-Trichloroethane |
| Calcium | 1,1,2,2-Tetrachloroethane |
| Magnesium | Trans-dichloroethene |
| Sodium | Tetrachloroethene |
| Potassium | Trichloroethene |
| Alkalinity | Dichloromethane (methylene chloride) |
| Chloride | Tetrachloromethane (carbon tetrachloride) |
| Sulfate | Trichloromethane (chloroform) |
| Fluoride | 1,2-Dichloropropane |
| Silica | Dissolved organic carbon |
| Hardness | |

Ammonia
Total Kjeldahl nitrogen
Nitrate

| | |
|---|---|
| Aluminum | Manganese |
| Arsenic | Mercury |
| Cadmium | Nickel |
| Chromium | Silver |
| Copper | Zinc |
| Iron | |
| Lead | |

A sample from well 25/45-16K1 should also be analyzed for a complete scan of EPA "priority pollutants" to determine what other potentially hazardous contaminants are present in the ground water at that point.

All the samples should be analyzed for the same constituents at the start of the investigation. As the presence or absence of the constituents listed (or others in addition to those listed) is noted, they may be deleted from (or added to) the analysis schedule to avoid unnecessary analyses. Before any changes are made, however, the suggested analytical coverage should be continued through a fall-winter rainy season. Existing wells may be used to sample ground water for these constituents, but knowledge of their construction and materials present in the well will be necessary to avoid misinterpretation of the results.

4) Seismic surveys.

Seismic surveys would help determine the configuration of the underlying bedrock and aid in placing the test wells.

# SUMMARY

The Greenacres landfill was used for waste disposal from about 1951 to 1972. This landfill is designated by the U.S. Environmental Protection Agency as a "Superfund" site. The wastes emplaced in the landfill reportedly include household and industrial waste materials, and various hazardous wastes. The lower part of the landfill overlies the Spokane aquifer, designated as a "Sole Source Aquifer" by the U.S. Environmental Protection Agency. Contamination of the aquifer caused by off-site migration of hazardous materials emplaced in the landfill could potentially affect the quality of the water that serves as the only source of water for domestic, industrial, and irrigation purposes for a substantial portion of the population of the Spokane Valley.

The landfill is located primarily on bedrock in an intermittent stream channel that drains into the Spokane Valley. Water from the drainage area above the landfill and from precipitation onto the landfill is thought to flow through the landfill and drain ultimately into the Spokane aquifer. The rate of water entering the Spokane aquifer from the landfill is estimated to range between 21,000 and 85,000 gal/d, and probably causes leaching of waste materials.

Local degradation of ground-water quality in the aquifer is apparent in samples from well 25/45-16K1, located 500 feet below the landfill. The well is contaminated with a variety of potentially hazardous substances including trans-dichlorethene, tetrachloroethene, 1,2-dichloroethane, plus several more organic chemicals in lower, but significant, concentrations. The specific conductance of the water from well 24/45-16K1 is higher than is normal for water in the area, as are the concentrations of most major dissolved constituents including chloride.

A computer simulation of a potential leachate plume in the Spokane aquifer (using chloride as an example) was made, using an existing solute transport model. The resultant plume would encompass an area of the aquifer from which residential and municipal water supplies are drawn. Average pumpage for 1977 from the potentially affected area of the aquifer amounted to more than 18 million gal/d. However, even using a chloride concentration of 38 mg/L (representative of water for well 25/45-16K1, very near the landfill), and a leachate flow into the aquifer of 85,000 gal/day, the increase in chloride concentration in the aquifer only a short distance from the landfill would probably be undetectable using standard methodology. It must be emphasized that the simulation is based on chloride, a conservative component, and nonconservative components may not move similarly.

Although the hydrologic and chemical evidence are suggestive, it cannot be conclusively determined if the landfill is the source of the contamination in the well. No other wells downgradient of the landfill, in or outside of the projected leachate plume, indicate any persistent water-quality problems. However, the unquestioned presence of pollutants in well 25/45-16K1 near the edge of the Spokane aquifer indicate that there may be a threat to the water quality in wells located downgradient of the landfill.

The existing data are adequate to provide background information regarding the geology, hydrology, and water chemistry of the area surrounding the landfill. More data need to be collected, though, to determine the extent and source of contamination in well 25/45-16K1 and to determine ground-water movement and quality in the area surrounding the landfill and locally in the Spokane aquifer. This can be done through the installation of test wells in selected areas. These wells would be monitored to determine background water quality, ground-water flow, and pollutant distribution.

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TABLE 1 THROUGH TABLE 2D

TABLE 1.--Selected wells in the study area

| LOCAL NUMBER | OWNER | DATE COMPLETED | USE OF WATER | ALTITUDE OF LAND SURFACE (FEET) | DEPTH OF WELL (FEET) | CASING DIAM-ETER (INCHES) | FINISH |
|---|---|---|---|---|---|---|---|
| 25N/45E-07A01 | CON.IRR.19-5A | 08/14/1964 | P,I | 2021.5 | 195 | 20 | S |
| 25N/45E-07A02 | CON.IRR.19-5B | 09/01/1964 | P,I | 2021.5 | 168 | 16 | S |
| 25N/45E-07A03 | CON.IRR.19-5C | 09/18/1964 | P,I | 2021.5 | 170 | 16 | S |
| 25N/45E-07A04 | SP.CNTY,W.FARMS | -- | -- | -- | -- | -- | -- |
| 25N/45E-07C01 | VEGALENE CO | -- | U | 2000 | 68 | -- | -- |
| 25N/45E-07G02 | GA CARRIER | 1926 | H | 2018.0 | 96 | 36 | O |
| 25N/45E-08B01 | AA BILLINGS | 1945 | H | 2010 | 100 | 6 | O |
| 25N/45E-08C01 | BURTON, EDITH | -- | H | 2022 | -- | -- | -- |
| 25N/45E-08R01 | JC DOWL | -- | H | 2053.2 | 111 | -- | -- |
| 25N/45E-08R02 | SPOKANE COUNTY, MIS | 06/09/1977 | U | 2048.75 | 165 | 6 | P |
| 25N/45E-09B01 | JACKLIN SEED CO | 08/08/1955 | I | 2028 | 107 | 29 | P |
| 25N/45E-10C01 | WA WATER PWR | -- | U | 2024.6 | 68 | -- | -- |
| 25N/45E-10F01 | DELP, L W | 1930 | H | 2031 | 85 | 48 | -- |
| 25N/45E-10K01 | SCHNEIDMILLER | 1964 | I | 2060 | 140 | 12 | S |
| 25N/45E-10N01 | JG MORRIS | 1920 | U | 2060 | 126 | 6 | -- |
| 25N/45E-10N02 | DARLENE SCHULZ | 1948 | U | 2060 | 152 | 8 | -- |
| 25N/45E-15C01 | SCHNEIDMILLER | 07/15/1954 | I | 2082 | 157 | 20 | P |
| 25N/45E-15D01 | HOLIDAY HILLS | 1970 | P | 2070 | 195 | 30 | P |
| 25N/45E-15R01 | LIB.LK.UTL.CO | 1961 | P | 2072 | 155 | 48 | P |
| 25N/45E-16C01 | INLAND PAPER CO | -- | H | 2060.0 | 129 | -- | -- |
| 25N/45E-16K01 | RUTH JEFFERS | 1963 | H | 2070 | 185 | 6 | -- |
| 25N/45E-17D01 | CON.IRR.19-4A | 1964 | P | 2036.0 | 217 | 20 | S |
| 25N/45E-17D02 | CON.IRR.19-4B | 1964 | P | 2036.0 | 213 | 16 | S |
| 25N/45E-17D03 | CON.IRR.19-4C | 1964 | P | 2036.0 | 215 | 16 | S |
| 25N/45E-17D04 | CON.IRR.19-4D | 1964 | P | 2036.0 | 228 | 20 | S |
| 25N/45E-17E01 | COMMUNITY SERV | -- | U | 2041.0 | 104 | -- | -- |
| 25N/45E-17P01 | CON.IRR.19-3A | 08/18/1964 | P,I | 2044.4 | 203 | 16 | S |
| 25N/45E-17P02 | CON.IRR.19-3B | 07/30/1964 | P,I | 2044.4 | 218 | 16 | S |
| 25N/45E-17P03 | CON.IRR.19-3C | 07/13/1964 | P,I | 2044.4 | 228 | 20 | S |
| 25N/45E-17Q01 | SP.GUN CLUB | 12/30/1949 | P | 2045 | 287 | 8 | P |
| 25N/45E-17R01 | BECK, DARRELL | -- | S,H | 2071 | 185 | -- | -- |
| 25N/45E-18A01 | GREEN WATER WKS | 1920 | P | 2039.4 | 99 | 72 | O |
| 25N/45E-18F01 | BACON IRR DIST | 1910 | U | 2034.5 | 98 | 54 | O |
| 25N/45E-18Q01 | JAMES MACDONALD | 1921 | I | 2040 | 99 | 30 | -- |
| 25N/45E-18R01 | CON.IRR.19-2A | 04/18/1963 | P,I | 2039.5 | 190 | 20 | S |
| 25N/45E-18R02 | CON.IRR.19-2B | 07/16/1964 | P,I | 2039.5 | 227 | 20 | S |
| 25N/45E-18R03 | CON.IRR.19-2C | 07/31/1964 | P,I | 2039.5 | 195 | 16 | S |
| 25N/45E-20A01 | WHEELER | -- | H | 2078 | 136 | -- | -- |
| 25N/45E-20A02 | SPOKANE COUNTY, PEB | -- | -- | -- | -- | -- | -- |
| 25N/45E-20M01 | VIRGIL HEPTON | -- | U | 2085 | 134 | -- | -- |
| 25N/45E-20M02 | FRED ARNOLD | 1953 | U | 2085 | 400 | 8 | X |
| 25N/45E-20P02 | VIRGIL HEPTON | 1947 | H | 2080 | 370 | 8 | -- |

TABLE 1.--continued

| LOCAL NUMBER | WATER LEVEL (FEET) | DATE WATER LEVEL MEASURED | DISCHARGE (GALLONS PER MINUTE) | DRAW-DOWN (FEET) | SPECIFIC CAPACITY (GPM/FT) | PUMPING PERIOD (HOURS) |
|---|---|---|---|---|---|---|
| 25N/45E-07A01 | 70.90 | 08/14/1964 | 4500 | 5 | 1000.0 | 18.0 |
| 25N/45E-07A02 | 71.70 | 08/31/1964 | 3140 | 9 | 348.9 | 18.0 |
| 25N/45E-07A03 | 72.30 | 09/18/1964 | 2700 | 8 | 325.3 | 18.0 |
| 25N/45E-07A04 | -- | -- | -- | -- | -- | -- |
| 25N/45E-07C01 | 56.81 | 03/21/1929 | -- | -- | -- | -- |
| 25N/45E-07G02 | 62.06 | 06/26/1951 | -- | -- | -- | -- |
| 25N/45E-08B01 | 80.00 | 11/07/1951 | -- | -- | -- | -- |
| 25N/45E-08C01 | 76.05 | 03/08/1977 | -- | -- | -- | -- |
| 25N/45E-08R01 | 87.60 | 06/13/1951 | -- | -- | -- | -- |
| 25N/45E-08R02 | 93.00 | 06/09/1977 | 50 | -- | -- | -- |
| 25N/45E-09B01 | 71.00 | 08/08/1955 | 1000 | 4 | 285.7 | -- |
| 25N/45E-10C01 | 63.50 | 01/21/1938 | -- | -- | -- | -- |
| 25N/45E-10F01 | 76.80 | 03/21/1942 | 125 | 2 | 83.3 | 4.0 |
| 25N/45E-10K01 | 98.00 | 05/29/1964 | -- | -- | -- | -- |
| 25N/45E-10N01 | 97.06 | 06/13/1951 | -- | -- | -- | -- |
| 25N/45E-10N02 | 100.64 | 06/13/1951 | 30 | -- | -- | -- |
| 25N/45E-15C01 | 121.83 | 12/16/1954 | 2000 | 6 | 333.3 | -- |
| 25N/45E-15D01 | -- | -- | -- | -- | -- | -- |
| 25N/45E-15R01 | 110.00 | 06/10/1961 | 2000 | 3 | 666.7 | 4.0 |
| 25N/45E-16C01 | 106.00 | 01/ /1938 | -- | -- | -- | -- |
| 25N/45E-16K01 | -- | -- | -- | -- | -- | -- |
| 25N/45E-17D01 | 87.90 | 11/02/1964 | 4500 | 2 | 2812.5 | 18.0 |
| 25N/45E-17D02 | 88.20 | 11/11/1964 | 3600 | 3 | 1384.6 | 18.0 |
| 25N/45E-17D03 | 87.90 | 10/09/1964 | 3600 | 3 | 1384.6 | 18.0 |
| 25N/45E-17D04 | 86.80 | 09/13/1964 | 4500 | 1 | 3214.3 | 18.0 |
| 25N/45E-17E01 | 93.00 | 03/ /1942 | -- | -- | -- | -- |
| 25N/45E-17P01 | 94.20 | 08/18/1964 | 3150 | 2 | 1369.6 | 18.0 |
| 25N/45E-17P02 | 96.40 | 10/01/1964 | 3600 | 4 | 900.0 | 18.0 |
| 25N/45E-17P03 | 89.90 | 07/09/1964 | 4500 | 2 | 2142.9 | 18.0 |
| 25N/45E-17Q01 | 90.00 | 06/08/1950 | 125 | 2 | 62.5 | 6.0 |
| 25N/45E-17R01 | 125.13 | 03/21/1942 | -- | -- | -- | -- |
| 25N/45E-18A01 | 88.13 | 03/05/1928 | -- | -- | -- | -- |
| 25N/45E-18F01 | 86.11 | 03/26/1942 | 850 | 0 | 850.0 | 4.0 |
| 25N/45E-18Q01 | 95.25 | 03/25/1942 | -- | -- | -- | -- |
| 25N/45E-18R01 | 88.60 | 04/24/1963 | 2500 | 1 | 2500.0 | 3.0 |
| 25N/45E-18R02 | 88.00 | 07/16/1964 | 4500 | 2 | 2500.0 | 13.0 |
| 25N/45E-18R03 | 89.60 | 07/27/1964 | 3600 | 3 | 1125.0 | 19.0 |
| 25N/45E-20A01 | 130.48 | 03/21/1942 | -- | -- | -- | -- |
| 25N/45E-20A02 | -- | -- | -- | -- | -- | -- |
| 25N/45E-20M01 | 117.15 | 06/08/1951 | -- | -- | -- | -- |
| 25N/45E-20M02 | 115.46 | 11/17/1954 | 50 | -- | -- | -- |
| 25N/45E-20P02 | -- | -- | -- | -- | -- | -- |

TABLE 2.--Ground-water quality at selected sites

EXPLANATION
FOR SOURCE ABBREVIATIONS

USGS, United States Geological Survey

DSHS, State of Washington Department of Social and Health Services

EPA, Environmental Protection Agency

SCEO, Spokane County Engineer's Office

USBR, United States Bureau of Reclamation

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major dissolved constituents.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | SPE-CIFIC CON-DUCT-ANCE (UMHOS) | PH (STAND-ARD UNITS) | TEMPER-ATURE (DEG C) | HARD-NESS (MG/L AS CACO3) | CALCIUM, DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | SODIUM, DIS-SOLVED (MG/L AS NA) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) |
|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-15C01 | 77-05-16 | USGS | 243 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 78-05-11 | USGS | 240 | -- | 11.5 | -- | -- | -- | -- | -- |
| 25/45E-15D01 | 71-07-21 | DSHS | 236 | 7.3 | 11.5 | 150 | 34 | 17 | 5.0 | 1.8 |
| | 71-08-18 | DSHS | 270 | 8.1 | -- | 130 | 27 | 16 | 4.7 | 2.0 |
| | 71-05-26 | DSHS | 260 | 7.8 | -- | 132 | 34 | 12 | 6.5 | 1.9 |
| | 71-09-16 | DSHS | 260 | 7.4 | -- | 200 | 35 | 28 | 5.4 | 2.0 |
| | 71-10-13 | DSHS | 228 | 7.7 | -- | 110 | 30 | 8.8 | 5.9 | 2.0 |
| | 71-11-16 | DSHS | 250 | 7.7 | -- | 140 | 33 | 13 | 6.4 | 1.8 |
| | 71-12-13 | DSHS | 216 | 7.2 | -- | 120 | 25 | 15 | 5.4 | 2.0 |
| | 72-01-18 | DSHS | 248 | 7.9 | -- | 58 | 15 | 4.9 | 4.8 | 1.6 |
| | 72-02-14 | DSHS | 248 | 8.2 | -- | 150 | 38 | 13 | 6.0 | 2.2 |
| | 72-03-28 | DSHS | 220 | -- | -- | 120 | 30 | 11 | 4.8 | 1.7 |
| | 72-04-18 | DSHS | 184 | 7.3 | -- | 260 | 28 | 46 | 4.0 | 1.8 |
| | 72-05-10 | DSHS | 192 | 8.0 | 11.5 | 120 | 19 | 18 | 4.6 | 1.5 |
| | 72-06-19 | DSHS | 242 | 8.1 | -- | 120 | 30 | 12 | 5.9 | 1.8 |
| | 72-07-24 | DSHS | 248 | 7.6 | -- | 130 | 26 | 17 | 6.8 | 2.1 |
| | 72-08-14 | DSHS | 246 | 8.1 | -- | 150 | 35 | 14 | 6.5 | 1.9 |
| | 72-09-14 | DSHS | 256 | 7.5 | -- | 140 | 28 | 17 | 5.9 | 1.8 |
| | 72-09-14 | EPA | 260 | -- | -- | 130 | 68 | 8 | 4.6 | 1.7 |
| | 73-06-28 | USGS | 266 | 7.6 | 12.0 | 120 | 32 | 8.9 | 4.4 | 1.8 |
| | 73-09-25 | USGS | 259 | 8.1 | 12.0 | 120 | 35 | 8.7 | 3.9 | 1.9 |
| | 73-12-18 | USGS | 263 | 8.1 | 12.0 | 120 | 35 | 8.8 | 4.4 | 2.0 |
| | 74-03-20 | USGS | 242 | 7.8 | 12.0 | 120 | 33 | 8.2 | 4.5 | 1.8 |
| | 75-07-03 | DSHS | 243 | 8.0 | -- | 128 | 38 | 7.8 | 3.4 | -- |
| | 77-03-31 | USGS | 230 | 7.8 | 11.5 | 130 | 35 | 10 | 4.3 | 1.9 |
| | 77-11-03 | SCEO | 160 | 6.8 | 14.0 | 144 | -- | -- | -- | -- |
| | 77-12-14 | SCEO | 250 | 7.0 | 12.0 | 134 | -- | -- | -- | -- |
| | 78-02-07 | SCEO | 250 | 6.8 | 12.0 | 200 | -- | -- | -- | -- |
| | 78-03-09 | SCEO | 240 | 6.7 | 8.0 | 154 | -- | -- | -- | -- |
| | 78-04-19 | SCEO | 250 | 6.4 | 12.0 | 128 | -- | -- | -- | -- |
| | 78-06-07 | SCEO | 250 | 7.2 | 15.0 | 118 | -- | -- | -- | -- |
| | 79-03-19 | EPA | 236 | -- | 9.0 | 129 | -- | -- | 4.3 | -- |
| | 80-09-15 | EPA | 225 | 7.4 | 11.5 | -- | -- | -- | -- | -- |
| | 81-10-27 | EPA | 200 | -- | 12.0 | -- | -- | -- | -- | -- |
| | 83-07-26 | EPA | 215 | 7.2 | 13.5 | 140 | 40T | 10T | 4.7T | 7.2T |
| 25/45E-15R01 | 71-04-13 | DSHS | 40 | 7.1 | 3.5 | 50 | 17 | 1.9 | 5.8 | 1.4 |
| | 71-08-26 | DSHS | 124 | 7.2 | -- | 83 | 22 | 6.8 | 5.2 | 1.3 |
| | 71-09-16 | DSHS | 124 | 6.9 | -- | 140 | 18 | 22 | 5.6 | 1.4 |
| | 71-10-13 | DSHS | 112 | 6.9 | -- | 53 | 13 | 4.9 | 5.5 | 1.5 |
| | 71-11-17 | DSHS | -- | 7.2 | -- | 59 | 15 | 5.3 | 5.9 | 1.1 |
| | 71-12-13 | DSHS | 110 | 6.8 | -- | 48 | 9.6 | 5.8 | 5.8 | 1.7 |
| | 72-01-18 | DSHS | 123 | 7.1 | -- | 56 | 14 | 5.1 | 5.7 | 1.1 |
| | 72-02-12 | DSHS | 120 | 7.3 | -- | 60 | 16 | 4.9 | 5.5 | 1.1 |
| | 72-03-28 | DSHS | 116 | 7.3 | -- | 57 | 12 | 6.6 | 6.2 | 1.4 |
| | 72-04-19 | DSHS | 123 | 6.9 | -- | 110 | 29 | 8.8 | 7.4 | 1.4 |
| | 72-05-10 | DSHS | 120 | 7.4 | 10.5 | 65 | 11 | 9.0 | 5.5 | 1.1 |
| | 72-06-19 | DSHS | 122 | 7.9 | -- | 79 | 12 | 12 | 5.9 | 1.3 |
| | 72-07-24 | DSHS | 116 | 7.0 | -- | 110 | 15 | 17 | 6.4 | 1.5 |
| | 72-08-14 | DSHS | 128 | 7.0 | -- | 89 | 11 | 15 | 7.6 | 1.5 |
| | 72-09-14 | DSHS | 120 | 7.2 | -- | 87 | 10 | 15 | 6.0 | 1.1 |
| | 72-09-14 | EPA | 120 | 6.7 | -- | 51 | 30T | 2.0 | 5.2 | 1.5 |
| | 75-07-03 | DSHS | 112 | 7.2 | -- | 44 | 17 | .5 | 2.7 | -- |
| | 77-05-16 | USGS | 132 | -- | 9.5 | -- | -- | -- | -- | -- |
| | 77-10-12 | USGS | 100 | -- | 9.0 | -- | -- | -- | -- | -- |
| | 78-05-11 | USGS | 145 | -- | 9.0 | -- | -- | -- | -- | -- |

T - value represents a total concentration rather than a dissolved concentration

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major dissolved constituents. --cont.

| LOCAL IDENT- I- FIER | DATE OF SAMPLE | ALKA- LINITY (MG/L AS CACO3) | SULFATE, DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | SILICA, DIS- SOLVED (MG/L AS SIO2) | DIS- SOLVED SOLIDS, (MG/L) |
|---|---|---|---|---|---|---|---|
| 25/45E-15C01 | 77-05-16 | -- | -- | 2.2 | -- | -- | -- |
| | 78-05-11 | -- | -- | 3.3 | -- | -- | -- |
| 25/45E-15D01 | 71-07-21 | 136 | 16 | -- | .10 | 6.0 | 163 |
| | 71-08-18 | 98 | 16 | 7.0 | .10 | 3.0 | 136 |
| | 71-08-26 | 90 | 12 | 3.5 | .20 | 7.5 | 134 |
| | 71-09-16 | 192 | 9.0 | 5.0 | .10 | 5.0 | 196 |
| | 71-10-13 | 96 | 21 | 4.0 | .10 | -- | 134 |
| | 71-11-16 | 110 | 14 | 5.0 | .20 | .0 | 159 |
| | 71-12-13 | 104 | 7.0 | 2.0 | .20 | 5.0 | 127 |
| | 72-01-18 | 76 | 14 | 4.0 | .10 | 5.0 | 97 |
| | 72-02-14 | 106 | 28 | 5.0 | .20 | [illegible] | 164 |
| | 72-03-28 | 120 | 18 | 2.0 | .20 | 16 | 156 |
| | 72-04-18 | 136 | 2.0 | 2.0 | .10 | 4.5 | 176 |
| | 72-05-10 | 79 | 10 | 7.0 | .10 | 15 | 124 |
| | 72-06-19 | 104 | 16 | 6.0 | .10 | .8 | 138 |
| | 72-07-24 | 102 | 17 | 9.0 | .20 | .8 | 141 |
| | 72-08-14 | 120 | 10 | 3.0 | .10 | 5.5 | 149 |
| | 72-09-14 | 108 | 17 | 5.0 | .10 | 2.4 | 144 |
| | 72-09-14 | 114 | 8.0 | 2.0 | <.05 | -- | 181 |
| | 73-06-28 | 116 | 12 | 2.3 | .10 | -- | 158 |
| | 73-09-25 | 111 | 11 | 2.3 | .10 | -- | 157 |
| | 73-12-18 | 107 | 11 | 2.5 | .20 | -- | 154 |
| | 74-03-20 | 102 | 8.0 | 2.6 | .10 | -- | 143 |
| | 75-07-03 | 89 | 9.5 | 2.5 | .40 | 14 | 132 |
| | 77-03-31 | 110 | 14 | 3.1 | .10 | -- | 152 |
| | 77-11-03 | -- | -- | 3.0 | -- | -- | -- |
| | 77-12-14 | -- | -- | 2.9 | -- | -- | -- |
| | 78-02-07 | -- | -- | 2.6 | -- | -- | -- |
| | 78-03-09 | -- | -- | 2.5 | -- | -- | -- |
| | 78-04-19 | -- | -- | 2.8 | -- | -- | -- |
| | 78-06-07 | -- | -- | 2.0 | -- | -- | -- |
| | 79-03-19 | -- | 12 | 2.0 | <.10 | -- | 202 |
| | 80-09-15 | -- | -- | -- | -- | -- | -- |
| | 81-10-27 | -- | -- | 1.0 | -- | -- | -- |
| | 83-07-26 | -- | 10 | 2.0 | .06 | -- | -- |
| 25/45E-15R01 | 71-04-13 | 30 | 5.0 | 10 | .10 | 2.5 | 63 |
| | 71-08-26 | 64 | 18 | 2.0 | .20 | 7.5 | 102 |
| | 71-09-16 | 130 | 7.0 | 3.0 | .20 | 10 | 146 |
| | 71-10-13 | 52 | 6.0 | 4.0 | .10 | 10 | 77 |
| | 71-11-17 | 52 | 8.0 | 18 | .20 | 5.0 | 90 |
| | 71-12-13 | 74 | 8.0 | 1.0 | .20 | 2.5 | 80 |
| | 72-01-18 | 60 | 11 | 2.0 | .20 | .0 | 76 |
| | 72-02-12 | 56 | 14 | 1.0 | .20 | 2.5 | 80 |
| | 72-03-28 | 52 | 15 | 2.0 | .10 | 2.5 | 77 |
| | 72-04-19 | 104 | 11 | 4.0 | .10 | 5.0 | 128 |
| | 72-05-10 | 47 | 7.0 | 4.0 | .10 | 16 | 83 |
| | 72-06-19 | 95 | 8.0 | 5.0 | .20 | 6.7 | 121 |
| | 72-07-24 | 107 | 4.0 | 9.0 | .10 | .1 | 120 |
| | 72-08-14 | 92 | 5.0 | 2.0 | .20 | 4.0 | 103 |
| | 72-09-14 | 62 | 5.0 | 5.0 | .70 | 1.8 | 80 |
| | 72-09-14 | 51 | 3.0 | 1.0 | <.10 | -- | 72 |
| | 75-07-03 | 41 | 5.3 | 1.0 | .20 | 17 | 68 |
| | 77-05-16 | -- | -- | 2.3 | -- | -- | -- |
| | 77-10-12 | -- | -- | 2.3 | -- | -- | -- |
| | 78-05-11 | -- | -- | 3.2 | -- | -- | -- |

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major dissolved constituents. --cont.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | SPE-CIFIC CON-DUCT-ANCE (UMHOS) | PH (STAND-ARD UNITS) | TEMPER-ATURE (DEG C) | HARD-NESS (MG/L AS CACO3) | CALCIUM, DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | SODIUM, DIS-SOLVED (MG/L AS NA) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) |
|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-16K01 | 73-06-28 | USGS | 780 | 6.9 | 14.0 | 410 | 110 | 33 | 9.7 | 3.1 |
| | 73-09-25 | USGS | 811 | 7.1 | 12.0 | 440 | 120 | 35 | 10 | 3.4 |
| | 73-12-18 | USGS | 837 | 7.2 | 13.0 | 440 | 120 | 35 | 10 | 3.5 |
| | 74-03-20 | USGS | 832 | 6.9 | 13.0 | 440 | 120 | 35 | 9.3 | 3.4 |
| | 77-03-31 | USGS | 1040 | 6.6 | 14.0 | 560 | 150 | 45 | 10 | 3.7 |
| | 77-06-13 | SCEO | 1080 | 6.4 | 14.0 | 653 | -- | -- | -- | -- |
| | 77-07-26 | SCEO | 1110 | 6.3 | 14.0 | 604 | -- | -- | -- | -- |
| | 77-09-25 | SCEO | 900 | 6.4 | 14.0 | 640 | -- | -- | -- | -- |
| | 77-10-04 | SCEO | 1150 | 6.4 | 14.0 | 646 | -- | -- | -- | -- |
| | 77-10-04 | SCEO | 1066 | -- | -- | 612 | 195 | 47.5 | 11.7 | 3.7 |
| | 77-11-02 | SCEO | 1115 | 6.4 | 14.0 | 618 | -- | -- | -- | -- |
| | 77-12-14 | SCEO | 1150 | 6.8 | 14.0 | 742 | -- | -- | -- | -- |
| | 78-02-07 | SCEO | 1120 | 6.7 | 13.0 | 586 | -- | -- | -- | -- |
| | 78-03-09 | SCEO | 1090 | 6.5 | 12.0 | 612 | -- | -- | -- | -- |
| | 78-04-19 | SCEO | 1100 | 7.1 | 11.0 | 604 | -- | -- | -- | -- |
| | 78-05-25 | SCEO | 1080 | 6.6 | 14.0 | 620 | -- | -- | -- | -- |
| | 78-06-07 | SCEO | 1150 | 6.6 | 14.0 | 640 | -- | -- | -- | -- |
| | 81-05-27 | EPA | 850 | 6.9 | 15.5 | -- | -- | -- | -- | -- |
| | 82-07-27 | EPA | 920 | 7.3 | 13.0 | 530 | 144T | 42T | 14T | 3.9T |
| | 82-10-26 | EPA | 820 | 6.8 | 14.0 | 530 | 141T | 44T | 14T | 4.1T |
| | 83-01-25 | EPA | 800 | 6.5 | 13.0 | 530 | 141T | 43 | 16 | 3.9 |
| | 83-04-25 | EPA | 850 | 6.5 | 13.8 | 560 | 150T | 44T | 14T | 4.0T |
| | 83-07-26 | EPA | 780 | 6.8 | 13.0 | 480 | 126T | 41T | 10T | 4.2T |
| | 83-10-24 | EPA | 620 | 7.9 | 10.0 | 420 | 109T | 55T | 9T | 3.5T |
| 25/45E-17D02 | 77-05-17 | USGS | 187 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 81-05-26 | WDOE | 180 | -- | -- | -- | -- | -- | <5T | -- |
| | 81-07-28 | WDOE | 180 | -- | -- | -- | -- | -- | <5T | -- |
| | 81-11-03 | WDOE | 170 | -- | -- | -- | -- | -- | <5T | -- |
| 25/45E-17D03 | 70-10-28 | DSHS | 180 | 8.1 | 10.0 | 94 | 22 | 9.7 | 2.1 | 1.6 |
| | 75-03-21 | DSHS | 186 | 8.3 | -- | 92 | 24 | 7.8 | 1.8 | -- |
| | 77-10-12 | USGS | 155 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 78-05-08 | USGS | 170 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 79-07-06 | USGS | 167 | 7.6 | 11.0 | 79 | 19 | 7.7 | 2.1 | 1.6 |
| | 80-09-15 | EPA | 125 | 7.2 | 12.0 | -- | -- | -- | -- | -- |
| | 80-10-13 | EPA | 170 | -- | -- | -- | -- | -- | <10T | -- |
| | 81-01-26 | EPA | 140 | 7.7 | 12.0 | -- | -- | -- | <5T | -- |
| | 81-05-26 | EPA | 128 | 8.2 | 12.0 | -- | -- | -- | -- | -- |
| | 81-07-28 | EPA | 130 | 7.6 | 13.0 | -- | -- | -- | -- | -- |
| | 81-10-27 | EPA | 115 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 82-07-27 | EPA | 125 | 8.1 | 11.0 | 67 | 16T | 6.6T | 2.0T | 1.3T |
| | 83-07-26 | EPA | 118 | 6.8 | 13.0 | 78 | 19T | 7.4T | 2.0T | 1.5T |
| 25/45E-17P01 | 77-05-16 | USGS | 180 | -- | 10.5 | -- | -- | -- | -- | -- |
| 25/45E-17P02 | 70-05-14 | DSHS | 150 | 7.8 | 8.9 | 60 | 16 | 4.6 | 2.4 | 2.2 |
| | 71-04-27 | DSHS | 168 | 8.0 | 8.4 | 90 | 22 | 8.5 | 2.6 | 1.2 |
| | 75-06-27 | DSHS | 194 | 8.2 | -- | 98 | 30 | 5.9 | 2.9 | -- |
| | 77-08-24 | SCEO | 210 | 6.8 | 10.0 | 114 | -- | -- | -- | -- |
| | 77-10-12 | USGS | 165 | -- | 10.5 | -- | -- | -- | -- | -- |
| | 77-11-01 | SCEO | 200 | 6.8 | 11.0 | 102 | -- | -- | -- | -- |
| | 78-04-12 | SCEO | 180 | 7.1 | 10.5 | 90 | -- | -- | -- | -- |
| | 78-05-08 | USGS | 200 | -- | 10.5 | -- | -- | -- | -- | -- |
| | 78-06-01 | SCEO | 180 | 7.6 | 12.0 | 100 | -- | -- | -- | -- |
| | 79-03-19 | EPA | 158 | -- | 10.0 | 83 | -- | -- | 2.5 | -- |
| | 79-04-17 | EPA | 125 | -- | 10.0 | 78 | -- | -- | 2.1 | -- |
| | 80-09-17 | EPA | 150 | 7.7 | 12.0 | -- | -- | -- | -- | -- |
| | 80-10-13 | WDOE | -- | -- | -- | -- | -- | -- | <10T | -- |
| | 81-01-26 | EPA | 100 | 7.9 | 11.5 | -- | -- | -- | <5T | -- |
| | 81-05-26 | EPA | 137 | 8.4 | 11.0 | -- | -- | -- | <5T | -- |
| | 81-07-28 | EPA | 140 | 7.9 | 13.0 | -- | -- | -- | <5T | -- |
| | 81-10-27 | EPA | 145 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 81-11-03 | WDOE | -- | -- | -- | -- | -- | -- | 3.0T | -- |
| | 83-07-26 | EPA | 148 | 7.2 | 12.0 | 99 | 28T | 7.0T | 2.8T | 1.6T |
| 25/45E-17Q01 | 51-06 | USBR | 137 | -- | -- | 76 | -- | -- | -- | -- |
| | 55-01-03 | USBR | 160 | 8.1 | -- | 66 | 18 | 5.2 | 3.0 | .4 |
| 25/45E-17Q02 | 55-01-03 | USBR | 182 | 7.9 | -- | 130 | 22 | 6.3 | 4.1 | 1.2 |
| 25/45E-18A01 | 42-05-07 | USGS | 183 | -- | 11.0 | 94 | 23 | 8.8 | 2.2 | 1.5 |
| | 71-04-01 | DSHS | 188 | 7.5 | -- | 100 | 22 | 11 | 2.8 | 1.1 |

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major dissolved constituents. --cont.

| LOCAL IDENT- I- FIER | DATE OF SAMPLE | ALKA- LINITY (MG/L AS CACO3) | SULFATE, DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | SILICA, DIS- SOLVED (MG/L AS SIO2) | DIS- SOLVED SOLIDS, (MG/L) |
|---|---|---|---|---|---|---|---|
| 25/45E-16K01 | 73-06-28 | 386 | 12 | 17 | .50 | -- | 445 |
| | 73-09-25 | 410 | 11 | 16 | .40 | -- | 480 |
| | 73-12-18 | 422 | 11 | 17 | .60 | -- | 452 |
| | 74-03-20 | 429 | 12 | 16 | .50 | -- | 486 |
| | 77-03-31 | 510 | 15 | 38 | .40 | -- | 594 |
| | 77-06-13 | -- | -- | 4 | -- | -- | -- |
| | 77-07-26 | -- | -- | 9 | -- | -- | -- |
| | 77-08-25 | -- | -- | 34 | -- | -- | -- |
| | 77-10-04 | -- | -- | 35 | -- | -- | -- |
| | 77-10-04 | 523 | 11 | 53 | -- | -- | 674 |
| | 77-11-02 | -- | -- | 21 | -- | -- | -- |
| | 77-12-14 | -- | -- | 28 | -- | -- | -- |
| | 78-02-07 | -- | -- | 40 | -- | -- | -- |
| | 78-03-09 | -- | -- | 29 | -- | -- | -- |
| | 78-04-19 | -- | -- | 39 | -- | -- | -- |
| | 78-05-25 | -- | -- | 43 | -- | -- | -- |
| | 78-06-07 | -- | -- | 44 | -- | -- | -- |
| | 81-05-27 | -- | -- | 65 | -- | -- | -- |
| | 82-07-27 | -- | 16 | 63 | .38 | -- | -- |
| | 82-10-26 | -- | 17 | 65 | .37 | -- | -- |
| | 83-09-25 | -- | 14 | 68 | .33 | -- | -- |
| | 83-04-25 | -- | 12 | 68 | .39 | -- | -- |
| | 83-07-26 | -- | 10 | 27 | .43 | -- | -- |
| | 83-10-24 | -- | 7 | 76 | .32 | -- | -- |
| 25/45E-17D02 | 77-05-17 | -- | -- | 1.0 | -- | -- | -- |
| | 81-05-26 | -- | 20 | 10 | <.2 | -- | -- |
| | 81-07-28 | -- | 10 | <5 | <.2 | -- | -- |
| | 81-11-03 | -- | 9 | 2 | <.2 | -- | -- |
| 25/45E-17D03 | 70-10-28 | 98 | 12 | .2 | 0 | 7.5 | 117 |
| | 75-03-21 | 75 | 17 | 3.0 | <.1 | 10 | 110 |
| | 77-10-12 | -- | -- | -- | -- | -- | -- |
| | 78-05-08 | -- | -- | .90 | -- | -- | -- |
| | 79-07-06 | 67 | 12 | .90 | -- | 11 | 95 |
| | 80-09-15 | -- | -- | -- | -- | -- | -- |
| | 80-10-13 | -- | 20 | <5 | <.2 | -- | -- |
| | 81-01-26 | -- | 20 | <5 | <.2 | -- | -- |
| | 81-05-26 | -- | -- | 10 | -- | -- | -- |
| | 81-07-28 | -- | -- | 5 | -- | -- | -- |
| | 81-10-27 | -- | -- | 2 | -- | -- | -- |
| | 82-07-27 | -- | 11 | 2 | <.10 | -- | -- |
| | 83-07-26 | -- | 7 | 1 | <.06 | -- | -- |
| 25/45E-17P01 | 77-05-16 | -- | -- | 1.4 | -- | -- | -- |
| 25/45E-17P02 | 70-05-14 | 62 | 6.8 | 0 | .2 | 19 | 92 |
| | 71-04-27 | 74 | 20 | 1.2 | .0 | 7.0 | 108 |
| | 75-06-27 | 79 | 9.6 | 1.0 | .1 | 10 | 109 |
| | 77-08-24 | -- | -- | 1.7 | -- | -- | -- |
| | 77-10-12 | -- | -- | 1.1 | -- | -- | -- |
| | 77-11-01 | -- | -- | 1.7 | -- | -- | -- |
| | 78-04-12 | -- | -- | 1.2 | -- | -- | -- |
| | 78-05-08 | -- | -- | 1.4 | -- | -- | -- |
| | 78-06-01 | -- | -- | 1.1 | -- | -- | -- |
| | 79-03-19 | -- | 9 | <1 | <.1 | -- | -- |
| | 79-04-17 | -- | 9 | 1 | -- | -- | 127 |
| | 80-09-17 | -- | -- | -- | -- | -- | -- |
| | 80-10-13 | -- | 20 | <5 | -- | -- | -- |
| | 81-01-26 | -- | 20 | <5 | -- | -- | -- |
| | 81-05-26 | -- | 20 | 5 | -- | -- | -- |
| | 81-07-28 | -- | 10 | 5 | -- | -- | -- |
| | 81-10-27 | -- | -- | 2 | -- | -- | -- |
| | 81-11-03 | -- | 10 | 2 | -- | -- | -- |
| | 83-07-26 | -- | 9 | 2 | .05 | -- | -- |
| 25/45E-17Q01 | 51-06 | 96 | -- | 3.1 | -- | -- | -- |
| | 55-01-03 | 33 | 7.2 | .7 | -- | -- | -- |
| 25/45E-17Q02 | 55-01-03 | 41 | 4.8 | 1.1 | -- | -- | -- |
| 25/45E-18A01 | 42-05-07 | 83 | 10 | 1.0 | .00 | 11 | 104 |
| | 71-04-01 | 82 | 14 | .5 | .10 | 3.2 | 105 |

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major dissolved constituents. --cont.

| LOCAL IDENT- I- FIER | DATE OF SAMPLE | SOURCE | SPE- CIFIC CON- DUCT- ANCE (UMHOS) | PH (STAND- ARD UNITS) | TEMPER- ATURE (DEG C) | HARD- NESS (MG/L AS CACO3) | CALCIUM, DIS- SOLVED (MG/L AS CA) | MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) | SODIUM, DIS- SOLVED (MG/L AS NA) | POTAS- SIUM, DIS- SOLVED (MG/L AS K) |
|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-18R01 | 70-05-14 | DSHS | 150 | 7.8 | 9.0 | 59 | 16 | 4.6 | 2.4 | 2.2 |
| | 71-09-14 | DSHS | 210 | 7.1 | -- | 130 | 27 | 16 | 2.4 | 1.1 |
| | 71-10-13 | DSHS | 172 | 7.5 | -- | 88 | 25 | 6.3 | 2.4 | 1.3 |
| | 71-11-17 | DSHS | 180 | 7.6 | -- | 130 | 28 | 14 | 2.6 | 1.4 |
| | 71-12-14 | DSHS | 170 | 7.5 | -- | 100 | 21 | 12 | 3.2 | 1.5 |
| | 72-01-17 | DSHS | 180 | 7.7 | -- | 82 | 31 | 1.0 | 2.2 | 1.4 |
| | 72-02-16 | DSHS | 172 | 8.2 | -- | 85 | 30 | 2.4 | 3.8 | 1.8 |
| | 72-03-28 | DSHS | 150 | 7.7 | -- | 85 | 20 | 8.5 | 2.1 | 1.1 |
| | 72-04-19 | DSHS | 150 | 7.7 | -- | 130 | 22 | 18 | 2.4 | 1.1 |
| | 72-05-10 | DSHS | 164 | 7.8 | -- | 88 | 17 | 11 | 2.4 | 1.3 |
| | 72-06-19 | DSHS | 159 | 7.7 | -- | 100 | 17 | 14 | 2.8 | 1.1 |
| | 72-07-24 | DSHS | 168 | 7.4 | -- | 170 | 24 | 27 | 3.0 | 1.6 |
| | 72-08-14 | DSHS | 168 | 7.4 | -- | 68 | 24 | 1.9 | 2.8 | 1.4 |
| | 72-09-14 | DSHS | 168 | 7.4 | -- | 100 | 27 | 1.9 | 2.8 | 1.4 |
| | 72-09-14 | EPA | 180 | 7.2 | -- | 88 | 49 | 5.5 | 2.7 | 1.5 |
| | 74-05-06 | USGS | 170 | 7.8 | 11.0 | 88 | 22 | 7.7 | 2.5 | 1.7 |
| | 75-03-21 | DSHS | 170 | 8.2 | -- | 84 | 30 | 2.4 | 2.9 | -- |
| | 77-05-16 | USGS | 150 | -- | 11.0 | -- | -- | -- | -- | -- |
| | 77-06-13 | SCEO | 160 | 6.6 | 10.2 | 83 | -- | -- | -- | -- |
| | 77-07-19 | SCEO | 170 | 6.8 | 10.0 | 94 | -- | -- | -- | -- |
| | 77-08-24 | SCEO | 170 | 6.2 | 10.0 | 88 | -- | -- | -- | -- |
| | 77-10-05 | SCEO | 180 | 7.3 | 10.0 | 110 | -- | -- | -- | -- |
| | 77-10-12 | USGS | 120 | -- | 10.5 | -- | -- | -- | -- | -- |
| | 77-12-08 | SCEO | 150 | 7.0 | 11.2 | 106 | -- | -- | -- | -- |
| | 78-01-19 | SCEO | 150 | 6.4 | 11.0 | 78 | -- | -- | -- | -- |
| | 78-03-09 | SCEO | 167 | 6.8 | 10.0 | 102 | -- | -- | -- | -- |
| | 80-06-02 | EPA | 150 | -- | -- | 80 | 22T | 6.0T | 4.0T | 1.0T |
| | 80-09-15 | EPA | 120 | 7.4 | 12.0 | -- | -- | -- | -- | -- |
| | 80-10-13 | EPA | 170 | -- | -- | 74 | 18T | 7.0T | 4.0T | 2.0T |
| | 80-05-26 | EPA | 180 | -- | -- | 76 | 22T | 5.0T | 3.0T | 2.0T |
| | 81-07-28 | EPA | 180 | -- | -- | 110 | 29T | 9.0T | 2.0T | 1.0T |
| | 82-07-27 | EPA | -- | -- | -- | 76 | 21T | 5.6T | 2.1T | 1.2T |
| | 82-10-26 | EPA | -- | -- | -- | 84 | 24T | 5.9T | 2.1T | 1.4T |
| | 83-01-25 | EPA | 132 | 7.2 | 11.0 | 78 | 22T | 5.6T | 2.3T | 1.3T |
| | 83-04-25 | EPA | 120 | 6.9 | 12.0 | 78 | 22T | 5.7T | 2.1T | 1.3T |
| | 83-07-26 | EPA | 130 | 7.0 | 12.0 | 86 | 24T | 6.2T | 2.2T | 1.5T |
| | 83-10-24 | EPA | 128 | 8.5 | 11.0 | 91 | 26T | 6.4T | 2.3T | 1.3T |
| | 84-01-24 | EPA | 127 | 6.5 | 11.0 | 86 | 25T | 5.6T | 2.2T | 1.1T |
| 25/45E-18R02 | 78-05-08 | USGS | 170 | -- | 10.0 | -- | -- | -- | -- | -- |
| | 80-06-02 | WDOE | 150 | -- | -- | -- | -- | -- | <10T | -- |
| | 81-07-28 | WDOE | 180 | 7.9 | -- | -- | -- | -- | <5T | -- |
| 25/45E-18R03 | 80-06-02 | WDOE | 150 | -- | -- | -- | -- | -- | <10T | -- |
| 25/45E-20P02 | 51-06 | USBR | 483 | -- | -- | 239 | -- | -- | -- | -- |
| 25/45E-20R01 | 51-06 | USBR | 266 | -- | -- | 143 | -- | -- | -- | -- |

T - value represents a total concentration rather than a dissolved concentration

Table 2. Ground-water quality at selected sites.
Part A-- Physical characteristics and major disssolved constituents. --cont.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | ALKA-LINITY (MG/L AS CACO3) | SULFATE, DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | SILICA, DIS-SOLVED (MG/L AS SIO2) | DIS-SOLVED SOLIDS, (MG/L) |
|---|---|---|---|---|---|---|---|
| 25/45E-18R01 | 70-05-14 | 62 | 7.0 | .00 | .20 | 19 | 92 |
| | 71-09-14 | 114 | 10 | 1.0 | .10 | 2.5 | 131 |
| | 71-10-13 | 74 | 23 | 2.0 | .10 | .0 | 105 |
| | 71-11-17 | 90 | 11 | 3.0 | .10 | 5.0 | 120 |
| | 71-12-14 | 72 | 11 | 6.0 | .10 | 5.0 | 104 |
| | 72-01-17 | 84 | 21 | 7.0 | .10 | 2.5 | 118 |
| | 72-02-16 | 74 | 16 | 2.0 | .10 | 2.8 | 104 |
| | 72-03-28 | 80 | 19 | .00 | .10 | 11 | 111 |
| | 72-04-19 | 106 | 20 | 3.0 | .10 | 4.5 | 136 |
| | 72-05-10 | 66 | 13 | 1.0 | .10 | 11 | 98 |
| | 72-06-19 | 65 | 17 | 7.0 | .10 | 24 | 122 |
| | 72-07-24 | 68 | 15 | 10 | .10 | 2.7 | 126 |
| | 72-08-14 | 76 | 11 | 2.0 | .10 | 2.2 | 100 |
| | 72-09-14 | 88 | 23 | 2.5 | .10 | 4.5 | 127 |
| | 72-09-14 | 78 | 9.0 | 1.0 | <.05 | -- | 367 |
| | 74-06-06 | 75 | 7.3 | <.5 | .10 | -- | 121 |
| | 75-03-21 | 78 | 8.8 | 1.5 | .10 | -- | 105 |
| | 77-05-16 | -- | -- | 1.1 | -- | -- | -- |
| | 77-06-13 | -- | -- | .70 | -- | -- | -- |
| | 77-07-19 | -- | -- | 1.0 | -- | -- | -- |
| | 77-08-24 | -- | -- | 1.0 | -- | -- | -- |
| | 77-10-05 | -- | -- | 1.1 | -- | -- | -- |
| | 77-10-12 | -- | -- | .80 | -- | -- | -- |
| | 77-12-08 | -- | -- | .80 | -- | -- | -- |
| | 78-01-19 | -- | -- | .90 | -- | -- | -- |
| | 78-03-09 | -- | -- | 1.2 | -- | -- | -- |
| | 80-06-02 | -- | 7.0 | 1.0 | .30 | -- | -- |
| | 80-09-15 | -- | -- | -- | -- | -- | -- |
| | 80-10-13 | -- | 18 | 1.0 | .20 | -- | -- |
| | 81-05-26 | -- | 17 | 4.0 | .20 | -- | -- |
| | 81-07-28 | -- | 10 | 1.0 | .20 | -- | -- |
| | 82-07-27 | -- | 10 | 2.0 | <.10 | -- | -- |
| | 82-10-26 | -- | 13 | 3.0 | <.10 | -- | -- |
| | 83-01-25 | -- | 12 | 2.0 | <.10 | -- | -- |
| | 83-04-25 | -- | 11 | 1.0 | .09 | -- | -- |
| | 83-07-26 | -- | 8 | 1.0 | .04 | -- | -- |
| | 83-10-24 | -- | 10 | <2.0 | .11 | -- | -- |
| | 84-01-24 | -- | 8 | 1.0 | <.11 | -- | -- |
| 25/45E-18R02 | 78-05-08 | -- | -- | .90 | -- | -- | -- |
| | 80-06-02 | -- | <1.0 | <10 | .30 | -- | -- |
| | 81-07-28 | -- | 10 | 5.0 | <.20 | -- | -- |
| 25/45E-18R03 | 80-06-02 | -- | <10 | <10 | .30 | -- | -- |
| 25/45E-20P02 | 51-06 | 132 | -- | 16 | -- | -- | -- |
| 25/45E-20R01 | 51-06 | 164 | -- | 2.0 | -- | -- | -- |

Table 2. Ground-water quality at selected sites
Part B-- Nutrients.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) |
|---|---|---|---|---|---|
| 25/45E-15C01 | 77-05-16 | USGS | 1.50 | .010 | -- |
| | 78-05-11 | USGS | 2.50 | .010 | -- |
| 25/45E-15D01 | 71-07-21 | DSHS | .450 | -- | -- |
| | 71-08-18 | DSHS | 1.40 | -- | -- |
| | 71-08-26 | DSHS | 2.7 | -- | -- |
| | 71-09-16 | DSHS | 2.30 | -- | -- |
| | 71-10-13 | DSHS | 2.00 | -- | -- |
| | 71-11-16 | DSHS | 2.60 | -- | -- |
| | 71-12-13 | DSHS | 2.40 | -- | -- |
| | 72-01-18 | DSHS | 2.50 | -- | -- |
| | 72-02-14 | DSHS | 3.50 | -- | -- |
| | 72-03-28 | DSHS | 1.20 | -- | -- |
| | 72-04-18 | DSHS | .760 | -- | -- |
| | 72-05-10 | DSHS | 1.40 | -- | -- |
| | 72-06-19 | DSHS | 2.50 | -- | -- |
| | 72-07-24 | DSHS | 1.30 | -- | -- |
| | 72-08-14 | DSHS | 1.20 | -- | -- |
| | 72-09-14 | DSHS | 2.00 | -- | -- |
| | 72-09-14 | EPA | 2.20 | -- | -- |
| | 73-06-28 | USGS | 2.80 | .030 | .06 |
| | 73-09-25 | USGS | 1.50 | .010 | .05 |
| | 73-12-18 | USGS | 2.00 | .010 | .04 |
| | 74-03-20 | USGS | 1.30 | .030 | .56 |
| | 75-07-03 | DSHS | 2.0 | -- | -- |
| | 77-03-31 | USGS | 3.30 | .010 | .06 |
| | 77-11-03 | SCEO | 3.8 | -- | -- |
| | 77-12-14 | SCEO | 3.0 | -- | -- |
| | 78-02-07 | SCEO | 3.2 | -- | -- |
| | 78-03-09 | SCEO | 3.2 | -- | -- |
| | 78-04-19 | SCEO | 2.9 | -- | -- |
| | 78-06-07 | SCEO | 2.3 | -- | -- |
| | 79-03-19 | EPA | 3.6 | -- | -- |
| | 81-10-27 | EPA | 2.3 | -- | -- |
| | 83-07-26 | EPA | 2.3 | -- | -- |
| 25/45E-15R01 | 71-04-13 | DSHS | 1.80 | -- | -- |
| | 71-08-26 | DSHS | .840 | -- | -- |
| | 71-09-16 | DSHS | .780 | -- | -- |
| | 71-10-13 | DSHS | .900 | -- | -- |
| | 71-11-17 | DSHS | .910 | -- | -- |
| | 71-12-13 | DSHS | .720 | -- | -- |
| | 72-01-18 | DSHS | .720 | -- | -- |
| | 72-02-12 | DSHS | .500 | -- | -- |
| | 72-03-28 | DSHS | .200 | -- | -- |
| | 72-04-19 | DSHS | .010 | -- | -- |
| | 72-05-10 | DSHS | 1.00 | -- | -- |
| | 72-06-19 | DSHS | 1.10 | -- | -- |
| | 72-07-24 | DSHS | .940 | -- | -- |
| | 72-08-14 | DSHS | .400 | -- | -- |
| | 72-09-14 | DSHS | .320 | -- | -- |
| | 72-09-14 | EPA | .680 | -- | -- |
| | 75-07-03 | DSHS | .40 | -- | -- |
| | 77-05-16 | USGS | 1.00 | .030 | -- |
| | 77-10-12 | USGS | 1.10 | .030 | -- |
| | 78-05-11 | USGS | 1.40 | .020 | -- |

Table 2. Ground-water quality at selected sites
Part B-- Nutrients --cont.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) |
|---|---|---|---|---|---|
| 25/45E-16K01 | 73-06-28 | USGS | 1.20 | .020 | .12 |
| | 73-09-25 | USGS | 1.60 | .020 | .13 |
| | 73-12-18 | USGS | .950 | .010 | .11 |
| | 74-03-20 | USGS | 1.00 | .010 | .18 |
| | 77-03-31 | USGS | 1.10 | .050 | .25 |
| | 77-06-13 | SCEO | 1.5 | -- | -- |
| | 77-07-26 | SCEO | 1.7 | -- | -- |
| | 77-08-25 | SCEO | 1.4 | -- | -- |
| | 77-10-04 | SCEO | 1.3 | -- | -- |
| | 77-10-04 | SCEO | .85 | <.010 | .16 |
| | 77-11-02 | SCEO | 1.6 | -- | -- |
| | 77-12-14 | SCEO | 1.1 | -- | -- |
| | 78-02-07 | SCEO | 1.2 | -- | -- |
| | 78-03-09 | SCEO | .70 | -- | -- |
| | 78-04-19 | SCEO | 1.1 | -- | -- |
| | 78-06-07 | SCEO | .80 | -- | -- |
| | 80-10-27 | SCEO | .50 | -- | -- |
| | 81-05-27 | EPA | .70 | -- | -- |
| | 81-07-29 | EPA | .60 | -- | -- |
| | 81-10-27 | EPA | .60 | -- | -- |
| | 82-07-27 | EPA | 1.10 | -- | -- |
| | 82-10-26 | EPA | .70 | -- | -- |
| | 83-01-25 | EPA | .71 | -- | -- |
| | 83-04-25 | EPA | .86 | -- | -- |
| | 83-07-26 | EPA | .21 | -- | -- |
| | 83-10-24 | EPA | .03 | -- | -- |
| 25/45E-17D02 | 77-05-17 | USGS | .310 | .020 | -- |
| | 81-05-26 | WDOE | .60 | -- | -- |
| | 81-07-28 | WDOE | .60 | -- | -- |
| | 81-11-03 | WDOE | .60 | -- | -- |
| 25/45E-17D03 | 70-10-28 | DSHS | .76 | -- | -- |
| | 75-03-21 | DSHS | .50 | -- | -- |
| | 77-10-12 | USGS | .820 | .030 | -- |
| | 78-05-08 | USGS | .800 | .020 | -- |
| | 79-07-06 | USGS | .660 | -- | -- |
| | 80-10-13 | EPA | .70 | -- | -- |
| | 81-01-26 | EPA | .90 | -- | -- |
| | 81-05-26 | EPA | .60 | -- | -- |
| | 81-07-28 | EPA | .60 | -- | -- |
| | 81-10-27 | EPA | .60 | -- | -- |
| | 82-07-27 | EPA | .65 | -- | -- |
| | 83-07-26 | EPA | .75 | -- | -- |
| 25/45E-17P01 | 77-05-16 | USGS | 1.50 | .020 | -- |
| 25/45E-17P02 | 70-05-14 | DSHS | .78 | -- | -- |
| | 71-04-27 | DSHS | 1.8 | -- | -- |
| | 75-06-27 | DSHS | 2.2 | -- | -- |
| | 77-08-24 | SCEO | 1.9 | -- | -- |
| | 77-10-12 | USGS | 1.40 | .030 | -- |
| | 77-11-01 | SCEO | 1.3 | -- | -- |
| | 78-04-12 | SCEO | 1.3 | -- | -- |
| | 78-05-08 | USGS | 1.30 | .010 | -- |
| | 78-06-01 | SCEO | 1.4 | -- | -- |
| | 79-03-19 | EPA | 1.1 | -- | -- |
| | 79-04-17 | EPA | 1.0 | -- | -- |
| | 80-10-13 | WDOE | 1.6 | -- | -- |
| | 81-01-26 | EPA | 1.6 | -- | -- |
| | 81-05-26 | EPA | 1.7 | -- | -- |
| | 81-07-28 | EPA | 1.3 | -- | -- |
| | 81-10-27 | EPA | 1.6 | -- | -- |
| | 81-11-03 | WDOE | 1.6 | -- | -- |
| | 83-07-26 | EPA | 2.0 | -- | -- |
| 25/45E-17Q01 | 55-01-03 | USBR | 0 | -- | -- |
| 25/45E-17Q02 | 55-01-03 | USBR | 1.4 | -- | -- |
| 25/45E-18A01 | 42-05-07 | USGS | .53 | -- | -- |
| | 71-04-01 | DSHS | 1.4 | -- | -- |

Table 2. Ground-water quality at selected sites
Part B-- Nutrients --cont.

| LOCAL IDENT- I- FIER | DATE OF SAMPLE | SOURCE | NITRO- GEN, NITRATE TOTAL (MG/L AS N) | NITRO- GEN, AMMONIA TOTAL (MG/L AS N) | NITRO- GEN, ORGANIC TOTAL (MG/L AS N) |
|---|---|---|---|---|---|
| 25/45E-18R01 | 70-05-14 | DSHS | .760 | -- | -- |
| | 71-09-14 | DSHS | 2.00 | -- | -- |
| | 71-10-13 | DSHS | 1.10 | -- | -- |
| | 71-11-17 | DSHS | 1.40 | -- | -- |
| | 71-12-14 | DSHS | 1.60 | -- | -- |
| | 72-01-17 | DSHS | 1.40 | -- | -- |
| | 72-02-16 | DSHS | 1.10 | -- | -- |
| | 72-03-28 | DSHS | .620 | -- | -- |
| | 72-04-19 | DSHS | .220 | -- | -- |
| | 72-05-10 | DSHS | 1.30 | -- | -- |
| | 72-06-19 | DSHS | .750 | -- | -- |
| | 72-07-24 | DSHS | .050 | -- | -- |
| | 72-08-14 | DSHS | .330 | -- | -- |
| | 72-09-14 | DSHS | .90 | -- | -- |
| | 72-09-14 | EPA | .960 | -- | -- |
| | 74-06-06 | USGS | 1.2 | <.06 | <.28 |
| | 75-03-21 | DSHS | 1.5 | -- | -- |
| | 77-05-16 | USGS | 1.00 | .040 | -- |
| | 77-06-13 | SCEO | 1.4 | -- | -- |
| | 77-07-19 | SCEO | 1.4 | -- | -- |
| | 77-08-24 | SCEO | 1.1 | -- | -- |
| | 77-10-05 | SCEO | 1.3 | -- | -- |
| | 77-10-12 | USGS | .930 | .040 | -- |
| | 77-12-08 | SCEO | .9 | -- | -- |
| | 78-01-19 | SCEO | .9 | -- | -- |
| | 78-03-09 | SCEO | .9 | -- | -- |
| | 80-06-02 | EPA | 1.1 | -- | -- |
| | 80-10-13 | EPA | 1.0 | -- | -- |
| | 81-05-26 | EPA | .7 | -- | -- |
| | 81-07-28 | EPA | .8 | -- | -- |
| | 82-07-27 | EPA | 1.2 | -- | -- |
| | 82-10-26 | EPA | 1.7 | -- | -- |
| | 83-01-25 | EPA | 1.1 | -- | -- |
| | 83-04-25 | EPA | 1.3 | -- | -- |
| | 83-07-26 | EPA | 1.5 | -- | -- |
| | 83-10-24 | EPA | 1.5 | -- | -- |
| | 84-01-24 | EPA | 1.2 | -- | -- |
| 25/45E-18R02 | 78-05-08 | USGS | .890 | .020 | -- |
| | 80-06-02 | WDOE | 1.3 | -- | -- |
| | 81-07-28 | WDOE | .8 | -- | -- |
| 25/45E-18R03 | 80-06-02 | WDOE | 1.0 | -- | -- |

Table 2. Ground-water quality at selected sites
Part C-- Metals

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | ARSENIC, DIS-SOLVED (UG/L AS AS) | CADMIUM, DIS-SOLVED (UG/L AS CD) | CHRO-MIUM, DIS-SOLVED (UG/L AS CR) | COPPER, DIS-SOLVED (UG/L AS CU) | IRON, DIS-SOLVED (UG/L AS FE) | LEAD, DIS-SOLVED (UG/L AS PB) | MANGA-NESE, DIS-SOLVED (UG/L AS MN) | MERCURY, DIS-SOLVED (UG/L AS HG) | ZINC, DIS-SOLVED (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-15D01 | 71-07-21 | DSHS | -- | -- | -- | -- | 120T | -- | 4T | -- | -- |
| | 71-08-18 | DSHS | -- | -- | -- | -- | -- | -- | 15T | -- | -- |
| | 71-08-26 | DSHS | -- | -- | -- | -- | 0 | -- | 15 | -- | -- |
| | 71-09-16 | DSHS | -- | -- | -- | -- | 100T | -- | 9T | -- | -- |
| | 71-10-13 | DSHS | -- | -- | -- | -- | 140T | -- | -- | -- | -- |
| | 71-11-16 | DSHS | -- | -- | -- | -- | 50T | -- | 3T | -- | -- |
| | 71-12-13 | DSHS | -- | -- | -- | -- | 340T | -- | 0T | -- | -- |
| | 72-01-18 | DSHS | -- | -- | -- | -- | 20T | -- | -- | -- | -- |
| | 72-02-14 | DSHS | -- | -- | -- | -- | 80T | -- | 9T | -- | -- |
| | 72-03-28 | DSHS | -- | -- | -- | -- | 60T | -- | 6T | -- | -- |
| | 72-04-18 | DSHS | -- | -- | -- | -- | 80T | -- | 0T | -- | -- |
| | 72-05-10 | DSHS | -- | -- | -- | -- | 300T | -- | 9T | -- | -- |
| | 72-06-19 | DSHS | -- | -- | -- | -- | 4000T | -- | 6T | -- | -- |
| | 72-07-24 | DSHS | -- | -- | -- | -- | 20T | -- | 3T | -- | -- |
| | 72-08-14 | DSHS | -- | -- | -- | -- | 300T | -- | 3T | -- | -- |
| | 72-09-14 | DSHS | -- | -- | -- | -- | 80T | -- | 6T | -- | -- |
| | 72-09-14 | EPA | 4T | 4T | 4T | 147T | <100T | 20T | 2T | -- | 110T |
| | 73-01-15 | EPA | -- | -- | -- | 4T | 15 | 20T | 2T | <.2T | 27T |
| | 73-06-28 | USGS | 5 | <2 | ND | 3 | <10 | <2 | <10 | <.5T | <20 |
| | 73-09-25 | USGS | 6 | ND | ND | 6 | <10 | 2 | <10 | <.5T | <50 |
| | 73-12-18 | USGS | 5 | ND | ND | 3 | <10 | ND | <10 | <.5T | ND |
| | 74-03-20 | USGS | 2 | ND | ND | 5 | 20 | <2 | 7 | <.5T | 20 |
| | 75-07-03 | DSHS | -- | -- | -- | -- | 190 | -- | 40 | -- | -- |
| | 77-03-31 | USGS | 3 | ND | ND | <2 | 60 | ND | <10 | <.5T | ND |
| | 79-03-19 | EPA | 3T | 0T | <1T | -- | 2T | -- | -- | -- | -- |
| | 83-07-26 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| 25/45E-15R01 | 71-04-13 | DSHS | -- | -- | -- | -- | 80T | -- | 12T | -- | -- |
| | 71-08-26 | DSHS | -- | -- | -- | -- | 140T | -- | 15T | -- | -- |
| | 71-09-16 | DSHS | -- | -- | -- | -- | <10T | -- | 0T | -- | -- |
| | 71-10-13 | DSHS | -- | -- | -- | -- | <10T | -- | 6T | -- | -- |
| | 71-11-17 | DSHS | -- | -- | -- | -- | 140T | -- | 12T | -- | -- |
| | 71-12-13 | DSHS | -- | -- | -- | -- | 220T | -- | 24T | -- | -- |
| | 72-01-18 | DSHS | -- | -- | -- | -- | 100T | -- | 0T | -- | -- |
| | 72-02-12 | DSHS | -- | -- | -- | -- | 340T | -- | 6T | -- | -- |
| | 72-03-28 | DSHS | -- | -- | -- | -- | <10T | -- | 0T | -- | -- |
| | 72-04-19 | DSHS | -- | -- | -- | -- | 180T | -- | 6T | -- | -- |
| | 72-05-10 | DSHS | -- | -- | -- | -- | 10T | -- | 0T | -- | -- |
| | 72-06-19 | DSHS | -- | -- | -- | -- | 260T | -- | 9T | -- | -- |
| | 72-07-24 | DSHS | -- | -- | -- | -- | 20T | -- | 6T | -- | -- |
| | 72-08-14 | DSHS | -- | -- | -- | -- | 320T | -- | 12T | -- | -- |
| | 72-09-14 | DSHS | -- | -- | -- | -- | 100T | -- | 6T | -- | -- |
| | 72-09-14 | EPA | <2T | 2T | 4T | 75T | <100T | 10T | 0T | 6.1T | 35T |
| | 75-07-03 | DSHS | -- | -- | -- | -- | 220 | -- | 50 | -- | -- |

T - value represents a total concentration rather than a dissolved concentration

Table 2. Ground-water quality at selected sites
Part C-- Metals --cont.

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | ARSENIC, DIS-SOLVED (UG/L AS AS) | CADMIUM, DIS-SOLVED (UG/L AS CD) | CHRO-MIUM, DIS-SOLVED (UG/L AS CR) | COPPER, DIS-SOLVED (UG/L AS CU) | IRON, DIS-SOLVED (UG/L AS FE) | LEAD, DIS-SOLVED (UG/L AS PB) | MANGA-NESE, DIS-SOLVED (UG/L AS MN) | MERCURY, DIS-SOLVED (UG/L AS HG) | ZINC, DIS-SOLVED (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-16K01 | 73-06-28 | USGS | <1 | <2 | ND | 13 | <10 | <2 | <10 | <.5T | 90 |
| | 73-09-25 | USGS | <1 | ND | ND | 9 | <10 | 6 | <10 | <.5T | 200 |
| | 73-12-18 | USGS | <1 | ND | ND | 7 | <10 | <2. | <10 | <.5T | 170 |
| | 74-03-20 | USGS | <1 | ND | ND | <20 | 30 | ND | <10 | <.5T | 140 |
| | 77-03-31 | USGS | <1 | ND | ND | 4 | <10 | ND | <10 | <.5T | 60 |
| | 77-10-04 | SCED | <10 | <5 | <10 | <10 | -- | <10 | <10 | 4.0 | 58 |
| | 82-07-27 | EPA | -- | -- | -- | -- | -- | -- | 0T | -- | -- |
| | 82-10-26 | EPA | -- | -- | -- | -- | -- | -- | 0T | -- | -- |
| | 83-01-25 | EPA | -- | -- | -- | -- | -- | -- | 10T | -- | -- |
| | 83-04-25 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| | 83-07-26 | EPA | -- | -- | -- | -- | -- | -- | 330T | -- | -- |
| | 83-10-24 | EPA | -- | -- | -- | -- | -- | -- | 370T | -- | -- |
| 25/45E-17D03 | 70-10-28 | DSHS | -- | -- | -- | -- | 0 | -- | 3 | -- | -- |
| | 75-03-21 | DSHS | -- | -- | -- | -- | 150 | -- | <10 | -- | -- |
| | 79-07-06 | USGS | -- | -- | -- | -- | <10 | -- | <1 | -- | -- |
| | 82-07-27 | EPA | -- | -- | -- | -- | -- | -- | 0T | -- | -- |
| | 83-07-26 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| 25/45E-17P02 | 70-05-14 | DSHS | -- | -- | -- | -- | 0 | -- | 6 | -- | -- |
| | 71-04-27 | DSHS | -- | -- | -- | -- | 0 | -- | 0 | -- | -- |
| | 75-06-27 | DSHS | -- | -- | -- | -- | 60 | -- | <5 | -- | -- |
| | 79-03-19 | EPA | 2T | 0T | <1T | -- | -- | 2T | -- | <.1T | -- |
| | 83-07-26 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| 25/45E-18A01 | 71-04-01 | DSHS | -- | -- | -- | -- | 40 | -- | 3 | -- | -- |
| 25/45E-18R01 | 70-05-14 | DSHS | -- | -- | -- | -- | <10T | -- | 6T | -- | -- |
| | 71-09-14 | DSHS | -- | -- | -- | -- | <10T | -- | 18T | -- | -- |
| | 71-10-13 | DSHS | -- | -- | -- | -- | 20T | -- | 15T | -- | -- |
| | 71-11-17 | DSHS | -- | -- | -- | -- | 140T | -- | 9T | -- | -- |
| | 71-12-14 | DSHS | -- | -- | -- | -- | <10T | -- | 0T | -- | -- |
| | 72-01-17 | DSHS | -- | -- | -- | -- | 120T | -- | 0T | -- | -- |
| | 72-02-16 | DSHS | -- | -- | -- | -- | 140T | -- | 3T | -- | -- |
| | 72-03-28 | DSHS | -- | -- | -- | -- | 140T | -- | 6T | -- | -- |
| | 72-04-19 | DSHS | -- | -- | -- | -- | 140T | -- | 3T | -- | -- |
| | 72-05-10 | DSHS | -- | -- | -- | -- | 20T | -- | 3T | -- | -- |
| | 72-06-19 | DSHS | -- | -- | -- | -- | 140T | -- | 0T | -- | -- |
| | 72-07-24 | DSHS | -- | -- | -- | -- | 680T | -- | 6T | -- | -- |
| | 72-08-14 | DSHS | -- | -- | -- | -- | 40T | -- | 6T | -- | -- |
| | 72-09-14 | DSHS | -- | -- | -- | -- | 120 | -- | 6 | -- | -- |
| | 72-09-14 | EPA | <2T | 1T | 4T | 63T | <100T | 10T | <2T | 4.6T | 30T |
| | 74-06-06 | USGS | <6 | <5 | <5 | 330 | <10 | 30 | <10 | <.2 | 540 |
| | 75-03-21 | DSHS | -- | -- | -- | -- | 80 | -- | <5 | -- | -- |
| | 80-06-02 | EPA | -- | -- | -- | -- | -- | -- | 10T | -- | -- |
| | 82-07-27 | EPA | -- | -- | -- | -- | -- | -- | 0T | -- | -- |
| | 82-10-26 | EPA | -- | -- | -- | -- | -- | -- | 0T | -- | -- |
| | 83-01-25 | EPA | -- | -- | -- | -- | -- | -- | 10T | -- | -- |
| | 83-04-25 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| | 83-07-26 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| | 83-10-24 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| | 84-01-24 | EPA | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| 25/45E-18R02 | 80-06-02 | WDOE | -- | -- | -- | -- | -- | -- | <10T | -- | -- |
| 25/45E-18R03 | 80-06-02 | WDOE | -- | -- | -- | -- | -- | -- | <10T | -- | -- |

T - value represents a total concentration rather than a dissolved concentration

Table 2. Ground-water quality at selected sites
Part D-- Organic Compounds

| LOCAL IDENT-I-FIER | DATE OF SAMPLE | SOURCE | 1,1-DI-CHLORO-ETHANE, TOTAL (UG/L) | 1,2-DI-CHLORO-ETHANE, TOTAL (UG/L) | 1,1,1-TRI-CHLORO-ETHANE, TOTAL (UG/L) | 1,1,2,2-TETRA-CHLORO-ETHANE, TOTAL (UG/L) | TRANS-DI-CHLORO-ETHENE, TOTAL (UG/L) | TETRA-CHLORO-ETHENE, TOTAL (UG/L) | TRI-CHLORO-ETHENE, TOTAL (UG/L) | DI-CHLORO-METHANE, TOTAL (UG/L) | TETRA-CHLORO-METHANE, TOTAL (UG/L) | TRI-CHLORO-METHANE, TOTAL (UG/L) | 1,2-DI-CHLORO-PROPANE, TOTAL (UG/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25/45E-15D01 | 80-09-15 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | 6.7 | -- |
| | 81-10-27 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-07-26 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 25/45E-16K01 | 80-09-15 | EPA | -- | 14.0 | 1.2 | -- | -- | 5.6 | 5.6 | -- | -- | 7.0 | -- |
| | 81-01-26 | EPA | -- | -- | <1.0 | -- | -- | 14.0 | 2.4 | -- | -- | -- | -- |
| | 81-02-10 | EPA | <1.0 | 10.0 | <1.0 | -- | 115 | 23.0 | 8.3 | <1.0 | <1.0 | 11.0 | -- |
| | 81-05-27 | EPA | -- | -- | 2.1 | -- | -- | 83.0 | 14.0 | -- | -- | -- | -- |
| | 81-07-29 | EPA | -- | -- | 6.5 | -- | -- | 16.0 | 9.4 | -- | -- | -- | -- |
| | 81-10-27 | EPA | 1.7 | 7.2 | <1.0 | <1.0 | 151 | 18.0 | 4.4 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 82-07-27 | EPA | 3.0 | 13.0 | 4.0 | <1.0 | 225 | 23.0 | 12.0 | <1.0 | <1.0 | <1.0 | 1.5 |
| | 82-10-26 | EPA | 1.4 | 15.0 | <1.0 | <1.0 | 245 | 22.0 | 6.6 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-01-25 | EPA | 2.5 | 17.0 | <1.0 | <1.0 | 385 | 22.0 | 9.5 | <1.0 | <1.0 | <1.0 | 1.1 |
| | 83-04-25 | EPA | 2.6 | 21.0 | <1.0 | <1.0 | 392 | 22.0 | 8.0 | <1.0 | <1.0 | <1.0 | 1.6 |
| | 83-07-26 | EPA | 4.0E | 6.8 | 4.0E | <1.0 | 203 | 28.0 | 4.8 | <1.0 | <1.0 | <1.0 | 4.0E |
| | 83-10-24 | EPA | 3.5 | 5.5 | <1.0 | <1.0 | 267 | 20.0 | 4.0 | <1.0 | <1.0 | <1.0 | 1.0 |
| 25/45E-17D03 | 80-09-15 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | 17.0 | -- |
| | 81-01-26 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-05-26 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-07-28 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-10-27 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 82-07-27 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 25/45E-17P02 | 80-09-17 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | 6.7 | -- |
| | 81-01-26 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-05-26 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-07-28 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-10-27 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-07-26 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 25/45E-18R01 | 80-09-15 | EPA | -- | -- | 2.3* | -- | -- | <1.0 | <1.0 | -- | -- | 7.1 | -- |
| | 81-05-26 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 81-07-28 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 82-07-27 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 82-10-26 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-01-25 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-04-25 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-10-24 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 83-01-24 | EPA | <1.0 | <1.0 | <1.0 | -- | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | 84-04-23 | EPA | <1.0 | <1.0 | <1.0 | -- | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 25/45E-18R02 | 81-07-28 | EPA | -- | -- | <1.0 | -- | -- | <1.0 | <1.0 | -- | -- | -- | -- |
| | 83-10-24 | EPA | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |

E Indicates an estimated concentration.

* A duplicate analysis of this sample has a concentration of <1.0 .