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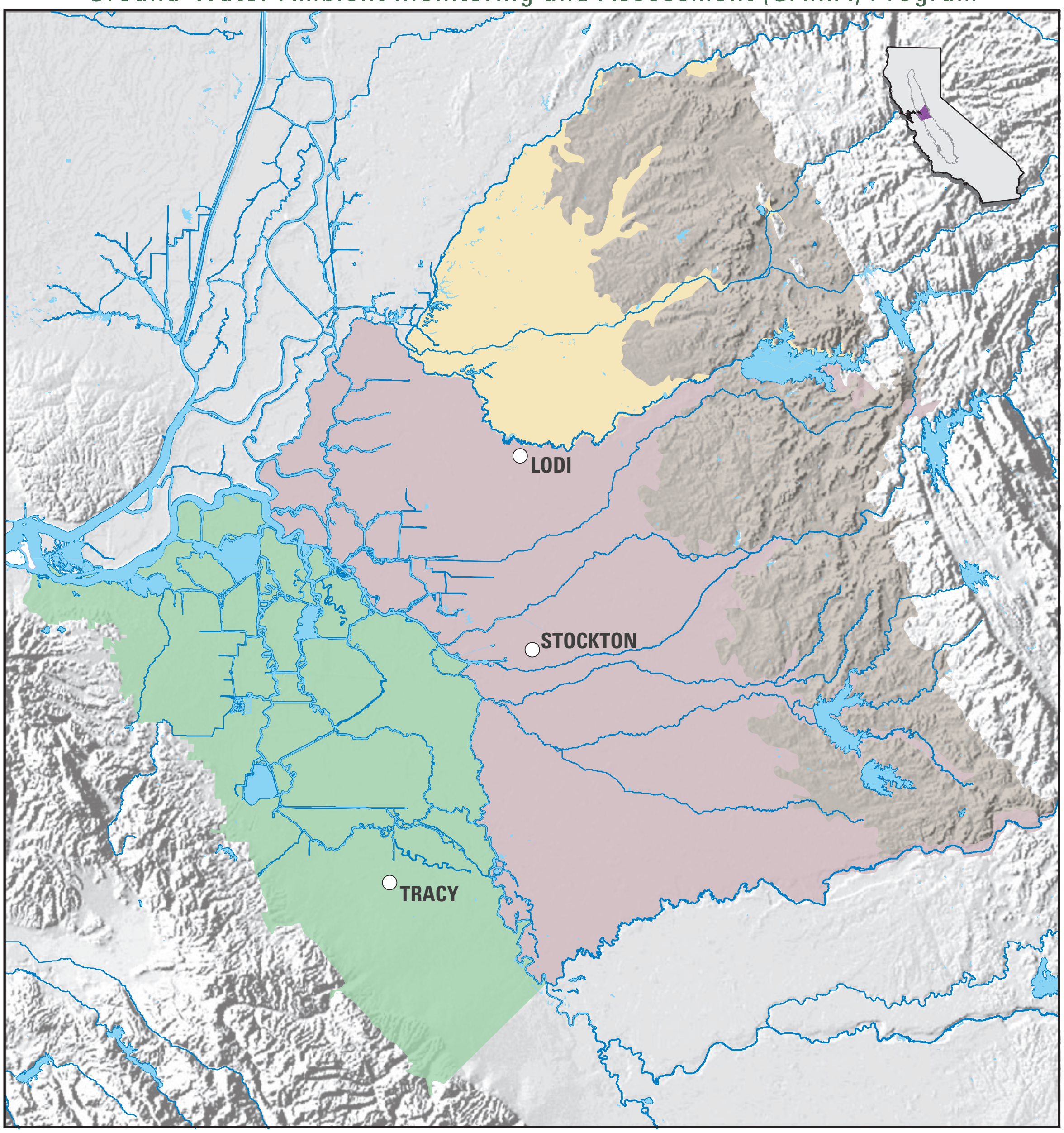
# California GAMA Program: Ground-Water Quality Data in the Northern San Joaquin Basin Study Unit, 2005

Data Series 196

Ground-Water Ambient Monitoring and Assessment (GAMA) Program




**U.S. Department of the Interior**
**U.S. Geological Survey**

# California GAMA Program: Ground-Water Quality Data in the Northern San Joaquin Basin Study Unit, 2005

By George L. Bennett V, Kenneth Belitz, and Barbara J. Milby Dawson

A product of the California Ground-Water Ambient Monitoring and Assessment (GAMA) Program

In cooperation with the California State Water Resources Control Board

Data Series 196

**U.S. Department of the Interior**
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*Suggested citation*
Bennett, G.L., V, Belitz, Kenneth,Milby Dawson, B.J., 2006, California GAMA Program—Ground-water quality data in the northern San Joaquin basin study unit, 2005: U.S. Geological Survey Data Series 196, 122 p.

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## Abbreviations, Acronyms, and Initialisms

(Clarification or additional information given in parentheses)

Abbreviation: A shortened form of a word, such as “m” for meter, “L” for liter, “St.” for street, and “Calif.” or “CA” for California.

Acronym: A shortened form of a group of words, usually taking the first letters of each word. An acronym can be pronounced, such as NASA, NAWQA, and FEMA.

Initialism: A shortened form of a group of words, usually taking the first letters of each word. An initialism is pronounced by each letter in the initialism, such as AMCL, CWSC, and GIS.

| | |
|---|---|
| AMCL | Alternate Maximum Contaminant Level (USEPA) |
| CAS | Chemical Abstracts Service (American Chemical Society) |
| COS | Cosumnes Basin |
| CFC-12 | dichlorodifluoromethane |
| CSU | combined standard uncertainty |
| CWSC | California Water Science Center (USGS) |
| DBCP | 1,2-dibromo-3-chloropropane |
| DLR | detection level for the purpose of reporting |
| DO | dissolved oxygen |
| DOC | dissolved organic carbon |
| EDB | 1,2-dibromoethane |
| ESJ | Eastern San Joaquin Basin |
| ESJDD | Eastern San Joaquin Basin depth dependent |
| ESJFP | Eastern San Joaquin Basin flowpath |
| ESJMW | Eastern San Joaquin Basin monitoring well |
| Freon21 | dichlorofluoromethane |
| GAMA | Ground-Water Ambient Monitoring and Assessment (State Water Board) |
| GC/MS | gas chromatography/mass spectrometry |
| HA-L | lifetime health advisory (USEPA) |
| HCFC-22 | chlorodifluromethane |
| IRL | interim reporting level |
| LRL | laboratory reporting level |
| LSD | land-surface datum |
| LT-MDL | long-term method detection level |
| MCL | Maximum Contaminant Level (CADHS and USEPA) |
| MDL | method detection limit |
| MRL | Minimum Reporting Level |
| NAWQA | National Water Quality Assessment (USGS) |
| NDMA | *N*-Nitrosodimethylamine |
| NIST | National Institute for Standards and Technology |
| NL | notification level (CADHS) |

| | |
|---|---|
| NRP | National Research Program (USGS) |
| NWIS | National Water Information System (USGS) |
| PCE | tetrachloroethylene |
| QC | quality control |
| QPC | Uplands Basin (Quaternary Pleistocene semiconsolidated deposits) |
| RSD | relative standard deviation |
| RSD5 | risk-specific dose at a cancer risk level of 1 in 100,000 or 10E–5 (USEPA) |
| SC | specific conductance |
| SMCL | Secondary Maximum Contaminant Level (CADHS and USEPA) |
| SSMDC | sample-specific minimum detectable concentration |
| TCE | trichloroethylene |
| 1,2,3-TCP | 1,2,3-trichloropropane |
| TDS | total dissolved solids |
| THM | trihalomethane |
| TIC | tentatively identified compound |
| TRCY | Tracy Basin |
| TRCYFP | Tracy Basin flowpath |
| UV-VIS | ultraviolet-visible |
| VOC | volatile organic compound |

## Organizations

| | |
|---|---|
| CADHS | California Department of Health Services |
| CADWR | California Department of Water Resources |
| CWSC | California Water Science Center (USGS) |
| LLNL | Lawrence Livermore National Laboratory |
| MWH | Montgomery Watson Harza Laboratory |
| NWQL | National Water Quality Laboratory (USGS) |
| RSIL | Reston Stable Isotope Laboratory (USGS) |
| USEPA | U.S. Environmental Protection Agency |
| USGS | U.S. Geological Survey |

Note: In this report, the California State Water Resources Control Board is referred to in its abbreviated form as the “State Water Board.” The initialism “SWB” is not used in the text.

## Units of measurement

| | |
|---|---|
| ft | foot (feet) |
| in | inch |
| kg | kilogram ($10^3$ grams) |
| $km^2$ | square kilometer |
| L | liter |
| mg | milligram ($10^{-3}$ gram) |
| mg/L | milligram per liter ($10^{-3}$ gram per liter) |
| $mi^2$ | square mile |
| mL | milliliter ($10^{-3}$ liter) |
| µg/L | microgram per liter ($10^{-6}$ gram per liter) |
| µL | microliter ($10^{-6}$ liter) |
| µm | micrometer ($10^{-6}$ meter) |
| pCi/L | picocurie per liter |
| pCi/µg | picocurie per microgram |

## Notes

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L). One thousand micrograms per liter is equivalent to 1 milligram per liter. Milligrams per liter is equivalent to parts per million (ppm) and micrograms per liter is equivalent to parts per billion (ppb).

In this report, the USEPA designation for “lifetime health advisory” is “HA-L,” to avoid possible confusion with USEPA’s Health Advisory Level (HAL), which is a nonregulatory health-based reference level of chemical traces (usually in ppm) in drinking water at which there are no adverse health risks when ingested over various periods of time. It is an estimate of acceptable drinking-water concentrations and provides guidance to water-supply managers. HA-L represents the concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for a lifetime of exposure. The HA-L assumes consumption of 2 liters of water per day over a 70-year lifetime by a 70-kilogram (154 pound) adult and that 20 percent of exposure comes from drinking water. Only the HA-L is used in this report.

# California GAMA Program: Ground-Water Quality Data in the Northern San Joaquin Basin Study Unit, 2005

By George L. Bennett V, Kenneth Belitz, and Barbara J. Milby Dawson

## Abstract

Growing concern over the closure of public-supply wells because of ground-water contamination has led the State Water Board to establish the Ground-Water Ambient Monitoring and Assessment (GAMA) Program. With the aid of the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory, the program goals are to enhance understanding and provide a current assessment of ground-water quality in areas where ground water is an important source of drinking water. The Northern San Joaquin Basin GAMA study unit covers an area of approximately 2,079 square miles ($mi^2$) across four hydrologic study areas in the San Joaquin Valley. The four study areas are the California Department of Water Resources (CADWR) defined Tracy subbasin, the CADWR-defined Eastern San Joaquin subbasin, the CADWR-defined Cosumnes subbasin, and the sedimentologically distinct USGS-defined Uplands study area, which includes portions of both the Cosumnes and Eastern San Joaquin subbasins.

Seventy ground-water samples were collected from 64 public-supply, irrigation, domestic, and monitoring wells within the Northern San Joaquin Basin GAMA study unit. Thirty-two of these samples were collected in the Eastern San Joaquin Basin study area, 17 in the Tracy Basin study area, 10 in the Cosumnes Basin study area, and 11 in the Uplands Basin study area. Of the 32 samples collected in the Eastern San Joaquin Basin, 6 were collected using a depth-dependent sampling pump. This pump allows for the collection of samples from discrete depths within the pumping well. Two wells were chosen for depth-dependent sampling and three samples were collected at varying depths within each well. Over 350 water-quality field parameters, chemical constituents, and microbial constituents were analyzed and are reported as concentrations and as detection frequencies, by compound classification as well as for individual constituents, for the Northern San Joaquin Basin study unit as a whole and for each individual study area. Results are presented in a descending order based on detection frequencies (most frequently detected compound listed first), or alphabetically when a detection frequency could not be calculated. Only certain wells were measured for all constituents and water-quality parameters.

The results of all of the analyses were compared with U.S. Environmental Protection Agency (USEPA) and California Department of Health Services (CADHS) Maximum Contaminant Levels (MCLs), Secondary Maximum Contaminant Levels (SMCLs), USEPA lifetime health advisories (HA-Ls), the risk-specific dose at a cancer risk level equal to 1 in 100,000 or 10E-5 (RSD5), and CADHS notification levels (NLs). When USEPA and CADHS MCLs are the same, detection levels were compared with the USEPA standard; however, in some cases, the CADHS MCL may be lower. In those cases, the data were compared with the CADHS MCL.

Constituents listed by CADHS as “unregulated chemicals for which monitoring is required” were compared with the CADHS “detection level for the purposes of reporting” (DLR). DLRs unlike MCLs are not health based standards. Instead, they are levels at which current laboratory detection capabilities allow eighty percent of qualified laboratories to achieve measurements within thirty percent of the true concentration.

Twenty-three volatile organic compounds (VOCs) and seven gasoline oxygenates were detected in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit. Additionally, 13 tentatively identified compounds were detected. VOCs were most frequently detected in the Eastern San Joaquin Basin study area and least frequently detected in samples collected in the Cosumnes Basin study area. Dichlorodifluoromethane (CFC-12), a CADHS “unregulated chemical for which monitoring is required,” was detected in two wells at concentrations greater than the DLR. Trihalomethanes were the most frequently detected class of VOC constituents. Chloroform (trichloromethane) was the most frequently detected VOC. None of the 88 VOCs analyzed were detected at concentrations above an MCL, SMCL, NL, HA-L, or RSD5.

Fifteen pesticides and pesticide degradates were detected in ground-water samples within the Northern San Joaquin Basin GAMA study unit. Pesticide and pesticide degradates were detected in 27 of the 70 samples collected for pesticide analysis. Pesticides were most frequently detected in ground-water samples from the Eastern San Joaquin Basin study area and least frequently detected in the Cosumnes Basin study area. Herbicides were the most frequently detected class of pesticide; simazine, a herbicide, was the most frequently detected pesticide. Two herbicides, 1,2-dibromo-3-chloropropane and 1,2-dibromoethane, were detected at concentrations above their USEPA MCLs. None of the other 120 pesticide or pesticide degradates analyzed were detected at concentrations above an MCL, SMCL, NL, HA-L, or RSD5.

Five wastewater-indicator constituents were identified in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit. Thirteen of the 16 samples analyzed for wastewater-indicator constituents had at least a single detection. Isophorone was the most frequently detected wastewater-indicator constituent. None of the 63 wastewater-indicator constituents analyzed were detected at concentrations above an MCL, SMCL, NL, HA-L, or RSD5.

Twenty-four pharmaceutical constituents were analyzed for in ground-water samples collected at all wells in the Northern San Joaquin Basin GAMA study unit. However, as of the writing of this report, the analytical methods employed in the detection and quantification of the selected pharmaceutical constituents were still in development, and additional quality-control data were needed to verify the results. The results of the pharmaceutical analysis within the Northern San Joaquin Basin GAMA study unit are planned for publication in a future report.

Thirty-four ground-water samples were analyzed for the following constituents of special interest: perchlorate, *N*-nitrosodimethylamine (NDMA), and 1,2,3-trichloropropane (1,2,3-TCP). Perchlorate, an "unregulated chemical for which monitoring is required," was detected in two ground-water samples in the Eastern San Joaquin Basin study area at concentrations below the CADHS DLR and NL. NDMA and 1,2,3-TCP were not detected in any ground-water samples.

Eighteen ground-water samples were collected for nutrient analysis, and 10 samples were collected for dissolved organic carbon analysis. Nitrite plus nitrate was detected in 11 of 13 samples (excluding the depth-dependent analyses), whereas nitrite was detected in only two samples; concentrations of nitrite were not above the USEPA MCL of 1 milligram per liter (mg/L) (as nitrogen). Concentrations of nitrite plus nitrate were not above the USEPA MCL of 10 mg/L (as nitrogen). Dissolved organic carbon was detected in 5 of the 10 samples in which it was analyzed.

Thirty-nine ground-water samples were analyzed for 10 major and minor ions, as well as total dissolved solids (TDS). Eight samples had TDS concentrations above the USEPA recommended SMCL of 500 mg/L. All eight samples with TDS concentrations above the USEPA SMCL were from wells located within the Tracy Basin study area. Three ground-water samples had detections of sulfate above the USEPA SMCL of 250 mg/L, which like TDS, were all located in the Tracy Basin study area.

Thirty-nine ground-water samples were collected and analyzed for 25 different trace elements. Arsenic was detected in all 39 samples; however, it was detected in only three samples above the USEPA MCL of 10 μg/L. Hexavalent chromium, a CADHS "unregulated chemical for which monitoring is required," was detected in 16 of 39 ground-water samples in which it was analyzed, all of which were at concentrations above the CADHS DLR of 1 μg/L. Iron, detected in 26 of 39 samples, was detected in three samples at concentrations above the USEPA SMCL of 300 μg/L. Manganese, detected in 36 of 39 samples, was detected in eight samples at concentrations above the USEPA SMCL of 50 μg/L. In addition, three samples contained manganese at concentrations above the CADHS NL of 500 μg/L. Boron, a CADHS "unregulated chemical for which monitoring is required," was detected in all 39 ground-water samples in which it was analyzed. Of those 39 detections, 11 were at concentrations above the CADHS DLR of 100 μg/L, and 5 were at concentrations above the CADHS NL of 1,000 μg/L. Concentrations of boron above the CADHS NL were found only in the Tracy Basin study area. Boron concentrations above the DLR were most frequently found in ground-water samples in the Tracy Basin study area, followed by the Eastern San Joaquin Basin study area, and lastly in the Uplands Basin study area. Vanadium, a CADHS "unregulated chemical for which monitoring is required," was detected in 38 of 39 ground-water samples, and of those, 33 were above the CADHS DLR of 3 μg/L. However, none of the vanadium detections in ground water were at concentrations above the CADHS NL of 50 μg/L.

USGS laboratories analyzed 70 ground-water samples for stable isotopes of water and tritium. Stable isotopes of water (deuterium and oxygen-18) are used in the assessment of ground-water recharge sources, whereas tritium is often used as an environmental tracer. In addition to the analyses performed by the USGS laboratories, 27 samples were also analyzed for tritium, and 16 were analyzed for noble gases at the Lawrence Livermore National Laboratory. Finally, 13 wells were sampled for radium-226, radium-228, radon-222, gross-alpha radioactivity (72-hour and 30-day count), gross-beta radioactivity (72-hour and 30-day count), and stable carbon isotopes. Tritium was detected in 61 of 70 samples of which all detections showed activities well below the CADHS MCL of 20,000 picocuries per liter (pCi/L). Radium-226 was detected in all ground-water samples in which it was analyzed, whereas radon-228 was detected in only three samples. None of the ground-water samples collected were above the USEPA combined radium-226 and radium-228 MCL of 5 pCi/L. Gross-alpha and gross-beta radioactivity in ground-water samples were in all cases below their USEPA MCLs. Radon-222 was detected in all ground-water samples in which it was analyzed. The proposed USEPA MCL for radon-222 is 300 pCi/L, whereas the proposed Alternate Maximum Concentration Level (AMCL) is 4,000 pCi/L (U.S. Environmental Protection Agency, 2006). Of the 13 samples in which radon-222 was analyzed and detected, only one was below the proposed USEPA MCL, whereas all were below the AMCL. Stable isotope values, reported as ratios of hydrogen and oxygen isotopes, ranged from –81.1 per mill to –43.0 per mill for the hydrogen isotopes and from –11.2 per mill to –5.6 per mill for the oxygen isotopes.

Microbial constituents, including total coliform and *Escherichia* spp. coliform (*E. coli*), as well as the viruses F-specific coliphage and somatic coliphage, were analyzed in eight ground-water samples. F-specific coliphage, somatic coliphage, and *Escherichia* spp. coliform were not detected in any ground-water samples, whereas an estimated three total coliform colonies per 100 milliliters of water were detected in a sample collected in the Uplands Basin study area.

# Introduction

The U.S. Geological Survey (USGS) is collaborating with the State Water Board, the California Department of Health Services (CADHS), and Lawrence Livermore National Laboratory (LLNL) on implementing the Ground-Water Ambient Monitoring and Assessment (GAMA) Program. The GAMA Program was developed in response to the California Ground-Water Quality Monitoring Act of 2001 (Sections 10780–10782.3 of the California Water Code) and is designed to address a growing concern about ground-water quality throughout the State of California. The program has three main objectives (1) status—to assess the current quality of the ground-water resource, (2) trends—to detect changes in ground-water quality, and (3) understanding—to identify the natural and human factors affecting ground-water quality (Belitz and others, 2003; Kulongoski and Belitz, 2004).

To achieve the program goals, the USGS developed a systematic approach to sampling (Belitz and others, 2003) that will provide a comprehensive and statistically unbiased assessment of statewide ground-water quality. This approach was achieved through the design of a randomized well-selection routine within a grid cell framework designed within distinct study areas. Samples collected by the GAMA Program are intended to represent the wide range of geologic, hydrologic, and climatic conditions found within the State of California (Belitz and others, 2003). Therefore, the state has been separated into 10 hydrogeologic provinces (*fig. 1*), each with its own unique physical, geologic, hydrologic, and geographic characteristics. Each province contains ground-water basins composed of primarily unconsolidated deposits of alluvial or volcanic origin (California Department of Water Resources, 2003). Eighty percent of public supply wells in California are located within ground-water basins, whereas the other twenty percent are located in relatively low-permeability hard rock areas. By targeting both areas, the GAMA Program will provide a full assessment of the quality of ground water used for drinking-water supply within the state. Analysis of a broad suite of chemical constituents, analyzed at detection levels lower than those currently required by the CADHS, will provide a database of information that may aid in the early identification and understanding of contamination issues throughout the state.


**Figure 1.** Hydrogeologic provinces of California and the location of the Northern San Joaquin Basin study unit (black area).

## Purpose and Scope

The purpose of this report is to present the analytical results for general water-quality parameters, inorganic constituents, organic constituents, and microbial constituents obtained for ground-water samples collected for the Northern San Joaquin Basin GAMA study unit. Constituent detections are presented within classes (for example, "organic solvents") in a descending order that is based on the constituent's frequency of detection. Seventy samples were collected from a variety of well types, including public supply, domestic, irrigation, and monitoring wells. Wells located in Amador, Calaveras, Contra Costa, Sacramento, San Joaquin, and Stanislaus counties were randomly selected for sampling, and ground-water samples were collected between December 2004 and February 2005. The constituents that were targeted for analysis included 88 volatile organic compounds (VOCs), 122 pesticides and pesticide degradates, 63 wastewater-indicator constituents, 24 pharmaceutical constituents, 3 constituents of special interest (perchlorate, *N*-nitrosodimethylamine [NDMA], and 1,2,3-trichloropropane [1,2,3-TCP]), 5 nutrients, dissolved organic carbon (DOC), 10 major and minor ions, total dissolved solids (TDS), 25 trace elements, eight isotopic constituents, five noble gases, and the microbial constituents coliform and coliphage. General water-quality indicators were measured and included dissolved oxygen (DO), pH, specific conductance (SC), alkalinity, and water temperature.

Detected concentrations in ground-water samples of constituents that are regularly monitored by the CADHS were compared with CADHS and U.S. Environmental Protection Agency (USEPA) drinking-water regulations (California Department of Health Services, 2005a, 2005b, and 2005c; U.S. Environmental Protection Agency, 2005). Concentrations above USEPA or CADHS primary Maximum Contaminant Levels (MCLs), whichever is lower, and Secondary Maximum Contaminant Levels (SMCLs) will be highlighted. Constituents detected in ground-water samples that lack MCLs were compared with CADHS notification levels (NLs). For those constituents that lack an MCL or NL, concentrations are compared with the USEPA lifetime health advisory (HA-L). Lastly, for those constituents that lack an MCL, NL, or HA-L, concentrations were compared with the risk-specific dose at a cancer risk level equal of 1 in 100,000 or 10E-5 (RSD5). Comparisons of raw ground water to MCLs, SMCLs, NLs, HA-Ls, and RSD5s are for illustrative purposes only and do not indicate a drinking-water violation or noncompliance with drinking-water regulations. Explanations of the levels used in this report are provided as follows:

**MCLs**—Legally enforceable standards that apply to public-water systems and are designed to protect public health by limiting the levels of contaminants in drinking water (U.S. Environmental Protection Agency, 1974).

**SMCLs**—Nonenforceable contaminant concentration levels that affect the aesthetic qualities of drinking water, such as the taste, odor, and color (U.S. Environmental Protection Agency, 1974).

**NLs**—Health-based advisory levels established by the CADHS for chemicals in drinking water that lack MCLs. If a chemical is detected above its NL, State law requires timely notification of the local governing bodies and recommends consumer notification (California Department of Health Services, 2005d).

**HA-Ls**—The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for a lifetime of exposure. The USEPA lifetime health advisory, assumes consumption of 2 liters (L) of water per day over a 70-year lifetime by a 70-kilogram (70-kg or 154-pound) adult, and that 20 percent of exposure comes from drinking water (U.S. Environmental Protection Agency, 2004b).

**RSD5**—The concentration of a chemical in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 100,000, hereinafter referred to as the risk specific dose at $10^{-5}$ (U.S. Environmental Protection Agency, 2004b).

In addition to the above listed comparison thresholds, constituents classified by CADHS as "unregulated chemicals for which monitoring is required" will be compared with the "detection level for the purpose of reporting" **(DLR)** set by CADHS (California Department of Health Services, 2005b). DLRs are the minimum concentration at or above which any analytical finding of a contaminant in drinking water as a result of monitoring required by Title 22 of the California Code of Regulations must be reported to the CADHS. DLRs are analytical detection limits that are based on the level of confidence in the quantification of a contaminant's presence in drinking water and are set on the basis of interlaboratory measurement precision of 20 percent or better, where at least 80 percent of qualified laboratories could achieve results within ±30 percent of the true concentration (California Department of Health Services, 2005e).

Detection frequencies will be reported for each anthropogenic (man-made) compound that is detected in at least one ground-water sample. Anthropogenic constituents include VOCs, pesticides, pesticide degradates, wastewater-indicator constituents, and contaminants of special interest. Any regulated anthropogenic or CADHS "unregulated chemical for which monitoring is required" classified compound that is detected at a frequency greater than, or equal to, 10 percent will be highlighted. Constituents with a detection frequency of 10 percent or greater may be indicative of degradation of ground-water quality.

Also presented in this report are the results and interpretation of the quality-control (QC) samples collected during the Northern San Joaquin GAMA study unit. Results for pharmaceutical analyses of ground-water and QC samples will not be presented here, but are planned for publication in a future report. As of the writing of this report, the pharmaceutical analytical method was still in development, and additional QC data were needed to verify results. Discussion of factors that may influence the occurrence and distribution of chemical and microbial constituents detected in ground-water samples is beyond the scope of this report.

## Acknowledgments

This study was funded and supported by the State Water Board. The authors also thank the following agencies for their support: California Department of Health Services, California Department of Water Resources, and Lawrence Livermore National Laboratory.

We also thank the cooperating well owners and water purveyors for their generosity in allowing the USGS to collect samples from their wells.

## Hydrogeologic Setting of the Northern San Joaquin Basin Study Unit

The Northern San Joaquin Basin GAMA study unit lies within the Central Valley Hydrogeologic Province described by Belitz and others (2003) and includes three California Department of Water Resources (CADWR) San Joaquin Valley ground-water subbasins: Tracy subbasin, Eastern San Joaquin subbasin, and Cosumnes subbasin. Combined, they define the outline of the Northern San Joaquin Basin GAMA study unit. The three subbasins together cover an area of approximately 2,079 square miles ($mi^2$) that includes most of San Joaquin County and portions of Alameda, Amador, Calaveras, Contra Costa, and Stanislaus Counties. The study unit is bounded by the Southern Coast Ranges to the west, the Sierra Nevada to the east, the San Joaquin Delta and Sacramento Valley to the north, and the central San Joaquin Valley to the south.

The Northern San Joaquin Basin GAMA study unit has a Mediterranean climate, with hot and dry summers, and winters that are cool and moist. Average rainfall across the study unit ranges from 11 inches (in.) in the southern to southwesterly portions of the study unit to upwards of 25 in. in the eastern to northeastern portions study unit (California Department of Water Resources, 2005a, 2005b, 2005c). Several creeks and rivers drain the Northern San Joaquin Basin GAMA study unit. The Calaveras, Cosumnes, Mokelumne, and Stanislaus Rivers, as well as their tributaries, drain the eastern portions of the study unit. Each of these rivers ultimately drains directly into either the San Joaquin River, which flows north and empties into the Sacramento and San Joaquin Delta, or directly into the Delta, which discharges its waters into the San Francisco Bay. The west side of the study unit is drained by Middle and Old Rivers as well as other smaller tributaries, which also drain into the San Joaquin River or the Sacramento and San Joaquin Delta. For the purposes of this report, the Northern San Joaquin Basin GAMA study unit is divided into four separate study areas: the Eastern San Joaquin Basin study area, the Tracy Basin study area, the Cosumnes Basin study area, and the Uplands Basin study area (*fig. 2*).

### Eastern San Joaquin Basin Study Area

The GAMA-defined boundaries of the Eastern San Joaquin Basin study area (*fig. 2*) closely match those defined by the CADWR for the "eastern San Joaquin subbasin," which are described as the aerial extent of unconsolidated to semiconsolidated sedimentary deposits south of the Mokelumne River, east of the San Joaquin River, north of the Stanislaus River, and west of the consolidated bedrock of the Sierra Nevada (California Department of Water Resources, 2005a). For the purposes of this report, the Eastern San Joaquin Basin GAMA study area is defined as the aerial extent of the unconsolidated Quaternary age deposits west of the older exposed Pliocene and Pleistocene age semiconsolidated deposits that border the consolidated bedrock of the Sierra Nevada. The study area covers approximately 757 $mi^2$ and is located in San Joaquin County with small portions in Stanislaus and Calaveras counties. Average annual precipitation within the Eastern San Joaquin Basin study area ranges from 11 in. in the southwest to upwards of 20 in. in the northeast (California Department of Water Resources, 2005a). The study area is drained by the San Joaquin River and its major tributaries, which include the Stanislaus, Calaveras, and Mokelumne Rivers. The main aquifers within the Eastern San Joaquin Basin study area include the older alluvial deposits of the Modesto and Riverbank Formations, flood basin deposits, and the deeper Laguna, Mehrten, and Valley Springs Formations (California Department of Water Resources, 2005a). The Mehrten Formation is a Miocene–Pliocene age volcanic deposit considered to be the oldest fresh water-bearing deposit on the east side of the basin because the older underlying Valley Springs Formation produces only minor amounts of water (California Department of Water Resources, 1967).

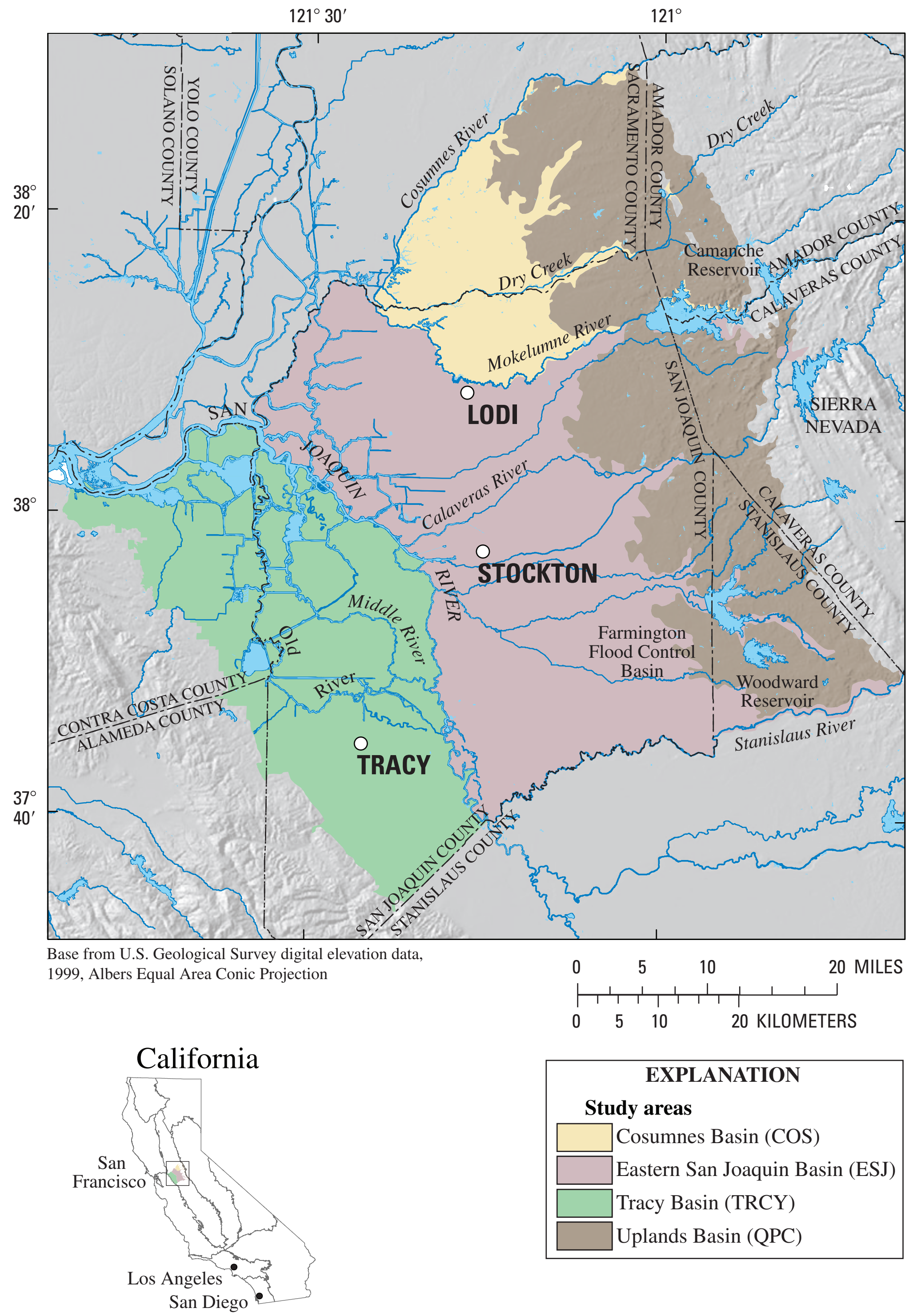



**Figure 2.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit and locations of the four study areas.

## Tracy Basin Study Area

The boundaries of the GAMA-defined Tracy Basin study area (*fig. 2*) match those defined by the CADWR for the "Tracy subbasin" and are described as the aerial extent of unconsolidated to semiconsolidated sedimentary deposits that are bounded by the Diablo Mountain range to the west, the Mokelumne and San Joaquin Rivers to the north, the Eastern San Joaquin subbasin to the east, and the Delta–Mendota subbasin to the south (California Department of Water Resources, 2005b). The study area covers approximately 539 mi$^2$ and lies within portions of San Joaquin, Contra Costa, and Alameda counties. Annual precipitation within the Tracy Basin study area is reported to range from 11 in. in the south to 16 in. in the north, (California Department of Water Resources, 2005b). Precipitation is drained from the study area by the San Joaquin, Middle, and Old Rivers, in addition to smaller creeks and sloughs that all eventually flow into and become part of the Sacramento and San Joaquin Delta (California Department of Water Resources, 2005b). The main aquifers within the Tracy Basin study area are the Late Tertiary to Quaternary Tulare Formation, Older Alluvium, flood basin deposits, and Younger Alluvium, which when combined, range from a few hundred feet thick near the Coast Ranges to more than 3,000-feet (ft) thick near the eastern edge of the Tracy Basin study area (Davis and others, 1964; Hotchkiss and Balding, 1971; and Bertoldi and others, 1991).

## Cosumnes Basin Study Area

The boundaries of the GAMA-defined Cosumnes Basin study area (*fig. 2*) closely match those defined by the CADWR for the "Cosumnes subbasin," which is described as the aerial extent of the unconsolidated and semiconsolidated deposits that are bounded to the north and west by the Cosumnes River, to the south by the Mokelumne River, and to the east by the consolidated bedrock of the Sierra Nevada (California Department of Water Resources, 2005c). For this report, the Cosumnes Basin study area has been limited to the exposed unconsolidated Quaternary age deposits west of the older exposed Pliocene and Pleistocene age semiconsolidated deposits that border the consolidated bedrock of the Sierra Nevada. The Cosumnes Basin study area covers approximately 194 mi$^2$. Annual precipitation within the Cosumnes Basin study area ranges from 15 in. in the west to 22 in. in the east (California Department of Water Resources, 2005c). The Cosumnes Basin study area is drained by three main rivers, namely the Cosumnes, Dry Creek, and the Mokelumne, which all flow westward towards the Sacramento and San Joaquin Delta. The main aquifers within the Cosumnes Basin study area are the Younger Alluvium, the Older Alluvium, and the Mehrten Formation. The Younger Alluvium consists of recent stream channel deposits and dredge tailings (Olmstead and Davis, 1961). The Older Alluvium consists of Quaternary, Pliocene, and Pleistocene age alluvial deposits that have been assigned many different formation names including the Modesto, Riverbank, Victor, and Laguna (Olmstead and Davis, 1961; California Department of Water Resources, 1974; and Helley and Harwood, 1985). The Mehrten Formation is a Miocene–Pliocene age volcanic deposit, which is composed of "black sands," gravels, silts, and clay interbedded with layers of dense tuff breccia (Olmstead and Davis, 1961; California Department of Water Resources, 2005c).

## Uplands Basin Study Area

The Uplands study area (*fig. 2*) is defined as those portions of the CADWR defined as the eastern San Joaquin and Cosumnes subbasins that represent the exposed aerial extent of the Pliocene and Pleistocene age semiconsolidated deposits west of the consolidated bedrock of the Sierra Nevada, also referred to in this report as the "Quaternary Pleistocene age semiconsolidated deposits," or "QPC" (Jennings, 1977). Annual precipitation within the Uplands study area averages about 22 in. in the northern area (California Department of Water Resources, 2005c) and upwards of 20 in. in the central to southern area (California Department of Water Resources, 2005a). Precipitation in the Uplands Basin study area is drained by several rivers including the Calaveras, Cosumnes, Dry Creek, Mokelumne, and Stanislaus Rivers. Within the Uplands Basin study area the Mokelumne River is constrained by the Camanche Dam, creating the Camanche Reservoir. Two other reservoirs are located in the Uplands Basin study area: the Farmington Flood Control Basin and the Woodward Reservoir, both of which are located at the southern end of the study area and are fed by several small creeks and canals. The geologic formations identified within this study area include the Modesto, Riverbank, Victor, Laguna, Mehrten, and Valley Springs (Piper and others 1939; Olmstead and Davis, 1961; California Department of Water Resources, 1974; and Helley and Harwood, 1985). The Arroyo Seco and South Fork Gravels have also been identified in the Cosumnes portion of the Uplands study area (Piper and others 1939; Shlemon, 1972; California Department of Water Resources, 1974). The Uplands study area covers approximately 588 mi$^2$.

# Methods of Study

The following sections introduce study and sampling design, field methods, laboratory methods, data-reporting conventions, and QC procedures and results.

## Study and Sampling Design

The primary objectives in the selection of wells for study-area assessments within the Central Valley hydrogeologic province are (1) to attain a sampling density of at least one well per 100 square kilometers ($km^2$), (2) randomly select at least 10 wells per study area wherever possible, and (3) minimize variability in well type (Gilliom and others, 1995). These objectives assure an adequate and statistically unbiased assessment of the quality of ground-water resources used for public supply. In the Northern San Joaquin Basin GAMA study unit, public-supply wells were the preferred choice, but in cases where public-supply wells were not available because of sparse population density or inadequate well characteristics, domestic or irrigation wells were substituted in the selection process. Wells that had available construction information (well depth, depth of perforations, date constructed) were selected when possible for sampling; however, construction information was not available for some of the sampled wells.

Well selection within each study area was developed using a grid-based program that produces random, equal-area cells within each study area (*fig. 3*; Scott, 1990). The program was used to generate 20 cells in the Eastern San Joaquin Basin study area and 15 cells each in the Tracy, Cosumnes, and Upland Basin study areas. For grid cells with multiple wells, each well was randomly assigned a rank. The lowest randomly ranked well that met as many sampling criteria as possible (for example, sampling point prior to treatment, capability to pump over extended periods of time, and available well construction information) were chosen for sampling. Using this method, one randomly ranked well was selected for each grid cell throughout the entire study unit; the selected wells are subsequently referred to as “grid wells” (*fig. 3*). Analytical results from an individual study area’s set of grid wells are presumed to be representative of ground-water quality in that study area. To enhance the understanding of ground-water quality throughout the study area, additional wells were selected for sampling within the study unit; specifically, additional wells were sampled along two flowpaths, whereas others were aerially distributed to provide a better sampling coverage in specific areas (*fig. 4*). These additional wells are referred to as “nongrid cell wells.”

Wells were sampled for a “slow,” “intermediate,” “fast,” and (or) “depth-dependent” list of analytes (*table 1*), depending on the well type. The fast analyte list was collected at all wells sampled in this study and provides an initial assessment of ground-water quality in the area. Slow-list wells were selected along ground-water flowpaths and were sampled for all analytes, including those on the fast list. Grid wells that were near or along the selected ground-water flowpaths or in areas of interest had additional analytes added to their fast list (becoming intermediate-list wells). Depth-dependent samples were collected in two public supply-wells along the flowpaths (*fig. 4*: ESJFP-19 and ESJFP-10) and were sampled for a subset of the slow list of analytes. Monitoring wells along the flowpaths were sampled for the slow list analytes, with the exception of the microbial constituents. Wells that were sampled off the randomized grid (nongrid wells) were located along flowpaths or in select locations within the basin off of the flowpaths to enhance study-unit coverage and were sampled for slow, intermediate, and depth-dependent lists of analytes.

Samples collected in the four study areas of the Northern San Joaquin Basin GAMA study unit were assigned a GAMA identification number based on study area designation and sequence number in the order of sample collection (*figs. 3* and *4*). Study areas were designated as follows: TRCY (Tracy Basin), COS (Cosumnes Basin), ESJ (Eastern San Joaquin Basin) and QPC (Uplands Basin), which includes portions of both the Eastern San Joaquin and Cosumnes Basins. QPC is an initialism for “Quaternary Pleistocene age semiconsolidated deposits.” Additional samples were collected in the Tracy Basin and Eastern San Joaquin Basin study areas to ascertain how ground-water-quality changes as it moves along two flowpaths; these samples were given the designations TRCYFP or ESJFP. Depth-dependent samples collected at two wells in the Eastern San Joaquin Basin study area are identified as ESJDD. Samples collected at a multilevel monitoring well located close to a public-supply well chosen for depth-dependent sample collection were identified as ESJMW.

## Field Methods

*Tables 2A–M* list the names of all the chemical and microbial constituents analyzed for in ground-water samples collected as part of the Northern San Joaquin Basin GAMA study unit. In addition, the tables provide regulatory information, including MCLs, SMCLs, and NLs for those constituents being monitored, as well as laboratory reporting levels. *Table 3* provides the GAMA identification number, the date and time each sample in the Northern San Joaquin Basin GAMA study unit was collected, the constituent list that was sampled at each site, and well-construction information, including date of construction and opening information when available. A total of 70 ground-water samples were collected from a combination of 46 public supply, 10 domestic, five irrigation, and three monitoring wells between mid-December 2004 and mid-February 2005, with six additional depth-dependent samples collected from two of the 46 public-supply wells sampled. Of the 64 wells sampled, 26 are in the Eastern San Joaquin Basin study area, 17 are in the Tracy Basin study area, 10 are in the Cosumnes Basin study area, and 11 are in the Uplands Basin study area.

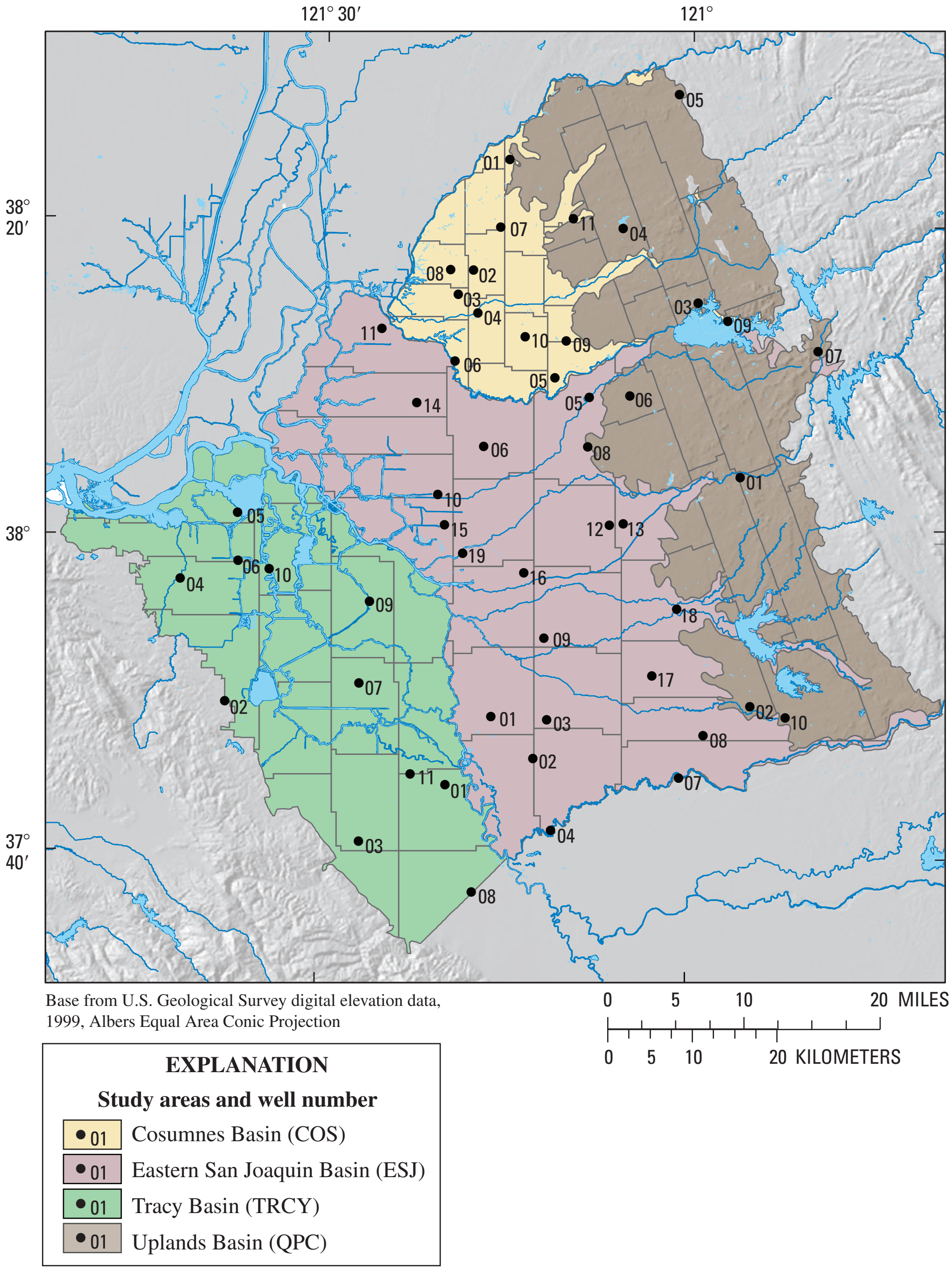



**Figure 3.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas, distribution of study area grid cells, and location of sampled grid cell wells.

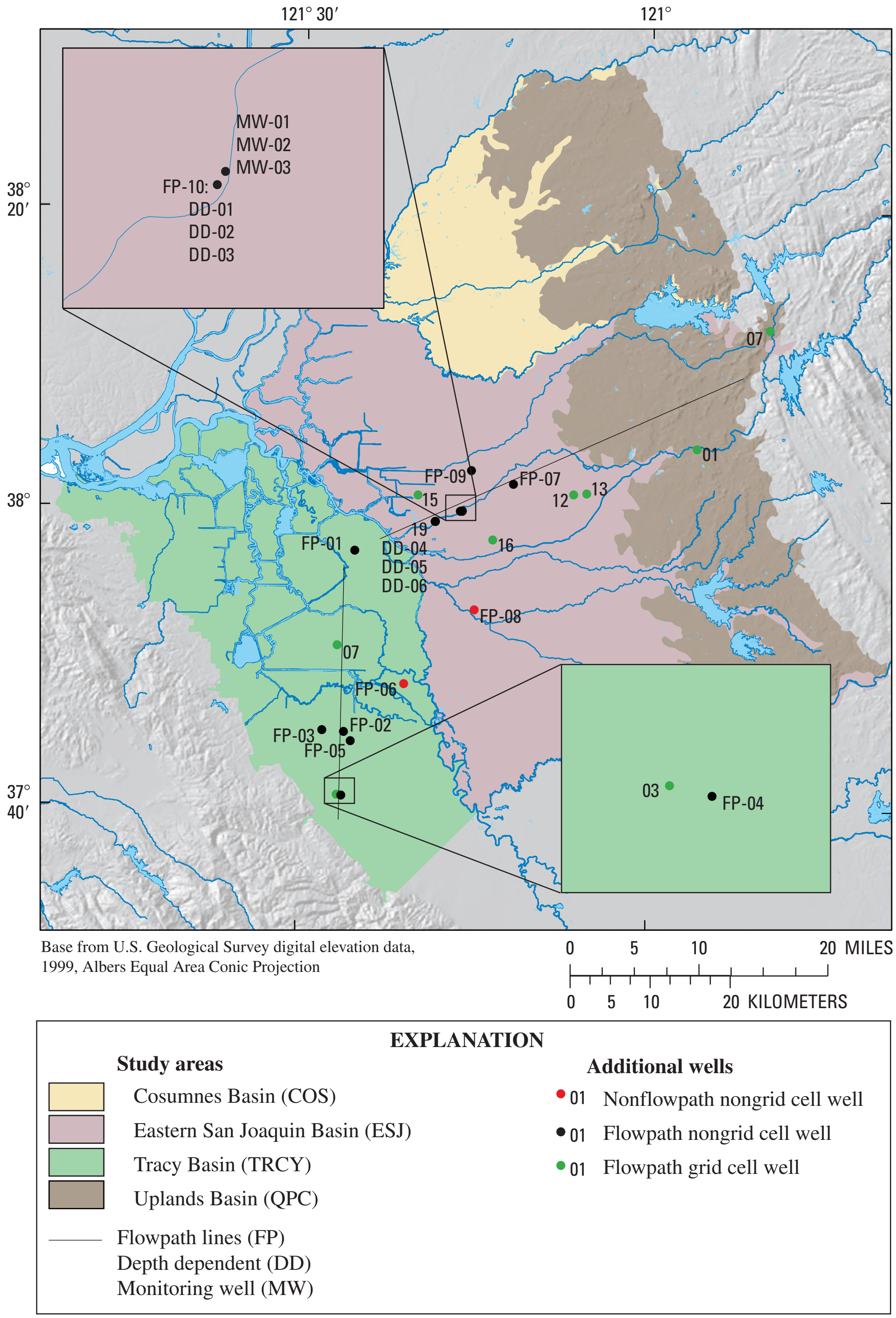



**Figure 4.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and distribution of additional wells sampled.

Ground-water samples were collected from the selected wells using standard and modified USGS protocols (U.S. Geological Survey, 1999; Koterba and others, 1995) and protocols described by Weiss, 1968; Shelton and others, 2001; Ball and McClesky, 2003a,b; and Wright and others, 2005, which helps ensure that a representative sample was collected from the aquifer. Public-supply, domestic, and irrigation wells were sampled using Teflon tubing with brass and stainless-steel fittings attached to a sampling point on the well discharge pipe as close to the well as possible. If a site was sampled using the fast or intermediate analyte list, a modified USGS protocol was used and samples were collected at the sampling point using a foot-long section of Teflon tubing after a total of three casing volumes were extracted from the well. If a site was sampled using the slow analyte list, including monitoring wells, USGS ground-water sampling protocols were followed and samples were collected inside an enclosed chamber located in a mobile water-quality laboratory once field parameters (pH, DO, and SC) measured in a flow-thru chamber fitted with a multiprobe meter became stable. Field parameters were considered stable once their measurements, taken every five minutes, were consistent for at least 20 minutes. Monitoring wells were sampled using a portable, stainless-steel submersible pump attached to Teflon tubing with stainless-steel fittings.

For depth-dependent samples, ground water was pumped to the surface using a gas-displacement small-diameter pump to collect samples at discrete depths within the well bore (Izbicki, 2004). The sampling equipment consisted of two 1/8-in.-diameter Teflon tubes bundled together to form a single strand mounted on a motorized reel. Once lowered to the desired depth, compressed ultra-high purity (grade 5) nitrogen gas was used to displace water from one line into the other while one-way flow valves prevented the displaced water from flowing back toward the pump at the lower end of the hose (Izbicki, 2004). Repeated pressurization and depressurization of the lines was used to slowly bring the water at depth to the surface where it could be collected following the protocols described for the fast and intermediate analyte lists.

When possible, samples were collected before any type of filtration or chemical treatment, such as chlorination. Chlorination of the water, however, could not be avoided at one public-supply well (ESJ-19). At this well, 25 milligrams (mg) of powdered ascorbic acid was added to all of the organic samples as a preservative to prevent organic compound degradation as a result of exposure chlorine. At the site where chlorination took place in the well bore, the chlorinator was shut off at least 24 hours prior to sampling to minimize the degree of chlorination of the sample water.

## Laboratory Methods

Ten laboratories performed chemical and microbial analyses for the Northern San Joaquin Basin GAMA study unit ground-water samples. *Table 4* lists the analyte, analytical method, laboratory at which each analysis was conducted, and method citation.

## Data Reporting and Constituents on Multiple Analytical Schedules

As summarized in the San Diego GAMA study unit data report by Wright and others, (2005) the USGS's National Water Quality Laboratory (NWQL) uses laboratory reporting levels (LRLs), long-term method detection limits (LT-MDLs), interim reporting levels (IRLs), method detection limits (MDLs), and Minimum Reporting Levels (MRLs) to communicate the level at which method performance is sufficient to allow for quantitative measurement of an analyte. These reporting levels each serve to minimize the reporting of false-negative and false-positive readings. Some concentrations in the Northern San Joaquin Basin unit study are reported using method uncertainties. The method uncertainty generally indicates the precision of a particular analytical measurement, and therefore, indicates the range of values wherein the true value will be found.

**MDLs**—"Minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. It is determined from the analysis of a sample in a given matrix containing the analyte (U.S. Environmental Protection Agency, 2002a). At the MDL concentration, the risk of a false positive is predicted to be less than or equal to 1 percent" (Childress and others, 1999).

**LT-MDLs**—"A detection level derived by determining the standard deviation of a minimum of 24 MDL spike sample measurements over an extended period of time. LT-MDL data are collected continually to assess year-to-year variations in the LT-MDL. The LT-MDL controls false-positive error. The chance of falsely reporting a concentration at or greater than the LT–MDL for a sample that did not contain the analyte is predicted to be less than or equal to 1 percent" (Childress and others, 1999).

**LRLs**—"Generally equal to twice the yearly determined LT-MDL. The LRL controls false-negative error. The probability of falsely reporting a nondetection for a sample that contained an analyte at a concentration equal to or greater than the LRL is predicted to be less than or equal to 1 percent. These values are re-evaluated annually using the most current QC data and may, therefore, change" (Childress and others, 1999).

**IRLs**—"A temporary reporting level used for new or custom schedules when LT-MDL data are unavailable and a LRL has not been established" (U.S. Geological Survey, 2005).

**MRLs**—"Smallest measured concentration of a constituent that may be reliably reported by using a given analytical method" (Timme, 1995).

The reporting levels for selected radioactive constituents (gross-alpha radioactivity, gross-beta radioactivity, radium-226, and radium-228) are based on a sample-specific minimum detectable concentration (SSMDC), a critical value (also sample specific), and the combined standard uncertainty (CSU) (U.S. Environmental Protection Agency and others, 2004). In this report, a result above the critical value represents a greater-than-95-percent certainty that the result is greater than zero (significantly different from the instruments background response to a blank sample), whereas a result above the SSMDC represents a greater-than-95-percent certainty that the result is greater than the critical value (U.S. Environmental Protection Agency and others, 2004). Using these reporting level elements, three unique cases were possible when screening the raw analytical data. First, if the analytical result is less than the critical value (case 1), the analyte is considered not detected, and a value is presented in the table as less than the SSMDC. If the analytical result is greater than the critical value, the ratio of the CSU to the analytical result (relative CSU) was calculated as a percent. For those samples with results that have a relative CSU less than 20 percent, the analytical result is reported unqualified (case 2). For those samples with results that have a relative CSU greater than 20 percent, the analytical results were qualified as estimated values and are preceded in the table with an "E" (case 3). For table clarity, only the screened results are reported here. The unnamed table provided below gives an example of the screening process for each of the three cases described above.

Twenty-four constituents targeted in the Northern San Joaquin Basin GAMA study unit are analyzed on more than one analytical schedule (*table 5*). Some analytical schedules are preferred over others because the methodology is more accurate and precise, and generally yields a greater sensitivity for a specific constituent. When a constituent appears on multiple analytical schedules, only the detections determined by the preferred analytical schedule are reported.

## Quality-Control Procedures and Results

QC samples were collected concurrently with approximately 10 percent of the samples in Northern San Joaquin Basin GAMA study unit. QC samples are collected to assess the bias and variability of ground-water data potentially introduced during sample collection, processing, storage, transportation, and laboratory analysis, as well as intrinsic variability within the ground water itself. Four types of QC samples were analyzed: blanks, sequential field replicates, laboratory surrogate compounds, and laboratory matrix spikes.

### Blanks

Three types of blanks were collected for the Northern San Joaquin Basin GAMA study unit: source-solution, equipment, and field. All blanks were collected using nitrogen-purged blank water that was certified to be free of VOCs, pesticides, wastewater-indicator constituents, low-level nutrients, dissolved organic carbon, major ions, and trace elements above their reporting levels. Associated blanks and ground-water samples in this study are defined as samples that were collected at the same site.

| Scenario | Critical value (pCi/L) | SSMDC (pCi/L) | Combined standard uncertainty (pCi/L) | Relative CSU (percent) | Raw result (pCi/L) | Reported result (pCi/L) |
|---|---|---|---|---|---|---|
| Case 1—Result less than critical value | 1.4 | 3.2 | ±1.2 | 133 | 0.9 | <3.2 |
| Case 2—Relative combined standard uncertainty less than 20 percent | 0.4 | 1.1 | ±0.5 | 14 | 3.2 | 3.2 |
| Case 3—Relative combined standard uncertainty greater than 20 percent | 0.5 | 1.4 | ±0.6 | 32 | 2.0 | [1]E2.0 |

[1]Estimated.

**Source-solution blanks**—Source-solution blanks were collected to verify that the blank water (source solution) used for the associated equipment and field blanks had no detectable concentrations of VOCs, pesticides, pesticide degradates, or wastewater-indicator constituents. Source-solution blanks were analyzed for VOCs, pesticides, and wastewater-indicator constituents because some of these chemicals are volatile and ubiquitous, and could contaminate the blank water used for QC purposes. Source-solution blanks were collected at the sampling site by pouring blank water directly into sample containers that were then stored, shipped, and analyzed in the same manner as the other blanks and ground-water samples.

**Equipment blanks**—Equipment blanks were analyzed to evaluate the sampling pumps used to collect depth-dependent and monitoring-well samples to determine if the equipment could introduce contaminants to the samples. The equipment blank for the depth-dependent sampler was collected at the USGS's California Water Science Center (CWSC) San Diego Projects Office. The equipment blank for the portable submersible pump used to sample the monitoring wells was collected at the USGS's CWSC Sacramento Field Office.

**Field blanks**—Field blanks were collected at selected sampling sites and were used to evaluate potential bias introduced by sampling equipment, processing, shipping, and analysis. Depending on the list of analytes (depth dependent, slow, intermediate, or fast) collected at a particular sampling site, blank water was either pumped or poured through the same sampling equipment (fittings and tubing) used to collect the ground-water samples, then processed and transported using the same protocols that were used for the ground-water samples.

A constituent was of potential QC concern if the following criteria were met: (1) a constituent was detected in one or more equipment or field blanks and in ground-water samples, (2) the concentration detected in the equipment or field blank was greater than the concentration in the associated source-solution blank, and (3) the minimum concentration detected in ground-water samples was less than the maximum concentration detected in field blanks plus one half of that constituent's reporting level. If the results for a constituent met the above criteria, the pattern of detections in blanks and ground-water samples was evaluated. If a constituent was detected in the field blanks, but not in the associated ground-water sample, then the ground-water data were not censored. If a constituent was detected in at least one associated blank and ground-water sample at similar concentrations, then all detections in ground-water samples were censored.

Detections in ground-water samples that were determined to be of QC concern were censored and counted as nondetections; however, the measured values are reported here and flagged within the appropriate tables with a "V" remark code. The threshold for censoring data was determined by summing the highest blank concentration with the LT-MDL or MDL for the constituent in question. For example, if the highest concentration of toluene in a field blank was 0.02 micrograms per liter (µg/L), and the LT-MDL for toluene is 0.02 µg/L, then the concentration of toluene in the associated ground-water sample would have to be greater than, or equal to, 0.04 µg/L to be considered a numerical value. This method of censoring is based on the assumption that the amount of contamination in the field blank and the associated ground-water sample(s) are comparable. Therefore, detections in ground-water samples that are not censored will have at least a concentration equal to, or greater than the LT-MDL or MDL.

## Source-Solution Results

Detections of constituents within the source-solution water may help explain detection within the equipment and field blanks conducted as part of this study. If any such detection within the blank water aids in the explanation of a blank detection, it will be evaluated in the equipment and field blank results sections.

### Depth-Dependent Equipment Blank Results

*Table 6* summarizes the depth-dependent equipment blanks collected on January 4, 2005, by the CWSC San Diego Projects Office using the depth-dependent sampling pump. Wastewater-indicator constituents, constituents of special interest, and pesticide and pesticide degradate constituents were not detected in the depth-dependent equipment blank. Constituents detected in the depth-dependent equipment blank, but interpreted to be of no concern, included the major ions calcium, magnesium, and silica as well as the trace elements barium, strontium, and zinc. These analytes were detected in the blank samples; however, their concentrations were all well below the concentrations observed in ground-water samples collected using the depth-dependent equipment.

Toluene was detected in the depth-dependent equipment blank as well as the associated source-solution blank. The depth-dependent equipment was used to collect six ground-water samples in the Northern San Joaquin Basin GAMA study unit, and toluene was detected in all of those samples within the range of concentrations observed in the equipment blank. Given the numerous occurrences of toluene in ground water and blank samples collected throughout the Northern San Joaquin GAMA study unit, regardless of equipment type, all occurrences of toluene in ground water at or below the censor limit (0.31 µg/L) were censored.

Tentatively identified compounds (TICs), detected in the depth-dependent equipment blank included hexofluoropropene (Chemical Abstracts Service [CAS] number 116-15-4), pentafluoropropene (CAS number 690-27-7), and an unknown compound. These constituents were not identified in the associated source-solution blank. TICs are identified by comparison with the National Institute for Standards and Technology library spectra and examination by a gas chromatography/mass spectrometry (GC/MS) analyst. Reported concentrations of TICs are approximate (Connor and others, 1998). These TICs were also identified in ground-water samples collected using the depth-dependent equipment. The minimum concentration of hexofluoropropene in ground water was below the level detected in the equipment blank, suggesting contamination. Pentafluoropropene and the unknown constituent were each detected in two ground-water samples. In all three cases, the concentrations in ground-water samples were at the same level or below the equipment-blank concentrations, suggesting the detections were the result of equipment contamination; therefore, these constituent concentrations were censored.

Manganese was detected in the depth-dependent equipment blank at a concentration greater than the minimum detection in ground water, suggesting contamination. Therefore, values less than 0.7 µg/L (maximum concentration in the equipment blank plus the LT-MDL) were censored.

The concentration of total nitrogen (nitrate, nitrite, ammonia, and organic nitrogen) in the depth-dependent equipment blank was 0.2 milligrams per liter (mg/L), whereas the minimum concentration in ground-water samples collected using the same equipment was 0.04 mg/L. Because the equipment blank concentration was greater than the minimum concentration in ground water, values of total nitrogen less than or equal to 0.23 mg/L were censored.

### Portable Pump Equipment Blank Results

*Table 7* summarizes the results from the portable pump equipment blank collected on January 27, 2005, at the CWSC Sacramento Field Office. TICs, constituents of special interest, pesticide and pesticide degradate constituents, as well as nutrients and dissolved organic carbon were not detected in the portable pump equipment blank used to sample three monitoring wells in the Northern San Joaquin Basin GAMA study unit. Detections in the portable pump equipment blank of the major ion silica and the trace element vanadium had concentrations well below those observed in ground water and are, therefore, interpreted to have a minimal effect on the measured concentrations of these constituents in ground water. The VOC benzene was also detected in the portable equipment blank; however, it was not detected in any ground-water samples collected using this equipment; therefore potential contamination can be ruled out. It should be noted that samples collected using this equipment also pass through sample lines used in the GAMA mobile laboratory camper vehicle. Therefore, constituent detections may not be directly attributed to the portable pump.

In addition to benzene, five VOCs—1,2,4-trichlorobenzene, ethylbenzene, *m*-and *p*-xylene, *o*-xylene, and toluene—were detected in the portable pump equipment blank. Three ground-water samples were collected using this equipment. Within the second of those three ground-water samples, ethylbenzene, *m*-and *p*-xylene, *o*-xylene, and 1,2,4-trichlorobenzene were detected. The concentrations at which they were detected were within the same range of concentrations observed in the equipment blank for the same constituents. One sample a day for three consecutive days was collected using this equipment. The first ground-water sample collected (sample 1) using this equipment following the collection of the equipment blank yielded no detections of the previously listed constituents; however, the sample collected the following day (sample 2) did. The last sample (sample 3) collected using this equipment contained none of the previously mentioned constituents. Although these constituents were not detected in the sample immediately following the equipment blank, the similarity in the detection concentrations suggests a relation between the blank and the ground-water detections. This similarity is demonstrated in *figure 5*, which graphically compares the concentrations of the constituents detected in the equipment blank with those concentrations detected in the second ground-water sample. On the basis of this comparison, these VOCs are assumed to be the result of sample contamination. Potential sources of contamination include the cleaning procedures, vehicle exhaust, and ambient air quality. Detections of these constituents within ground-water samples collected using this equipment have, therefore, been treated as nondetects. Toluene was detected in the portable pump equipment blank and was also detected in the associated source-solution blank, but the concentration of toluene in the source-solution blank does not explain the equipment blank detection. Toluene was also detected in all of the ground-water samples collected using this equipment. Given the persistent presence of toluene in field blanks, equipment blanks, associated source-solution blanks, at concentrations similar to those observed in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit, toluene detections have been censored.

Phenol was the only wastewater-indicator constituent detected in the portable pump equipment blank. Phenol was also detected in the associated source-solution blank at a concentration greater than the equipment blank, therefore providing a source for the detection in the field blank. However, as described earlier, phenol has been a persistent contaminant in blanks across the nation (Wright and others, 2005). Therefore, all phenol detections less than or equal to 0.9 µg/L, which is the maximum blank detection (0.4 µg/L) plus the LT-MDL for phenol (0.5 µg/L) have been censored.

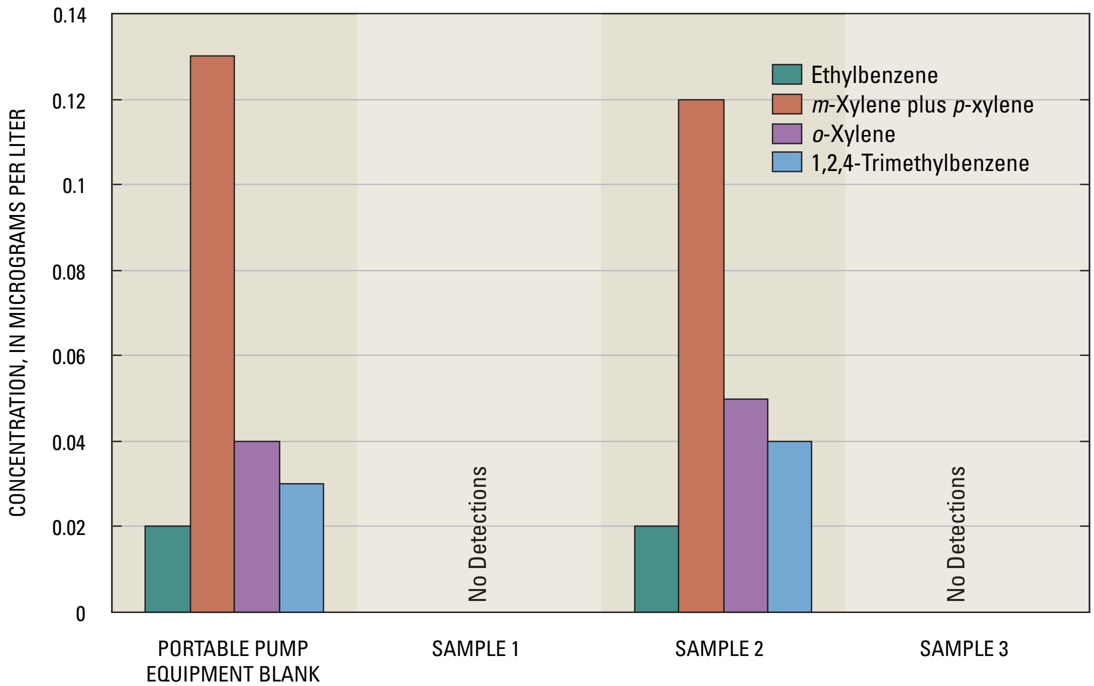



**Figure 5.** Bar graph that compares concentrations of constituents suspected to be the result of contamination detected in the portable pump equipment blank and subsequent ground-water samples collected using the same equipment.

Zinc was detected in the portable pump equipment blank at a concentration equal to the minimum concentration of zinc in ground-water samples collected using this equipment. Given that zinc contamination was present in field and equipment blanks in the Northern San Joaquin Basin GAMA study unit, any ground-water detection of zinc, regardless of equipment used, at concentrations less than 2.3 µg/L have been censored and will not be included in analyses of ground-water-quality data.

## Field Blank Results

A summary of compound detections in field blanks collected for the Northern San Joaquin Basin GAMA study unit is provided in *table 8*. Six VOCs (acetone, ethyl methyl ketone, ethylbenzene, *m*- and *p*-xylene, *o*-xylene, and toluene), one wastewater-indicator constituent (phenol), three major ions (calcium, iodide, and silica), five trace elements (barium, copper, manganese, nickel, and zinc), and DOC were detected in one or more field blanks. Constituents of special interest, TICs, and pesticides were not detected in any of the field blanks. Of the six VOCs detected in field blanks, acetone, ethylbenzene, *m*- and *p*-xylene, *o*-xylene, and ethyl methyl ketone were interpreted not to be of concern after implementing the blank contamination QC criteria outlined above. Additional constituents that were detected in field blanks, but were interpreted to be of no concern, included the major ions calcium and silica, and the trace elements barium and nickel.

The VOC toluene was detected in three field blanks as well as the associated source-solution blanks. Toluene was also detected in 16 ground-water samples collected using the same equipment tested by the field blanks. Associated source-solution blank concentrations only explain one of the field-blank detections. Therefore, toluene may be a potential laboratory or field contaminant, and ground-water samples that have reported detections of toluene may not be representative of actual toluene occurrence in the ground water. To avoid misrepresenting the occurrence of toluene in ground-water samples collected as part of the Northern San Joaquin Basin GAMA study unit, toluene detections have been censored. The censor limit is based on the maximum concentration detected in the field blanks (0.3 µg/L) plus the LT-MDL (0.01 µg/L). Therefore, any detections of toluene below the censor threshold of 0.31 µg/L was reported as not detected.

As initially reported in Wright and others (2005), phenol, a wastewater indicator, has a known history of being a persistent contaminant in field blanks collected across the nation. QC data presented by the National Water Quality Assessment's (NAWQA) Source Water Quality Assessment shows phenol present in 66 percent of field blanks collected nationwide (Wright and others, 2005). Phenol was the only wastewater-indicator constituent detected in the Northern San Joaquin GAMA study unit. Therefore, all phenol detections in this study unit were censored. The maximum concentration of phenol detected in field blanks was 0.4 µg/L (estimated value), whereas the LT-MDL for phenol at the time of reporting was 0.5 µg/L, thus the censor level was established at 0.9 µg/L. No detections of phenol in the Northern San Joaquin GAMA study unit were equal to or greater than the censor threshold.

Iodide was detected at a concentration of 0.001 mg/L (estimated value) in two field blanks collected in the Northern San Joaquin Basin GAMA study unit. Concentrations of iodide in ground-water samples ranged from 0.001 mg/L (estimated value) to 1.8 mg/L. Iodide was not detected in the associated source-solution blanks. The maximum iodide concentration in any field blank was 0.001 mg/L (estimated value), whereas the LT-MDL for iodide was 0.001 mg/L. Therefore, detections in ground water that were less than or equal to the maximum field blank concentration plus the LT-MDL (0.002 mg/L) will be censored.

The minimum concentration of copper observed in ground water was less than the maximum field-blank detection; therefore, copper detections in ground-water samples were censored using the sum of the maximum concentration observed in the field blanks (0.5 µg/L) and the LT-MDL (0.2 µg/L), which establishes a censor level of 0.7 µg/L. Manganese was detected in one field blank within the range of manganese detections in ground water. Therefore, manganese concentrations in ground water below 0.2 µg/L have been censored. Zinc was detected in all four trace element field blanks, yet it was not detected in any of the associated source-solution blanks. The minimum concentration of zinc detected in ground water was less than the maximum field-blank concentration. Therefore, zinc detections in ground-water samples that were below 2.3 µg/L have been censored.

Thirty-nine ground-water samples collected in the Northern San Joaquin Basin GAMA study unit were analyzed for the oxidation species of arsenic, chromium, and iron at the USGS's Trace Metal Laboratory in Boulder, Colorado. In addition to the 39 environmental samples, four field blanks were also analyzed. Total arsenic, which is the sum of all dissolved arsenic species in a sample, and arsenic(V), which is measured independently, were not detected in any of the four field blanks analyzed by the Trace Metal Laboratory.

Total chromium, which is the sum of all dissolved chromium species in a sample, was detected in two field blanks analyzed at the Trace Metal Laboratory. The concentration of total chromium in those field blanks was 1 µg/L and 6 µg/L. The minimum concentration in ground-water samples of total chromium was 1 µg/L. Because the maximum field blank concentration was greater then the minimum ground-water concentration, ground-water samples with concentrations less than the sum of the maximum field blank concentration (6 µg/L) and the MDL (1 µg/L) were censored. This procedure established a censor threshold of 7 µg/L for total chromium samples analyzed at the Trace Metal Laboratory and resulted in the censoring of 21 detections of total chromium (*table 8*).

Hexavalent chromium (chromium(VI)), which is measured independently of total chromium, was detected in three field blanks analyzed at the Trace Metal Laboratory. Within the three field blank samples, hexavalent chromium was detected at concentrations of 1 µg/L, 1 µg/L, and 5 µg/L. The minimum concentration of hexavalent chromium in ground-water samples was 1 µg/L. Because the maximum field blank concentration is greater then the minimum ground-water concentration, ground-water samples less than the sum of the maximum field blank concentration (5 µg/L) and the MDL (1 µg/L) were censored. This procedure established a censor threshold of 6 µg/L for hexavalent chromium samples analyzed at the Trace Metal Laboratory and resulted in the censoring of 16 detections of hexavalent chromium (chromium(VI); *table 8*).

Total iron, which is the sum of all dissolved iron species in a sample, was detected in one of the four field blanks analyzed at the Trace Metal Laboratory, whereas iron(II), measured independently of total iron, was not detected in any. Within the field blank sample, total iron was detected at a concentration of 3 µg/L. The minimum concentration of total iron as measured by the Trace Metal Laboratory in ground-water samples was 2 µg/L. Because the maximum field blank concentration was greater then the minimum ground-water concentration, ground-water samples less than the sum of the maximum field blank concentration (3 µg/L) and the MDL (2 µg/L) were censored. This procedure established a censor threshold of 5 µg/L for total iron samples analyzed at the Trace Metal Laboratory and resulted in the censoring of 20 of 39 ground-water samples (*table 8*).

DOC was detected in two field blanks at concentrations of 0.2 mg/L (estimated value), which is below the LRL of 0.3 mg/L, yet DOC was not detected in the associated source-solution blanks. The minimum concentration detected in ground water was 0.2 mg/L (estimated value). Because the concentrations observed in the field blanks were within the range detected in ground-water samples, values of DOC below 0.3 mg/L were censored.

## Replicates and Results

Sequential replicate samples were collected to assess the variability in concentrations of inorganic and organic constituents. Because ground water moves relatively slowly, there should be little intrinsic variability between sequential replicates. Sample handling and laboratory processing can be additional sources of variability. Variability between replicates was expressed as the relative standard deviation (RSD), which is defined as the standard deviation divided by the mean concentration for each replicate pair sample, multiplied by 100 percent. If one value in a sample pair was reported as not detected, and the other value was reported as below the reporting level, the RSD was set to zero because the values are analytically identical. If one value in a sample pair was reported as not detected, and the other value was greater than the LRL or MRL, then the nondetection value was set equal to one-quarter of the LRL, which is also one half of the LT-MDL, and the RSD was calculated (Childress and others, 1999). Values of RSD less than 20 percent are considered acceptable in this study (Hamlin and others, 2002). RSD values above 20 percent for a compound may be due to analytical uncertainty at low concentrations, particularly for concentrations below the reporting level.

*Tables 9A–E* summarize replicate sample pairs with RSD greater than zero for samples collected in the Northern San Joaquin Basin GAMA study unit. For those RSD values greater than zero, the maximum RSD value and the median of all RSDs greater than zero are given. Median RSD values for replicate analyses that were greater than 20 percent include hexavalent chromium, radium-228, and gross-alpha radioactivity (both 72-hour and 30-day counts). All other median RSD values were below the acceptable threshold of 20 percent.

Of the nearly 1,500 replicate analyses, 23 were above the acceptable RSD set for this study of 20 percent, whereas most replicate analyses (1,345) had RSDs less than 10 percent. Replicate analyses with RSDs above 20 percent represent one VOC compound, one measure of DOC, six trace element constituents, and five isotope or radioactive constituents. RSDs for pesticides and pesticide degradates, nutrients, and major ions were all less than 7 percent. Nine trace elements had replicate pairs with RSDs above 10 percent (*table 9D*).

Two measures of gross alpha and beta radioactivity in water and three radioisotopes had replicate analyses RSDs that were higher than the acceptable level of 20 percent (*table 9E*). Two replicate pairs for 72-hour count gross-alpha radioactivity had high RSDs, whereas one replicate analysis of the 30-day count gross-alpha radioactivity had a high RSD. The radioisotope radium-226 had one replicate analysis slightly higher than the acceptable limit at 29 percent, whereas radium-228 had a replicate analysis with an RSD of 44 percent. Two of six replicate pairs of tritium measured by the USGS's Stable Isotope and Tritium Laboratory in Menlo Park, California, had RSDs above the acceptable limit, with one slightly higher at 22 percent and the other much higher at 141 percent.

## Laboratory Surrogates and Results

Surrogates are compounds that are not normally found in the environment, but are similar in physical and chemical properties to the target analytes. Prior to analysis at a lab, each sample analyzed for VOCs, gasoline oxygenates, NDMA, 1,2,3-TCP, pesticides, and wastewater-indicator constituents was spiked with one or more surrogate compounds. Surrogate recovery data are used to evaluate the capability of the analysis methods to detect the target analytes in each sample and to assess bias and variability attributed to matrix effects and gross sample-processing errors. Surrogate data in blank samples are used to identify general problems that may arise during sample analysis: surrogate data in ground-water, replicate, and spike samples are used to evaluate matrix interferences. For most of the analytical schedules, a 70- to 130-percent recovery of surrogates is generally considered acceptable (Hamlin and others, 2002). However, the NWQL analytical schedule for wastewater-indicator constituents (1433) has higher control limits; therefore, recoveries of 100 percent may not be expected under ideal conditions. In the case of the Schedule 1433 analytes, a 70- to 130-percent recovery may be inappropriate. In samples with low surrogate recoveries (less than 70 percent), target analytes may not have been detected when they were present at low concentrations. Samples with high surrogate recoveries (greater than 130 percent) indicate that the target analytes will be detected if present; however, the concentrations measured in these samples may be greater than the actual concentration. When all surrogates for a sample are outside of the acceptable range, there could have been an issue with the analytical methods. When one or more surrogates for a sample are outside of the acceptable range, then the sample chemistry may be interfering with the capability of the analytical methods to detect and quantify the target analytes (matrix interference).

*Table 10* summarizes the surrogate recoveries for ground-water and QC samples. Median surrogate recoveries for nonblank samples were acceptable, except for the wastewater-indicator surrogates decafluorobiphenyl and bisphenol A-d3, which had low median surrogate recoveries. Median surrogate recoveries for the blank samples were acceptable, with the exception of caffeine-13C, which was above the 130-percent threshold, and bisphenol A-d3, which was below the 70-percent threshold.

Surrogate compounds added to samples analyzed for VOCs and gasoline oxygenates include isobutyl alcohol-d6, 1,2-dichloroethane-d4, 1-bromo-4-fluorobenzene, and toluene-d8. Recoveries for the surrogate compound isobutyl alcohol-d6 were below the acceptable limit of 70 percent in two ground-water samples and one replicate sample. The recovery for the surrogate compound 1,2-dichloroethane-d4 was above the acceptable limit of 130 percent in one ground-water sample. Recoveries for the surrogates 1-bromo-4-fluorobenzene and toluene-d8 were all within the acceptable range of 70 to 130 percent.

Surrogate compounds added to samples for pesticide analysis included $\alpha$-HCH-d6, barban, caffeine-13c, diazinon-d10, and 2,4,5-T. Recoveries for the surrogate compound diazinon-d10 were below the 70-percent threshold in 26 samples (20 ground-water samples, four blank samples, and two replicate pairs). Recoveries for the surrogate compound $\alpha$-HCH-d6 were above the 130-percent threshold in two ground-water samples. Seven of the 20 ground-water samples with diazinon-d10 surrogate recoveries below 70 percent had pesticide detections, whereas the two ground-water samples with recoveries of $\alpha$-HCH-d6 above 130 percent had no detections of pesticides. Sixteen ground-water samples, three blanks, two spiked samples, and two replicate pairs were analyzed for recoveries of 2,4,5-T, barban, and caffeine-13C. The surrogate compound 2,4,5-T was recovered below the 70-percent threshold in four ground-water samples, two spiked samples, and two replicate pairs. Caffeine-13C was detected above the 130-percent threshold in six ground-water samples, two blank samples, and one replicate pair.

Surrogate compounds added to samples for wastewater-indicator analysis include bisphenol A-d3, caffeine-13C, decafluorobiphenyl, and floranthene-d10. Of those four compounds, only fluoranthene-d10 was recovered within the acceptable range (between 70 and 130 percent) of recoveries in all analyses. Conversely, 25 analyses of the surrogate compound bisphenol A-d3 were below the 70-percent threshold, 11 of 26 analyses of caffeine-13C were below the 70-percent threshold, and the surrogate compound decafluorobiphenyl was detected below the 70-percent threshold in 18 of 26 analyses. On the basis of the high number of surrogate recoveries within the wastewater-indicator samples below the 70-percent threshold analyses of constituents within this schedule, the results may be biased, which may be the result of sample processing or analytical method problems, or both.

For the constituents of special interest, which were analyzed at the Montgomery Watson Harza Laboratory, the surrogate constituents toluene-d8 and NDMA-d6 were added to 34 ground-water samples, 12 blanks (NDMA-d6 was only added to ten blanks), five spiked samples, and four replicate pairs. Toluene-d8 was recovered within the acceptable range of 70 to 130 percent in all cases, whereas NDMA-d6 was recovered below the 70-percent threshold in one of the replicate pairs.

## Laboratory Matrix Spikes and Results

Laboratory matrix spikes are QC samples used to evaluate the bias and variability of analytical results attributed to potential interferences from the chemistry of the ground water sampled (matrix interferences). Laboratory matrix spikes are prepared by adding solutions containing known concentrations of target analytes to replicate ground-water samples before sample preparation and analysis at the lab. The constituents added in matrix spikes are the same as those being analyzed. Constituents with low recoveries, generally less than 70 percent, are of potential concern because the constituent may not have been detected if present in ground water at low concentrations. Low recoveries are also a concern if environmental concentrations are close to an MCL, because low spike recoveries indicate that the true concentration of the target analyte could be greater than the reported concentration. Conversely, constituents with high recoveries, generally greater than 130 percent, are of potential concern if the environmental concentrations are above MCLs, because a high spike recovery could indicate that the true concentration of the target analyte is lower than the reported concentration. Recoveries between 70 to 130 percent for matrix spikes were considered acceptable in this study (Hamlin and others, 2002). Matrix-spike recoveries were background-corrected by subtracting the concentrations of any spike analytes detected in the nonspiked samples.

A summary of matrix-spike recoveries for the Northern San Joaquin Basin GAMA study unit is provided in *tables 11A–C*. Four VOCs had matrix-spike recoveries greater than the acceptable limit of 130 percent (*table 11A*). Of those four, only two were detected in ground-water samples: bromodichloromethane was detected in five ground-water samples and bromomethane was detected in one ground-water sample. The concentration of the single detection of bromomethane in ground water was too low to be quantified. Neither bromomethane nor bromodichloromethane have an MCL. Seven VOCs had matrix-spike recoveries below the 70-percent threshold. Of those seven, three were detected in ground-water samples. The first two, carbon disulfide and dichlorodifluoromethane (CFC-12), are both unregulated constituents; however, two detections of CFC-12 in ground water were above the CADHS DLR of 0.5 µg/L. The herbicide 1,2-dibromo-3-chloropropane (DBCP) was detected in four ground-water samples, twice at levels above the USEPA MCL of 0.2 µg/L.

Twenty-one pesticides had at least one matrix-spike recovery greater than 130 percent (*table 11B*). Of those 21 pesticides, only imazaquin was detected in ground water; however, the concentration could not be quantified by the laboratory. No Federal or State MCL has been established for imazaquin. Sixty-four pesticides had matrix-spike recoveries below 70 percent (*table 11B*). Of these 64 pesticides, five were detected in ground water: 3,4-dichloroaniline, trifluralin, hexazinone, phorate, and deisopropyl-atrazine. None of the pesticides with a low matrix-spike recovery are regulated constituents.

Only one wastewater-indicator constituent, 4-Nonylphenoldiethoxylate, had a matrix-spike recovery greater than 130 percent (*table 11C*). This compound was not detected in any ground-water samples and has no MCL. Nine wastewater-indicator constituents had matrix-spike recoveries below 70 percent. These nine constituents were not detected in any ground-water samples, and only two of the nine constituents are regulated: tetrachloroethylene and 1,4-dichlorobenzene.

# Ground-Water-Quality Results

The Northern San Joaquin Basin GAMA study unit ground-water-quality data presented in this report are archived in the USGS's National Water Information System database (NWIS), except for the following constituents: tritium and noble gases analyzed at the LLNL; chromium, arsenic, and iron speciation analyzed at the Trace Metal Laboratory; stable isotopes analyzed at the USGS's Reston Stable Isotope Laboratory (RSIL); and perchlorate, NDMA, and 1,2,3-TCP analyzed at Montgomery Watson Harza Laboratory. Data not available from NWIS are maintained by the CWSC in Sacramento, California, and are available upon request.

*Table 12* shows the general water-quality indicators determined in the field; *tables 13–23* show the results of analysis of ground-water samples organized by constituent class and are presented as follows: VOCs; gasoline oxygenates; TICs; pesticide constituents; wastewater-indicator constituents; constituents of special interest; nutrients and DOC; major inorganic ions and total dissolved solids; trace elements; chromium, arsenic and iron speciation; stable isotopes and radioactive constituents; tritium and noble gases; and microbial indicators. These tables are limited in presentation only to those constituents that were detected and only to those wells with one or more constituent detections. Each table shows the number of times a particular constituent was detected, the frequency at which that constituent was detected, and the number of constituent detections per well (or sample in the case of depth-dependent samples). Additionally, VOCs and gasoline oxygenates have been combined into one table. Constituent concentrations and radioisotope activities that are above an MCL, SMCL, NL, HA-L, RSD5, or DLR in the case of the "unregulated chemical for which monitoring is required," are highlighted in the tables in bold font. Additionally, the locations of wells with constituent detections above an MCL, SMCL, NL, HA-L, RSD5, or DLR (for those constituents which CADHS requires monitoring) have also been highlighted in *figures 6–10*.

Study areas containing nongrid cell wells in addition to the randomly selected grid cell wells have had their constituent detections divided into two categories: grid cell wells or nongrid cell wells. Nongrid cell wells were excluded from comparisons made between the four study areas because they could introduce a spatial bias as a result of increased sampling density in a particular area within the study unit. Additionally, nongrid cell wells were not used in the calculation of detection frequencies.

The chemical and microbial data presented in this report are meant to characterize the quality of the untreated ground-water resources within the Northern San Joaquin Basin GAMA study unit and are in no way intended to represent the treated drinking water delivered to consumers by water purveyors. The chemical and microbial composition of treated drinking water may differ from untreated ground water in that treated drinking water may be subjected to disinfection, filtration, mixing with other waters, and exposure to the atmosphere prior to its delivery to consumers.

## VOCs, Gasoline Oxygenates, and Tentatively Identified Compounds

*Table 13A* provides a summary of VOC and gasoline oxygenate constituents detected in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit, and *table 13B* provides a summary of the TICs detected in ground-water samples. VOCs and gasoline oxygenates constituents were collected at all wells (grid cell and nongrid cell) sampled with the exception of three gasoline oxygenate constituents (methyl acetate, *tert*-amyl alcohol, and *tert*-butyl alcohol), which were only sampled at thirteen slow analyte list wells. Thirty-seven of those 70 samples had at least a single detection of a VOC, gasoline oxygenate, or TIC (*tables 13A* and *13B*).

Thirty of the 88 VOC and gasoline oxygenate constituents analyzed were detected in ground-water samples of either the grid cell or nongrid cell wells (*table 13A*). Solvents were the most frequently detected compound class and were detected in 11 of 51 samples from the grid cell wells (22 percent). Trihalomethanes were detected in 10 of 51 samples from the grid cell wells (20 percent). Organic synthesis constituents were detected in 6 of 51 samples from the grid cell wells (12 percent). Gasoline class constituents were detected in 5 of 51 samples from the grid cell wells (10 percent). Refrigerants, the least frequently detected constituent class, were detected in 4 of 51 samples from the grid cell wells (8 percent). Chloroform, a trihalomethane, was the most frequently detected VOC and was detected in 18 percent of samples collected from the grid cell wells followed by tetrachloroethylene (PCE), which was detected in 14 percent of samples from the grid cell wells. No other VOC was detected at greater than 10 percent of the samples from the grid cell wells. No VOC analyzed was detected in ground-water samples at concentrations above an MCL, SMCL, NL, HA-L, or RSD5; however, dichlorodifluoromethane (CFC-12) a DHS "unregulated chemicals for which monitoring is required" was detected in ground-water samples from two wells (ESJ-09 and ESJFP-09) at concentrations above the CADHS DLR (*table 13A*).

In addition to the 88 VOCs targeted for analysis, 6 TICs (cyclopentane, chlorodifluoromethane (HCFC-22), dichlorofluoromethane (Freon 21), 1-pentene (C5-alkene), cyclopropane-C2, and sulfur dioxide) were detected in grid cell wells (*table 13B*). In any of the grid cell wells, only one TIC was detected more than once; cyclopentane was detected in five samples (*table 13B*). HCFC-22, Freon 21, C5-alkene, cyclopropane-C2, and sulfur dioxide were each detected in one sample.

## Pesticides and Pesticide Degradates

*Table 14* provides the summary of pesticide and pesticide degradate constituents detected in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit. A primary list of pesticide and pesticide degradate samples were collected at 63 grid and nongrid cell wells sampled (*table 2C)*. In addition, a secondary list of pesticide and pesticide degradate samples were collected at 16 grid and nongrid cell wells sampled within the study unit *(table 2D)*. The secondary pesticide constituent list sample was not uniformly sampled throughout the entire Northern San Joaquin Basin GAMA study unit; therefore, its constituents were not included in the calculation of detection frequencies within the individual study areas.

Fifteen of the 122 pesticide and pesticide degradate constituents analyzed were detected in ground-water samples. Herbicides were the most frequently detected class of pesticide: these were detected in 14 of 51 samples from grid cell wells (27 percent). Pesticide degradates, as a class, were detected in 11 of 51 samples from grid cell wells (22 percent). Simazine, an herbicide that is regulated by the USEPA, and 2-chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine), a pesticide degradate of atrazine, were the most frequently detected pesticide constituents and were each detected in eight samples (16 percent) collected from grid cell wells. Atrazine and DBCP, both regulated by the USEPA, were the second most frequently detected pesticide constituents and were each detected in four samples (8 percent) collected from grid cell wells. No other pesticide or pesticide degradate was detected in greater than 5 percent of ground-water samples from grid cell wells. The herbicide DBCP was detected in samples from two wells (COS-05 and ESJ-07) at concentrations above the USEPA MCL of 0.2 µg/L (*table 14*, *fig. 6*). The herbicide EDB was detected in a nongrid cell well (ESJFP-09) at a concentration above the USEPA MCL of 0.05 µg/L (*table 14*, *fig. 6*). No other pesticide or pesticide degradates were detected in ground-water samples at concentrations above an MCL, SMCL, NL, HA-L, or RSD5.

## Wastewater-Indicator Constituents

*Table 15* provides a summary of wastewater-indicator constituents detected in ground-water samples collected in the Northern San Joaquin Basin GAMA study unit. Sixteen samples were analyzed for wastewater-indicator constituents collected from thirteen wells, and three additional depth-dependent samples were collected at ESJ-19. Wastewater-indicator constituents were not uniformly collected throughout the study unit; therefore, constituent detections will not be used when calculating detection frequencies throughout the entire Northern San Joaquin Basin GAMA study unit. Additionally, the following summary of wastewater-indicator constituent detections is presented without separating grid cell and nongrid cell wells because wastewater-indicator constituents were collected exclusively at "slow" analyte list wells, which were typically nongrid cell wells.

Six different wastewater-indicator constituents were identified in ground water. Thirteen of the 16 samples had at least a single detection of a wastewater-indicator constituent. The most frequently detected wastewater-indicator constituent was isophorone, which was detected in 7 of 16 ground-water samples in which it was analyzed (44 percent). Two compounds, 4-nonylphenol and benzophenone, were detected in the same four wells and were the second and third most frequently detected wastewater-indicator constituents. Caffeine was detected in 3 of 16 samples. The least frequently detected wastewater-indicator constituents were bisphenol A and tris (dichloroisopropyl) phosphate, each detected in only one of the 16 samples collected. None of the wastewater-indicator constituents detected in ground-water samples collected for this study were detected above an MCL, SMCL, NL, HA-L, or RSD5.

## Perchlorate, *N*-Nitrosodimethylamine, and 1,2,3-Trichloropropane

*Table 16* provides a summary of detections of perchlorate, NDMA, and 1,2,3-TCP in ground-water samples that were collected at 34 grid and nongrid cell wells throughout the Northern San Joaquin Basin GAMA study unit. These constituents of special interest were not uniformly collected at all wells in the Northern San Joaquin Basin GAMA study unit, and therefore, these constituents will not be used for calculating detection frequencies throughout the study unit.

Perchlorate, a CADHS "unregulated chemical for which monitoring is required," was detected at a concentration of 0.7 µg/L in a depth-dependent sample (ESJDD-03) collected at a depth of 500 ft within the ESJFP-10 well (*table 16*). Concentrations of constituents detected using the depth-dependent sampler were not corrected for potential dilution as a result of mixing with water from above or below the point at which the samples were collected. Perchlorate was also detected at a concentration of 1 µg/L in ground-water samples from ESJ-16 (*table 16*). The DLR for perchlorate is 4 µg/L and the CADHS NL is 6 µg/L, both of which are greater than the detected concentrations observed in the Northern San Joaquin Basin GAMA study unit. Drinking-water standards have not been established for NDMA or 1,2,3-TCP; however, both have CADHS NLs, and 1,2,3-TCP is on the CADHS list of "unregulated chemicals for which monitoring is required." NDMA and 1,2,3-TCP were not detected in any ground-water samples collected as part of this investigation of the Northern San Joaquin Basin GAMA study unit.

## Nutrients and Dissolved Organic Carbon

*Table 17* provides a summary of nutrient and DOC detections in ground-water samples collected from the Northern San Joaquin GAMA study unit. Eighteen ground-water samples were collected for nutrients (13 wells and 5 depth-dependent samples), whereas only 10 ground-water samples were collected for DOC. Nitrite plus nitrate was detected in 11 ground-water samples (excluding the depth-dependent analyses), whereas nitrite was detected in only two ground-water samples. Concentrations of nitrite plus nitrate were not above the USEPA MCL of 10 mg/L (as nitrogen). Similarly, the concentrations of nitrite in ground-water samples were below the USEPA MCL of 1 mg/L (as nitrogen). DOC was detected in 5 of the 10 ground-water samples in which it was analyzed, with values ranging from 0.3 to 9.6 mg/L.

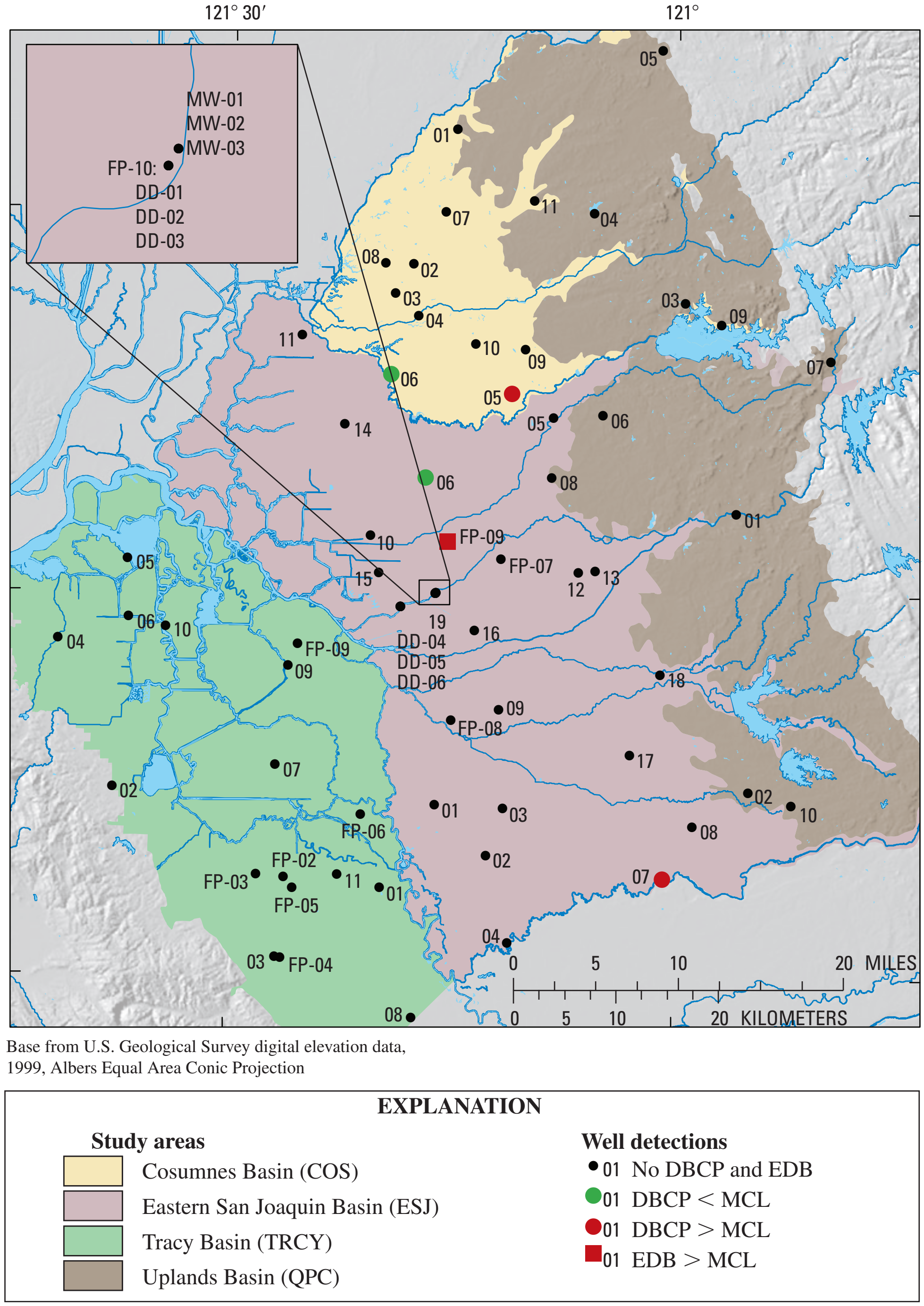



**Figure 6.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and locations of wells sampled for DBCP and EDB with detections referenced to the Maximum Contaminant Level (MCL).

## Major and Minor Ions and Total Dissolved Solids

*Table 18* provides a summary of major ions and TDS detections and concentrations obtained in the Northern San Joaquin GAMA study unit. Thirty-nine ground-water samples (33 wells and 6 depth-dependent samples) were analyzed for 10 major and minor ions as well as TDS. Ground-water samples from TRCYFP-01 and TRCY-07 had chloride concentrations above the CADHS chloride SMCL of 250 mg/L (*fig. 7A*). Ground-water samples from TRCYFP-02, TRCYFP-04, and TRCY-07 had sulfate concentrations above the USEPA recommended SMCL of 250 mg/L (*fig. 7B*). Eight ground-water samples had TDS concentrations above the USEPA recommended SMCL of 500 mg/L (*table 18, fig. 7C*). All eight ground-water samples with TDS concentrations above the USEPA SMCL were from wells located within the Tracy Basin study area. Of all the ground-water samples collected outside of the Tracy Basin study area at which TDS was measured, the maximum concentration was 355 mg/L.

## Trace Elements

*Table 19* provides a summary of trace element detections in ground water analyzed by the NWQL. Thirty-nine samples (33 wells and 6 depth-dependent samples) were analyzed for 25 trace elements (*table 2I*). Additionally, *table 20* provides a summary of arsenic, chromium, and iron speciation analyses conducted at the Trace Metal Laboratory. The Trace Metal Laboratory is used in this study because this laboratory is able to provide analyses of hexavalent chromium (chromium(VI)), identified by the CADHS as an "unregulated chemical for which monitoring is required." Of the 22 trace elements analyzed by NWQL, the dissolved total arsenic, total chromium, and total iron analyzed by *both* NWQL and the Trace Metal Laboratory and the arsenic(III), chromium(VI), and iron(II) species analyzed at the Trace Metal Laboratory, 14 have MCLs, 5 have HA-Ls, and 3 have NLs (*table 2I*). Additionally, boron, manganese, and vanadium are listed as CADHS "unregulated chemicals for which monitoring is required" and, therefore, can be compared with their CADHS DLRs (*table 2I*). Trace element detections in ground-water samples that were above their respective MCLs, HA-Ls, NLs or DLRs include arsenic, boron, hexavalent chromium, iron, manganese, and vanadium (*table 19*). Only those trace elements with detections greater then an MCL, HA-L, NL, or DLR are discussed.

Total dissolved arsenic, analyzed by both NWQL and the Trace Metal Laboratory, was detected in all 39 samples in which it was analyzed. Arsenic was detected in three samples above the USEPA MCL of 10 µg/L (*tables 19, 20,* and *fig. 8A*).

Boron, a CADHS "unregulated chemical for which monitoring is required," was analyzed by NWQL and was also detected in all 39 ground-water samples. Five samples (13 percent) analyzed for boron had concentrations above the CADHS NL of 1,000 µg/L (*table 19* and *fig. 8B*), whereas 11 samples (28 percent) had boron concentrations above the CADHS DLR of 100 µg/L (*table 19*).

Hexavalent chromium (chromium(VI)) was analyzed by the Trace Metal Laboratory and was detected in all 39 ground-water samples. However, an anomalously high concentration of hexavalent chromium in a field blank sample (5.4 µg/L) resulted in the application of a relatively high censoring threshold. Detections below the censoring threshold are considered nondetects, are preceded by a "V" in *table 20*, and will not be used in any additional ground-water analysis; however, the reported concentrations are still listed for comparative purposes. After applying the censoring threshold of 5.5 µg/L, 23 out of the 39 samples were censored, leaving 16 hexavalent chromium detections with concentrations above the CADHS DLR of 1 µg/L (*table 20*). Given the application of a censor threshold and the uncertainty of contamination in samples with concentrations of total dissolved chromium and hexavalent chromium above the censor limit, all detections in *table 20* above the censor threshold are preceded by an "E," indicating that their concentrations are potentially biased high.

Total dissolved iron, measured by both NWQL and the Trace Metal Laboratory, was detected in three samples (TRCY-07, TRCY-09, and TRCYFP-01) at concentrations above its USEPA SMCL of 300 µg/L (*tables 19, 20, and fig. 8C*). One of four field blank samples analyzed at the Trace Metal Laboratory contained iron at a concentration of 3 µg/L, which was greater than the minimum detected ground-water concentration. This resulted in the establishment of a censor threshold of 5 µg/L and the censoring of 14 total dissolved iron detections from the Trace Metal Laboratory.

Manganese, analyzed by the NWQL, was detected in three ground-water samples at concentrations above the CADHS NL of 500 µg/L (*table 19 and figure 8D*). Additionally, manganese was detected in 8 of 39 ground-water samples above its USEPA SMCL of 50 µg/L (*table 19*).

Lastly, vanadium, an "unregulated chemical for which monitoring is required," was analyzed by NWQL and detected in 38 ground-water samples, of which 33 (85 percent) were above the CADHS DLR of 3 µg/L. However, none of the vanadium detections in ground-water samples were above the CADHS NL of 50 µg/L (*table 19*).

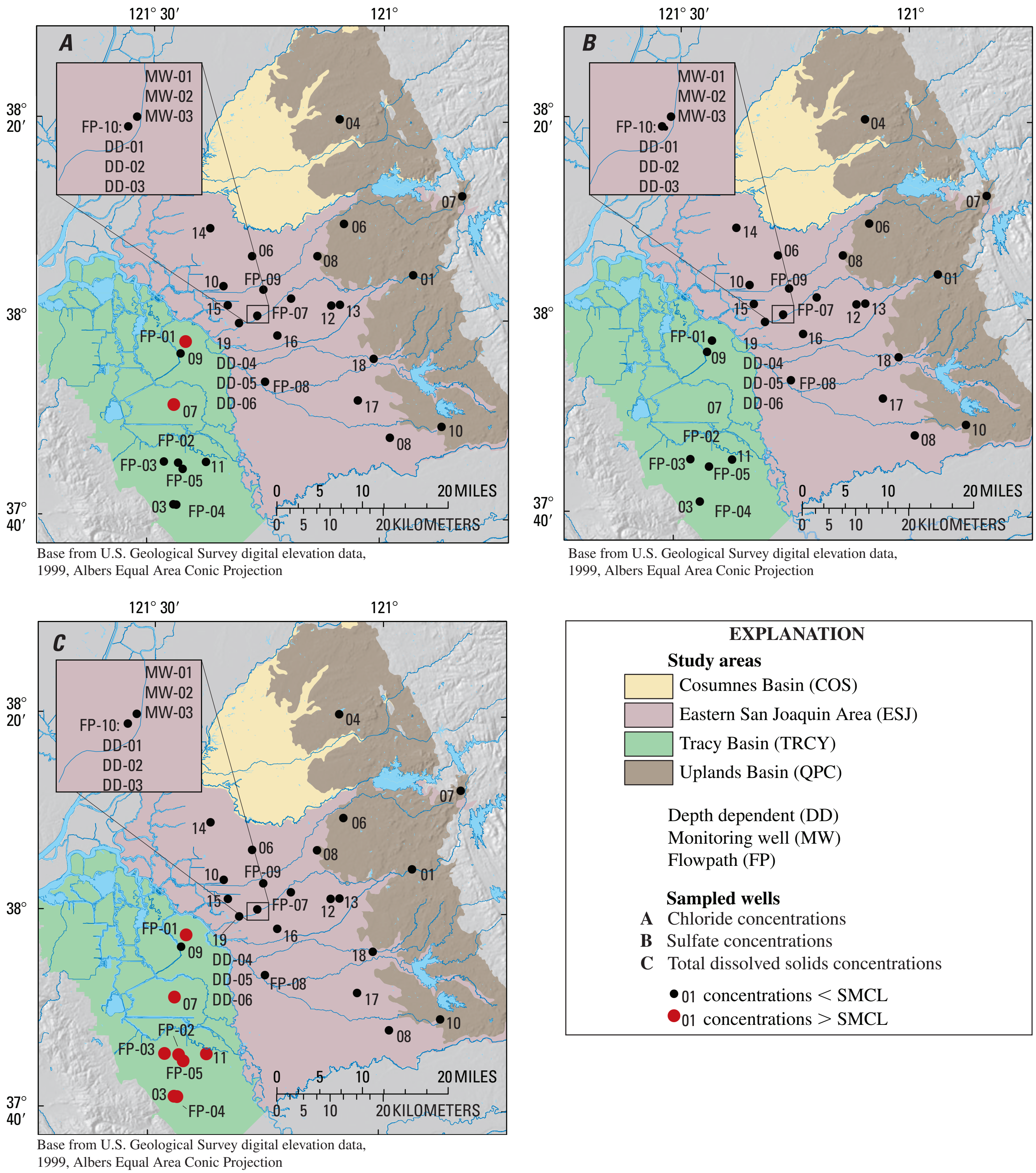



**Figure 7.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and locations of wells sampled with detections referenced to the Secondary Maximum Contaminant Level (SMCL). *A*, wells sampled for chloride. *B*, wells sampled for sulfate. *C*, wells sampled for total dissolved solids.

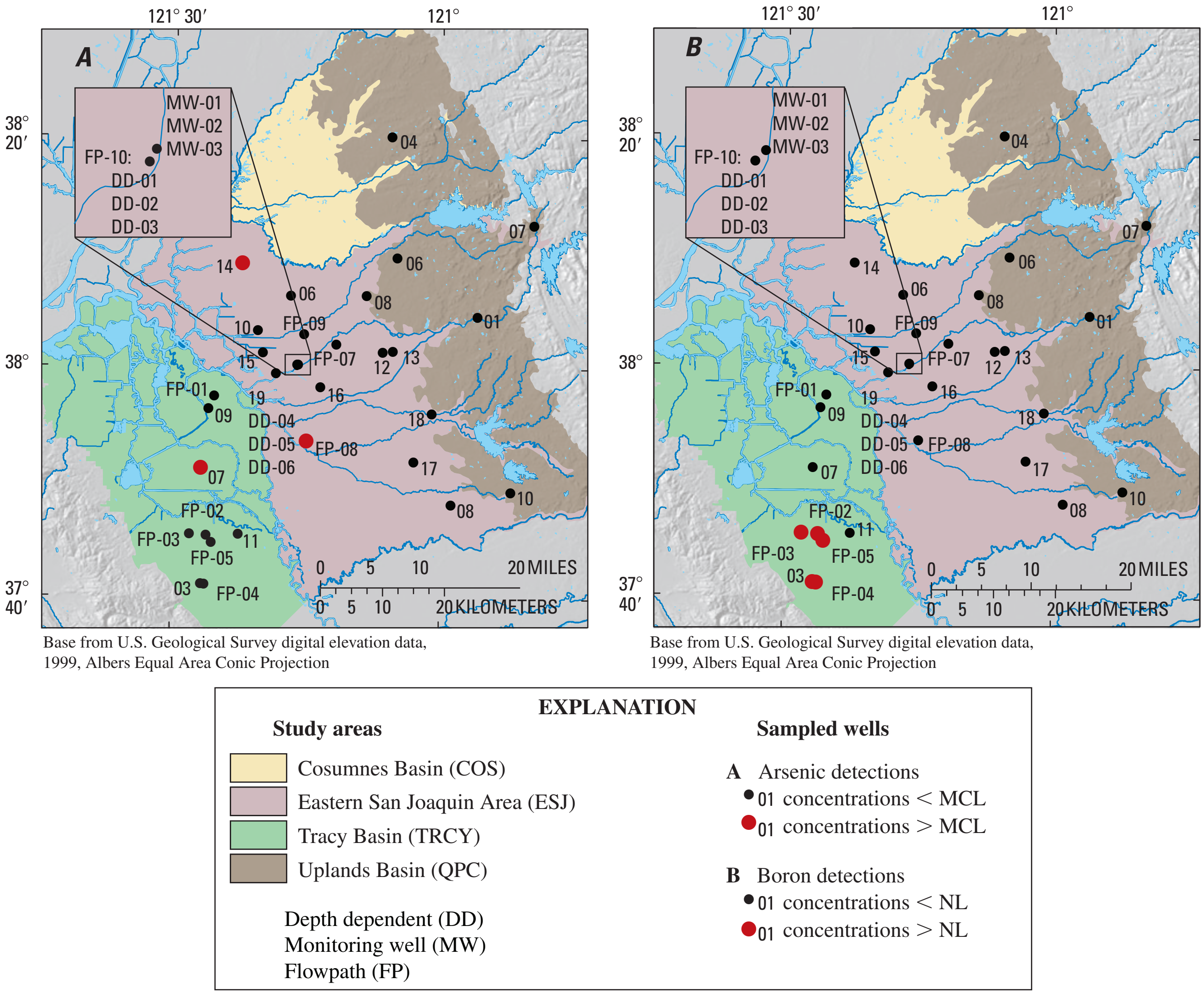
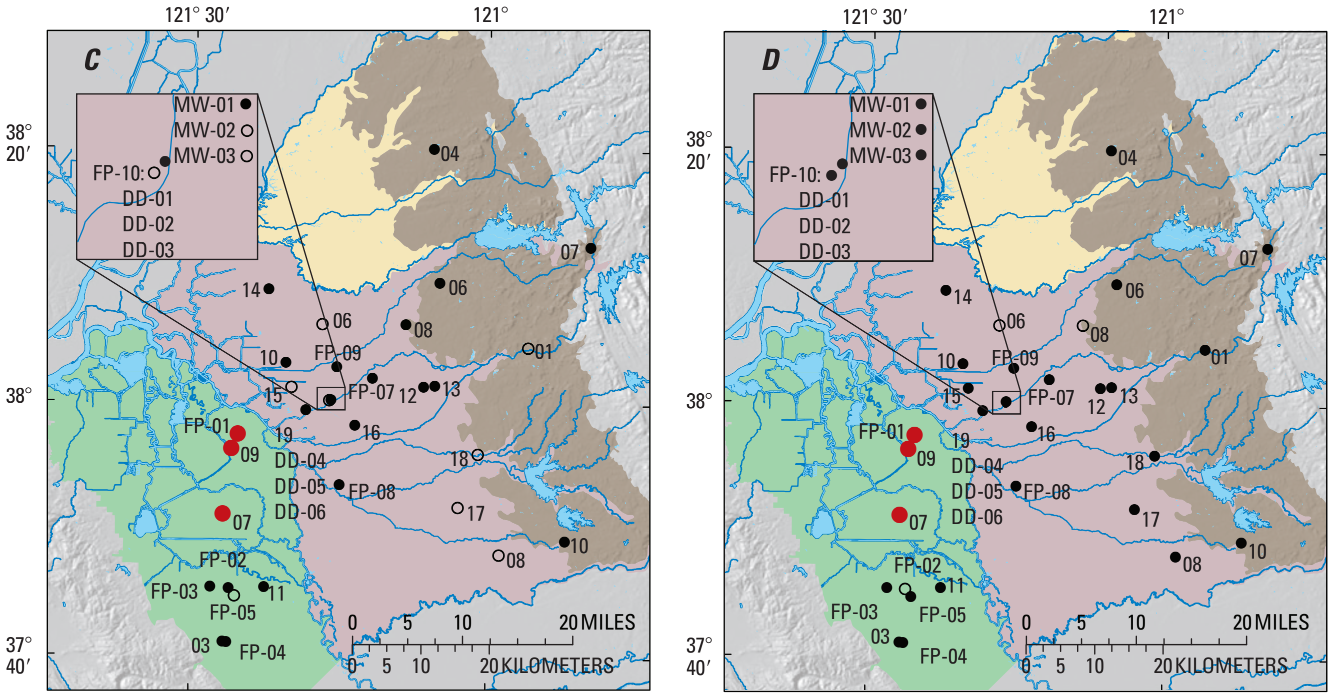



**Figure 8.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and locations of wells. *A*, wells sampled for arsenic with detections referenced to the Maximum Contaminant Level (MCL). *B*, wells sampled for boron with detections referenced to the notification level (NL). *C*, wells sampled for iron with detections referenced to the Secondary Maximum Contaminant Level (SMCL). *D*, wells sampled for manganese with detections referenced to the notification level (NL).




Base from U.S. Geological Survey digital elevation data, 1999, Albers Equal Area Conic Projection

Base from U.S. Geological Survey digital elevation data, 1999, Albers Equal Area Conic Projection

**EXPLANATION**

**Study areas**

- Cosumnes Basin (COS)
- Eastern San Joaquin Area (ESJ)
- Tracy Basin (TRCY)
- Uplands Basin (QPC)

Depth dependent (DD)
Monitoring well (MW)
Flowpath (FP)

**Sampled wells**

**C** Iron detections
- ○ 01 no detections
- ● 01 concentrations < SMCL
- ● 01 concentrations > SMCL

**D** Manganese detections
- ○ 01 no detections
- ● 01 concentrations < NL
- ● 01 concentrations > NL

**Figure 8.**—Continued.

## Isotopes, Radioactivity, and Noble Gases

*Tables 21 and 22* provide summaries of isotope activities, stable isotopes, and gross alpha–beta radioactivity determined in ground-water samples collected for the Northern San Joaquin Basin GAMA study unit. Seventy samples (64 wells and 6 depth-dependent samples) were analyzed for stable isotopes of water (analyzed at the USGS's Reston Stable Isotope Laboratory) and tritium (analyzed at the USGS's Menlo Park Stable Isotope and Tritium Laboratory (*table 21*). Twenty-seven samples (23 wells and 4 depth-dependent samples) were also analyzed for tritium at LLNL (*table 22*). Additionally, LLNL also analyzed 16 samples (13 wells and 3 depth-dependent samples) for the noble gases helium-4, neon, argon, krypton, and xenon (*table 22*). Tritium and noble gas analyses can be used to help determine the chronology and source of ground-water recharge. Thirteen wells were sampled for the following radioactive constituents: radium-226, radium-228, radon-222, gross-alpha radioactivity (72-hour and 30-day count), and gross-beta radioactivity (72-hour and 30-day count). Lastly, sixteen ground-water samples were analyzed for stable carbon isotopes.

Tritium was detected in 45 of 70 ground-water samples analyzed at the Stable Isotope and Tritium Laboratory (*table 21*). The highest activity detected in any ground-water sample was 37 picocuries per liter (pCi/L), whereas the USEPA MCL for tritium is 20,000 pCi/L. Radium-226 was detected in all 13 ground-water samples for which it was analyzed, at concentrations below the USEPA MCL of 3 pCi/L. Radium-228 was detected in 3 of the 13 samples, all of which were below the USEPA MCL of 2 pCi/L. No ground-water sample was above the combined radium-226 and radium-228 USEPA MCL of 5 pCi/L. Gross-alpha radioactivity in ground-water samples was not found above the USEPA MCL of 15 pCi/L. Similarly, gross-beta radioactivity was below the USEPA MCL of 50 pCi/L. Radon-222 was detected in all ground-water samples in which it was analyzed (*table 21*). The USEPA proposed MCL for radon-222 is 300 pCi/L, whereas the proposed Alternate Maximum Contaminant Level (AMCL) is 4,000 pCi/L (U.S. Environmental Protection Agency, 2006). Of the 13 ground-water samples for which radon-222 was analyzed, all except one were greater than the proposed MCL; however, all were below the AMCL (*fig. 9*).

Stable isotopes of water were collected at all sampled wells and are reported in *table 21* as the ratio of deuterium to protium and the ratio of oxygen-18 to oxygen-16. These values are used to aid in the interpretation of ground-water recharge sources. The values of the ratio of deuterium to protium ranged from –81.1 per mill to –43.0 per mill. The values of the ratio of oxygen-18 to oxygen-16 ranged from –11.2 per mill to –5.6 per mill.

## Microbial Constituents

Microbial constituents, including total coliform and *Escherichia* spp. coliform (*E. coli*), as well as the viruses F-specific coliphage and somatic coliphage, were analyzed in eight ground-water samples collected from the Northern San Joaquin Basin GAMA study unit (*table 23*). F-specific coliphage, somatic coliphage, and *E. coli* were not detected in any ground-water samples. An estimated three total coliform colonies were detected in one 100-mL sample of ground water collected at QPC-01 (*fig. 10*).

# Summary

The Ground-Water Ambient Monitoring and Assessment (GAMA) Program is intended to provide a comprehensive statewide assessment of ground-water quality in areas of California where ground water is a significant source of drinking water. The Northern San Joaquin Basin GAMA study unit is the third region in which the GAMA Program has implemented its program objectives. The Northern San Joaquin Basin GAMA study unit lies within the Central Valley Hydrologic Province and consists of four hydrogeologic study areas: the Tracy Basin study area, the Eastern San Joaquin Basin study area, the Cosumnes Basin study area, and the Uplands Basin study area. A total of 70 ground-water samples (grid cell and nongrid cell) were collected from a combination of public-supply, irrigation, domestic, and monitoring wells within the study unit. Thirty-two of these samples were collected in the Eastern San Joaquin Basin study area, 17 samples were collected in the Tracy Basin study area, 11 samples were collected in the Uplands Basin study area, and 10 samples were collected in the Cosumnes Basin study area.

This report presents the results of ground-water sample collection and analyses for over 350 water-quality field parameters, chemical, and microbial constituents, measured in the 70 samples obtained between December 2004 and February 2005. The chemical and microbial data presented in this report are compared to health-based regulatory values set by CADHS or the USEPA (maximum contaminant level or MCL), health-based advisory levels set by CADHS (notification level NL) or USEPA (lifetime health advisory level or HA-L), nonenforceble levels set for aesthetic qualities (secondary maximum contaminant level or SMCL), and levels set by CADHS for the purposes of tracking "unregulated chemicals for which monitoring is required" (detection limit for the purposes of reporting or DLR). The data presented in this report are intended to characterize the quality of untreated ground-water resources within the study unit, not the treated drinking water delivered to consumers by water purveyors. The composition of treated drinking water may differ considerably from untreated ground water as a result of treatment processes, such as disinfection, filtration, mixing with other waters, and exposure to the atmosphere.

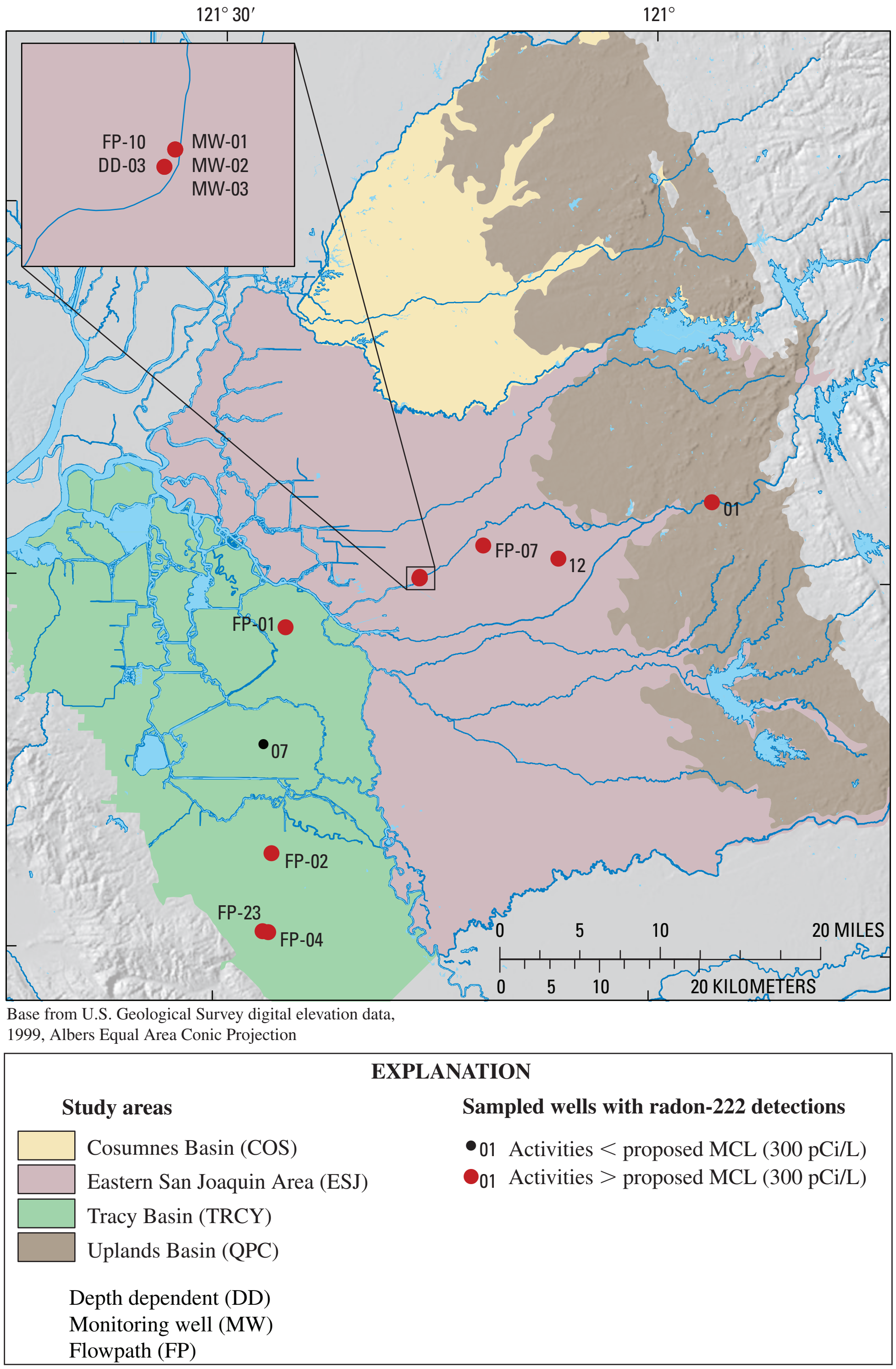



**Figure 9.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and locations of wells sampled for radon-222 with detections referenced to the proposed Maximum Contaminant Level (MCL) of 300 pCi/L.

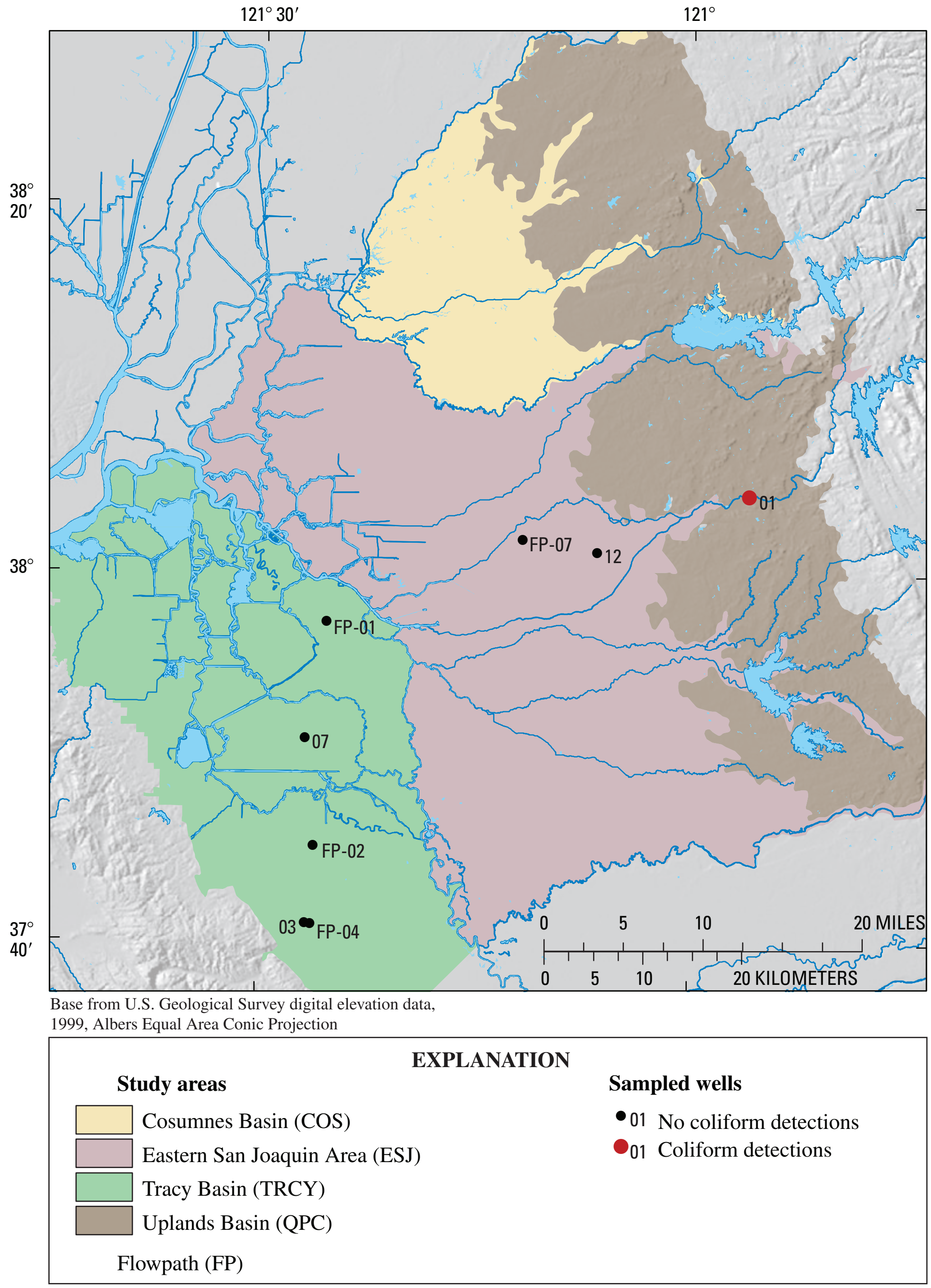



**Figure 10.** Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit showing study areas and locations of wells sampled for coliform with detections referenced to colonies detected in one 100-mL sample of ground water.

Thirty of the 88 VOCs and gasoline oxygenates analyzed were detected in ground-water samples and 13 TICs were also detected. VOCs and gasoline oxygenates were detected in 43 ground-water samples (25 grid cell samples and 18 nongrid cell samples). These constituents were most frequently detected in the Eastern San Joaquin Basin study area (24 of 32 samples) and least detected in the Cosumnes Basin study area (2 of 10 samples). Trihalomethanes, which are a byproduct of water treatment using chlorination, were the most frequently detected class of VOC constituents (21 of 70 samples). Within the trihalomethane class, chloroform was the most frequently detected constituent (20 of 70 samples). None of the VOCs analyzed were detected at concentrations above a USEPA MCL or CADHS NL; however, dichlorodifluoromethane (CFC-12), an “unregulated chemical for which monitoring is required,” was detected in two wells at concentrations greater than the California Department of Health Services DLR.

Fifteen of the 122 pesticides and pesticide degradate constituents analyzed for in ground-water samples were detected in this study (*table 14*). Pesticide and pesticide degradates were detected in 27 of 70 (grid cell and nongrid cell wells) samples collected. These constituents were most frequently detected in the Eastern San Joaquin Basin study area (17 of 32 samples) and least frequently detected in the Cosumnes Basin study area (4 of 10 samples). Herbicides were the most frequently detected class of constituents throughout the Northern San Joaquin Basin GAMA study unit (21 of 70 samples), and simazine, an herbicide, was the most frequently detected compound (27 of 70 samples). Two herbicides, DBCP and EDB, were detected at concentrations above established USEPA MCLs.

Six wastewater-indicator constituents were identified in samples collected in the Northern San Joaquin Basin GAMA study unit (*table 15*). Thirteen of the 16 samples analyzed for wastewater-indicator constituents had at least a single detection. Isophorone was the most frequently detected wastewater-indicator compound (7 of 16 samples), yet it was only detected at concentrations high enough to be quantified twice. None of wastewater-indicator constituents were detected above an MCL, SMCL, NL, HA-L, or RSD5.

Thirty-four ground-water samples of perchlorate, NDMA, and 1,2,3-TCP (constituents of special interest) were collected throughout the Northern San Joaquin Basin GAMA study unit. Perchlorate was detected in two samples located in the Eastern San Joaquin Basin study area (*table 16*). Neither concentration of perchlorate was above the CADHS NL or CADHS DLR. The constituents NDMA and 1,2,3-trichloropropane were not detected in any ground-water samples.

Eighteen ground-water samples were collected for nutrient constituents (13 wells and 5 depth-dependent samples), whereas only 10 samples were collected for DOC (*table 17*). Nitrite plus nitrate was detected in 11 samples (excluding the depth-dependent analyses), whereas nitrite was detected in only two samples. Concentrations of nitrite plus nitrate were below the USEPA MCL of 10 mg/L (as nitrogen). Similarly, nitrite concentrations were below the USEPA MCL of 1 mg/L (as nitrogen). Dissolved organic carbon was detected in 5 of the 10 samples in which it was analyzed.

Thirty-nine ground-water samples (33 wells and 6 depth-dependent samples) were collected for 10 major and minor ions as well as TDS. Eight ground-water samples had TDS concentrations above the USEPA recommended SMCL of 500 mg/L. Two samples had chloride concentrations above the CADHS SMCL of 250 mg/L, whereas three samples had sulfate concentrations above the USEPA SMCL of 250 mg/L.

Thirty-nine ground-water samples (33 wells and 6 depth-dependent samples) were collected for trace element analyses. A total of 25 trace elements and three oxidation species were analyzed. Trace elements detected in ground-water samples that were above their respective MCL, NL, HA-L, or DLR, (for CADHS “unregulated chemical for which monitoring is required”) included arsenic, boron, hexavalent chromium (chromium(VI)), iron, manganese, and vanadium. Arsenic was detected in three samples above the USEPA MCL of 10 µg/L. Boron, an “unregulated chemical for which monitoring is required,” was detected in five samples at concentrations above the CADHS NL of 1,000 µg/L and in 11 samples above the CADHS DLR of 100 µg/L. Hexavalent chromium, also an “unregulated chemical for which monitoring is required,” was detected in all 39 samples in which it was analyzed at the USGS’s Trace Metal Laboratory in Boulder, Colorado. Sixteen of the 39 hexavalent chromium ground-water samples had concentrations above the CADHS DLR of 1 µg/L. Iron was detected in three samples at concentrations above its USEPA SMCL of 300 µg/L. Manganese was detected in 8 of 39 samples above its USEPA SMCL of 30 µg/L. Of those eight samples with concentrations of Manganese greater than the SMCL, three were detected at concentrations above the CADHS NL of 500 µg/L. Lastly, vanadium, an “unregulated chemical for which monitoring is required,” was detected in 38 of 39 samples, of which 33 were above the CADHS DLR of 3 µg/L. Of the 33 samples detected at concentrations above the DLR, none were detected at concentrations above the CADHS NL of 50 µg/L.

Seventy ground-water samples (64 wells and 6 depth-dependent samples) were analyzed for stable isotopes of water and tritium. Samples from 13 wells were analyzed for radium-226, radium-228, radon-222, gross-alpha radioactivity (72-hour and 30-day count), and gross-beta radioactivity (72-hour and 30-day count), and sixteen ground-water samples were analyzed for stable carbon isotopes. None of the ground-water samples had measured activities above the combined radium-226 and radium-228 USEPA MCL of 5 pCi/L. Gross-alpha and gross-beta radioactivity in ground-water samples were not found to be above the USEPA MCLs of 15 and 50 pCi/L, respectively. Radon-222 was detected in all samples in which it was analyzed; however, the proposed USEPA MCL for radon-222 is 300 pCi/L, whereas the proposed AMCL is 4,000 pCi/L (U.S. Environmental Protection Agency, 2006). Of the 13 ground-water samples in which radon-222 was analyzed, 12 were above the proposed USEPA MCL; however, all samples were below the AMCL. Stable isotopes of water are reported as the ratio of deuterium to protium and the ratio of oxygen-18 to oxygen-16, and values of the ratio of deuterium to protium (hydrogen isotopes) ranged from –81.1 per mill to –43.0 per mill, whereas the values of the ratio of oxygen-18 to oxygen-16 ranged from –11.2 per mill to –5.6 per mill.

Microbial constituents, including total coliform and *Escherichia* spp. coliform, as well as the viruses F-specific coliphage and somatic coliphage, were analyzed for in eight ground-water samples collected for the Northern San Joaquin Basin GAMA study unit (*table 23*). F-specific coliphage, somatic coliphage, and *Escherichia* spp. coliform were not detected in any ground-water samples, whereas an estimated three total coliform colonies were detected in 100 mL of ground water from one a sample collected at QPC-01.

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# Tables

**Table 1.** Classes of chemical, radioactive, and microbial constituents and water-quality indicators collected for the slow, intermediate, fast, and depth-dependent analyte lists in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[DBCP, 1,2-dibromo-3-chloropropane; DO, dissolved oxygen; EDB, 1,2-dibromoethane; nc, not collected; NDMA, *N*-nitrosodimethylamine; SC, specific conductance]

| Slow analyte list | Intermediate analyte list | Fast analyte list | Depth-dependent analyte list |
|---|---|---|---|
| Water-quality indicators (alkalinity, DO, pH, SC, temperature, turbidity) | Water-quality indicators (SC and temperature) | Water-quality indicators (SC and temperature) | Water-quality indicators (alkalinity, DO, pH, SC, temperature) |
| Volatile organic compounds | Volatile organic compounds | Volatile organic compounds | Volatile organic compounds |
| Gasoline oxygenates | Gasoline oxygenates | nc | Gasoline oxygenates |
| Pesticides, including low-detection limit DBCP and EDB | Pesticides, including low-detection limit DBCP and EDB | Pesticides, including low-detection limit DBCP and EDB | Pesticides, including low-detection limit DBCP and EDB |
| Polar pesticides and degradates | nc | nc | nc |
| Wastewater-indicator constituents | nc | nc | Wastewater-indicator constituents |
| Pharmaceuticals | Pharmaceuticals | Pharmaceuticals | nc |
| Constituents of Special Interest (perchlorate, NDMA, 1,2,3-trichloropropane)[1] | Constituents of Special Interest (perchlorate, NDMA, 1,2,3-trichloropropane)[1] | nc | Constituents of Special Interest (perchlorate, NDMA, 1,2,3-trichloropropane)[1] |
| Nutrients and dissolved organic carbon | nc | nc | Nutrients and dissolved organic carbon |
| Major ions and trace elements | Major ions and trace elements | nc | Major ions and trace elements |
| Chromium speciation | Chromium speciation | nc | Chromium speciation |
| Arsenic and iron speciation | Arsenic and iron speciation | nc | Arsenic and iron speciation |
| Stable isotopes of water | Stable isotopes of water | Stable isotopes of water | Stable isotopes of water |
| Carbon isotopes | nc | nc | Carbon isotopes |
| Radium isotopes | nc | nc | nc |
| Gross alpha and beta radioactivity | nc | nc | nc |
| Radon-222 | nc | nc | nc |
| Tritium[2] | Tritium[2] | Tritium[2] | Tritium[2] |
| Tritium and noble gases[3] | nc | nc | Tritium and noble gases[3] |
| Microbial constituents | nc | nc | nc |

[1]Analyzed at Montgomery Watson Harza Laboratory, Monrovia, California.

[2]Analyzed at the U.S. Geological Survey's Stable Isotope and Tritium Laboratory, Menlo Park, California.

[3]Analyzed at Lawrence Livermore National Laboratory, Livermore, California.

**Table 2A.** Volatile organic compounds, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 2020, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Acetone | Solvent | 81552 | 67-64-1 | 6 | n/a | n/a |
| Acrylonitrile | Organic synthesis | 34215 | 107-13-1 | 0.8 | RSD5 | 0.6 |
| Benzene | Gasoline | 34030 | 71-43-2 | 0.021 | MCL-CA | 1 |
| Bromobenzene | Solvent | 81555 | 108-86-1 | 0.028 | n/a | n/a |
| Bromochloromethane | Organic synthesis | 77297 | 74-97-5 | 0.12 | HA-L | 9 |
| Bromodichloromethane (THM) | Disinfection by-product | 32101 | 75-27-4 | 0.028 | MCL-US | 80 |
| Bromoethene | Fire retardant | 50002 | 593-60-2 | 0.1 | n/a | n/a |
| Bromoform (tribromomethane) (THM) | Disinfection by-product | 32104 | 75-25-2 | 0.1 | MCL-US | 80 |
| Bromomethane | Fumigant | 34413 | 74-83-9 | 0.26 | HA-L | 10 |
| 2-Butanone (ethyl methyl ketone) | Solvent | 81595 | 78-93-3 | 2 | HA-L | 4,000 |
| *n*-Butylbenzene | Organic synthesis | 77342 | 104-51-8 | 0.12 | NL | 260 |
| *sec*-Butylbenzene | Organic synthesis | 77350 | 135-98-8 | 0.06 | NL | 260 |
| *tert*-Butylbenzene | Organic synthesis | 77353 | 98-06-6 | 0.06 | NL | 260 |
| Carbon disulfide | Organic synthesis | 77041 | 75-15-0 | 0.038 | NL | 160 |
| Chlorobenzene | Solvent | 34301 | 108-90-7 | 0.028 | MCL-CA | 70 |
| Chloroethane | Solvent | 34311 | 75-00-3 | 0.12 | n/a | n/a |
| Chloroform (trichloromethane) (THM) | Disinfection by-product | 32106 | 67-66-3 | 0.024 | MCL-US | 80 |
| Chloromethane | Refrigerant | 34418 | 74-87-3 | 0.17 | HA-L | 30 |
| 3-Chloropropene | Organic synthesis | 78109 | 107-05-1 | 0.5 | n/a | n/a |
| 2-Chlorotoluene | Solvent | 77275 | 95-49-8 | 0.04 | NL | 140 |
| 4-Chlorotoluene | Solvent | 77277 | 106-43-4 | 0.05 | NL | 140 |
| Dibromochloromethane (THM) | Disinfection by-product | 32105 | 124-48-1 | 0.1 | MCL-US | 80 |
| 1,2-Dibromo-3-chloropropane (DBCP) | Fumigant | 82625 | 96-12-8 | 0.51 | MCL-US | 0.2 |
| 1,2-Dibromoethane (EDB) | Solvent/Fumigant | 77651 | 106-93-4 | 0.036 | MCL-US | 0.05 |

*See footnote at end of table.*

**Table 2A.** Volatile organic compounds, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 2020, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Dibromomethane | Solvent | 30217 | 74-95-3 | 0.05 | n/a | n/a |
| 1,2-Dichlorobenzene | Solvent | 34536 | 95-50-1 | 0.048 | MCL-US | 600 |
| 1,3-Dichlorobenzene | Solvent | 34566 | 541-73-1 | 0.03 | HA-L | 600 |
| 1,4-Dichlorobenzene | Fumigant | 34571 | 106-46-7 | 0.034 | MCL-CA | 5 |
| *trans*-1,4-Dichloro-2-butene | Organic synthesis | 73547 | 110-57-6 | 0.700 | n/a | n/a |
| Dichlorodifluoromethane (CFC-12) | Refrigerant | 34668 | 75-71-8 | 0.18 | NL | 1,000 |
| 1,1-Dichloroethane | Solvent | 34496 | 75-34-3 | 0.035 | MCL-US | 5 |
| 1,2-Dichloroethane | Solvent | 32103 | 107-06-2 | 0.13 | MCL-CA | 0.5 |
| 1,1-Dichloroethylene | Organic synthesis | 34501 | 75-35-4 | 0.024 | MCL-CA | 6 |
| *cis*-1,2-Dichloroethylene | Solvent | 77093 | 156-59-2 | 0.024 | MCL-CA | 6 |
| *trans*-1,2-Dichloroethylene | Solvent | 34546 | 156-60-5 | 0.032 | MCL-CA | 10 |
| Dichloromethane (methylene chloride) | Solvent | 34423 | 75-09-2 | 0.06 | MCL-US | 5 |
| 1,2-Dichloropropane | Solvent | 34541 | 78-87-5 | 0.029 | MCL-US | 5 |
| 1,3-Dichloropropane | Organic synthesis | 77173 | 142-28-9 | 0.06 | MCL-US | 5 |
| 2,2-Dichloropropane | Organic synthesis | 77170 | 594-20-7 | 0.05 | n/a | n/a |
| 1,1-Dichloropropene | Organic synthesis | 77168 | 563-58-6 | 0.026 | n/a | n/a |
| *cis*-1,3-Dichloropropene | Fumigant | 34704 | 10061-01-5 | 0.05 | RSD5 | [1]4 |
| *trans*-1,3-Dichloropropene | Fumigant | 34699 | 10061-02-6 | 0.09 | RSD5 | [1]4 |
| Diethyl ether | Solvent | 81576 | 60-29-7 | 0.08 | n/a | n/a |
| Diisopropyl ether | Gasoline oxygenate | 81577 | 108-20-3 | 0.1 | n/a | n/a |
| Ethylbenzene | Gasoline | 34371 | 100-41-4 | 0.03 | MCL-CA | 300 |
| Ethyl tert-butyl ether (ETBE) | Gasoline oxygenate | 50004 | 637-92-3 | 0.03 | n/a | n/a |
| Ethyl methacrylate | Organic synthesis | 73570 | 97-63-2 | 0.18 | n/a | n/a |
| *o*-Ethyl toluene | Hydrocarbon | 77220 | 611-14-3 | 0.06 | n/a | n/a |

*See footnote at end of table.*

**Table 2A.** Volatile organic compounds, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 2020, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Hexachlorobutadiene | Organic synthesis | 39702 | 87-68-3 | 0.14 | HA-L | 1 |
| Hexachloroethane | Solvent | 34396 | 67-72-1 | 0.14 | HA-L | 1 |
| 2-Hexanone | Solvent | 77103 | 591-78-6 | 0.4 | n/a | n/a |
| Isopropylbezene | Organic synthesis | 77223 | 98-82-8 | 0.038 | NL | 770 |
| 4-Isopropyl-1-methylbenzene | Organic synthesis | 77356 | 99-87-6 | 0.08 | n/a | n/a |
| *m*- and *p*-Xylene | Gasoline | 85795 | 108-38-3/106-42-3 | 0.06 | MCL-CA | 1,750 |
| Methyl acrylate | Organic synthesis | 49991 | 96-33-3 | 1 | n/a | n/a |
| Methyl acrylonitrile | Organic synthesis | 81593 | 126-98-7 | 0.4 | n/a | n/a |
| Methyl *tert*-butyl ether (MTBE) | Gasoline oxygenate | 78032 | 1634-04-4 | 0.1 | MCL-US | 13 |
| Methyl iodide | Organic synthesis | 77424 | 74-88-4 | 0.5 | n/a | n/a |
| Methyl methacrylate | Organic synthesis | 81597 | 80-62-6 | 0.2 | n/a | n/a |
| 4-Methyl-2-pentanone (MIBK) | Solvent | 78133 | 108-10-1 | 0.37 | NL | 120 |
| Methyl *tert*-pentyl ether | Gasoline oxygenate | 50005 | 994-05-8 | 0.04 | n/a | n/a |
| Naphthalene | Organic synthesis | 34696 | 91-20-3 | 0.52 | NL | 17 |
| *n*-Propylbenzene | Solvent | 77224 | 103-65-1 | 0.042 | NL | 260 |
| Styrene | Organic synthesis | 77128 | 100-42-5 | 0.042 | MCL-US | 100 |
| 1,1,1,2-Tetrachloroethane | Solvent | 77562 | 630-20-6 | 0.03 | HA-L | 70 |
| 1,1,2,2-Tetrachloroethane | Solvent | 34516 | 79-34-5 | 0.08 | MCL-CA | 1 |
| Tetrachloroethylene (PCE) | Solvent | 34475 | 127-18-4 | 0.03 | MCL-US | 5 |
| Tetrahydrofuran | Solvent | 81607 | 109-99-9 | 1.0 | n/a | n/a |
| Tetrachloromethane (carbon tetrachloride) | Solvent | 32102 | 56-23-5 | 0.06 | MCL-CA | 0.5 |
| 1,2,3,4-Tetramethylbenzene | Hydrocarbon | 49999 | 488-23-3 | 0.14 | n/a | n/a |
| 1,2,3,5-Tetramethylbenzene (isodurene) | Hydrocarbon | 50000 | 527-53-7 | 0.14 | n/a | n/a |

*See footnote at end of table.*

**Table 2A.** Volatile organic compounds, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 2020, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Toluene | Gasoline | 34010 | 108-88-3 | 0.02 | MCL-CA | 150 |
| 1,2,3-Trichlorobenzene | Organic synthesis | 77613 | 87-61-6 | 0.18 | n/a | n/a |
| 1,2,4-Trichlorobenzene | Solvent | 34551 | 120-82-1 | 0.12 | MCL-CA | 5 |
| 1,1,1-Trichloroethane (TCA) | Solvent | 34506 | 71-55-6 | 0.032 | MCL-US | 200 |
| 1,1,2-Trichloroethane | Solvent | 34511 | 79-00-5 | 0.04 | MCL-US | 5 |
| Trichloroethylene (TCE) | Solvent | 39180 | 79-01-6 | 0.038 | MCL-US | 5 |
| Trichlorofluoromethane (CFC-11) | Refrigerant | 34488 | 75-69-4 | 0.08 | MCL-CA | 150 |
| 1,2,3-Trichloropropane (1,2,3-TCP) | Solvent | 77443 | 96-18-4 | 0.18 | NL | 0.005 |
| 1,1,2-Trichlorotrifluoroethane (CFC-113) | Refrigerant | 77652 | 76-13-1 | 0.038 | MCL-US | 1,200 |
| 1,2,3-Trimethylbenzene | Gasoline | 77221 | 526-73-8 | 0.06 | n/a | n/a |
| 1,2,4-Trimethylbenzene | Organic synthesis | 77222 | 95-63-6 | 0.056 | NL | 330 |
| 1,3,5-Trimethylbenzene | Gasoline | 77226 | 108-67-8 | 0.044 | NL | 330 |
| *o*-Xylene | Gasoline | 77135 | 95-47-6 | 0.038 | MCL-CA | 1,750 |
| Vinyl chloride | Organic synthesis | 39175 | 75-01-4 | 0.08 | MCL-CA | 0.5 |

[1]The RSD5 threshold for 1,3-dichloropropene is the sum of its isomers (*cis* and *trans*).

**Table 2B.** Gasoline oxygenates and gasoline oxygenate degradates, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting level (LRL) for the USGS's National Water Quality Laboratory analytical Schedule 4024, type of comparison threshold for ground-water detections, and the threshold concentration.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. DLR, detection level for the purpose of reporting (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Acetone | Degradate/solvent | 81552 | 67-64-1 | 1.2 | n/a | n/a |
| Diisopropyl ether | Gasoline oxygenate | 81577 | 108-20-3 | 0.04 | n/a | n/a |
| Ethyl *tert*-butyl ether (ETBE) | Gasoline oxygenate | 50004 | 637-92-3 | 0.04 | DLR | 3 |
| Methyl acetate | Degradate | 77032 | 79-20-9 | 0.43 | n/a | n/a |
| *tert*-Amyl alcohol | Degradate | 77073 | 75-85-4 | 1 | n/a | n/a |
| *tert*-Butyl alcohol (TBA) | Degradate | 77035 | 75-65-0 | 1 | NL | 12 |
| Methyl *tert*-butyl ether (MTBE) | Gasoline oxygenate | 78032 | 1634-04-4 | 0.04 | MCL-US | 13 |
| Methyl *tert*-pentyl ether | Gasoline oxygenate | 50005 | 994-05-8 | 0.04 | DLR | 3 |

**Table 2C.** Pesticides and pesticide degradates, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory (NWQL) analytical Schedule 2003, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Acetochlor | Herbicide | 49260 | 34256-82-1 | 0.006 | n/a | n/a |
| Alachlor | Herbicide | 46342 | 15972-60-8 | 0.005 | MCL-US | 2 |
| Atrazine | Herbicide | 39632 | 1912-24-9 | 0.007 | MCL-CA | 1 |
| Azinphos-methyl | Insecticide | 82686 | 86-50-0 | 0.05 | n/a | n/a |
| Azinphos-methyl-oxon | Degradate | 61635 | 961-22-8 | 0.07 | n/a | n/a |
| Benfluralin | Herbicide | 82673 | 1861-40-1 | 0.01 | n/a | n/a |
| Carbaryl | Insecticide | 82680 | 63-25-2 | 0.041 | HA-L | 700 |
| 2-Chloro-2,6-diethylacetanilide | Degradate | 61618 | 6967-29-9 | 0.005 | n/a | n/a |
| 2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) | Degradate | 04040 | 6190-65-4 | 0.006 | n/a | n/a |
| 4-Chloro-2-methylphenol | Degradate | 61633 | 1570-64-5 | 0.005 | n/a | n/a |
| Chlorpyrifos | Insecticide | 38933 | 2921-88-2 | 0.005 | HA-L | 20 |
| Chlorpyrofos, oxygen analog | Degradate | 61636 | 5598-15-2 | 0.056 | n/a | n/a |
| *cis*-Permethrin | Insecticide | 82687 | 54774-45-7 | 0.006 | n/a | n/a |
| Cyfluthrin | Insecticide | 61585 | 68359-37-5 | 0.008 | n/a | n/a |
| Cypermethrin | Insecticide | 61586 | 52315-07-8 | 0.008 | n/a | n/a |
| Dacthal (DCPA) | Herbicide | 82682 | 1861-32-1 | 0.003 | HA-L | 70 |
| Desulfinylfipronil | Degradate | 62170 | n/a | 0.012 | n/a | n/a |
| Desulfinylfipronil amide | Degradate | 62169 | n/a | 0.029 | n/a | n/a |
| Diazinon | Insecticide | 39572 | 333-41-5 | 0.005 | HA-L | 0.6 |
| Diazinon, oxon | Insecticide | 61638 | 962-58-3 | 0.01 | n/a | n/a |
| 3,4-Dichloroaniline | Degradate | 61625 | 95-76-1 | 0.004 | n/a | n/a |
| Dichlorvos | Fumigant | 38775 | 62-73-7 | 0.012 | n/a | n/a |
| Dicrotophos | Insecticide | 38454 | 141-66-2 | 0.084 | n/a | n/a |
| Dieldrin | Insecticide | 39381 | 60-57-1 | 0.009 | RSD5 | 0.02 |

**Table 2C.** Pesticides and pesticide degradates, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory (NWQL) analytical Schedule 2003, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| 2,6-Diethylaniline | Degradate | 82660 | 579-66-8 | 0.006 | n/a | n/a |
| Dimethoate | Insecticide | 82662 | 60-51-5 | 0.006 | n/a | n/a |
| Ethion | Insecticide | 82346 | 563-12-2 | 0.004 | n/a | n/a |
| Ethion monoxon | Degradate | 61644 | 17356-42-2 | 0.002 | n/a | n/a |
| 2-Ethyl-6-methylaniline | Degradate | 61620 | 24549-06-2 | 0.004 | n/a | n/a |
| Fenamiphos | Insecticide | 61591 | 22224-92-6 | 0.029 | HA-L | 2 |
| Fenamiphos sulfone | Degradate | 61645 | 31972-44-8 | 0.049 | n/a | n/a |
| Fenamiphos sulfoxide | Degradate | 61646 | 31972-43-7 | 0.039 | n/a | n/a |
| Fipronil | Insecticide | 62166 | 120068-37-3 | 0.016 | n/a | n/a |
| Fipronil sulfide | Degradate | 62167 | 120067-83-6 | 0.013 | n/a | n/a |
| Fipronil sulfone | Degradate | 62168 | 120068-36-2 | 0.024 | n/a | n/a |
| Fonofos | Insecticide | 04095 | 944-22-9 | 0.003 | HA-L | 10 |
| Hexazinone | Herbicide | 04025 | 51235-04-2 | 0.013 | HA-L | 400 |
| Iprodione | Fungicide | 61593 | 36734-19-7 | 0.387 | n/a | n/a |
| Isofenphos | Insecticide | 61594 | 25311-71-1 | 0.003 | n/a | n/a |
| Malaoxon | Degradate | 61652 | 1634-78-2 | 0.03 | n/a | n/a |
| Malathion | Insecticide | 39532 | 121-75-5 | 0.027 | HA-L | 100 |
| Metalaxyl | Fungicide | 61596 | 57837-19-1 | 0.005 | n/a | n/a |
| Methidathion | Insecticide | 61598 | 950-37-8 | 0.006 | n/a | n/a |
| Metolachlor | Herbicide | 39415 | 51218-45-2 | 0.006 | HA-L | 100 |
| Metribuzin | Herbicide | 82630 | 21087-64-9 | 0.006 | HA-L | 200 |
| Myclobutanil | Fungicide | 61599 | 88671-89-0 | 0.008 | n/a | n/a |
| Paraoxon-methyl | Insecticide | 61664 | 950-35-6 | 0.03 | n/a | n/a |
| Parathion-methyl | Insecticide | 82667 | 298-00-0 | 0.015 | n/a | n/a |
| 1-Naphthol | Degradate | 49295 | 90-15-3 | 0.088 | n/a | n/a |

**Table 2C.** Pesticides and pesticide degradates, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory (NWQL) analytical Schedule 2003, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Pendimethalin | Herbicide | 82683 | 40487-42-1 | 0.022 | n/a | n/a |
| Phorate | Insecticide | 82664 | 298-02-2 | 0.011 | n/a | n/a |
| Phorate oxon | Degradate | 61666 | 2600-69-3 | 0.105 | n/a | n/a |
| Phosmet | Insecticide | 61601 | 732-11-6 | 0.008 | n/a | n/a |
| Phosmet oxon | Degradate | 61668 | 3735-33-9 | 0.051 | n/a | n/a |
| Prometon | Herbicide | 04037 | 1610-18-0 | 0.01 | HA-L | 100 |
| Prometryn | Herbicide | 04036 | 7287-19-6 | 0.005 | n/a | n/a |
| Propyzamide | Herbicide | 82676 | 23950-58-5 | 0.004 | n/a | n/a |
| Simazine | Herbicide | 04035 | 122-34-9 | 0.005 | MCL-US | 4 |
| Tebuthiuron | Herbicide | 82670 | 34014-18-1 | 0.016 | HA-L | 500 |
| Terbufos | Insecticide | 82675 | 13071-79-9 | 0.017 | HA-L | 0.9 |
| Terbufos oxon sulfone | Degradate | 61674 | 56070-15-6 | 0.068 | n/a | n/a |
| Terbuthylazine | Herbicide | 04022 | 5915-41-3 | 0.01 | n/a | n/a |
| Trifluralin | Herbicide | 82661 | 1582-09-8 | 0.009 | HA-L | 5 |

**Table 2D.** Pesticides, pesticide degradates and caffeine, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting level (LRL) for the USGS's National Water Quality Laboratory analytical Schedule 2060, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Acifluorfen | Herbicide | 49315 | 50594-66-6 | 0.028 | n/a | n/a |
| Aldicarb[1] | Insecticide | 49312 | 116-06-3 | 0.04 | MCL-US | 3 |
| Aldicarb sulfone | Insecticide/degradate | 49313 | 1646-88-4 | 0.018 | MCL-US | 3 |
| Aldicarb sulfoxide | Degradate | 49314 | 1646-87-3 | 0.022 | MCL-US | 4 |
| Atrazine | Herbicide | 39632 | 1912-24-9 | 0.008 | MCL-CA | 1 |
| Bendiocarb | Insecticide | 50299 | 22781-23-3 | 0.02 | n/a | n/a |
| Benomyl | Fungicide | 50300 | 17804-35-2 | 0.022 | n/a | n/a |
| Bensulfuron-methyl | Herbicide | 61693 | 83055-99-6 | 0.018 | n/a | n/a |
| Bentazon | Herbicide | 38711 | 25057-89-0 | 0.012 | MCL-CA | 18 |
| Bromacil | Herbicide | 04029 | 314-40-9 | 0.018 | HA-L | 90 |
| Bromoxynil | Herbicide | 49311 | 1689-84-5 | 0.028 | n/a | n/a |
| Caffeine | Beverages | 50305 | 58-08-2 | 0.018 | n/a | n/a |
| Carbaryl | Herbicide | 49310 | 63-25-2 | 0.018 | HA-L | 700 |
| Carbofuran | Herbicide | 49309 | 1563-66-2 | 0.016 | MCL-CA | 18 |
| Chloramben, methyl ester | Herbicide | 61188 | 7286-84-2 | 0.024 | n/a | n/a |
| Chlordiamino-*s*-triazine | Degradate | 04039 | 3397-62-4 | 0.04 | n/a | n/a |
| Chlorimuron-ethyl | Herbicide | 50306 | 90982-32-4 | 0.032 | n/a | n/a |
| 2-Chloro-6-ethylamino-4-amino-*s*-triazine (deisopropylatrazine) | Degradate | 04038 | 1007-28-9 | 0.08 | n/a | n/a |
| 2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) | Degradate | 04040 | 6190-65-4 | 0.028 | n/a | n/a |
| Chlorothalonil | Herbicide | 49306 | 1897-45-6 | 0.035 | RSD5 | 15 |
| Clopyralid | Herbicide | 49305 | 1702-17-6 | 0.024 | n/a | n/a |
| Cycloate | Herbicide | 04031 | 1134-23-2 | 0.014 | n/a | n/a |

*See footnote at end of table.*

**Table 2D.** Pesticides, pesticide degradates and caffeine, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting level (LRL) for the USGS's National Water Quality Laboratory analytical Schedule 2060, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Dacthal monoacid | Degradate | 49304 | 887-54-7 | 0.028 | n/a | n/a |
| Dicamba | Herbicide | 38442 | 1918-00-9 | 0.036 | HA-L | 200 |
| 2,4-Dichlorophenoxyacetic acid (2,4-D) | Herbicide | 39732 | 94-75-7 | 0.038 | MCL-US | 70 |
| 2,4-Dichlorophenoxyacetic acid (2,4-D) methyl ester | Herbicide | 50470 | 1928-38-7 | 0.016 | n/a | n/a |
| 4-(2,4-Dichlorophenoxy)butyric acid (2,4-DB) | Herbicide | 38746 | 94-82-6 | 0.020 | n/a | n/a |
| Dichlorprop | Herbicide | 49302 | 120-36-5 | 0.028 | n/a | n/a |
| Dinoseb | Herbicide | 49301 | 88-85-7 | 0.038 | MCL-CA | 7 |
| Diphenamid | Herbicide | 04033 | 957-51-7 | 0.01 | HA-L | 200 |
| Diuron | Herbicide | 49300 | 330-54-1 | 0.014 | HA-L | 10 |
| Fenuron | Herbicide | 49297 | 101-42-8 | 0.018 | n/a | n/a |
| Flumetsulam | Herbicide | 61694 | 98967-40-9 | 0.04 | n/a | n/a |
| Fluometuron | Herbicide | 38811 | 2164-17-2 | 0.016 | HA-L | 90 |
| 3-Hydroxycarbofuran | Degradate | 49308 | 16655-82-6 | 0.008 | n/a | n/a |
| 2-Hydroxy-4-isopropylamino-6-ethylamino-s-triazine | Degradate | 50355 | 2163-68-0 | 0.032 | n/a | n/a |
| Imazaquin | Herbicide | 50356 | 81335-37-7 | 0.036 | n/a | n/a |
| Imazethapyr | Herbicide | 50407 | 81335-77-5 | 0.038 | n/a | n/a |
| Imidacloprid | Insecticide | 61695 | 138261-41-3 | 0.02 | n/a | n/a |
| 3-Ketocarbofuran | Degradate | 50295 | 16709-30-1 | 0.02 | n/a | n/a |
| Linuron | Herbicide | 38478 | 330-55-2 | 0.014 | n/a | n/a |
| 2-Methyl-4-chlorophenoxyacetic acid (MCPA) | Herbicide | 38482 | 94-74-6 | 0.03 | HA-L | 4 |
| 4-(2-Methyl-4-chlorophenoxy) butyric acid (MCPB) | Herbicide | 38487 | 94-81-5 | 0.01 | n/a | n/a |
| Metalaxyl | Fungicide | 50359 | 57837-19-1 | 0.012 | n/a | n/a |
| Methiocarb | Insecticide | 38501 | 2032-65-7 | 0.01 | n/a | n/a |

*See footnote at end of table.*

**Table 2D.** Pesticides, pesticide degradates and caffeine, primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting level (LRL) for the USGS's National Water Quality Laboratory analytical Schedule 2060, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Methomyl | Insecticide | 49296 | 16752-77-5 | 0.02 | HA-L | 200 |
| 3-(4-Chlorophenyl)-1-methyl urea | Degradate | 61692 | 5352-88-5 | 0.036 | n/a | n/a |
| Metsulfuron methyl[1] | Herbicide | 61697 | 74223-64-6 | 0.025 | n/a | n/a |
| Neburon | Herbicide | 49294 | 555-37-3 | 0.012 | n/a | n/a |
| Nicosulfuron | Herbicide | 50364 | 111991-09-4 | 0.04 | n/a | n/a |
| Norflurazon | Herbicide | 49293 | 27314-13-2 | 0.02 | n/a | n/a |
| Oryzalin | Herbicide | 49292 | 19044-88-3 | 0.012 | n/a | n/a |
| Oxamyl | Insecticide | 38866 | 23135-22-0 | 0.03 | MCL-CA | 50 |
| Picloram | Herbicide | 49291 | 1918-02-01 | 0.032 | MCL-US | 500 |
| Propham | Herbicide | 49236 | 122-42-9 | 0.03 | HA-L | 100 |
| Propiconazole | Fungicide | 50471 | 60207-90-1 | 0.01 | n/a | n/a |
| Propoxur | Insecticide | 38538 | 114-26-1 | 0.008 | n/a | n/a |
| Siduron | Herbicide | 38548 | 1982-49-6 | 0.02 | n/a | n/a |
| Sulfometuron-methyl | Herbicide | 50337 | 74222-97-2 | 0.038 | n/a | n/a |
| Tebuthiuron | Herbicide | 82670 | 34014-18-1 | 0.026 | HA-L | 500 |
| Terbacil | Herbicide | 04032 | 5902-51-2 | 0.016 | HA-L | 90 |
| Triclopyr | Herbicide | 49235 | 55335-06-3 | 0.026 | n/a | n/a |

[1]Although listed as an LRL, these constituents are reported using method reporting levels (MRLs)

**Table 2E.** Low-detection limit 1,2-dibromo-3-chloropropane (DBCP) and 1,2-dibromoethane (EDB), primary use or source, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS minimum reporting levels (MRLs) for the USGS's National Water Quality Laboratory analytical Schedule 1306, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); µg/L, microgram per liter]

| Constituent | Primary use/source | USGS parameter code | CAS number | MRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| 1,2-Dibromo-3-chloropropane (DBCP) | Fumigant | 82625 | 96-12-8 | 0.03 | MCL-US | 0.2 |
| 1,2-Dibromoethane (EDB) | Fumigant/solvent | 77651 | 106-93-4 | 0.036 | MCL-US | 0.05 |

**Table 2F.** Wastewater-indicator constituents, primary uses or sources, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS National Water Quality Laboratory analytical Schedule 1433, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; UV, ultraviolet; µg/L, microgram per liter]

| Constituent | Primary uses/sources | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Acetophenone | Fragrance in detergent and tobacco, flavor in beverages | 62064 | 98-86-2 | 0.5 | n/a | n/a |
| Acetyl hexamethyl tetrahydronaphthalene (AHTN) | Musk fragrance | 62065 | 21145-77-7 | 0.5 | n/a | n/a |
| Anthracene | Wood preservative, tar, diesel, crude oil, combustion product | 34221 | 120-12-7 | 0.5 | n/a | n/a |
| Anthraquinone | Manufactured dye/textiles, seed treatment, bird repellant | 62066 | 84-65-1 | 0.5 | n/a | n/a |
| Benzo[a]pyrene | Cancer research, combustion product | 34248 | 50-32-8 | 0.5 | MCL-US | 0.2 |
| Benzophenone | Fixative for perfumes and soaps | 62067 | 119-61-9 | 0.5 | n/a | n/a |
| ß-Sitosterol | Plant sterol | 62068 | 83-46-5 | 2 | n/a | n/a |
| ß-Stigmastanol | Plant sterol | 62086 | 19466-47-8 | 2 | n/a | n/a |
| Bisphenol A | Manufactured polycarbonate resins, antioxidant, flame retardant | 62069 | 80-05-7 | 1 | n/a | n/a |
| 3-*tert*-Butyl-4-hydroxy anisole (BHA) | Antioxidant, general preservative | 62059 | 25013-16-5 | 5 | n/a | n/a |
| Bromacil | Herbicide, greater than 80 percent noncrop usage on grass/brush | 04029 | 314-40-9 | 0.5 | n/a | n/a |
| Bromoform (tribromomethane) | Byproduct wastewater treatment, military/explosives | 34288 | 75-25-2 | 0.5 | MCL-US | 100 |
| Caffeine | Beverages | 50305 | 58-08-2 | 0.5 | n/a | n/a |
| Camphor | Flavor, odorant, ointments | 62070 | 76-22-2 | 0.5 | n/a | n/a |
| Carbaryl | Insecticide, crop and garden uses | 82680 | 63-25-2 | 1 | HA-L | 700 |
| Carbazole | Insecticide, manuf. dyes, explosives, and lubricants | 62071 | 86-74-8 | 0.5 | n/a | n/a |
| Chlorpyrifos | Insecticide, domestic pest and termite control | 38933 | 2921-88-2 | 0.5 | HA-L | 20 |
| Cholesterol | Fecal indicator, plant sterol | 62072 | 57-88-5 | 2 | n/a | n/a |
| 3ß-Coprostanol | Carnivore fecal indicator | 62057 | 360-68-9 | 2 | n/a | n/a |
| Cotinine | Primary nicotine metabolite | 62005 | 486-56-6 | 1 | n/a | n/a |
| 4-Cumylphenol | Nonionic detergent metabolite | 62060 | 599-64-4 | 1 | n/a | n/a |

**Table 2F.** Wastewater-indicator constituents, primary uses or sources, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS National Water Quality Laboratory analytical Schedule 1433, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; UV, ultraviolet; µg/L, microgram per liter]

| Constituent | Primary uses/sources | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| Diazinon | Insecticide, greater than 40 percent nonagricultural usage, ants, flies | 39572 | 333-41-5 | 0.5 | HA-L | 0.6 |
| 1,4-Dichlorobenzene | Moth repellant, fumigant, deodorant | 34572 | 106-46-7 | 0.5 | MCL-CA | 5 |
| Dichlorvos | Insecticide degradate of naled or trichlofon | 38775 | 62-73-7 | 1 | n/a | n/a |
| 2,6-Dimethylnaphthalene | Diesel/kerosene (trace in gasoline) | 62055 | 581-42-0 | 0.5 | n/a | n/a |
| *d*-Limonene | Fungicide, antimicrobial, antiviral, fragrance in aerosols | 62073 | 5989-27-5 | 0.5 | n/a | n/a |
| Fluoranthene | Component of coal tar and asphalt | 34377 | 206-44-0 | 0.5 | n/a | n/a |
| Hexahydrohexamethylcyclopentabenzopyran (HHCB) | Musk fragrance | 62075 | 1222-05-5 | 0.5 | n/a | n/a |
| Indole | Pesticide ingredient, fragrance in coffee | 62076 | 120-72-9 | 0.5 | n/a | n/a |
| Isoborneol | Fragrance in perfumery, in disinfectants | 62077 | 124-76-5 | 0.5 | n/a | n/a |
| Isophorone | Solvent for lacquer, plastic, oil, silicon, resin | 34409 | 78-59-1 | 0.5 | HA-L | 100 |
| Isopropylbenzene | Manufactured phenol/acetone, fuels and paint thinner | 62078 | 98-82-8 | 0.5 | n/a | n/a |
| Isoquinoline | Flavors and fragrances | 62079 | 119-65-3 | 0.5 | n/a | n/a |
| Menthol | Cigarettes, cough drops, liniment, mouthwash | 62080 | 89-78-1 | 0.5 | n/a | n/a |
| Metalaxyl | Herbicide, fungicide, mildew, blight, pathogens, golf/turf | 50359 | 57837-19-1 | 0.5 | n/a | n/a |
| 5-Methyl-1H-benzotriazole | Antioxidant in antifreeze and deicers | 62063 | 136-85-6 | 2 | n/a | n/a |
| 3-Methyl-1(H)-indole (Skatole) | Fragrance, stench in feces and coal tar | 62058 | 83-34-1 | 1 | n/a | n/a |
| 1-Methylnaphthalene | Gasoline, diesel fuel, or crude oil | 62054 | 90-12-0 | 0.5 | n/a | n/a |
| 2-Methylnaphthalene | Gasoline, diesel fuel, or crude oil | 62056 | 91-57-6 | 0.5 | n/a | n/a |
| Methyl salicylate | Liniment, food, beverage, UV-absorbing lotion | 62081 | 119-36-8 | 0.5 | n/a | n/a |
| Metolachlor | Herbicide, indicator of agricultural drainage | 39415 | 51218-45-2 | 0.5 | HA-L | 100 |
| *N,N*-diethyl-*meta*-toluamide (DEET) | Insecticide, urban uses, mosquito repellent | 62082 | 134-62-3 | 0.5 | n/a | n/a |
| Naphthalene | Fumigant, moth repellent, major component of gasoline | 34443 | 91-20-3 | 0.5 | HA-L | 100 |
| 4-Nonylphenol diethoxylates | Nonionic detergent metabolite | 62083 | n/a | 5 | n/a | n/a |

**Table 2F.** Wastewater-indicator constituents, primary uses or sources, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS National Water Quality Laboratory analytical Schedule 1433, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; UV, ultraviolet; µg/L, microgram per liter]

| Constituent | Primary uses/sources | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|---|
| 4-Octylphenol diethoxylates | Nonionic detergent metabolite | 61705 | n/a | 1 | n/a | n/a |
| 4-Octylphenol monoethoxylates | Nonionic detergent metabolite | 61706 | n/a | 1 | n/a | n/a |
| 4-*n*-Octylphenol | Nonionic detergent metabolite | 62061 | 1806-26-4 | 1 | n/a | n/a |
| 4-*tert*-Octylphenol | Nonionic detergent metabolite | 62062 | 140-66-9 | 1 | n/a | n/a |
| *para*-Nonylphenol (total) | Nonionic detergent metabolite | 62085 | 84852-15-3 | 5 | n/a | n/a |
| *para*-Cresol | Wood preservative | 62084 | 106-44-5 | 1 | n/a | n/a |
| Pentachlorophenol | Herbicide, fumigant, wood preservative, termite control | 34459 | 87-86-5 | 2 | MCL-US | 1 |
| Phenanthrene | Manufactured explosives, tar, diesel, crude oil, combustion product | 34462 | 85-01-8 | 0.5 | n/a | n/a |
| Phenol | Disinfectant, product manufacturing, leachate | 34466 | 108-95-2 | 0.5 | HA-L | 2,000 |
| Prometon | Herbicide (noncrop only) applied prior to blacktop | 04037 | 1610-18-0 | 0.5 | HA-L | 100 |
| Pyrene | Component of coal tar and asphalt | 34470 | 129-00-0 | 0.5 | n/a | n/a |
| Tetrachloroethylene (PCE) | Solvent, degreaser, veterinary anthelmintic | 34476 | 127-18-4 | 0.5 | MCL-US | 5 |
| Tri(2-butoxyethyl)phosphate | Flame retardant | 62093 | 78-51-3 | 0.5 | n/a | n/a |
| Tri(2-chloroethyl)phosphate | Plasticizer, flame retardant | 62087 | 115-96-8 | 0.5 | n/a | n/a |
| Tributyl phosphate | Antifoaming agent, flame retardant | 62089 | 126-73-8 | 0.5 | n/a | n/a |
| Triclosan | Disinfectant, antimicrobial | 62090 | 3380-34-5 | 1 | n/a | n/a |
| Triethyl citrate (ethyl citrate) | Cosmetics, pharmaceuticals | 62091 | 77-93-0 | 0.5 | n/a | n/a |
| Triphenyl phosphate | Plasticizer, resin, wax, finish, roofing paper, flame retardant | 62092 | 115-86-6 | 0.5 | n/a | n/a |
| Tri(dichlorisopropyl)phosphate | Flame retardant | 62088 | 13674-87-8 | 0.5 | n/a | n/a |

**Table 2G.** Constituents of special interest, primary use or source, Chemical Abstracts Service (CAS) number, Montgomery Watson Harza Laboratory method detection limits (MDLs), type of comparison threshold for ground-water detections, and the corresponding threshold level.

[NL, notification level (California Department of Health Services, 2005d); µg/L, microgram per liter]

| Constituent | Primary use/source | CAS number | MDL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|
| Perchlorate | Rocket fuel, fireworks, flares | 14797-73-0 | 0.5 | NL | 6 |
| 1,2,3-Trichloropropane (1,2,3-TCP) | Industrial solvent, organic synthesis | 96-18-4 | 0.005 | NL | 0.005 |
| *N*-Nitrosodimethylamine (NDMA) | Rocket fuel, plasticizer | 62-75-9 | 0.002 | NL | 0.010 |

**Table 2H.** Nutrients and dissolved organic carbon, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 2755 and laboratory code 2613, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); mg/L, milligram per liter; N, nitrogen; n/a, not applicable]

| Constituent | USGS parameter code | CAS number | LRL (mg/L) | Type of comparison threshold | Threshold level (mg/L) |
|---|---|---|---|---|---|
| Ammonia | 00608 | 7664-41-7 | 0.04 | HA-L | 30 |
| Nitrite | 00613 | 14797-65-0 | 0.008 | MCL-US | 1 (as N) |
| Nitrate plus nitrite | 00631 | n/a | 0.06 | MCL-US | 10 (as N) |
| Total nitrogen (ammonia, nitrite, nitrate, organic nitrogen) | 62854 | 17778-88-0 | 0.06 | n/a | n/a |
| Phosphorus, phosphate, orthophosphate | 00671 | 14265-44-2 | 0.006 | n/a | n/a |
| Dissolved organic carbon (DOC) | 00681 | n/a | 0.3 | n/a | n/a |

**Table 2I.** Major ions and trace elements, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 1948, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. Standard conversion from mass units to activity is 0.67 pCi/µg for uranium (U.S. Environmental Protection Agency, 2004a). HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); mg/L, milligram per liter; pCi/µg, picocurie per microgram; µg/L, microgram per liter]

| Constituent | USGS parameter code | CAS number | LRL (mg/L) | Type of comparison threshold | Threshold level (mg/L) |
|---|---|---|---|---|---|
| | | Major ions | | | |
| Bromide | 71870 | 24959-67-9 | 0.02 | n/a | n/a |
| Calcium | 00915 | 7440-70-2 | 0.02 | n/a | n/a |
| Chloride | 00940 | 16887-00-6 | 0.20 | SMCL-US | 250 |
| Fluoride | 00950 | 16984-48-8 | 0.1 | MCL | 2 |
| Iodide | 71865 | 7553-56-2 | 0.002 | n/a | n/a |
| Magnesium | 00925 | 7439-95-4 | 0.008 | n/a | n/a |
| Potassium | 00935 | 7440-09-7 | 0.16 | n/a | n/a |
| Silica | 00955 | 7631-86-9 | 0.04 | n/a | n/a |
| Sodium | 00930 | 7440-23-5 | 0.2 | n/a | n/a |
| Sulfate | 00945 | 14808-79-8 | 0.18 | SMCL-US | 250 |
| Residue on evaporation | 70300 | n/a | 10 | SMCL-US | 500 |

| Constituent | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|
| | | Trace elements | | | |
| Aluminum | 01106 | 7429-90-5 | 1.6 | MCL-US | 1,000 |
| Antimony | 01095 | 7440-36-0 | 0.2 | MCL-US | 6 |
| Arsenic | 01000 | 7440-38-2 | 0.2 | MCL-US | 10 |
| Barium | 01005 | 7440-39-3 | 0.2 | MCL-CA | 1,000 |
| Beryllium | 01010 | 7440-41-7 | 0.06 | MCL-US | 4 |
| Boron | 01020 | 7440-42-8 | 8 | NL | 1,000 |
| Cadmium | 01025 | 7440-43-9 | 0.04 | MCL-US | 5 |
| Chromium | 01030 | 7440-47-3 | 0.8 | MCL-CA | 50 |
| Cobalt | 01035 | 7440-48-4 | 0.014 | n/a | n/a |
| Copper | 01040 | 7440-50-8 | 0.4 | MCL-US | [1]1,300 |
| Iron | 01046 | 7439-89-6 | 6 | HA-L | 300 |
| Lead | 01049 | 7439-92-1 | 0.08 | MCL-US | [1]15 |
| Lithium | 01130 | 7439-93-2 | 0.6 | n/a | n/a |
| Manganese | 01056 | 7439-96-5 | 0.2 | NL | 500 |
| Mercury | 71890 | 7439-97-6 | 0.01 | MCL-US | 2 |
| Molybdenum | 01060 | 7439-98-7 | 0.4 | HA-L | 40 |

*See footnote at end of table.*

**Table 2I.** Major ions and trace elements, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS laboratory reporting levels (LRLs) for the USGS's National Water Quality Laboratory analytical Schedule 1948, type of comparison threshold for ground-water detections, and the corresponding threshold level—Continued.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. Standard conversion from mass units to activity is 0.67 pCi/µg for uranium (U.S. Environmental Protection Agency, 2004a). HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); RSD5, risk-specific dose at 10E-5 (Note: RSD5 = RSD4 (risk level = 10E-4)/10) (U.S. Environmental Protection Agency, 2004b); SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); mg/L, milligram per liter; pCi/µg, picocurie per microgram; µg/L, microgram per liter]

| Constituent | USGS parameter code | CAS number | LRL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|
| Nickel | 01065 | 7440-02-0 | 0.06 | MCL-CA | 100 |
| Selenium | 01145 | 7782-49-2 | 0.4 | MCL-US | 50 |
| Silver | 01075 | 7440-22-4 | 0.2 | HA-L | 100 |
| Strontium | 01080 | 7440-24-6 | 0.4 | HA-L | 4,000 |
| Thallium | 01057 | 7440-28-0 | 0.04 | MCL-US | 2 |
| Tungsten | 01155 | 7440-33-7 | 0.5 | n/a | n/a |
| Uranium | 22703 | 7440-61-1 | 0.04 | MCL-US | 30 |
| Vanadium | 01085 | 7440-62-2 | 0.14 | NL | 50 |
| Zinc | 01090 | 7440-66-6 | 0.6 | HA-L | 2,000 |

[1]Values refered to as MCLs for lead and copper are "notification levels" under the lead and copper rule (California Department of Health Services, 2005a).

**Table 2J.** Iron, arsenic, and chromium speciation, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, USGS method detection limit (MDL) for the USGS's Trace Metal Laboratory, Boulder, Colorado, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. DLR, detection level for the purpose of reporting (California Department of Health Services, 2005a); HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); n/a, not applicable; µg/L, microgram per liter]

| Constituent | USGS parameter code | CAS number | MDL (µg/L) | Type of comparison threshold | Threshold level (µg/L) |
|---|---|---|---|---|---|
| Iron | 01046 | 7439-89-6 | 1 | HA-L | 300 |
| Iron(II) | 01047 | 7439-89-6 | 1 | n/a | n/a |
| Arsenic | 99033 | 7440-38-2 | 0.5 | MCL-US | 10 |
| Arsenic(III) | 99034 | 1327-53-3 | 1 | n/a | n/a |
| Chromium | 01030 | 7440-47-3 | 0.1 | MCL-CA | 50 |
| Chromium(VI), hexavalent | 01032 | 18540-29-9 | 0.1 | DLR | 1 |

**Table 2K.** Stable isotopes and radioactive constituents, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, reporting level type, reporting units and reporting level/uncertainty, type of comparison threshold for ground-water detections, and the corresponding threshold level.

[The reporting level type, reporting units, and reporting level/uncertainty are from USGS's National Water Quality Laboratory, USGS's Stable Isotope and Tritium Laboratory, Menlo Park, California, USGS's Stable Isotope Laboratory, Reston, Virginia (RSIL), and the contract laboratories Eberline Analytical Services, the University of Waterloo's Environmental Isotope Laboratory, and the University of Arizona's Accelerator Mass Spectrometry Laboratory. The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. Dual entries for CAS number correspond to dual entries for constituent. MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); MRL, Minimum Reporting Level; MU, method uncertainty; n/a, not applicable; SSMDC, sample-specific minimum detectable concentration; pCi/L, picocurie per liter]

| Constituent | USGS parameter code | CAS number | Reporting level type | Reporting units | Reporting level/ uncertainty | Type of comparison threshold | Threshold level |
|---|---|---|---|---|---|---|---|
| Radon-222 | 82303 | 14859-67-7 | SSMDC | pCi/L | see *Table 21* | Proposed MCL-US | 300 |
| [1]Tritium | 07000 | 10028-17-8 | MRL | pCi/L | 1 | MCL-CA | 20,000 |
| [2]Deuterium/protium | 82082 | 7782-39-0 / 1333-74-0 | MU | per mil | 2 | n/a | n/a |
| [2]Oxygen-18/oxygen-16 | 82085 | n/a / 7782-44-7 | MU | per mil | 0.20 | n/a | n/a |
| [3]Gross-alpha radioactivity, 72 hr count | 62636 | 12587-46-1 | SSMDC | pCi/L | see *Table 21* | MCL-US | 15 |
| [3]Gross-alpha radioactivity, 30 day count | 62639 | 12587-46-1 | SSMDC | pCi/L | see *Table 21* | MCL-US | 15 |
| [3]Gross-beta radioactivity, 72 hr count | 62642 | 12587-47-2 | SSMDC | pCi/L | see *Table 21* | MCL-CA | 50 |
| [3]Gross-beta radioactivity, 30 day count | 62645 | 12587-47-2 | SSMDC | pCi/L | see *Table 21* | MCL-CA | 50 |
| [3]Radium-226 | 09511 | 13982-63-3 | SSMDC | pCi/L | see *Table 21* | MCL-US | 5 |
| [3]Radium-228 | 81366 | 15262-20-1 | SSMDC | pCi/L | see *Table 21* | MCL-US | 5 |
| [4]Carbon-13/carbon-12 | 82081 | n/a / 7440-44-0 | $1\sigma$ | per mill | n/a | n/a | n/a |
| [4]Carbon-14 | 49933 | 14762-75-5 | $1\sigma$ | percent modern | n/a | n/a | n/a |

[1]U.S. Geological Survey's National Water Quality Laboratory, Stable Isotope and Tritium Laboratory, Menlo Park, California.

[2]U.S. Geological Survey's Stable Isotope Laboratory, Reston, Virginia.

[3]Eberline Analytical Services

[4]University of Waterloo's Environmental Isotope Laboratory and the University of Arizona's Accelerator Mass Spectrometry Laboratory.

**Table 2L.** Tritium and noble gas compounds, U.S. Geological Survey (USGS) parameter code, Chemical Abstracts Service (CAS) number, method uncertainty (MU), reporting units from the Lawrence Livermore National Laboratory, type of comparison threshold, and threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. Dual entry for CAS number corresponds to dual entry for constituent. MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); n/a, not applicable; $cm^3$ STP/g, cubic centimeter of gas at standard temperature and pressure per gram of water; pCi/L, picocurie per liter]

| Constituent | USGS parameter code | CAS number | MU (percent) | Reporting units | Type of comparison threshold | Threshold level |
|---|---|---|---|---|---|---|
| Argon | 85563 | 7440-37-1 | 2 | $cm^3$ STP/g | n/a | n/a |
| Helium-3/helium-4 | 61040 | n/a / 7440-59-7 | 0.75 | n/a | n/a | n/a |
| Helium-4 | 85561 | 7440-59-7 | 2 | $cm^3$ STP/g | n/a | n/a |
| Krypton | 85565 | 7439-90-9 | 2 | $cm^3$ STP/g | n/a | n/a |
| Neon | 61046 | 7440-01-09 | 2 | $cm^3$ STP/g | n/a | n/a |
| Tritium | 07000 | 10028-17-8 | n/a | pCi/L | MCL-CA | 20,000 |
| Xenon | 85567 | 7440-63-3 | 2 | $cm^3$ STP/g | n/a | n/a |

**Table 2M.** Microbial constituents, U.S. Geological Survey (USGS) parameter code, primary uses and sources, method detection limit (MDL) for the USGS's Ohio Water Microbiology Laboratory parameter codes 90901, 90900, 99335 and 99332, type of comparison threshold, and threshold level.

[The five digit number below the USGS parameter code is used to uniquely identify a specific constituent or property. Abbreviations and symbols: MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2004b); mL, milliliter; n/a, not applicable; TT, treatment technique—a required process intended to reduce the level of a contaminant in drinking water (U.S. Environmental Protection Agency, 2004b)]

| Microbial constiuent | USGS parameter code | Primary use/source | MDL | Type of comparison threshold | Threshold level |
|---|---|---|---|---|---|
| *Escherichia* coliform—(*E. coli*) | 90901 | Sewage and animal waste indicator/Intestinal tracts of humans and animals | 1 colony/100 mL | TT | No fecal coliforms are allowed. |
| Total coliform (including fecal coliform and *E. coli*) | 90900 | Water-quality indicator/Soil, water, and intestinal tracts of animals | 1 colony/100 mL | MCL-US | No more then 5.0% samples total coliform-positives in a month. Every sample that has total coliforms must be analyzed for fecal coliforms; no fecal coliforms are allowed. |
| F-specific coliphage | 99335 | Viral indicator/Intestinal tracts of warm-blooded animals | n/a | TT | 99.99% killed /inactivated |
| Somatic coliphage | 99332 | Viral indicator/Fecal contaminated waters | n/a | TT | 99.99% killed /inactivated |

**Table 3.** Identification, sampling, altitude, and construction information for sampled wells in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[COS, Cosumnes Basin; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; ft, feet; LSD, land surface datum; mm/dd/yy, month/day/year; nd, no data; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath]

| GAMA well identification number | Sampling information | | | | Construction information | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date (mm/dd/yy) | Time (hhmm) | Sampling schedule | Well head altitude (ft above LSD) | Year of construction | Well depth (ft below LSD) | Top perforation (ft below LSD) | Bottom perforation (ft below LSD) | Total open length (ft) | Number of openings |
| Cosumnes Basin wells | | | | | | | | | | |
| COS-01 | 12/13/04 | 1340 | Fast | 84 | 1978 | 360 | 300 | 360 | 60 | 1 |
| COS-02 | 12/14/04 | 0950 | Fast | 53 | 1995 | 930 | 750 | 910 | 160 | 2 |
| COS-03 | 12/14/04 | 1010 | Fast | 45 | 1988 | 470 | 250 | 460 | 210 | 4 |
| COS-04 | 12/14/04 | 1150 | Fast | 51 | 1985 | 660 | 180 | 650 | 470 | 10 |
| COS-05 | 12/15/04 | 0920 | Fast | 90 | 1972 | 256 | nd | nd | nd | nd |
| COS-06 | 12/15/04 | 1630 | Fast | 38 | 1969 | 117 | 117 | nd | nd | nd |
| COS-07 | 01/03/05 | 1410 | Fast | 62 | 1978 | 160 | nd | nd | nd | nd |
| COS-08 | 01/03/05 | 1600 | Fast | 42 | 1999 | 575 | 178 | 570 | 392 | 11 |
| COS-09 | 01/10/05 | 0950 | Fast | 12 | nd | nd | nd | nd | nd | nd |
| COS-10 | 01/25/05 | 1330 | Fast | 79 | nd | nd | nd | nd | nd | nd |
| Eastern San Joaquin Basin wells | | | | | | | | | | |
| ESJ-01 | 01/04/05 | 0910 | Fast | 28 | 1985 | 270 | 180 | 265 | 85 | 2 |
| ESJ-02 | 01/04/05 | 1110 | Fast | 39 | 1998 | 340 | 138 | 340 | 202 | 4 |
| ESJ-03 | 01/04/05 | 1230 | Fast | 42 | 1995 | 360 | 50 | 360 | 310 | 3 |
| ESJ-04 | 01/04/05 | 1550 | Fast | 42 | nd | nd | nd | nd | nd | nd |
| ESJ-05 | 01/10/05 | 1120 | Fast | 102 | 1979 | 535 | 224 | 455 | 231 | 2 |
| ESJ-06 | 01/10/05 | 1330 | Intermediate | 40 | 1980 | 403 | 200 | 395 | 195 | 1 |
| ESJ-07 | 01/11/05 | 0840 | Fast | 75 | nd | nd | nd | nd | nd | nd |
| ESJ-08 | 01/11/05 | 1010 | Intermediate | 126 | 1997 | 610 | 280 | 600 | 320 | 1 |
| ESJ-09 | 01/12/05 | 1210 | Fast | 39 | 1986 | 365 | 130 | 345 | 215 | 2 |
| ESJ-10 | 01/12/05 | 1350 | Intermediate | 14 | 2000 | 364 | 156 | 354 | 198 | nd |
| ESJ-11 | 01/13/05 | 0930 | Fast | 12 | 1978 | 245 | 135 | nd | nd | 1 |
| ESJ-12 | 01/13/05 | 1030 | Slow | 82 | 1961 | 270 | 190 | 270 | 80 | 1 |
| ESJ-13 | 01/13/05 | 1350 | Intermediate | 89 | 1955 | 619 | 619 | nd | nd | nd |

**Table 3.** Identification, sampling, altitude, and construction information for sampled wells in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[COS, Cosumnes Basin; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; ft, feet; LSD, land surface datum; mm/dd/yy, month/day/year; nd, no data; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath]

| GAMA well identification number | Sampling information | | | | Construction information | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date (mm/dd/yy) | Time (hhmm) | Sampling schedule | Well head altitude (ft above LSD) | Year of construction | Well depth (ft below LSD) | Top perforation (ft below LSD) | Bottom perforation (ft below LSD) | Total open length (ft) | Number of openings |
| ESJ-14 | 01/13/05 | 1430 | Intermediate | 20 | 2001 | 212 | nd | nd | nd | nd |
| ESJ-15 | 01/25/05 | 0910 | Intermediate | 11 | 1954 | 268 | 170 | 236 | 66 | 1 |
| ESJ-16 | 02/08/05 | 0910 | Intermediate | 34 | 1954 | 427 | 196 | 419 | 223 | 1 |
| ESJ-17 | 02/14/05 | 1120 | Intermediate | 92 | 1985 | 390 | 290 | 390 | 100 | 1 |
| ESJ-18 | 02/15/05 | 0810 | Intermediate | 100 | nd | nd | nd | nd | nd | nd |
| ESJ-19 | 02/18/05 | 1000 | Slow | 17 | 1957 | 519 | 195 | 495 | 300 | 3 |
| Tracy Basin wells | | | | | | | | | | |
| TRCY-01 | 01/05/05 | 1350 | Fast | 16 | 1953 | 502 | 384 | 480 | 96 | 1 |
| TRCY-02 | 01/05/05 | 1540 | Fast | 62 | 1994 | 200 | 50 | 200 | 150 | 2 |
| TRCY-03 | 01/06/05 | 1030 | Slow | 207 | 1989 | 900 | 420 | 890 | 470 | 1 |
| TRCY-04 | 01/06/05 | 1110 | Fast | 52 | 1993 | 325 | nd | 325 | 325 | 2 |
| TRCY-05 | 01/06/05 | 1300 | Fast | 54 | 1980 | 380 | nd | nd | nd | nd |
| TRCY-06 | 01/06/05 | 1510 | Fast | 7 | nd | nd | nd | nd | nd | nd |
| TRCY-07 | 02/08/05 | 1120 | Slow | 2 | 1984 | 83 | 23 | 73 | 50 | 2 |
| TRCY-08 | 02/08/05 | 1200 | Fast | 105 | 1997 | 340 | 320 | 340 | 20 | 1 |
| TRCY-09 | 02/09/05 | 1030 | Intermediate | –3 | nd | nd | nd | nd | nd | nd |
| TRCY-10 | 02/17/05 | 1030 | Fast | –10 | 1978 | 185 | 175 | 185 | 10 | 1 |
| TRCY-11 | 02/17/05 | 1430 | Intermediate | 26 | 1985 | 400 | 310 | 400 | 90 | 2 |
| Upland Basin wells | | | | | | | | | | |
| QPC-01 | 01/11/05 | 1050 | Slow | 172 | 1942 | nd | nd | nd | nd | nd |
| QPC-02 | 01/11/05 | 1330 | Fast | 151 | 1975 | nd | 130 | 175 | 45 | 1 |
| QPC-03 | 01/24/05 | 1020 | Fast | 302 | nd | nd | nd | nd | nd | nd |
| QPC-04 | 01/24/05 | 1300 | Intermediate | 260 | 1971 | 520 | 235 | 512 | 277 | 5 |
| QPC-05 | 01/24/05 | 1630 | Fast | 297 | 1990 | 200 | 160 | 200 | 40 | 1 |
| QPC-06 | 01/25/05 | 1650 | Intermediate | 192 | 1966 | 208 | nd | nd | nd | nd |
| QPC-07 | 01/27/05 | 0950 | Intermediate | 722 | 1994 | 310 | 100 | 310 | 210 | 2 |

**Table 3.** Identification, sampling, altitude, and construction information for sampled wells in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[COS, Cosumnes Basin; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; ft, feet; LSD, land surface datum; mm/dd/yy, month/day/year; nd, no data; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath]

| GAMA well identification number | Sampling information | | | | Construction information | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date (mm/dd/yy) | Time (hhmm) | Sampling schedule | Well head altitude (ft above LSD) | Year of construction | Well depth (ft below LSD) | Top perforation (ft below LSD) | Bottom perforation (ft below LSD) | Total open length (ft) | Number of openings |
| QPC-08 | 02/09/05 | 1330 | Intermediate | 90 | 1966 | 164 | nd | nd | nd | nd |
| QPC-09 | 02/10/05 | 0910 | Fast | 262 | 1977 | 366 | 150 | 350 | 200 | 3 |
| QPC-10 | 02/14/05 | 1440 | Intermediate | 197 | 1972 | nd | nd | nd | nd | nd |
| QPC-11 | 02/15/05 | 1240 | Fast | 147 | nd | nd | nd | nd | nd | nd |
| Nongrid cell wells | | | | | | | | | | |
| TRCYFP-01 | 01/03/05 | 1130 | Slow | –5 | 1995 | 130 | 90 | 130 | 40 | 1 |
| TRCYFP-02 | 01/04/05 | 1300 | Slow | 29 | 1961 | 1,148 | 337 | 561 | 224 | 5 |
| TRCYFP-03 | 01/05/05 | 1040 | Intermediate | 22 | nd | 400 | nd | nd | nd | nd |
| TRCYFP-04 | 01/05/05 | 1230 | Slow | 199 | 1988 | 870 | 420 | 850 | 430 | 1 |
| TRCYFP-05 | 01/05/05 | 1340 | Intermediate | 45 | 1989 | 990 | 490 | 980 | 490 | 1 |
| TRCYFP-06 | 01/06/05 | 0840 | Fast | 12 | 1974 | 148 | 128 | 148 | 20 | 1 |
| ESJFP-07 | 01/10/05 | 1400 | Slow | 105 | 1957 | 368 | 335 | 350 | 15 | nd |
| ESJFP-08 | 01/12/05 | 0930 | Intermediate | 23 | 1978 | 425 | 199 | 415 | 216 | nd |
| ESJFP-09 | 01/12/05 | 1330 | Intermediate | 38 | nd | nd | nd | nd | nd | nd |
| ESJFP-10 | 01/28/05 | 0830 | Slow | 27 | 1997 | 540 | 200 | 520 | 320 | 7 |
| Monitoring wells | | | | | | | | | | |
| ESJMW-01 | 02/01/05 | 1230 | Slow | 27 | nd | 530 | 500 | 520 | 20 | 1 |
| ESJMW-02 | 02/02/05 | 1100 | Slow | 27 | nd | 460 | 400 | 410 | 10 | 3 |
| ESJMW-03 | 02/03/05 | 1130 | Slow | 27 | nd | 232 | 195 | 215 | 20 | 1 |
| Depth-dependent samples | | | | | | | | | | |
| ESJDD-01 | 01/26/05 | 1250 | Depth dependent | 27 | 1997 | 540 | 200 | 520 | 320 | 7 |
| ESJDD-02 | 01/27/05 | 0900 | Depth dependent | 27 | 1997 | 540 | 200 | 520 | 320 | 7 |
| ESJDD-03 | 01/27/05 | 1300 | Depth dependent | 27 | 1997 | 540 | 200 | 520 | 320 | 7 |
| ESJDD-04 | 02/16/05 | 1500 | Depth dependent | 17 | 1957 | 519 | 195 | 495 | 300 | 3 |
| ESJDD-05 | 02/17/05 | 1130 | Depth dependent | 17 | 1957 | 519 | 195 | 495 | 300 | 3 |
| ESJDD-06 | 02/17/05 | 1900 | Depth dependent | 17 | 1957 | 519 | 195 | 495 | 300 | 3 |

**Table 4.** Analytical methods used for the determination of organic, inorganic, and microbial constituents by the U.S. Geological Survey's (USGS) National Water Quality Laboratory (NWQL) and laboratories other than NWQL.

[MI agar, supplemented nutrient agar that cause coliforms (total and *escherichia*) to produce distinctly different fluorescence under ultraviolet lighting, thus aiding in their detection and enumeration; UV, ultraviolet; VIS, visible; VOCs, volatile organic compounds]

| Analyte | Method | Laboratory | Citation(s) |
|---|---|---|---|
| VOCs | Purge and trap capillary gas chromatography/mass spectrometry | NWQL | Connor and others, 1998 |
| Gasoline oxygenates | Heated purge and trap/gas chromatography/mass spectrometry | NWQL | Rose and Sandstrom, 2003 |
| Pesticides | Solid-phase extraction and chromatography/mass spectrometry | NWQL | Furlong and others, 2001; Sandstrom and others, 2001 |
| Wastewater-indicator constituents | Polystyrene-divinylbenzene solid-phase extraction and capillary-column gas chromatography/mass spectrometry | NWQL | Zaugg and others, 2002 |
| Major and minor ions, trace elements and nutrients | Several methods | NWQL | Fishman and Friedman, 1989; Fishman, 1993; Faires, 1993; McLain, 1993; Garbarino, 1999; Garbarino and Damrau, 2001; Patton and Kryskalla, 2003 |
| Dissolved organic carbon | UV-promoted persulfate oxidation and infrared spectrometry | NWQL | Brenton and Arnett, 1993 |
| Radon-222 | Liquid scintillation counting | NWQL | American Society for Testing and Materials, 1998 |
| Stable isotopes of water | Gaseous hydrogen and carbon dioxide-water equilibration | USGS Stable Isotope Laboratory, Reston, Virginia | Epstein and Mayeda, 1953; Coplen and others, 1991 |
| Chromium, arsenic, and iron speciation | Various techniques of ultraviolet visible (UV-VIS) spectrophotometery and atomic absorbance spectroscopy | USGS Trace Metal Laboratory, Boulder, Colorado | Stookey, 1970; To and others, 1998; Ball and McCleskey, 2003a and 2003b; McCleskey and others, 2003 |
| F-specific and somatic coliphage | Single-agar layer (SAL) and two-step enrichment methods | USGS Ohio Water Microbiology Laboratory | U.S. Environmental Protection Agency, 2000 |
| Tritium | Electrolytic enrichment-liquid scintillation | USGS Stable Isotope and Tritium Laboratory, Menlo Park, California | Thatcher and others, 1977 |
| Perchlorate and *N*-nitrosodimethylamine (NDMA) | Chromatography and mass spectrometry | Montgomery Watson Harza Laboratory | U.S. Environmental Protection Agency, 1996; Hautman and others, 1999; U.S. Environmental Protection Agency, 1999 |
| 1,2,3-Trichloropropane | Gas chromatography/electron capture detector | Montgomery Watson Harza Laboratory | U.S. Environmental Protection Agency, 1995 |

**Table 4.** Analytical methods used for the determination of organic, inorganic, and microbial constituents by the U.S. Geological Survey's (USGS) National Water Quality Laboratory (NWQL) and laboratories other than NWQL—Continued.

[MI agar, supplemented nutrient agar that cause coliforms (total and Escherichia) to produce distinctly different fluorescence under ultraviolet lighting, thus aiding in their detection and enumeration; UV, ultraviolet; VIS, visible; VOCs, volatile organic compounds]

| Analyte | Method | Laboratory | Citation(s) |
|---|---|---|---|
| Tritium and noble gases | Helium in-growth and accelerator mass spectometry | Lawrence Livermore National Laboratory | Eaton and others, 2004 |
| Radium 226/228, gross alpha and beta radioactivity | Several methods | Eberline Services | U.S. Environmental Protection Agency, 1980 |
| Carbon isotopes | Accelerator mass spectometry | University of Waterloo, Environmental Isotope Laboratory; University of Arizona Isotope Geochemistry Laboratory | Donahue and others, 1990; Jull and others, 2004 |
| Total and *escherichia* coliform | Membrane filter technique with "MI agar" | USGS field personel | U.S. Environmental Protection Agency, 2002b |

**Table 5.** Constituents analyzed in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005 which appears on multiple analytical schedules, primary constituent classification, analytical schedules the constituent appears on, and the preferred analytical schedule.

[Preferred analytical schedules are the methods of analysis with the greatest accuracy and precision out of the ones used for the compound in question. MWH, Montgomery Watson Harza Laboratory; VOC, volatile organic compound]

| Constituent | Primary constituent classification | Analytical schedules | Preferred analytical schedule |
|---|---|---|---|
| Acetone | VOC | 2020, 4024 | 2020 |
| Bromoform (tribromomethane) | VOC | 1433, 2020 | 2020 |
| 1,4-Dichlorobenzene | VOC | 1433, 2020 | 2020 |
| Diisopropyl ether | VOC | 2020, 4024 | 2020 |
| Ethyl *tert*-Butyl ether (ETBE) | VOC | 2020, 4024 | 2020 |
| Isopropylbenzene | VOC | 1433, 2020 | 2020 |
| Methyl *tert*-butyl ether (MTBE) | VOC | 2020, 4024 | 2020 |
| Methyl *tert*-pentyl ether | VOC | 2020, 4024 | 2020 |
| Naphthalene | VOC | 1433, 2020 | 2020 |
| Tetrachloroethylene | VOC | 1433, 2020 | 2020 |
| 1,2,3-Trichloropropane (1,2,3-TCP) | VOC | 2020, MHW | MWH |
| Caffeine | Wastewater-indicator constituent | 1433, 2060, 9003 | 2060 |
| Cotinine | Wastewater-indicator constituent | 1433, 9003 | 1433 |
| Atrazine | Pesticide | 2003, 2060 | 2003 |
| Bromacil | Pesticide | 1433, 2060 | 2060 |
| Carbaryl | Pesticide | 1433, 2003, 2060 | 2003 |
| 2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) | Pesticide degradate | 2003, 2060 | 2003 |
| Chlorpyrifos | Pesticide | 1433, 2003 | 2003 |
| Diazinon | Pesticide | 1433, 2003 | 2003 |
| 1,2-Dibromo-3-chloropropane (DBCP) | Pesticide | 1306, 2020 | 1306 |
| 1,2-Dibromoethane (EDB) | Pesticide | 1306, 2020 | 1306 |
| Dichlorvos | Pesticide | 1433, 2003 | 2003 |
| Metalaxyl | Pesticide | 1433, 2003, 2060 | 2060 |
| Metolachlor | Pesticide | 1433, 2003 | 2003 |
| Prometon | Pesticide | 1433, 2003 | 2003 |

**Table 6.** Quality-control summary for volatile organic compounds, gasoline oxygenates, tentatively identified compounds (TICs), major and minor ions, trace elements, and nutrients detected in the depth-dependent sampling equipment blank and ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Numbers in parentheses are the Chemical Abstracts Service (CAS) registry numbers. E, estimated value; GC/MS, gas chromatography/mass spectrometry; mg/L, milligram per liter; µg/L, microgram per liter]

| Constituent | Maximum concentration detected in equipment blank sample (µg/L) | Minimum concentration detected in ground-water samples using this equipment (µg/L) | Number of ground-water samples censored |
|---|---|---|---|
| Volatile organic compounds and gasoline oxygenates | | | |
| Toluene | [1]E0.03 | E0.02 | 6 |
| Tentatively identified compounds[2] | | | |
| Hexafluoropropene (116-15-4) | 7.3 | 0.8 | 4 |
| Pentafluoropropene (690-27-7) | 0.8 | 0.1 | 2 |
| Unknown | 0.2 | 0.1 | 2 |
| Major and minor ions[3] | | | |
| Calcium | 0.12 | 21.1 | 0 |
| Magnesium | E0.004 | 12.6 | 0 |
| Silica | 0.05 | 51 | 0 |
| Trace elements | | | |
| Barium | E0.2 | 56.8 | 0 |
| Manganese | 0.6 | E0.1 | 3 |
| Strontium | 0.5 | 257 | 0 |
| Zinc | 1 | 2.8 | 0 |
| Nutrients[3] | | | |
| Total nitrogen[4] | 0.2 | E0.04 | 0 |

[1]Compound also detected in associated source-solution blank.

[2]TICs are based on comparison with the National Institute for Standards and Technology library spectra and examination by a GC/MS analyst; reported concentrations are approximate.

[3]Concentration in mg/L.

[4]Total nitrogen (nitrate + nitrite + ammonia + organic nitrogen), analytically determined.

**Table 7.** Quality-control summary for volatile organic compounds, gasoline oxygenates, wastewater-indicator constituents, major and minor ions, and trace elements detected in the portable pump equipment blank and ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[E, estimated value; mg/L, milligram per liter; µg/L, microgram per liter; —, not detected]

| Constituent | Maximum concentration detected in equipment blank sample (µg/L) | Minimum concentration detected in ground-water samples using this equipment (µg/L) | Number of ground-water samples censored |
|---|---|---|---|
| Volatile organic compounds and gasoline oxygenates | | | |
| Benzene | E0.013 | — | 0 |
| Ethylbenzene | E0.018 | E0.023 | 3 |
| Toluene | [1]0.11 | E0.02 | 3 |
| 1,2,4-Trichlorobenzene | E0.026 | E0.039 | 3 |
| *m*- and *p*-Xylene | E0.13 | E0.12 | 3 |
| *o*-Xylene | E0.038 | E0.048 | 3 |
| Wastewater-indicator constituents | | | |
| Phenol | [1]E0.4 | E0.17 | 2 |
| Major and minor ions[2] | | | |
| Silica | 0.04 | 60.5 | 0 |
| Trace elements | | | |
| Vanadium | 0.17 | 20.7 | 0 |
| Zinc | 0.8 | 0.8 | 3 |

[1]Compound also detected in associated source-solution blank.

[2]Concentration in mg/L.

**Table 8.** Quality-control summary for volatile organic compounds, gasoline oxygenates, wastewater-indicator constituents, major and minor ions, trace elements, nutrients, and dissolved organic carbon, detected in field blanks and ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[E, estimated value; mg/L, milligram per liter; µg/L, microgram per liter; —, not detected].

| Constituent | Maximum concentration detected in field blanks (µg/L) | Minimum concentration detected in ground-water samples (µg/L) | Number of ground-water samples censored |
|---|---|---|---|
| Volatile organic compounds and gasoline oxygenates | | | |
| Acetone | E4 | — | 0 |
| 2-Butanone (methyl ethyl keytone) | E0.6 | — | 0 |
| Ethylbenzene | 0.12 | E0.01 | 0 |
| *m*- and *p*-Xylene | 0.52 | E0.05 | 0 |
| *o*-Xylene | 0.23 | E0.06 | 0 |
| Toluene | [1]0.30 | E0.01 | 24 |
| Wastewater-indicator compounds | | | |
| Phenol | E0.4 | E0.2 | 6 |
| Major and minor ions[2] | | | |
| Calcium | E0.02 | 4.6 | 0 |
| Iodide | E0.001 | E0.001 | 17 |
| Silica | 21.6 | 20.1 | 0 |
| Trace elements | | | |
| Barium | 0.3 | 25.1 | 0 |
| Chromium(Total)[3] | 6 | 1 | 21 |
| Chromium(VI)[3] | 5 | 1 | 16 |
| Copper | 0.5 | E0.3 | 3 |
| Iron[3] | 3 | 2 | 20 |
| Manganese | E0.1 | 0.2 | 4 |
| Nickel | E0.05 | 0.13 | 0 |
| Zinc | 2.0 | 0.9 | 5 |
| Nutrients and dissolved organic carbon[2] | | | |
| Dissolved organic carbon | E0.2 | E0.2 | 4 |

[1]Compound also detected in associated source solution blank.

[2]Constituent concentrations are reported in mg/L.

[3]Constituent analyzed at the U.S. Geological Survey's Trace Metal Laboratory, Boulder, Colorado.

**Table 9A.** Quality-control summary of replicate volatile organic compound and gasoline oxygenates, and pesticide and pesticide degradates, with relative standard deviations greater than zero, collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Because of the large number of compounds, only compounds with relative standard deviations above zero are shown. No replicate pairs for wastewater-indicator constituents, constituents of special interest, or coliphage had a relative standard deviation greater than zero. n/a, not applicable (because median values require more than one value)]

| Constituent | Number of relative standard deviations greater than zero/replicate pairs | Maximum relative standard deviation (percent) | Median of relative standard deviations greater than zero (percent) |
|---|---|---|---|
| Volatile organic compounds and gasoline oxygenates | | | |
| 1,2-Dichloropropane | 1/6 | 3 | n/a |
| 1,2,4-Trimethylbenzene | 1/6 | 88 | n/a |
| Pesticides and pesticide degradates | | | |
| Diphenamid | 1/2 | 4 | n/a |

**Table 9B.** Quality-control summary of replicate nutrient and dissolved organic carbon samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[n/a, not applicable (because median values require more than one value)]

| Constituent | Number of relative standard deviations greater than zero/replicate pairs | Maximum relative standard deviation (percent) | Median of relative standard deviations greater than zero (percent) |
|---|---|---|---|
| Ammonia | 0/1 | 0 | n/a |
| Nitrite | 0/1 | 0 | n/a |
| Nitrate plus nitrite | 0/1 | 0 | n/a |
| Total nitrogen | 2/2 | 3 | 2 |
| Phosphorus | 1/1 | 2 | n/a |
| Dissolved organic carbon | 1/1 | 27 | n/a |

**Table 9C.** Quality-control summary of replicate major- and minor-ion samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[n/a, not applicable (because median values require more than one value); <, less than]

| Constituent | Number of relative standard deviations greater than zero/replicate pairs | Maximum relative standard deviation (percent) | Median of relative standard deviations greater than zero (percent) |
|---|---|---|---|
| Bromide | 1/2 | 4 | n/a |
| Calcium | 2/3 | 1 | 1 |
| Chloride | 2/3 | 1 | <1 |
| Fluoride | 2/3 | 7 | 4 |
| Iodide | 0/2 | 0 | n/a |
| Magnesium | 2/3 | 2 | <1 |
| Potassium | 3/3 | 2 | 1 |
| Silica | 2/3 | 1 | 1 |
| Sodium | 2/3 | 1 | <1 |
| Sulfate | 2/3 | 0 | <1 |
| Residue on evaporation | 3/3 | 1 | 1 |

**Table 9D.** Quality-control summary of replicate trace element samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[n/a, not applicable (because median values require more than one value); <, less than]

| Constituent | Number of relative standard deviations greater than zero/replicate pairs | Maximum relative standard deviation (percent) | Median of relative standard deviations greater than zero (percent) |
|---|---|---|---|
| Aluminum | 1/3 | 7 | n/a |
| Antimony | 0/3 | 0 | n/a |
| Arsenic | 3/3 | 4 | 1 |
| Arsenic[1] | 4/4 | 10 | 3 |
| Arsenic(III)[1] | 1/4 | 0 | n/a |
| Barium | 3/3 | 3 | 3 |
| Beryllium | 0/3 | 0 | n/a |
| Boron | 2/3 | 19 | 6 |
| Cadmium | 2/3 | 20 | 5 |
| Chromium | 0/3 | 0 | n/a |
| Chromium[1] | 4/4 | 29 | 14 |
| Chromium(VI)[1] | 4/4 | 39 | 25 |
| Cobalt | 3/3 | 2 | 1 |
| Copper | 1/3 | 2 | n/a |
| Iron | 1/3 | 1 | n/a |
| Iron[1] | 2/4 | 28 | <1 |
| Iron(II)[1] | 1/4 | 0 | n/a |
| Lead | 2/3 | 37 | 3 |
| Lithium | 3/3 | 15 | 7 |
| Manganese | 2/3 | 2 | 1 |
| Mercury | 0/2 | 0 | n/a |
| Molybdenum | 1/3 | 2 | n/a |
| Nickel | 3/3 | 3 | 1 |
| Selenium | 2/3 | 22 | 12 |
| Silver | 0/3 | 0 | n/a |
| Strontium | 3/3 | 3 | 3 |
| Thallium | 0/3 | 0 | n/a |
| Tungsten | 0/3 | 0 | n/a |
| Uranium | 3/3 | 6 | 3 |
| Vanadium | 3/3 | 8 | 4 |
| Zinc | 2/3 | 5 | 1 |

[1]Samples analyzed at U.S. Geological Survey's Trace Metal Laboratory, Boulder, Colorado. All other samples were analyzed at the U.S. Geological Survey's National Water Quality Laboratory, Denver, Colorado.

**Table 9E.** Quality-control summary of replicate stable isotope and radioactive constituent samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[n/a, not applicable (because median values require more than one value); <, less than]

| Isotopes and radioactive constituents | Number of relative standard deviations greater than zero/replicate pairs | Maximum relative standard deviation (percent) | Median of relative standard deviations greater than zero (percent) |
|---|---|---|---|
| Deuterium/protium | 4/4 | 1 | <1 |
| Oxygen-18/oxygen-16 | 3/4 | 1 | <1 |
| Tritium[1] | 1/1 | 2 | n/a |
| Tritium[2] | 6/6 | 141 | 15 |
| Gross-alpha radioactivity, 72 hour count | 2/2 | 625 | 340 |
| Gross-alpha radioactivity, 30 day count | 2/2 | 106 | 54 |
| Gross-beta radioactivity, 72 hour count | 2/2 | 11 | 8 |
| Gross-beta radioactivity, 30 day count | 2/2 | 9 | 5 |
| Radon-222 | 1/2 | 7 | n/a |
| Radium-226 | 2/2 | 29 | 15 |
| Radium-228 | 2/2 | 44 | 29 |

[1]Analyses done at Lawrence Livermore National Laboratory.

[2]Analyses done at the U.S. Geological Survey's Stable Isotope and Tritium Laboratory, Menlo Park, California.

**Table 10.** Summary of surrogate-constituent recoveries for ground water and quality-control analyses of volatile organic compounds, gasoline oxygenates, pesticides and pesticide degradates, wastewater-indicator constituents, and constituents of special interest collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[ MWH, Montgomery Watson Harza Laboratory; VOC, volatile organic compound]

| Surrogate constituent | Analytical schedule | Constituent class | Number of blank sample analyses | Number of nonblank sample analyses | Median recovery of blank samples (percent) | Median recovery of nonblank samples (percent) | Total number of sample analyses | Number of surrogate recoveries below 70 percent | Number of surrogate recoveries between 70 and 130 percent | Number of surrogate recoveries above 130 percent |
|---|---|---|---|---|---|---|---|---|---|---|
| α-HCH-d6 | 2003 | Pesticides and degradates | 9 | 82 | 94 | 96 | 91 | 0 | 89 | 2 |
| Barban | 2060 | Pesticides and degradates | 3 | 20 | 91 | 106 | 23 | 0 | 23 | 0 |
| Bisphenol A-d3 | 1433 | Wastewater indicators | 6 | 20 | 36 | 27 | 26 | 25 | 1 | 0 |
| 1-Bromo-4-fluoro-benzene | 2020, 4024 | VOC/Gasoline oxygenate | 15 | 85 | 108 | 102 | 100 | 0 | 100 | 0 |
| Caffeine-13C | 2060 | Pesticides and degradates | 3 | 20 | 152 | 122 | 23 | 0 | 14 | 9 |
| Caffeine-13C | 1433 | Wastewater-indicator constituent | 6 | 20 | 71 | 77 | 26 | 11 | 15 | 0 |
| Decafluorobiphenyl | 1433 | Wastewater-indicator constituent | 6 | 20 | 85 | 57 | 26 | 18 | 8 | 0 |
| Diazinon-d10 | 2003 | Pesticides and degradates | 9 | 82 | 70 | 82 | 91 | 26 | 65 | 0 |
| 1,2-Dichloroethane-d4 | 2020, 4024 | VOC/Gasoline oxygenate | 15 | 85 | 107 | 112 | 100 | 0 | 99 | 1 |
| Fluoranthene-d10 | 1433 | Wastewater indicators | 6 | 20 | 83 | 93 | 26 | 0 | 26 | 0 |
| Isobutyl alcohol-d6 | 2020, 4024 | VOC/Gasoline oxygenate | 5 | 17 | 88 | 85 | 22 | 3 | 19 | 0 |
| [1]NDMA-d6 | MWH | Constituent of special interest | 10 | 43 | 101 | 84 | 53 | 1 | 52 | 0 |
| 2,4,5-T | 2060 | Pesticides and degradates | 3 | 20 | 92 | 91 | 23 | 8 | 15 | 0 |
| Toluene-d8 | 2020, 4024 | VOC/Gasoline oxygenate | 15 | 85 | 98 | 98 | 100 | 0 | 100 | 0 |
| [1]Toluene-d8 | MWH | Constituent of special interest | 12 | 43 | 99 | 99 | 55 | 0 | 55 | 0 |

[1]Compound analyzed at Montgomery Watson Harza Laboratory.

**Table 11A.** Quality-control summary of volatile organic compounds, gasoline oxygenates, *N*-nitrosodimethylamine, and 1,2,3-trichloropropane matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| [1]Acetone | 7 | 100 | 117 | 106 |
| Acrylonitrile | 7 | 100 | 112 | 110 |
| *tert*-Amyl alcohol | 2 | 93 | 97 | 95 |
| Benzene | 7 | 99 | 113 | 106 |
| Bromobenzene | 7 | 84 | 100 | 92 |
| Bromochloromethane | 7 | 94 | 109 | 99 |
| Bromodichloromethane | 7 | 96 | 136 | 107 |
| Bromoethene | 7 | 91 | 110 | 104 |
| Bromoform (tribromomethane) | 7 | 87 | 123 | 96 |
| Bromomethane | 7 | 71 | 142 | 94 |
| 2-Butanone (ethyl methyl ketone) | 7 | 103 | 116 | 111 |
| *tert*-Butyl alcohol | 2 | 100 | 105 | 103 |
| *n*-Butylbenzene | 7 | 62 | 97 | 80 |
| *sec*-Butylbenzene | 7 | 75 | 100 | 87 |
| *tert*-Butylbenzene | 7 | 82 | 106 | 97 |
| Carbon disulfide | 7 | 69 | 101 | 88 |
| Chlorobenzene | 7 | 85 | 102 | 90 |
| Chloroethane | 7 | 88 | 116 | 104 |
| Chloroform (trichloromethane) | 7 | 98 | 119 | 104 |
| Chloromethane | 7 | 98 | 125 | 104 |
| 3-Chloropropene | 7 | 93 | 116 | 106 |
| 2-Chlorotoluene | 7 | 81 | 100 | 92 |
| 4-Chlorotoluene | 7 | 79 | 98 | 86 |
| [2]1,2-Dibromo-3-chloropropane (DBCP) | 7 | 66 | 111 | 89 |
| Dibromochloromethane | 7 | 89 | 119 | 95 |
| [2]1,2-Dibromoethane (EDB) | 7 | 70 | 107 | 93 |
| Dibromomethane | 7 | 98 | 108 | 102 |
| 1,2-Dichlorobenzene | 7 | 96 | 103 | 100 |
| 1,3-Dichlorobenzene | 7 | 80 | 98 | 92 |
| 1,4-Dichlorobenzene | 7 | 76 | 96 | 90 |
| *trans*-1,4-Dichloro-2-butene | 7 | 99 | 124 | 117 |
| Dichlorodifluoromethane (CFC-12) | 7 | 60 | 87 | 69 |
| 1,1-Dichloroethane | 7 | 97 | 111 | 106 |
| 1,2-Dichloroethane | 7 | 101 | 115 | 107 |
| 1,1-Dichloroethylene | 7 | 89 | 103 | 94 |
| *cis*-1,2-Dichloroethylene | 7 | 96 | 113 | 99 |
| *trans*-1,2-Dichloroethylene | 7 | 89 | 104 | 98 |
| Dichloromethane (methylene chloride) | 7 | 95 | 107 | 101 |
| 1,2-Dichloropropane | 7 | 92 | 135 | 99 |

*See footnotes at end of table.*

**Table 11A.** Quality-control summary of volatile organic compounds, gasoline oxygenates, *N*-nitrosodimethylamine, and 1,2,3-trichloropropane matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| 2,2-Dichloropropane | 7 | 81 | 108 | 96 |
| 1,3-Dichloropropane | 7 | 98 | 107 | 98 |
| 1,1-Dichloropropene | 7 | 90 | 113 | 99 |
| *cis*-1,3-Dichloropropene | 7 | 80 | 94 | 83 |
| *trans*-1,3-Dichloropropene | 7 | 88 | 102 | 96 |
| Diethyl ether | 7 | 100 | 106 | 100 |
| [1]Diisopropyl ether | 7 | 88 | 109 | 97 |
| Ethylbenzene | 7 | 86 | 107 | 90 |
| [1]Ethyl tert-butyl ether (ETBE) | 7 | 88 | 114 | 107 |
| Ethyl methacrylate | 7 | 89 | 108 | 92 |
| *o*-Ethyl toluene | 7 | 81 | 100 | 86 |
| Hexachlorobutadiene | 7 | 61 | 92 | 84 |
| Hexachloroethane | 7 | 78 | 101 | 95 |
| 2-Hexanone | 7 | 91 | 107 | 100 |
| Isopropylbenzene | 7 | 80 | 103 | 88 |
| 4-Isopropyl-1-methylbenzene | 7 | 73 | 99 | 84 |
| Methyl acetate | 2 | 41 | 44 | 43 |
| Methyl acrylate | 7 | 96 | 122 | 106 |
| Methyl acrylonitrile | 7 | 99 | 112 | 104 |
| [1]Methyl *tert*-butyl ether (MTBE) | 7 | 89 | 110 | 100 |
| Methyl iodide | 7 | 66 | 136 | 87 |
| Methyl methacrylate | 7 | 81 | 99 | 90 |
| 4-Methyl-2-pentanone | 7 | 92 | 103 | 96 |
| [1]Methyl *tert*-pentyl ether | 7 | 87 | 107 | 100 |
| Naphthalene | 7 | 85 | 128 | 98 |
| [4]*N*-Nitrosodimethylamine (NDMA) | 4 | 85 | 87 | 87 |
| *n*-Propylbenzene | 7 | 73 | 94 | 84 |
| Styrene | 7 | 84 | 93 | 86 |
| 1,1,1,2-Tetrachloroethane | 7 | 86 | 103 | 99 |
| 1,1,2,2-Tetrachloroethane | 7 | 92 | 112 | 100 |
| Tetrachloroethylene (PCE) | 7 | 75 | 104 | 83 |
| Tetrachloromethane (carbon tetrachloride) | 7 | 80 | 103 | 97 |
| Tetrahydrofuran | 7 | 105 | 119 | 108 |
| 1,2,3,4-Tetramethylbenzene | 7 | 97 | 111 | 101 |
| 1,2,3,5-Tetramethylbenzene (isodurene) | 7 | 93 | 115 | 106 |
| Toluene | 7 | 90 | 105 | 99 |
| 1,2,3-Trichlorobenzene | 7 | 87 | 106 | 94 |
| 1,2,4-Trichlorobenzene | 7 | 80 | 97 | 89 |

*See footnotes at end of table.*

**Table 11A.** Quality-control summary of volatile organic compounds, gasoline oxygenates, *N*-nitrosodimethylamine, and 1,2,3-trichloropropane matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| 1,1,1-Trichloroethane (TCA) | 7 | 91 | 106 | 102 |
| 1,1,2-Trichloroethane | 7 | 96 | 111 | 105 |
| Trichloroethylene (TCE) | 7 | 84 | 99 | 95 |
| Trichlorofluoromethane (CFC-11) | 7 | 87 | 112 | 102 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113) | 7 | 87 | 100 | 91 |
| [3]1,2,3-Trichloropropane (1,2,3 TCP) | 7 | 86 | 106 | 96 |
| [4]1,2,3-Trichloropropane (1,2,3 TCP) | 4 | 88 | 100 | 95 |
| 1,2,3-Trimethylbenzene | 7 | 79 | 106 | 97 |
| 1,2,4-Trimethylbenzene | 7 | 83 | 106 | 94 |
| 1,3,5-Trimethylbenzene | 7 | 81 | 100 | 89 |
| Vinyl chloride | 7 | 97 | 116 | 106 |
| *m*- and *p*-Xylene | 7 | 83 | 103 | 87 |
| *o*-Xylene | 7 | 86 | 104 | 90 |

[1]Compounds on Schedules 2020 and 4024; only 2020 values are reported in this table.

[2]Compounds on Schedules 1306 and 2020; only 1306 values are reported in this table.

[3]Compound analyzed at the U.S. Geological Survey's National Water Quality Laboratory.

[4]Compound analyzed at the Montgomery Watson Harza Laboratory.

**Table 11B.** Quality-control summary of pesticide matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| Acetochlor | 7 | 73 | 106 | 87 |
| Acifluorfen | 2 | 105 | 125 | 115 |
| Alachlor | 7 | 75 | 104 | 96 |
| Aldicarb sulfone | 2 | 21 | 87 | 54 |
| Aldicarb sulfoxide | 2 | 8 | 22 | 15 |
| [1]Atrazine | 7 | 85 | 108 | 95 |
| Azinphos-methyl | 7 | 44 | 75 | 54 |
| Azinphos-methyl oxon | 7 | 36 | 58 | 47 |
| Bendiocarb | 2 | 98 | 101 | 99 |
| Benfluralin | 7 | 46 | 66 | 55 |
| Benomyl | 2 | 64 | 97 | 80 |
| Bensulfuron | 2 | 91 | 210 | 150 |
| Bentazon | 2 | 60 | 66 | 63 |
| Bromacil | 2 | 39 | 91 | 65 |
| Bromoxynil | 2 | 63 | 91 | 77 |
| [1]Carbaryl | 7 | 81 | 108 | 91 |
| Carbofuran | 2 | 102 | 117 | 110 |
| Chloramben, methyl ester | 2 | 95 | 97 | 96 |
| Chlorimuron | 2 | 65 | 120 | 93 |
| Chlorodiamino-*s*-triazine | 2 | 117 | 136 | 126 |
| 2-Chloro-2,6-diethylacetanilide | 7 | 81 | 104 | 101 |
| 2-Chloro-6-ethylamino-4-amino-*s*-triazine | 2 | 41 | 90 | 66 |
| [1]2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) | 7 | 38 | 54 | 45 |
| 4-Chloro-2-methylphenol | 7 | 53 | 73 | 65 |
| Chlorothalonil | 2 | 13 | 90 | 51 |
| Chlorpyrifos | 7 | 69 | 91 | 79 |
| Chlorpyrifos oxon | 7 | 26 | 58 | 35 |
| Clopyralid | 2 | 61 | 72 | 67 |
| Cycloate | 2 | 102 | 130 | 116 |
| Cyfluthrin | 7 | 24 | 53 | 39 |
| Cypermethrin | 7 | 28 | 40 | 33 |
| Dacthal (DCPA) | 7 | 88 | 106 | 98 |
| Dacthal monoacid | 2 | 104 | 107 | 105 |
| Desulfinyl fipronil | 7 | 79 | 90 | 85 |
| Desulfinylfipronil amide | 7 | 47 | 104 | 70 |
| Diazinon | 7 | 77 | 95 | 91 |
| Diazinon oxon | 7 | 52 | 99 | 77 |
| Dicamba | 2 | 70 | 102 | 86 |
| 3,4-Dichloroaniline | 7 | 59 | 81 | 74 |

*See footnote at end of table.*

**Table 11B.** Quality-control summary of pesticide matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| 2,4-Dichlorophenoxyacetic acid (2,4-D) methyl ester | 2 | 104 | 139 | 121 |
| 4-(2,4-Dichlorophenoxy)butyric acid (2,4-DB) | 2 | 71 | 71 | 71 |
| Dichlorprop | 2 | 97 | 111 | 104 |
| Dichlorvos | 7 | 18 | 58 | 38 |
| Dicrotophos | 7 | 17 | 48 | 19 |
| Dieldrin | 7 | 78 | 102 | 92 |
| 2,6-Diethylaniline | 7 | 82 | 91 | 90 |
| Dimethoate | 7 | 19 | 44 | 29 |
| Dinoseb | 2 | 91 | 120 | 105 |
| Diphenamid | 2 | 106 | 145 | 126 |
| Diuron | 2 | 104 | 131 | 118 |
| 2,4-D methyl ester | 2 | 92 | 132 | 112 |
| Ethion | 7 | 43 | 60 | 46 |
| Ethion monoxon | 7 | 45 | 87 | 57 |
| 2-Ethyl-6-methylaniline | 7 | 82 | 103 | 98 |
| Fenamiphos | 7 | 43 | 58 | 45 |
| Fenamiphos sulfone | 7 | 40 | 78 | 48 |
| Fenamiphos sulfoxide | 7 | 26 | 39 | 36 |
| Fenuron | 2 | 89 | 104 | 96 |
| Fipronil | 7 | 46 | 67 | 54 |
| Fipronil sulfide | 7 | 64 | 82 | 72 |
| Fipronil sulfone | 7 | 46 | 67 | 54 |
| Flumetsulam | 2 | 142 | 167 | 155 |
| Fluometuron | 2 | 104 | 129 | 116 |
| Fonofos | 7 | 69 | 94 | 78 |
| Hexazinone | 7 | 41 | 101 | 49 |
| Hydroxyatrazine | 2 | 117 | 144 | 131 |
| 3-Hydroxy carbofuran | 2 | 55 | 82 | 68 |
| Imazaquin | 2 | 125 | 134 | 129 |
| Imazethapyr | 2 | 112 | 127 | 120 |
| Imidacloprid | 2 | 125 | 147 | 136 |
| Iprodione | 7 | 42 | 87 | 57 |
| Isofenphos | 7 | 54 | 90 | 72 |
| 3-Ketocarbofuran | 2 | 83 | 90 | 86 |
| Linuron | 2 | 98 | 134 | 116 |
| Malaoxon | 7 | 56 | 101 | 70 |
| Malathion | 7 | 59 | 126 | 87 |
| Metalaxyl | 2 | 100 | 140 | 120 |
| Metalaxyl | 7 | 74 | 99 | 96 |
| Methidathion | 7 | 55 | 88 | 66 |

*See footnote at end of table.*

**Table 11B.** Quality-control summary of pesticide matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximum recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| Methiocarb | 2 | 102 | 144 | 123 |
| Methomyl | 2 | 1 | 3 | 2 |
| 2-Methyl-4-chlorophenoxyacetic acid (MCPA) | 2 | 69 | 79 | 74 |
| 4-(2-Methyl-4-chlorophenoxy) butyric acid (MCPB) | 2 | 56 | 79 | 67 |
| Methyl paraoxon | 7 | 38 | 68 | 52 |
| Methyl parathion | 7 | 51 | 71 | 66 |
| Metolachlor | 7 | 83 | 119 | 93 |
| Metribuzin | 7 | 51 | 80 | 63 |
| Metsulfuron | 2 | 65 | 129 | 97 |
| Myclobutanil | 7 | 40 | 78 | 59 |
| 1-Naphthol | 7 | 9 | 29 | 10 |
| 3-(4-Chlorophenyl)-1-methyl urea | 2 | 60 | 100 | 80 |
| Neburon | 2 | 100 | 139 | 120 |
| Nicosulfuron | 2 | 109 | 158 | 133 |
| Norflurazon | 2 | 105 | 147 | 126 |
| Oryzalin | 2 | 99 | 141 | 120 |
| Oxamyl | 2 | 87 | 99 | 93 |
| Pendimethalin | 7 | 49 | 71 | 58 |
| Phorate | 7 | 20 | 77 | 34 |
| Phorate oxon | 7 | 45 | 97 | 57 |
| Phosmet | 7 | 15 | 42 | 25 |
| Phosmet oxon | 7 | 9 | 39 | 17 |
| Picloram | 2 | 87 | 97 | 92 |
| Prometon | 7 | 60 | 99 | 82 |
| Prometryn | 7 | 69 | 97 | 83 |
| Propham | 2 | 64 | 86 | 75 |
| Propiconazole | 2 | 95 | 130 | 113 |
| Propoxur | 2 | 57 | 72 | 65 |
| Propyzamide | 7 | 68 | 87 | 82 |
| Siduron | 2 | 112 | 162 | 137 |
| Simazine | 7 | 79 | 98 | 89 |
| Sulfometuron | 2 | 83 | 146 | 115 |
| [1]Tebuthiuron | 7 | 73 | 126 | 90 |
| Terbacil | 2 | 47 | 103 | 75 |
| Terbufos | 7 | 34 | 77 | 57 |
| Terbufos oxon sulfone | 7 | 61 | 116 | 75 |
| Terbuthylazine | 7 | 86 | 108 | 100 |
| Triclopyr | 2 | 84 | 100 | 92 |
| Trifluralin | 7 | 50 | 65 | 63 |

[1]Compounds on Schedules 2003 and 2060; only 2003 values are reported in this table.

**Table 11C.** Quality-control summary of wastewater-indicator constituent matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[n/a, not applicable (because median values require more than one value)]

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximun recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| Acetophenone | 1 | 115 | 115 | n/a |
| Acetyl hexamethyl tetrahydronaphthalene (AHTN) | 1 | 95 | 95 | n/a |
| Anthracene | 1 | 82 | 82 | n/a |
| Anthraquinone | 1 | 92 | 92 | n/a |
| Benzo[a]pyrene | 1 | 82 | 82 | n/a |
| Benzophenone | 1 | 101 | 101 | n/a |
| Bisphenol A | 1 | 81 | 81 | n/a |
| 3-*tert*-Butyl-4-hydroxy anisole (BHA) | 1 | 69 | 69 | n/a |
| [1]Caffeine | 2 | 92 | 104 | 98 |
| Camphor | 1 | 95 | 95 | n/a |
| Carbaryl | 1 | 104 | 104 | n/a |
| Carbazole | 1 | 91 | 91 | n/a |
| Cholesterol | 1 | 81 | 81 | n/a |
| 3-ß-Coprostanol | 1 | 86 | 86 | n/a |
| Cotinine | 1 | 84 | 84 | n/a |
| 4-Cumylphenol | 1 | 92 | 92 | n/a |
| *p*-Cresol | 1 | 92 | 92 | n/a |
| *N,N*-Diethyl-*meta*-toluamide (DEET) | 1 | 104 | 104 | n/a |
| 2,6-Dimethylnaphthalene | 1 | 88 | 88 | n/a |
| Fluoranthene | 1 | 93 | 93 | n/a |
| Hexahydrohexamethylcyclopentabenzopyran (HHCB) | 1 | 104 | 104 | n/a |
| Indole | 1 | 82 | 82 | n/a |
| Isoborneol | 1 | 97 | 97 | n/a |
| Isophorone | 1 | 97 | 97 | n/a |
| Isoquinoline | 1 | 83 | 83 | n/a |
| *D*-Limonene | 1 | 33 | 33 | n/a |
| Menthol | 1 | 98 | 98 | n/a |
| Metalaxyl | 1 | 115 | 115 | n/a |
| 5-Methyl-1H-benzotriazole | 1 | 69 | 69 | n/a |
| 3-Methyl-1(H)-indole (Skatole) | 1 | 92 | 92 | n/a |
| 1-Methylnaphthalene | 1 | 88 | 88 | n/a |
| 2-Methylnaphthalene | 1 | 85 | 85 | n/a |
| Methyl salicylate | 1 | 96 | 96 | n/a |
| 4-Nonylphenol | 1 | 79 | 79 | n/a |
| 4-Nonylphenol diethoxylates | 1 | 173 | 173 | n/a |
| 4-*n*-Octylphenol | 1 | 81 | 81 | n/a |
| 4-*tert*-Octylphenol | 1 | 92 | 92 | n/a |

*See footnote at end of table.*

**Table 11C.** Quality-control summary of wastewater-indicator constituent matrix-spike recoveries for samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[n/a, not applicable (because median values require more than one value)]

| Constituent | Number of spike samples | Minimum recovery (percent) | Maximun recovery (percent) | Median recovery (percent) |
|---|---|---|---|---|
| 4-Octylphenol diethoxylates | 1 | 98 | 98 | n/a |
| 4-Octylphenol monoethoxylates | 1 | 86 | 86 | n/a |
| Pentachlorophenol | 1 | 86 | 86 | n/a |
| Phenanthrene | 1 | 92 | 92 | n/a |
| Phenol | 1 | 109 | 109 | n/a |
| Pyrene | 1 | 93 | 93 | n/a |
| ß-Sitosterol | 1 | 63 | 63 | n/a |
| ß-Stigmastanol | 1 | 66 | 66 | n/a |
| Tri(2-butoxyethyl)phosphate | 1 | 104 | 104 | n/a |
| Tri(2-chloroethyl)phosphate | 1 | 104 | 104 | n/a |
| Tri(dichlorisopropyl)phosphate | 1 | 104 | 104 | n/a |
| Tributyl phosphate | 1 | 103 | 103 | n/a |
| Triclosan | 1 | 104 | 104 | n/a |
| Triethyl citrate | 1 | 99 | 99 | n/a |
| Triphenyl phosphate | 1 | 105 | 105 | n/a |

[1]Analyzed on pesticide Schedule 2060.

**Table 12.** General water-quality indicators determined in the field and at the U.S. Geological Survey's (USGS) National Water Quality Laboratory for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. A, averaged value; °C, degrees Celsius; COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJFP, Eastern San Joaquin Basin flowpath; LRL, laboratory reporting level; mg/L, milligram per liter; mm, millimeter; nc, sample not collected, not analyzed; NTU, nephelometric turbidity units; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µS/cm, microsiemens per centimeter]

| GAMA well identification number | Turbidity (NTU, field) (61028) | Barometric pressure (mm of mercury, field) (00025) | Water temperature (°C, field) (00010) | Dissolved oxygen (mg/L, field) (00300) | pH (standard units, field) (00400) | pH (standard units, laboratory) (00403) | Specific conductance (µS/cm at 25°C, field) (00095) | Total hardness, as $CaCO_3$ (mg/L, laboratory) (00900) | Alkalinity, dissolved, as $CaCO_3$ (mg/L, field) (29802) | Bicarbonate, dissolved, as $HCO_3$ (mg/L, field) (63786) | Carbonate, dissolved, as $CO_3$ (mg/L, field) (63788) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cosumnes Basin samples | | | | | | | | | | | |
| COS-01 | nc | nc | nc | nc | nc | nc | 239 | nc | nc | nc | nc |
| COS-02 | nc | nc | 24 | nc | nc | nc | 208 | nc | nc | nc | nc |
| COS-03 | nc | nc | 20.4 | nc | nc | nc | 260 | nc | nc | nc | nc |
| COS-04 | nc | nc | 16.7 | nc | nc | nc | 257 | nc | nc | nc | nc |
| COS-05 | nc | nc | 18 | nc | nc | nc | 360 | nc | nc | nc | nc |
| COS-06 | nc | nc | 16.5 | nc | nc | nc | 193 | nc | nc | nc | nc |
| COS-07 | nc | nc | 16.5 | nc | nc | nc | 412 | nc | nc | nc | nc |
| COS-08 | nc | nc | 20 | nc | nc | nc | 216 | nc | nc | nc | nc |
| COS-09 | nc | nc | nc | nc | nc | nc | 280 | nc | nc | nc | nc |
| COS-10 | nc | nc | nc | nc | nc | nc | 410 | nc | nc | nc | nc |
| Eastern San Joaquin Basin samples | | | | | | | | | | | |
| ESJ-01 | nc | nc | 19 | nc | nc | nc | 663 | nc | nc | nc | nc |
| ESJ-02 | nc | nc | 21 | nc | nc | nc | 323 | nc | nc | nc | nc |
| ESJ-03 | nc | nc | 19.5 | nc | nc | nc | 444 | nc | nc | nc | nc |
| ESJ-04 | nc | nc | 16 | nc | nc | nc | 352 | nc | nc | nc | nc |
| ESJ-05 | nc | nc | nc | nc | nc | nc | 214 | nc | nc | nc | nc |
| ESJ-06 | nc | nc | nc | nc | nc | 7.4 | 340 | 120 | nc | nc | nc |
| ESJ-07 | nc | nc | nc | nc | nc | nc | 335 | nc | nc | nc | nc |
| ESJ-08 | nc | nc | nc | nc | nc | 7.3 | 203 | 64 | nc | nc | nc |
| ESJ-09 | nc | nc | nc | nc | nc | nc | 637 | nc | nc | nc | nc |
| ESJ-10 | nc | nc | 20.1 | nc | nc | 7.6 | 252 | 91 | nc | nc | nc |
| ESJ-11 | nc | nc | nc | nc | nc | nc | 463 | nc | nc | nc | nc |

**Table 12.** General water-quality indicators determined in the field and at the U.S. Geological Survey's (USGS) National Water Quality Laboratory for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. A, averaged value; °C, degrees Celsius; COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJFP, Eastern San Joaquin Basin flowpath; LRL, laboratory reporting level; mg/L, milligram per liter; mm, millimeter; nc, sample not collected, not analyzed; NTU, nephelometric turbidity units; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µS/cm, microsiemens per centimeter]

| GAMA well identification number | Turbidity (NTU, field) (61028) | Barometric pressure (mm of mercury, field) (00025) | Water temperature (°C, field) (00010) | Dissolved oxygen (mg/L, field) (00300) | pH (standard units, field) (00400) | pH (standard units, laboratory) (00403) | Specific conductance (µS/cm at 25°C, field) (00095) | Total hardness, as $CaCO_3$ (mg/L, laboratory) (00900) | Alkalinity, dissolved, as $CaCO_3$ (mg/L, field) (29802) | Bicarbonate, dissolved, as $HCO_3$ (mg/L, field) (63786) | Carbonate, dissolved, as $CO_3$ (mg/L, field) (63788) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESJ-12 | 0.6 | 768 | 17.2 | 5.8 | 7.5 | E6.9 | 768 | 110 | A121 | A147 | <1 |
| ESJ-13 | nc | nc | nc | nc | nc | 7.2 | 198 | 80 | nc | nc | nc |
| ESJ-14 | nc | nc | nc | nc | nc | 7.8 | 298 | 98 | nc | nc | nc |
| ESJ-15 | nc | nc | 19 | nc | nc | 7.7 | 607 | 250 | nc | nc | nc |
| ESJ-16 | nc | nc | 18.4 | nc | nc | 7.5 | 290 | 120 | nc | nc | nc |
| ESJ-17 | nc | nc | 22.5 | nc | nc | 7.6 | 208 | 67 | nc | nc | nc |
| ESJ-18 | nc | nc | 21.3 | nc | nc | 7.6 | 211 | 71 | nc | nc | nc |
| ESJ-19 | 1.1 | 757 | 17.8 | 3.4 | 7.7 | 7.6 | 468 | 160 | A179 | A217 | <1 |
| Upland Basin samples | | | | | | | | | | | |
| QPC-01 | 0.2 | 754 | 15 | 5.6 | 6.8 | 6.8 | 369 | 160 | A130 | A158 | <1 |
| QPC-02 | nc | nc | nc | nc | nc | nc | 487 | nc | nc | nc | nc |
| QPC-03 | nc | nc | 19 | nc | nc | nc | 170 | nc | nc | nc | nc |
| QPC-04 | nc | nc | 22 | nc | nc | 6.8 | 140 | 22 | nc | nc | nc |
| QPC-05 | nc | nc | 19 | nc | nc | nc | 164 | nc | nc | nc | nc |
| QPC-06 | nc | nc | 19 | nc | nc | 7.3 | 195 | 59 | nc | nc | nc |
| QPC-07 | nc | nc | 20.5 | nc | nc | 7.2 | 389 | 150 | nc | nc | nc |
| QPC-08 | nc | nc | 21.5 | nc | nc | 7.4 | 219 | 75 | nc | nc | nc |
| QPC-09 | nc | nc | 21.4 | nc | nc | nc | 333 | nc | nc | nc | nc |
| QPC-10 | nc | nc | 19.7 | nc | nc | 7.6 | 204 | 72 | nc | nc | nc |
| QPC-11 | nc | nc | 21 | nc | nc | nc | 129 | nc | nc | nc | nc |
| Tracy Basin samples | | | | | | | | | | | |
| TRCY-01 | nc | nc | nc | nc | nc | nc | 1,880 | nc | nc | nc | nc |
| TRCY-02 | nc | nc | 20 | nc | nc | nc | 29,000 | nc | nc | nc | nc |
| TRCY-03 | 0.2 | 762 | 22.2 | 6.2 | 7.5 | E6.6 | 1,000 | 310 | A194 | A235 | <1 |

**Table 12.** General water-quality indicators determined in the field and at the U.S. Geological Survey's (USGS) National Water Quality Laboratory for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. A, averaged value; °C, degrees Celsius; COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJFP, Eastern San Joaquin Basin flowpath; LRL, laboratory reporting level; mg/L, milligram per liter; mm, millimeter; nc, sample not collected, not analyzed; NTU, nephelometric turbidity units; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µS/cm, microsiemens per centimeter]

| GAMA well identification number | Turbidity (NTU, field) (61028) | Barometric pressure (mm of mercury, field) (00025) | Water temperature (°C, field) (00010) | Dissolved oxygen (mg/L, field) (00300) | pH (standard units, field) (00400) | pH (standard units, laboratory) (00403) | Specific conductance (µS/cm at 25°C, field) (00095) | Total hardness, as $CaCO_3$ (mg/L, laboratory) (00900) | Alkalinity, dissolved, as $CaCO_3$ (mg/L, field) (29802) | Bicarbonate, dissolved, as $HCO_3$ (mg/L, field) (63786) | Carbonate, dissolved, as $CO_3$ (mg/L, field) (63788) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TRCY-04 | nc | nc | 20 | nc | nc | nc | 1,260 | nc | nc | nc | nc |
| TRCY-05 | nc | nc | 19.2 | nc | nc | nc | 1,550 | nc | nc | nc | nc |
| TRCY-06 | nc | nc | 18.5 | nc | nc | nc | 969 | nc | nc | nc | nc |
| TRCY-07 | 0.2 | 766 | 17.8 | 0.1 | 6.4 | 6.3 | 4,180 | 1,900 | A139 | A169 | <1 |
| TRCY-08 | nc | nc | 21.7 | nc | nc | nc | 699 | nc | nc | nc | nc |
| TRCY-09 | nc | nc | 18.6 | nc | nc | 7.3 | 711 | 170 | nc | nc | nc |
| TRCY-10 | nc | nc | 16.9 | nc | nc | nc | 957 | nc | nc | nc | nc |
| TRCY-11 | nc | nc | 21.2 | nc | nc | 7.9 | 938 | 160 | nc | nc | nc |
| Nongrid cell samples | | | | | | | | | | | |
| TRCYFP-01 | 0.2 | 762 | 16.3 | 0.1 | 7.4 | 7.5 | 5,990 | 1,200 | A110 | A133 | <1 |
| TRCYFP-02 | 0.1 | 760 | 22.9 | 1.8 | 7.7 | E7.2 | 999 | 290 | A122 | A149 | <1 |
| TRCYFP-03 | nc | nc | 22.5 | nc | nc | 7.5 | 1,060 | 210 | nc | nc | nc |
| TRCYFP-04 | 0.2 | 765 | 21.4 | 4.4 | 7.5 | 7.3 | 1,250 | 370 | A184 | A224 | <1 |
| TRCYFP-05 | nc | nc | 24 | nc | nc | 7.5 | 1,290 | 250 | nc | nc | nc |
| TRCYFP-06 | nc | nc | 14.5 | nc | nc | nc | 1,150 | nc | nc | nc | nc |
| ESJFP-07 | 0.4 | 758 | 19.2 | 6.6 | 7.8 | 7.6 | 240 | 98 | A114 | A138 | <1 |
| ESJFP-08 | nc | nc | nc | nc | nc | 7.5 | 541 | 170 | nc | nc | nc |
| ESJFP-09 | nc | nc | nc | nc | nc | 7.6 | 483 | 230 | nc | nc | nc |
| ESJFP-10 | 0.1 | 763 | 18 | 3.9 | 7.6 | 7.7 | 352 | 150 | A151 | A183 | <1 |
| Depth-dependent samples | | | | | | | | | | | |
| ESJDD-01 | nc | nc | nc | nc | nc | 7.7 | 393 | 150 | nc | nc | nc |
| ESJDD-02 | nc | nc | nc | nc | nc | 7.8 | 260 | 100 | nc | nc | nc |
| ESJDD-03 | nc | nc | nc | nc | nc | E7.6 | 298 | 130 | nc | nc | nc |
| ESJDD-04 | nc | 765 | 16.6 | 0.0 | 7.9 | 7.6 | 488 | 180 | 195 | 237 | <1 |

**Table 12.** General water-quality indicators determined in the field and at the U.S. Geological Survey's (USGS) National Water Quality Laboratory for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. A, averaged value; °C, degrees Celsius; COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJFP, Eastern San Joaquin Basin flowpath; LRL, laboratory reporting level; mg/L, milligram per liter; mm, millimeter; nc, sample not collected, not analyzed; NTU, nephelometric turbidity units; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µS/cm, microsiemens per centimeter]

| GAMA well identification number | Turbidity (NTU, field) (61028) | Barometric pressure (mm of mercury, field) (00025) | Water temperature (°C, field) (00010) | Dissolved oxygen (mg/L, field) (00300) | pH (standard units, field) (00400) | pH (standard units, laboratory) (00403) | Specific conductance (µS/cm at 25°C, field) (00095) | Total hardness, as $CaCO_3$ (mg/L, laboratory) (00900) | Alkalinity, dissolved, as $CaCO_3$ (mg/L, field) (29802) | Bicarbonate, dissolved, as $HCO_3$ (mg/L, field) (63786) | Carbonate, dissolved, as $CO_3$ (mg/L, field) (63788) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESJDD-05 | nc | 762 | 14.6 | 0.0 | 7.9 | 7.8 | 467 | 180 | A180 | A218 | <1 |
| ESJDD-06 | nc | 762 | 15.3 | 0.0 | 8.1 | 7.7 | 451 | 160 | 178 | 215 | <1 |
| Monitoring well samples | | | | | | | | | | | |
| ESJMW-01 | 36 | 770 | 20.7 | 3.4 | 8.0 | 7.8 | 252 | 99 | A118 | A143 | <1 |
| ESJMW-02 | 1.5 | 770 | 20.5 | 5.9 | 7.7 | 7.9 | 262 | 100 | A116 | A141 | <1 |
| ESJMW-03 | 0.4 | 769 | 21.1 | 1.4 | 7.6 | 7.6 | 313 | 130 | A129 | A157 | <1 |

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Trihalomethanes | | | | Solvents | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Chloroform (Trichloro-methane) (µg/L) (32106)** | **Bromoform (Tribromo-methane) (µg/L) (32104)** | **Bromodichloro-methane (µg/L) (32101)** | **Dibromo-chloro-methane (µg/L) (32105)** | **Tetrachloro-ethylene (PCE) (µg/L) (34475)** | **1,2-Di-chloro-propane (µg/L) (34541)** | **Trichloro-ethylene (TCE) (µg/L) (39180)** | **1,1-Dichloro-ethene (µg/L) (34501)** | ***cis*-1,2-Dichloro-ethene (µg/L) (77093)** | **Tetrahy-drofuran (µg/L) (81607)** |
| Threshold type | MCL-US | MCL-US | MCL-US | MCL-US | MCL-US | MCL-US | MCL-US | MCL-CA | MCL-CA | n/a |
| Threshold level (µg/L) | 80 | 80 | 80 | 80 | 5 | 5 | 5 | 6 | 6 | n/a |
| LRL | 0.02 | 0.1 | 0.03 | 0.1 | 0.03 | 0.03 | 0.04 | 0.02 | 0.02 | 1 |
| Grid cell samples | | | | | | | | | | |
| COS-02 | — | — | — | — | — | — | — | — | — | — |
| COS-06 | — | — | — | — | — | — | — | — | — | — |
| ESJ-01 | E0.01 | — | — | — | — | — | — | — | — | — |
| ESJ-02 | — | — | — | — | — | E0.02 | — | — | — | — |
| ESJ-03 | — | E0.1 | — | — | — | — | — | — | — | — |
| ESJ-04 | — | — | — | — | — | — | — | — | — | — |
| ESJ-06 | E0.04 | — | — | — | — | — | — | — | — | — |
| ESJ-07 | — | — | — | — | E0.1 | — | E0.02 | — | — | — |
| ESJ-09 | 0.11 | — | — | — | 0.95 | E0.05 | 0.19 | E0.05 | E0.02 | — |
| ESJ-13 | 0.11 | — | — | — | E0.02 | — | — | — | — | — |
| ESJ-15 | 0.19 | — | — | — | E0.01 | — | — | — | — | — |
| ESJ-16 | E0.05 | — | — | — | E0.02 | — | — | — | — | — |
| ESJ-19 | E0.01 | E0.1 | E0.04 | E0.1 | — | — | — | — | — | — |
| QPC-01 | — | — | — | — | E0.02 | — | — | — | — | — |
| QPC-02 | E0.05 | — | — | — | 0.24 | — | E0.07 | E0.03 | E0.07 | — |
| QPC-04 | — | — | — | — | — | — | — | — | — | — |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Trihalomethanes | | | | Solvents | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Chloroform (Trichloromethane) (µg/L) (32106) | Bromoform (Tribromomethane) (µg/L) (32104) | Bromodichloromethane (µg/L) (32101) | Dibromochloromethane (µg/L) (32105) | Tetrachloroethylene (PCE) (µg/L) (34475) | 1,2-Dichloropropane (µg/L) (34541) | Trichloroethylene (TCE) (µg/L) (39180) | 1,1-Dichloroethene (µg/L) (34501) | *cis*-1,2-Dichloroethene (µg/L) (77093) | Tetrahydrofuran (µg/L) (81607) |
| QPC-05 | — | — | — | — | — | — | — | — | — | E0.4 |
| TRCY-02 | — | — | — | — | — | — | — | — | — | 10 |
| TRCY-03 | E0.02 | — | — | — | — | — | — | — | — | — |
| TRCY-04 | — | — | — | — | — | — | — | — | — | — |
| TRCY-05 | — | — | — | — | — | — | — | — | — | — |
| TRCY-07 | — | — | — | — | — | 0.20 | — | — | — | — |
| TRCY-09 | — | — | — | — | — | — | — | — | — | — |
| Nongrid cell samples[1] | | | | | | | | | | |
| TRCYFP-01 | — | — | — | — | — | — | — | — | — | — |
| TRCYFP-02 | 1.82 | 1.2 | 3.06 | 2.9 | — | — | — | — | — | — |
| TRCYFP-03 | 2.39 | 3.8 | 5.91 | 6.8 | — | — | — | — | — | — |
| TRCYFP-04 | E0.02 | — | E0.03 | — | — | — | — | — | — | — |
| TRCYFP-05 | E0.03 | — | — | — | — | — | — | — | — | — |
| ESJFP-07 | — | — | — | — | — | — | — | — | — | — |
| ESJFP-08 | E0.07 | 0.4 | 0.12 | 0.3 | — | — | 0.20 | — | — | — |
| ESJFP-09 | 0.13 | 0.3 | — | — | 2.45 | — | 0.42 | — | 0.34 | — |
| ESJFP-10 | E0.01 | — | — | — | — | — | — | — | — | — |
| ESJDD-01 | 0.19 | — | — | — | — | — | — | — | — | — |
| ESJDD-02 | E0.02 | — | — | — | — | — | — | — | — | — |
| ESJDD-03 | E0.01 | — | — | — | — | — | — | — | — | — |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Trihalomethanes | | | | Solvents | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Chloroform (Trichloro-methane) (µg/L) (32106) | Bromoform (Tribromo-methane) (µg/L) (32104) | Bromodichloro-methane (µg/L) (32101) | Dibromo-chloro-methane (µg/L) (32105) | Tetrachloro-ethylene (PCE) (µg/L) (34475) | 1,2-Di-chloro-propane (µg/L) (34541) | Trichloro-ethylene (TCE) (µg/L) (39180) | 1,1-Dichloro-ethene (µg/L) (34501) | *cis*-1,2-Dichloro-ethene (µg/L) (77093) | Tetrahy-drofuran (µg/L) (81607) |
| ESJDD-04 | — | — | — | — | — | — | — | — | — | — |
| ESJDD-05 | — | — | — | — | — | — | — | — | — | — |
| ESJDD-06 | — | — | — | — | — | — | — | — | — | — |
| ESJMW-01 | E0.04 | — | — | — | — | — | — | — | — | — |
| ESJMW-02 | — | — | — | — | — | — | — | — | — | — |
| ESJMW-03 | — | — | — | — | — | — | — | — | — | — |
| Grid cell wells with VOC detections | 9 | 2 | 1 | 1 | 7 | 3 | 3 | 2 | 2 | 2 |
| Detection frequency in grid cell wells (percent) | 18 | 4 | 2 | 2 | 14 | 6 | 6 | 4 | 4 | 4 |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Solvents | | | | Gasoline | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Dichloro-methane (µg/L) (34423)** | **Dibromo-methane (µg/L) (30217)** | ***trans*-1,2-Di-chloro-ethene (µg/L) (34546)** | **Tetrachlo-romethane (Carbon tetra-chloride) (µg/L) (32102)** | **Ethyl-benzene (µg/L) (34371)** | **Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)** | **Benzene (µg/L) (34030)** | **Methyl *tert*-pentyl ether (µg/L) (50005)** | **Toluene (µg/L) (34010)** | ***m*-and *p*-Xylene (µg/L) (85795)** |
| Threshold type | MCL-US | n/a | MCL-CA | MCL-CA | MCL-CA | MCL-US | MCL-CA | n/a | MCL-CA | MCL-CA |
| Threshold level (µg/L) | 5 | n/a | 10 | 0.5 | 300 | 13 | 1 | n/a | 150 | 1,750 |
| LRL | 0.06 | 0.05 | 0.03 | 0.06 | 0.03 | 0.1 | 0.02 | 0.04 | 0.02 | 0.06 |
| Grid cell samples | | | | | | | | | | |
| COS-02 | — | — | — | — | — | — | E0.02 | — | V0.01 | — |
| COS-06 | — | — | — | — | — | 0.3 | — | — | — | — |
| ESJ-01 | — | — | — | — | — | — | — | — | — | — |
| ESJ-02 | — | — | — | — | — | — | — | — | — | — |
| ESJ-03 | — | — | — | — | — | — | — | — | — | — |
| ESJ-04 | — | — | — | — | — | — | — | — | V0.01 | — |
| ESJ-06 | — | — | — | — | — | — | — | — | — | — |
| ESJ-07 | — | — | — | — | — | — | — | — | — | — |
| ESJ-09 | — | — | — | — | — | — | — | — | — | — |
| ESJ-13 | — | — | — | — | — | — | — | — | V0.02 | — |
| ESJ-15 | E0.04 | — | — | — | — | — | — | — | — | — |
| ESJ-16 | — | — | — | — | — | — | — | — | — | — |
| ESJ-19 | — | — | — | — | E0.03 | — | — | — | V0.04 | E0.16 |
| QPC-01 | — | — | — | — | — | — | — | — | V0.01 | — |
| QPC-02 | — | — | — | — | — | — | — | — | — | — |
| QPC-04 | — | — | — | — | — | — | — | — | V0.01 | — |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Solvents | | | | Gasoline | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dichloromethane (µg/L) (34423) | Dibromomethane (µg/L) (30217) | *trans*-1,2-Dichloroethene (µg/L) (34546) | Tetrachloromethane (Carbon tetrachloride) (µg/L) (32102) | Ethylbenzene (µg/L) (34371) | Methyl *tert*-butyl ether (MTBE) (µg/L) (78032) | Benzene (µg/L) (34030) | Methyl *tert*-pentyl ether (µg/L) (50005) | Toluene (µg/L) (34010) | *m*-and *p*-Xylene (µg/L) (85795) |
| QPC-05 | — | — | — | — | — | — | — | — | 0.460 | — |
| TRCY-02 | — | — | — | — | E0.05 | — | — | — | V0.02 | — |
| TRCY-03 | — | — | — | — | — | — | — | — | — | — |
| TRCY-04 | — | — | — | — | — | — | — | — | V0.01 | — |
| TRCY-05 | — | — | — | — | — | — | — | — | V0.01 | — |
| TRCY-07 | — | — | — | — | — | — | — | — | V0.01 | — |
| TRCY-09 | — | — | — | — | — | 2.0 | — | E0.03 | — | — |
| Nongrid cell samples[1] | | | | | | | | | | |
| TRCYFP-01 | — | — | — | — | — | — | — | — | V0.02 | E0.05 |
| TRCYFP-02 | — | 0.14 | — | E0.02 | — | — | — | — | — | — |
| TRCYFP-03 | E0.03 | 0.38 | — | — | — | — | — | — | V0.01 | — |
| TRCYFP-04 | — | — | — | — | — | — | — | — | — | — |
| TRCYFP-05 | — | — | — | — | — | — | — | — | V0.01 | — |
| ESJFP-07 | — | — | — | — | — | — | — | — | V0.02 | — |
| ESJFP-08 | — | — | — | — | — | — | — | — | — | — |
| ESJFP-09 | — | — | E0.05 | — | — | — | — | — | — | — |
| ESJFP-10 | — | — | — | — | — | — | — | — | V0.01 | — |
| ESJDD-01 | — | — | — | — | — | — | — | — | V0.05 | E0.05 |
| ESJDD-02 | — | — | — | — | — | — | — | — | V0.02 | — |
| ESJDD-03 | — | — | — | — | — | — | — | — | V0.02 | E0.03 |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| | Solvents | | | | Gasoline | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| GAMA well identification number | Dichloro-methane (µg/L) (34423) | Dibromo-methane (µg/L) (30217) | *trans*-1,2-Di-chloro-ethene (µg/L) (34546) | Tetrachlo-romethane (Carbon tetra-chloride) (µg/L) (32102) | Ethyl-benzene (µg/L) (34371) | Methyl *tert*-butyl ether (MTBE) (µg/L) (78032) | Benzene (µg/L) (34030) | Methyl *tert*-pentyl ether (µg/L) (50005) | Toluene (µg/L) (34010) | *m*-and *p*-Xylene (µg/L) (85795) |
| ESJDD-04 | — | — | — | — | — | — | — | — | V0.04 | E0.03 |
| ESJDD-05 | — | — | — | — | E0.01 | — | — | — | V0.05 | E0.05 |
| ESJDD-06 | — | — | — | — | E0.02 | — | — | — | V0.05 | E0.07 |
| ESJMW-01 | — | — | — | — | — | — | — | — | V0.02 | — |
| ESJMW-02 | — | — | — | — | E0.02 | — | — | — | V0.12 | E0.12 |
| ESJMW-03 | — | — | — | — | — | — | — | — | V0.02 | — |
| Grid cell wells with VOC detections | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 |
| Detection frequency in grid cell wells (percent) | 2 | 0 | 0 | 0 | 4 | 4 | 2 | 2 | 2 | 2 |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Gasoline | Organic synthesis | | | | | Refrigerants | | | Detections per well |
|---|---|---|---|---|---|---|---|---|---|---|
| | *o*-Xylene (µg/L) (77135) | 1,1-Dichloro-ethane (µg/L) (34496) | 1,2,4-Tri-methyl-benzene (µg/L) (77222) | Carbon disulfide (µg/L) (77041) | Styrene (µg/L) (77128) | Bromo-chloro-methane (µg/L) (77297) | Trichloro-fluoro-methane (CFC-11) (µg/L) (34488) | Dichlorodi-fluoro-methane (CFC-12) (µg/L) (34668) | Chloro-methane (µg/L) (34418) | |
| Threshold type | MCL-CA | MCL-US | NL | NL | MCL-US | HA-L | MCL-CA | NL | HA-L | |
| Threshold level (µg/L) | 1,750 | 5 | 330 | 160 | 100 | 9 | 100 | 1,000 | 30 | |
| LRL | 0.04 | 0.04 | 0.06 | 0.04 | 0.04 | 0.12 | 0.08 | 0.18 | 0.17 | |
| Grid cell samples | | | | | | | | | | |
| COS-02 | — | — | — | — | — | — | — | — | — | 1 |
| COS-06 | — | — | — | — | — | — | — | — | — | 1 |
| ESJ-01 | — | — | — | — | — | — | — | — | — | 1 |
| ESJ-02 | — | — | — | — | — | — | — | — | — | 1 |
| ESJ-03 | — | — | — | — | — | — | — | — | — | 1 |
| ESJ-04 | — | — | — | — | — | — | — | — | — | 0 |
| ESJ-06 | — | — | — | — | — | — | — | — | — | 1 |
| ESJ-07 | — | E0.06 | — | — | — | — | E0.03 | — | — | 4 |
| ESJ-09 | — | E0.10 | — | — | — | — | E0.16 | E0.78 | — | 9 |
| ESJ-13 | — | — | — | — | — | — | — | — | — | 2 |
| ESJ-15 | — | — | — | — | — | — | E0.07 | — | — | 4 |
| ESJ-16 | — | — | — | — | — | — | — | — | — | 2 |
| ESJ-19 | E0.06 | — | — | — | — | — | — | — | — | 7 |
| QPC-01 | — | — | 0.15 | — | — | — | — | — | — | 2 |
| QPC-02 | — | E0.04 | — | — | — | — | — | — | — | 6 |
| QPC-04 | — | — | — | — | — | — | — | — | — | 0 |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Gasoline | Organic synthesis | | | | | Refrigerants | | | Detections per well |
|---|---|---|---|---|---|---|---|---|---|---|
| | *o*-Xylene (µg/L) (77135) | 1,1-Dichloro-ethane (µg/L) (34496) | 1,2,4-Tri-methyl-benzene (µg/L) (77222) | Carbon disulfide (µg/L) (77041) | Styrene (µg/L) (77128) | Bromo-chloro-methane (µg/L) (77297) | Trichloro-fluoro-methane (CFC-11) (µg/L) (34488) | Dichlorodi-fluoro-methane (CFC-12) (µg/L) (34668) | Chloro-methane (µg/L) (34418) | |
| QPC-05 | — | — | — | — | — | — | — | — | — | 2 |
| TRCY-02 | — | — | — | 0.40 | E0.02 | — | — | — | — | 4 |
| TRCY-03 | — | — | E0.08 | — | — | — | — | — | — | 2 |
| TRCY-04 | — | — | — | — | — | — | — | — | — | 0 |
| TRCY-05 | — | — | — | — | — | — | — | — | — | 0 |
| TRCY-07 | — | — | E0.06 | — | — | — | — | — | — | 2 |
| TRCY-09 | — | — | — | — | — | — | — | — | — | 2 |
| Nongrid cell samples[1] | | | | | | | | | | |
| TRCYFP-01 | — | — | E0.07 | — | — | — | — | — | — | 2 |
| TRCYFP-02 | — | — | — | — | — | — | — | — | — | 6 |
| TRCYFP-03 | — | — | — | — | — | 0.24 | — | — | — | 7 |
| TRCYFP-04 | — | — | E0.09 | — | — | — | — | — | — | 3 |
| TRCYFP-05 | — | — | — | — | — | — | — | — | — | 1 |
| ESJFP-07 | — | — | — | — | — | — | — | — | — | 0 |
| ESJFP-08 | — | — | — | — | — | — | — | — | E0.10 | 6 |
| ESJFP-09 | — | E0.07 | — | — | — | — | — | E30.0 | — | 9 |
| ESJFP-10 | — | — | — | — | — | — | — | — | — | 1 |
| ESJDD-01 | — | — | 0.76 | — | — | — | — | — | — | 3 |
| ESJDD-02 | — | — | — | — | — | — | — | — | — | 1 |

*See footnotes at end of table.*

**Table 13A.** Summary of volatile organic compounds and gasoline oxygenates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; NL, notification level (California Department of Health Services, 2005d); QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Gasoline | Organic synthesis | | | | | Refrigerants | | | Detections per well |
|---|---|---|---|---|---|---|---|---|---|---|
| | *o*-Xylene (µg/L) (77135) | 1,1-Dichloro-ethane (µg/L) (34496) | 1,2,4-Tri-methyl-benzene (µg/L) (77222) | Carbon disulfide (µg/L) (77041) | Styrene (µg/L) (77128) | Bromo-chloro-methane (µg/L) (77297) | Trichloro-fluoro-methane (CFC-11) (µg/L) (34488) | Dichlorodi-fluoro-methane (CFC-12) (µg/L) (34668) | Chloro-methane (µg/L) (34418) | |
| ESJDD-03 | — | — | — | — | — | — | — | — | — | 2 |
| ESJDD-04 | — | — | — | — | — | — | — | — | — | 1 |
| ESJDD-05 | E0.02 | — | — | — | — | — | — | — | — | 3 |
| ESJDD-06 | E0.03 | — | — | — | — | — | — | — | — | 3 |
| ESJMW-01 | — | — | — | E0.01 | — | — | — | — | — | 2 |
| ESJMW-02 | E0.05 | — | E0.04 | — | — | — | — | — | — | 4 |
| ESJMW-03 | — | — | — | — | — | — | — | — | — | 0 |
| Grid cell wells with VOC detections | 1 | 3 | 3 | 1 | 1 | 0 | 3 | 1 | 0 | [2]108 |
| Detection frequency in grid cell wells (percent) | 2 | 6 | 6 | 2 | 2 | 0 | 6 | 2 | 0 | [3]41 |

[1]These samples have been identified as nongrid samples and are not used in the calculation of a detection frequency.

[2]Total number of detections.

[3]Total number of samples with at least a single detection.

**Table 13B.** Summary of tentatively identified compounds (TICs) detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. CAS, Chemical Abstracts Service; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; GC/MS, gas chromatography/mass spectrometry; LRL, laboratory reporting level; QPC, Upland Basin; TRCY, Tracy Basin; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Tentatively identified compounds with CAS numbers[1] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Cyclopentane (µg/L) (287-92-3) | Methane chloro-difluoro (µg/L) (75-45-6) | Methane dichlorofluoro (µg/L) (75-43-4) | C5-Alkene (µg/L) (109-67-1) | C2-cyclo-propane (µg/L) (1191-96-4) | Sulfur dioxide (µg/L) (7446-09-5) | Hexafluoro-propene (µg/L) (116-15-40) |
| LRL | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Grid cell wells | | | | | | | |
| ESJ-01 | 0.1 | — | — | — | — | — | — |
| ESJ-02 | — | — | — | 0.1 | — | — | — |
| ESJ-09 | — | 0.1 | 0.8 | — | — | — | — |
| ESJ-13 | 0.2 | — | — | — | — | — | — |
| ESJ-16 | — | — | — | — | 0.1 | — | — |
| QPC-07 | 0.1 | — | — | — | — | — | — |
| QPC-09 | — | — | — | — | — | 14.6 | — |
| QPC-01 | 0.1 | — | — | — | — | — | — |
| TRCY-03 | 0.1 | — | — | — | — | — | — |
| Nongrid cell wells[2] | | | | | | | |
| ESJFP-09 | — | 1.3 | — | — | — | — | — |
| ESJDD-01 | — | — | — | — | — | — | — |
| ESJDD-02 | — | — | — | — | — | — | V5.7 |
| ESJDD-03 | — | — | — | — | — | — | — |
| ESJDD-04 | — | — | — | — | — | — | V1.5 |
| ESJDD-05 | — | — | — | — | — | — | V1.6 |
| ESJDD-06 | — | — | — | — | — | — | V0.8 |
| Grid cell wells with TIC detections | 5 | 1 | 1 | 1 | 1 | 1 | 0 |
| Detection frequency in grid cell wells (percent) | 10 | 2 | 2 | 2 | 2 | 2 | 0 |

*See footnotes at end of table.*

**Table 13B.** Summary of tentatively identified compounds (TICs) detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination. Percentage values are detection frequencies. CAS, Chemical Abstracts Service; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; GC/MS, gas chromatography/mass spectrometry; LRL, laboratory reporting level; QPC, Upland Basin; TRCY, Tracy Basin; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Tentatively identified compounds with CAS numbers[1] | | | | | | Detections per well |
|---|---|---|---|---|---|---|---|
| | Pentafluoro-propene (µg/L) (690-27-7) | Hexafluoro-propene and $CO_2$ (µg/L) | Pentafluoro-propene and $CO_2$ (µg/L) | Unknown (a) (µg/L) | C1-Cyclobutane (µg/L) (598-61-8) | Unknown (b) (µg/L) | |
| LRL | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| Grid cell wells | | | | | | | |
| ESJ-01 | — | — | — | — | — | — | 1 |
| ESJ-02 | — | — | — | — | — | — | 1 |
| ESJ-09 | — | — | — | — | — | — | 2 |
| ESJ-13 | — | — | — | — | — | — | 1 |
| ESJ-16 | — | — | — | — | — | — | 1 |
| QPC-07 | — | — | — | — | — | — | 1 |
| QPC-09 | — | — | — | — | — | — | 1 |
| QPC-01 | — | — | — | — | — | — | 1 |
| TRCY-03 | — | — | — | — | — | — | 1 |
| Nongrid cell wells[2] | | | | | | | |
| ESJFP-09 | — | — | — | — | — | — | 1 |
| ESJDD-01 | — | V2.3 | V0.3 | — | — | — | 2 |
| ESJDD-02 | V0.8 | — | — | V0.1 | — | — | 3 |
| ESJDD-03 | — | V3.3 | V0.7 | V0.2 | 0.1 | 0.2 | 5 |
| ESJDD-04 | — | — | — | — | — | — | 1 |
| ESJDD-05 | V0.1 | — | — | — | — | — | 2 |
| ESJDD-06 | — | — | — | — | — | — | 1 |
| Grid cell wells with TIC detections | 0 | 0 | 0 | 0 | 0 | 0 | [3]25 |
| Detection frequency in grid cell wells (percent) | 0 | 0 | 0 | 0 | 0 | 0 | [4]16 |

[1]TICs are based on comparison with the National Institute for Standards and Technology library spectra and examination by a GC/MS analyst; reported concentrations are approximate.

[2]These samples have been identified as nongrid wells and are not used in the calculation of a detection frequency.

[3]Total number of detections.

[4]Total number of samples with at least a single detection.

**Table 14.** Summary of pesticides and pesticide degradates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Bold numbers indicate values above the comparison threshold level. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, minimum reporting level; n/a, not applicable; nq, compound identified but not quantified; QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Herbicides | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Simazine (µg/L) (04035)** | **Atrazine (µg/L) (39632)** | **[1]1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625)** | **[2]Diphenamid (µg/L) (04033)** | **Hexazinone (µg/L) (04025)** | **Metolachlor (µg/L) (39415)** | **Tebuthiuron (µg/L) (82670)** | **Trifluralin (µg/L) (82661)** |
| Threshold type | MCL-US | MCL-CA | MCL-US | HA-L | HA-L | HA-L | HA-L | HA-L |
| Threshold level (µg/L) | 4 | 1 | 0.2 | 200 | 400 | 100 | 500 | 5 |
| LRL | 0.005 | 0.007 | [3]0.03 | 0.01 | 0.013 | 0.006 | 0.02 | 0.009 |
| Grid cell wells | | | | | | | | |
| COS-04 | 0.009 | — | — | — | — | — | — | — |
| COS-05 | — | — | **1.43** | — | — | — | — | — |
| COS-06 | 0.053 | — | E0.02 | — | — | — | — | — |
| COS-07 | — | — | — | — | — | — | — | — |
| ESJ-01 | 0.008 | 0.011 | — | — | — | — | — | — |
| ESJ-03 | 0.006 | — | — | — | — | — | — | — |
| ESJ-06 | — | — | 0.10 | — | — | — | — | — |
| ESJ-07 | — | — | **0.22** | — | — | — | — | — |
| ESJ-09 | 0.009 | 0.009 | — | — | — | 0.012 | — | — |
| ESJ-15 | 0.006 | — | — | — | — | — | — | E0.005 |
| ESJ-16 | 0.058 | 0.081 | — | — | — | — | — | — |
| ESJ-19 | 0.011 | — | — | — | — | — | — | — |
| QPC-01 | — | — | — | — | — | — | — | — |
| QPC-02 | — | 0.008 | — | — | — | — | — | — |
| TRCY-02 | — | — | — | — | — | — | — | — |
| TRCY-07 | — | — | — | 0.02 | — | — | — | — |
| TRCY-09 | — | — | — | — | 0.066 | — | 0.03 | — |

*See footnotes at end of table.*

**Table 14.** Summary of pesticides and pesticide degradates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate values above the comparison threshold level. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, minimum reporting level; n/a, not applicable; nq, compound identified but not quantified; QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Herbicides | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Simazine (µg/L) (04035) | Atrazine (µg/L) (39632) | [1]1,2-Dibromo-3-chloropropane (DBCP) (µg/L) (82625) | [2]Diphenamid (µg/L) (04033) | Hexazinone (µg/L) (04025) | Metolachlor (µg/L) (39415) | Tebuthiuron (µg/L) (82670) | Trifluralin (µg/L) (82661) |
| Nongrid cell wells[4] | | | | | | | | |
| ESJFP-08 | — | 0.008 | — | — | — | — | — | — |
| ESJFP-09 | — | — | — | — | — | — | — | — |
| ESJFP-10 | — | — | — | — | — | — | — | — |
| TRCYFP-02 | — | — | — | — | E0.008 | 0.006 | — | — |
| ESJMW-01 | — | — | — | — | — | — | — | — |
| ESJDD-01 | 0.007 | — | — | — | — | — | — | — |
| ESJDD-02 | 0.006 | — | — | — | — | — | — | — |
| ESJDD-04 | 0.018 | — | — | — | — | — | — | — |
| ESJDD-05 | 0.023 | — | — | — | — | — | — | — |
| ESJDD-06 | 0.018 | — | — | — | — | — | — | — |
| Detections per compound in grid cell wells | 8 | 4 | 4 | 1 | 1 | 1 | 1 | 1 |
| Detection frequency in grid cell wells (percent) | 16 | 8 | 8 | 2 | 2 | 2 | 2 | 2 |

*See footnotes at end of table.*

**Table 14.** Summary of pesticides and pesticide degradates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate values above the comparison threshold level. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, minimum reporting level; n/a, not applicable; nq, compound identified but not quantified; QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Herbicides | | | Pesticide degradates | | | | Detections per well |
|---|---|---|---|---|---|---|---|---|
| | [1]1,2-Dibromoethane (EDB) (µg/L) (77651) | [2]Imazaquin (µg/L) (50356) | Phorate (µg/L) (82664) | 2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) (µg/L) (04040) | [2]2-Chloro-6-ethylamino-4-amino-*s*-triazine (deisopropylatrazine) (µg/L) (04038) | 2,6-Diethylaniline (µg/L) (82660) | 3,4-Dichloroaniline (µg/L) (61625) | |
| Threshold type | MCL-US | n/a | n/a | n/a | n/a | n/a | n/a | |
| Threshold level (µg/L) | 0.05 | n/a | n/a | n/a | n/a | n/a | n/a | |
| LRL | [3]0.04 | 0.036 | 0.011 | 0.006 | 0.01 | 0.006 | 0.004 | |
| Grid cell wells | | | | | | | | |
| COS-04 | — | — | — | — | — | — | — | 1 |
| COS-05 | — | — | — | — | — | — | — | 1 |
| COS-06 | — | — | — | — | — | — | — | 2 |
| COS-07 | — | — | — | E0.046 | — | — | — | 1 |
| ESJ-01 | — | — | — | E0.007 | — | — | — | 3 |
| ESJ-03 | — | — | — | — | — | — | — | 1 |
| ESJ-06 | — | — | — | — | — | — | — | 1 |
| ESJ-07 | — | — | — | E0.009 | — | — | — | 1 |
| ESJ-09 | — | — | — | E0.007 | — | — | — | 4 |
| ESJ-15 | — | — | — | — | — | — | — | 2 |
| ESJ-16 | — | — | — | E0.035 | — | — | — | 3 |
| ESJ-19 | — | — | — | E0.008 | E0.04 | — | — | 3 |
| QPC-01 | — | — | — | E0.006 | E0.02 | — | — | 2 |
| QPC-02 | — | — | — | E0.008 | — | — | — | 2 |
| TRCY-02 | — | — | — | — | — | — | 0.045 | 1 |
| TRCY-07 | — | — | — | — | — | E0.004 | — | 2 |
| TRCY-09 | — | — | — | — | — | E0.004 | — | 3 |

*See footnotes at end of table.*

**Table 14.** Summary of pesticides and pesticide degradates in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[[Bold numbers indicate values above the comparison threshold level. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, minimum reporting level; n/a, not applicable; nq, compound identified but not quantified; QPC, Upland Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Herbicides | | | Pesticide degradates | | | | Detections per well |
|---|---|---|---|---|---|---|---|---|
| | [1]1,2-Dibromoethane (EDB) (µg/L) (77651) | [2]Imazaquin (µg/L) (50356) | Phorate (µg/L) (82664) | 2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) (µg/L) (04040) | [2]2-Chloro-6-ethylamino-4-amino-*s*-triazine (deisopropylatrazine) (µg/L) (04038) | 2,6-Diethylaniline (µg/L) (82660) | 3,4-Dichloroaniline (µg/L) (61625) | |
| Nongrid cell wells[4] | | | | | | | | |
| ESJFP-08 | — | — | — | E0.008 | — | — | — | 2 |
| ESJFP-09 | **0.14** | — | — | — | — | — | — | 1 |
| ESJFP-10 | — | — | — | — | E0.02 | — | — | 1 |
| TRCYFP-02 | — | — | — | — | — | — | — | 2 |
| ESJMW-01 | — | nq | — | — | — | — | — | 1 |
| ESJDD-01 | — | — | — | — | — | — | — | 1 |
| ESJDD-02 | — | — | — | — | — | — | — | 1 |
| ESJDD-04 | — | — | — | E0.009 | E0.08 | — | — | 3 |
| ESJDD-05 | — | — | — | E0.006 | E0.06 | — | — | 3 |
| ESJDD-06 | — | — | E0.004 | E0.005 | E0.04 | — | — | 4 |
| Detections per compound in grid cell wells | 0 | 0 | 0 | 8 | 2 | 2 | 1 | [5]52 |
| Detection frequency in grid cell wells (percent) | 0 | 0 | 0 | 16 | 4 | 4 | 2 | [6]27 |

[1]1,2-Dibromo-3-chloropropane (DBCP) and 1,2-Dibromoethane (EDB) concentrations reported from the preferred analysis method, pesticide analytical Schedule 1306.

[2]Concentrations of these compounds are reported from the preferred analytical Schedule 2060.

[3]Although listed as LRLs, DBCP and EDB are reported to the Minimum Reporting Level or MRL.

[4]These samples have been identified as nongrid wells and are not used in the calculation of a detection frequency.

[5]Total number of detections.

[6]Total number of samples with at least a single detection.

**Table 15.** Summary of wastewater-indicator constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study unit, California, December 2004 to February 2005.

[Concentrations preceded by a “V” indicate detections potentially biased by contamination and are not included in ground-water quality analysis. Percentage values are detection frequencies. Wastewater-indicator constituents were not collected at all sites; therefore, the detection frequency does not represent the detection frequency throughout the entire study unit. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); IRL, interim reporting limit; n/a, not applicable; nq, compound identified but not quantified; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, not detected]

| GAMA well identification number | Isophorone (µg/L) (34409) | Benzophenone (µg/L) (62067) | 4-Nonylphenol (µg/L) (62085) | [1]Caffeine (µg/L) (50305) | Bisphenol A (µg/L) (62069) | Tris (dichloroisopropyl) phosphate (µg/L) (62088) | [2]Phenol (µg/L) (34466) | Detections per well |
|---|---|---|---|---|---|---|---|---|
| Threshold type | HA-L | n/a | n/a | n/a | n/a | n/a | HA-L | |
| Threshold level (µg/L) | 100 | n/a | n/a | n/a | n/a | n/a | 2,000 | |
| IRL | 0.5 | 0.5 | 5.0 | 0.018 | 1.0 | 0.5 | 0.5 | |
| ESJ-12 | nq | — | — | — | — | — | VE0.5 | 1 |
| ESJ-19 | — | nq | nq | — | — | — | VE0.2 | 2 |
| QPC-01 | nq | — | — | 0.078 | — | — | VE0.5 | 2 |
| TRCY-07 | nq | — | — | E0.005 | — | — | — | 2 |
| TRCY-03 | E0.1 | — | — | — | — | — | V0.7 | 1 |
| ESJFP-07 | — | — | — | — | — | — | VE0.3 | 0 |
| ESJFP-10 | — | — | — | — | — | — | V0.9 | 0 |
| TRCYFP-01 | nq | — | — | — | — | — | — | 1 |
| TRCYFP-02 | nq | — | — | — | — | nq | — | 2 |
| TRCYFP-04 | nq | — | — | — | — | — | — | 1 |
| ESJDD-04 | — | nq | nq | — | — | — | VE0.3 | 2 |
| ESJDD-05 | — | nq | nq | — | — | — | VE0.5 | 2 |
| ESJDD-06 | — | E0.1 | E2 | — | — | — | VE0.3 | 2 |
| ESJMW-01 | — | — | — | E0.005 | — | — | — | 1 |
| ESJMW-02 | — | — | — | — | — | — | V0.9 | 0 |
| ESJMW-03 | — | — | — | — | nq | — | VE0.2 | 1 |
| Detections per compound[3] | 7 | 4 | 4 | 3 | 1 | 1 | 0 | [4]20 |
| Detection frequency (percent)[3] | 44 | 25 | 25 | 19 | 6 | 6 | 0 | [5]13 |

[1]Caffeine concentration reported is from the preferred analysis method, pesticide analytical Schedule 2060.

[2]Because of the high phenol contents in the blank samples, phenol detections have been censored.

[3]Wastewater-indicator constituents were not collected at all sites; therefore, the detection frequency does not represent the detection frequency throughout the entire study unit.

[4]Total number of detections.

[5]Total number of samples with at least a single detection.

**Table 16.** Summary of constituents of special interest for the ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[The constituents of special interest were not collected at all sites; therefore, the detection frequencies presented in this table do not represent detection frequencies throughout the entire study unit. Percentage values are detection frequencies. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; MRL, Minimum Reporting Level; NL, notification level (California Department of Health Services, 2005d); USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Perchlorate (µg/L) (61209) | *N*-Nitrosodimethylamine (NDMA) (µg/L) (64176) | 1,2,3-Trichloropropane (1,2,3-TCP) (µg/L) (77443) | Detections per well |
|---|---|---|---|---|
| Threshold type | NL | NL | NL | |
| Threshold level (µg/L) | 6 | 0.01 | 0.005 | |
| MRL | 0.5 | 0.002 | 0.005 | |
| ESJ-16 | 1.0 | — | — | 1 |
| ESJDD-01 | 0.7 | — | — | 1 |
| Detections per compound | 2 | 0 | 0 | [1]2 |
| Detection frequency (percent) | 6 | 0 | 0 | [2]2 |

[1]Total number of detections.

[2]Total number of samples with at least a single detection.

**Table 17.** Summary of nutrient and dissolved organic carbon data collected from ground-water samples in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Concentrations preceded by a "V" indicate detections potentially biased by contamination and are not included in ground-water quality analysis. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); mg/L, milligram per liter; n/a, not applicable; nc, not collected; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Ammonia, dissolved as nitrogen (mg/L) (00608) | Nitrite, dissolved as nitrogen (mg/L) (00613) | Nitrite plus nitrate, dissolved as nitrogen (mg/L) (00631) | Total nitrogen (nitrate + nitrite + ammonia + organic-nitrogen) dissolved as nitrogen (mg/L) (62854) | Orthophosphate, dissolved as phosphorous (mg/L) (00671) | Dissolved organic carbon (mg/L) (00681) |
|---|---|---|---|---|---|---|
| Threshold type | HA-L | MCL-US | MCL-US | n/a | n/a | n/a |
| Threshold level (mg/L) | 30 | 1 | 10 | n/a | n/a | n/a |
| LRL | 0.04 | 0.008 | 0.06 | 0.06 | 0.006 | 0.3 |
| Grid cell samples | | | | | | |
| ESJ-12 | — | — | 0.91 | 0.95 | 0.046 | VE0.2 |
| ESJ-19 | — | — | E0.05 | 0.06 | 0.054 | 0.4 |
| QPC-01 | — | — | 3.31 | 3.5 | 0.044 | 0.4 |
| TRCY-03 | — | — | 2.30 | 2.44 | 0.016 | VE0.2 |
| TRCY-07 | 0.63 | 0.026 | — | 0.81 | 0.227 | 9.6 |
| Flowpath samples | | | | | | |
| TRCYFP-01 | 0.71 | — | — | 0.75 | 0.148 | 8.5 |
| TRCYFP-02 | E0.03 | — | 1.69 | 1.79 | 0.02 | 0.3 |
| TRCYFP-04 | — | — | 1.86 | 2.01 | 0.02 | VE0.2 |
| ESJFP-07 | — | — | 0.54 | 0.57 | 0.025 | VE0.2 |
| ESJFP-10 | — | — | 1.37 | 1.44 | 0.033 | — |
| Monitoring well samples | | | | | | |
| ESJMW-01 | — | 0.016 | 0.77 | 0.78 | 0.022 | nc |
| ESJMW-02 | — | — | 0.70 | 0.7 | 0.03 | nc |
| ESJMW-03 | — | — | 1.06 | 1.1 | 0.031 | nc |
| Depth-dependent samples | | | | | | |
| ESJDD-02 | — | — | 0.69 | 0.78 | 0.034 | nc |
| ESJDD-03 | — | — | 0.95 | 0.99 | 0.034 | nc |
| ESJDD-04 | — | — | E0.04 | V0.12 | 0.034 | nc |
| ESJDD-05 | — | — | — | VE0.04 | 0.044 | nc |
| ESJDD-06 | — | — | — | — | 0.05 | nc |

**Table 18.** Summary of major and minor ions and total dissolved solids in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Bold numbers indicate ground-water detections above the threshold level. Values preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, total dissolved solids are reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; LRL, laboratory reporting level; MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); mg/L, milligram per liter; MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Bromide, dissolved (mg/L) (71870) | Calcium, dissolved (mg/L) (00915) | Chloride, dissolved (mg/L) (00940) | Fluoride, dissolved (mg/L) (00950) | Iodide, dissolved (mg/L) (71865) | Magnesium, dissolved (mg/L) (00925) | Potassium, dissolved (mg/L) (00935) | Silica, dissolved (mg/L) (00955) | Sodium, dissolved (mg/L) (00930) | Sulfate, dissolved (mg/L) (00945) | Total dissolved solids (residue on evaporation) (mg/L) (70300) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Threshold type | n/a | n/a | SMCL-US | MCL-US | n/a | n/a | n/a | n/a | n/a | SMCL-US | SMCL-US |
| Threshold level (mg/L) | n/a | n/a | 250 | 2 | n/a | n/a | n/a | n/a | n/a | 250 | 500 |
| LRL | 0.02 | 0.02 | 0.2 | 0.1 | 0.002 | 0.008 | 0.16 | 0.04 | 0.2 | 0.18 | 10 |
| Eastern San Joaquin Basin wells | | | | | | | | | | | |
| ESJ-06 | 0.08 | 28.1 | 13.5 | 0.1 | 0.004 | 13.2 | 7.42 | 67.2 | 19.2 | 13.6 | 243 |
| ESJ-08 | 0.03 | 13.1 | 7.6 | 0.3 | V0.002 | 7.57 | 3.25 | 82.5 | 16.2 | 2.93 | 190 |
| ESJ-10 | 0.10 | 23.4 | 15.5 | 0.1 | 0.037 | 7.7 | 4.34 | 56 | 19.8 | 4.16 | 189 |
| ESJ-12 | 0.06 | 24.8 | 4.1 | 0.2 | VE0.001 | 11.8 | 3.52 | 68 | 12 | 3.63 | 200 |
| ESJ-13 | 0.04 | 19.1 | 3.7 | 0.1 | VE0.001 | 7.86 | 4.41 | 70.3 | 10.5 | 3.61 | 177 |
| ESJ-14 | 0.08 | 23.6 | 13.1 | 0.1 | 0.025 | 9.27 | 2.06 | 51 | 27.6 | 6.34 | 204 |
| ESJ-15 | 0.20 | 63.9 | 48.6 | 0.1 | 0.048 | 22 | 3.76 | 48.3 | 25.8 | 30.9 | 355 |
| ESJ-16 | 0.06 | 26.3 | 6.2 | 0.1 | V0.002 | 12.5 | 5.71 | 66.2 | 15.3 | 12.1 | 224 |
| ESJ-17 | 0.06 | 13.7 | 10.2 | 0.2 | V0.002 | 7.89 | 3.13 | 80.7 | 16.1 | 11.2 | 194 |
| ESJ-18 | 0.06 | 14.8 | 9.3 | 0.2 | VE0.001 | 8.22 | 3.57 | 78.5 | 12.7 | 7.91 | 188 |
| ESJ-19 | 0.10 | 37.6 | 25.7 | E0.1 | 0.003 | 16.8 | 4.77 | 49.6 | 33.2 | 24.7 | 294 |
| Upland Basin wells | | | | | | | | | | | |
| QPC-01 | 0.10 | 37.6 | 9.5 | 0.1 | VE0.002 | 15.9 | 2.42 | 53.3 | 12 | 27.9 | 257 |
| QPC-04 | 0.04 | 4.59 | 3.9 | 0.2 | 0.004 | 2.58 | 4.1 | 93.3 | 22.8 | 2.33 | 165 |
| QPC-06 | 0.07 | 12.8 | 10.8 | 0.3 | 0.012 | 6.55 | 6.66 | 88.4 | 15.1 | 1.4 | 181 |
| QPC-07 | 0.10 | 22.3 | 18 | 0.2 | 0.012 | 22.4 | 2.62 | 59.2 | 27.2 | 10.8 | 259 |
| QPC-08 | 0.10 | 15.2 | 5.6 | 0.2 | — | 8.87 | 3.21 | 84.2 | 16.8 | 5.72 | 198 |

**Table 18.** Summary of major and minor ions and total dissolved solids in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Values preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, total dissolved solids are reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; LRL, laboratory reporting level; MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); mg/L, milligram per liter; MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Bromide, dissolved (mg/L) (71870) | Calcium, dissolved (mg/L) (00915) | Chloride, dissolved (mg/L) (00940) | Fluoride, dissolved (mg/L) (00950) | Iodide, dissolved (mg/L) (71865) | Magnesium, dissolved (mg/L) (00925) | Potassium, dissolved (mg/L) (00935) | Silica, dissolved (mg/L) (00955) | Sodium, dissolved (mg/L) (00930) | Sulfate, dissolved (mg/L) (00945) | Total dissolved solids (residue on evaporation) (mg/L) (70300) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QPC-10 | 0.06 | 14.3 | 8.4 | 0.3 | VE0.002 | 8.76 | 2.64 | 76 | 15.3 | 5.07 | 185 |
| Tracy Basin wells | | | | | | | | | | | |
| TRCY-03 | 0.39 | 80.9 | 102 | 0.2 | 0.015 | 26.8 | 3.17 | 23.4 | 138 | 248 | **751** |
| TRCY-09 | 0.46 | 38.7 | 108 | 0.2 | 0.068 | 18.3 | 2.82 | 29.4 | 77.5 | 34 | 414 |
| TRCY-11 | 0.51 | 38.5 | 82.1 | E0.1 | 0.12 | 16.2 | 3.39 | 34.3 | 134 | 191 | **604** |
| TRCY-07 | 3.07 | 397 | **1,020** | 0.2 | 0.15 | 213 | 4.2 | 45.7 | 240 | **750** | **2,740** |
| Flowpath wells | | | | | | | | | | | |
| TRCYFP-01 | 8.77 | 254 | **2,400** | — | 1.8 | 141 | 5.85 | 35.1 | 1,090 | 62.9 | **4,350** |
| TRCYFP-02 | 0.44 | 66.5 | 114 | 0.2 | 0.017 | 30.6 | 4 | 21.3 | 120 | **252** | **721** |
| TRCYFP-03 | 0.46 | 49.0 | 126 | 0.1 | 0.044 | 21.9 | 3.67 | 24 | 145 | 223 | **675** |
| TRCYFP-04 | 0.50 | 94 | 124 | 0.2 | 0.016 | 33.2 | 3.41 | 24.8 | 156 | **309** | **889** |
| TRCYFP-05 | 0.71 | 57.9 | 168 | 0.1 | 0.032 | 24.7 | 4.49 | 20.1 | 170 | 244 | **778** |
| ESJFP-07 | 0.03 | 20.4 | 4.3 | 0.1 | V0.002 | 11.3 | 5.28 | 70.9 | 12.2 | 6.05 | 192 |
| ESJFP-08 | 0.11 | 41.4 | 58.5 | 0.1 | 0.006 | 15 | 2.76 | 53.9 | 53.2 | 18.8 | 339 |
| ESJFP-09 | 0.10 | 47.7 | 12.8 | 0.1 | VE0.002 | 26.1 | 4.92 | 67 | 17.5 | 18.7 | 323 |
| ESJFP-10 | 0.07 | 31.3 | 6.9 | E0.1 | VE0.001 | 18.1 | 6.03 | 64.1 | 14.3 | 16.1 | 243 |
| Monitoring wells | | | | | | | | | | | |
| ESJMW-01 | 0.06 | 19.2 | 5.0 | E0.1 | 0.004 | 12.2 | 5.25 | 60.5 | 16.4 | 7.7 | 186 |
| ESJMW-02 | 0.06 | 20.4 | 4.8 | 0.1 | VE0.002 | 12.2 | 5.11 | 66.7 | 13.4 | 9.45 | 194 |
| ESJMW-03 | 0.08 | 27.4 | 5.7 | 0.1 | VE0.002 | 15.7 | 4.72 | 68.8 | 15.3 | 20.1 | 235 |

**Table 18.** Summary of major and minor ions and total dissolved solids in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Values preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, total dissolved solids are reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; LRL, laboratory reporting level; MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); mg/L, milligram per liter; MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Bromide, dissolved (mg/L) (71870) | Calcium, dissolved (mg/L) (00915) | Chloride, dissolved (mg/L) (00940) | Fluoride, dissolved (mg/L) (00950) | Iodide, dissolved (mg/L) (71865) | Magnesium, dissolved (mg/L) (00925) | Potassium, dissolved (mg/L) (00935) | Silica, dissolved (mg/L) (00955) | Sodium, dissolved (mg/L) (00930) | Sulfate, dissolved (mg/L) (00945) | Total dissolved solids (residue on evaporation) (mg/L) (70300) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth-dependent samples | | | | | | | | | | | |
| ESJDD-01 | 0.07 | 31.5 | 7.0 | E0.1 | V0.002 | 18.3 | 6.06 | 63.1 | 16 | 17.3 | 253 |
| ESJDD-02 | 0.04 | 21.1 | 5.1 | 0.1 | VE0.001 | 12.6 | 5.4 | 62.4 | 12.1 | 8 | 193 |
| ESJDD-03 | 0.07 | 26.1 | 5.8 | E0.1 | VE0.001 | 15.2 | 5.81 | 62.2 | 12.6 | 11 | 223 |
| ESJDD-04 | 0.22 | 42 | 20.4 | 0.1 | 0.033 | 18.7 | 4.09 | 51.7 | 28.3 | 23.8 | 313 |
| ESJDD-05 | 0.22 | 41 | 20.6 | 0.1 | 0.032 | 17.9 | 4.24 | 52.4 | 28.8 | 22.4 | 294 |
| ESJDD-06 | 0.11 | 37.3 | 21.4 | 0.2 | 0.031 | 16.6 | 4.35 | 51 | 33 | 19.1 | 271 |

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Aluminum, dissolved (µg/L) (01106) | Antimony, dissolved (µg/L) (01095) | Arsenic, dissolved (µg/L) (01000) | Barium, dissolved (µg/L) (01005) | Beryllium, dissolved (µg/L) (01010) | Boron, dissolved (µg/L) (01020) | Cadmium, dissolved (µg/L) (01025) | Chromium, dissolved (µg/L) (01030) |
|---|---|---|---|---|---|---|---|---|
| Threshold type | MCL-US | MCL-US | MCL-US | MCL-CA | MCL-US | NL | MCL-US | MCL-CA |
| Threshold level (µg/L) | 1,000 | 6 | 10 | 1,000 | 4 | 1,000 | 5 | 50 |
| LRL | 1.6 | 0.2 | 0.2 | 0.2 | 0.06 | 8 | 0.04 | 0.8 |
| Eastern San Joaquin Basin wells | | | | | | | | |
| ESJ-06 | nq | — | 4.5 | 97 | — | 34 | — | 4.6 |
| ESJ-08 | E1 | — | 3.3 | 68 | — | 65 | — | 4.3 |
| ESJ-10 | nq | E0.1 | 7 | 174 | — | 36 | — | — |
| ESJ-12 | E1 | — | 1.2 | 85 | — | 21 | — | 4.9 |
| ESJ-13 | nq | — | 1.2 | 83 | — | 22 | — | 2.9 |
| ESJ-14 | E1 | — | **24.9** | 175 | — | 41 | — | — |
| ESJ-15 | nq | — | 4.8 | 282 | — | 35 | — | — |
| ESJ-16 | E1 | — | 6.5 | 116 | — | 37 | — | 1.0 |
| ESJ-17 | E1 | — | 2.1 | 64 | — | 122 | E0.02 | 4.3 |
| ESJ-18 | E1 | — | 2 | 78 | — | 48 | — | 2.3 |
| ESJ-19 | E1 | E0.2 | 8 | 195 | — | 68 | — | — |
| Upland Basin wells | | | | | | | | |
| QPC-01 | — | — | 0.7 | 101 | — | 37 | — | 1.1 |
| QPC-04 | nq | — | 2.3 | 30 | — | 32 | — | 1.2 |
| QPC-06 | nq | E0.2 | 3.3 | 53 | — | 18 | — | — |
| QPC-07 | — | — | 1.7 | 98 | — | 222 | — | — |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Aluminum, dissolved (µg/L) (01106) | Antimony, dissolved (µg/L) (01095) | Arsenic, dissolved (µg/L) (01000) | Barium, dissolved (µg/L) (01005) | Beryllium, dissolved (µg/L) (01010) | Boron, dissolved (µg/L) (01020) | Cadmium, dissolved (µg/L) (01025) | Chromium, dissolved (µg/L) (01030) |
|---|---|---|---|---|---|---|---|---|
| QPC-08 | nq | — | 1.9 | 45.1 | — | 18 | — | 2.7 |
| QPC-10 | E1 | — | 2.8 | 83 | — | 50 | — | 1.4 |
| Tracy Basin wells | | | | | | | | |
| TRCY-03 | — | — | 0.8 | 25 | — | **2,190** | — | 7.2 |
| TRCY-07 | — | — | **23.6** | 59 | — | 77 | 0.16 | — |
| TRCY-09 | E1 | — | 4.7 | 102 | — | 194 | — | — |
| TRCY-11 | 3 | — | 7.2 | 44 | — | 916 | — | — |
| Flowpath wells | | | | | | | | |
| TRCYFP-01 | — | — | 7.2 | 158 | — | 738 | — | — |
| TRCYFP-02 | — | — | 1.3 | 30 | — | **1,340** | — | 6.7 |
| TRCYFP-03 | E3 | — | 2.5 | 28 | — | **1,180** | — | 1.2 |
| TRCYFP-04 | E1 | — | 0.8 | 26 | — | **2,310** | — | 7.1 |
| TRCYFP-05 | — | — | 1.7 | 26 | — | **1,180** | — | 1.9 |
| ESJFP-07 | 2 | — | 1.9 | 69 | — | 24 | — | 3.9 |
| ESJFP-08 | E1 | — | **13.9** | 210 | — | 201 | — | E0.4 |
| ESJFP-09 | E1 | — | 2.5 | 141 | — | 22 | — | 5.6 |
| ESJFP-10 | nq | — | 3.3 | 86 | — | 26 | — | 6.3 |
| Monitoring wells | | | | | | | | |
| ESJMW-01 | nq | — | 3.9 | 49 | — | 35 | 0.1 | 2.7 |
| ESJMW-02 | — | — | 4.2 | 61 | — | 26 | E0.03 | 7.7 |
| ESJMW-03 | nq | — | 3.3 | 83 | — | 22 | E0.03 | 2.1 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Aluminum, dissolved (µg/L) (01106) | Antimony, dissolved (µg/L) (01095) | Arsenic, dissolved (µg/L) (01000) | Barium, dissolved (µg/L) (01005) | Beryllium, dissolved (µg/L) (01010) | Boron, dissolved (µg/L) (01020) | Cadmium, dissolved (µg/L) (01025) | Chromium, dissolved (µg/L) (01030) |
|---|---|---|---|---|---|---|---|---|
| Depth-dependent samples | | | | | | | | |
| ESJDD-01 | 2 | — | 3.9 | 88 | — | 31 | — | 6.4 |
| ESJDD-02 | 3 | — | 3.9 | 57 | — | 28 | — | 8.3 |
| ESJDD-03 | E2 | — | 3.6 | 71 | — | 27 | — | 7.4 |
| ESJDD-04 | 9 | E0.1 | 8.2 | 193 | E0.04 | 65 | — | — |
| ESJDD-05 | E1 | E0.1 | 8.9 | 192 | — | 70 | — | — |
| ESJDD-06 | nq | E0.2 | 8.5 | 181 | — | 74 | — | — |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Cobalt, dissolved (µg/L) (01035) | Copper, dissolved (µg/L) (01040) | Iron, dissolved (µg/L) (01046) | Lead, dissolved (µg/L) (01049) | Lithium, dissolved (µg/L) (01130) | Manganese, dissolved (µg/L) (01056) | Mercury, dissolved (µg/L) (71890) | Molybdenum, dissolved (µg/L) (01060) |
|---|---|---|---|---|---|---|---|---|
| Threshold type | n/a | MCL-US | SMCL-US | MCL-US | n/a | NL | MCL-US | HA-L |
| Threshold level (µg/L) | n/a | [1]1,300 | 300 | 115 | n/a | 500 | 2 | 40 |
| LRL | 0.014 | 0.4 | 6 | 0.08 | 0.6 | 0.2 | 0.01 | 0.4 |
| Eastern San Joaquin Basin wells | | | | | | | | |
| ESJ-06 | 0.073 | VE0.4 | — | E0.07 | 0.8 | — | nc | 0.9 |
| ESJ-08 | 0.033 | 1.7 | — | 1.75 | 1.2 | 0.4 | nc | 0.9 |
| ESJ-10 | 0.072 | 2.4 | 17 | 1.08 | 1.5 | 66.2 | nc | 1.4 |
| ESJ-12 | 0.067 | 2.8 | 6 | 1.37 | 1.6 | 0.4 | — | 0.6 |
| ESJ-13 | 0.048 | 1.5 | 14 | 0.23 | 2.6 | 1.2 | nc | 0.8 |
| ESJ-14 | 0.062 | — | 65 | — | 0.7 | 187 | nc | 4.4 |
| ESJ-15 | 0.145 | 1.4 | — | 0.65 | 1.8 | 19 | nc | 1 |
| ESJ-16 | 0.056 | 4.2 | 13 | 6.48 | 1.3 | 6.5 | nc | 0.7 |
| ESJ-17 | 0.053 | VE0.4 | — | 0.27 | 2.6 | 2.2 | nc | 0.7 |
| ESJ-18 | 0.032 | 1.1 | — | 0.22 | 5.1 | V0.2 | nc | 0.6 |
| ESJ-19 | 0.118 | 2.3 | E4 | 0.91 | 2.1 | 0.9 | — | 1 |
| Upland Basin wells | | | | | | | | |
| QPC-01 | 0.103 | 3.2 | — | 2.30 | E0.6 | V0.2 | — | E0.3 |
| QPC-04 | 0.025 | — | 150 | 0.12 | 3.7 | 54.8 | nc | 0.8 |
| QPC-06 | 0.017 | — | E3 | 0.13 | 13.6 | 2.6 | nc | 0.5 |
| QPC-07 | 0.041 | 1.7 | E5 | 1.14 | 49.8 | 0.4 | nc | 0.7 |
| QPC-08 | 0.029 | 2.4 | E3 | 0.37 | 1.1 | — | nc | 0.5 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Cobalt, dissolved (µg/L) (01035) | Copper, dissolved (µg/L) (01040) | Iron, dissolved (µg/L) (01046) | Lead, dissolved (µg/L) (01049) | Lithium, dissolved (µg/L) (01130) | Manganese, dissolved (µg/L) (01056) | Mercury, dissolved (µg/L) (71890) | Molybdenum, dissolved (µg/L) (01060) |
|---|---|---|---|---|---|---|---|---|
| QPC-10 | 0.022 | 0.7 | E4 | 0.39 | 4.1 | 0.3 | nc | 0.4 |
| Tracy Basin wells | | | | | | | | |
| TRCY-03 | 0.247 | 3.0 | E4 | 0.89 | 32.3 | VE0.2 | — | 1.9 |
| TRCY-07 | 3.64 | 3.6 | **24,500** | 0.24 | 17.7 | **17,100** | — | 3 |
| TRCY-09 | 0.131 | VE0.3 | **4,180** | — | 5 | **519** | nc | 3 |
| TRCY-11 | 0.107 | 1.1 | 8 | 0.27 | 5.4 | 194 | nc | 4.5 |
| Flowpath wells | | | | | | | | |
| TRCYFP-01 | 0.85 | 3.4 | **1,240** | — | 10.2 | **2,480** | — | 5.1 |
| TRCYFP-02 | 0.211 | 3.0 | E3 | 1.15 | 20.8 | — | E0.01 | 1.5 |
| TRCYFP-03 | 0.142 | 1.2 | 9 | 0.44 | 16.6 | 1.9 | nc | 2.3 |
| TRCYFP-04 | 0.29 | 3.8 | 15 | 1 | 35.3 | 1.5 | — | 1.8 |
| TRCYFP-05 | 0.163 | 1.1 | — | 0.65 | 18.8 | 2.1 | nc | 1.5 |
| ESJFP-07 | 0.052 | 4.6 | E4 | 2.25 | E0.4 | 0.8 | — | 0.4 |
| ESJFP-08 | 0.111 | 9.1 | 13 | 1.16 | 2.6 | 87.9 | nc | 1.1 |
| ESJFP-09 | 0.128 | 4.4 | E5 | 0.5 | 1.4 | 0.4 | nc | 0.5 |
| ESJFP-10 | 0.046 | 2.7 | — | 0.88 | 0.8 | V0.2 | — | 0.5 |
| Monitoring wells | | | | | | | | |
| ESJMW-01 | 0.072 | — | 38 | — | E0.3 | 9 | — | 1.5 |
| ESJMW-02 | 0.065 | VE0.2 | — | — | E0.6 | VE0.1 | — | 0.9 |
| ESJMW-03 | 0.07 | VE0.3 | — | — | 1.3 | 0.2 | — | 0.8 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Cobalt, dissolved (µg/L) (01035) | Copper, dissolved (µg/L) (01040) | Iron, dissolved (µg/L) (01046) | Lead, dissolved (µg/L) (01049) | Lithium, dissolved (µg/L) (01130) | Manganese, dissolved (µg/L) (01056) | Mercury, dissolved (µg/L) (71890) | Molybdenum, dissolved (µg/L) (01060) |
|---|---|---|---|---|---|---|---|---|
| Depth-dependent samples | | | | | | | | |
| ESJDD-01 | 0.055 | V0.5 | — | — | 0.7 | V0.4 | nc | 0.8 |
| ESJDD-02 | 0.036 | V0.4 | — | E0.06 | 0.6 | VE0.1 | — | 0.7 |
| ESJDD-03 | 0.047 | V0.5 | — | — | 0.6 | V0.2 | — | 0.6 |
| ESJDD-04 | 0.103 | 2.3 | 11 | E0.06 | 1.2 | 1.2 | — | 1.1 |
| ESJDD-05 | 0.13 | V0.3 | 6 | — | 1.8 | 1.2 | — | 1 |
| ESJDD-06 | 0.12 | V0.3 | 7 | — | 1.9 | 1.1 | — | 1 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Nickel, dissolved (µg/L) (01065) | Selenium, dissolved (µg/L) (01145) | Strontium, dissolved (µg/L) (01080) | Thallium, dissolved (µg/L) (01057) | Tungsten, dissolved (µg/L) (01155) | Uranium, dissolved (µg/L) (22703) | Vanadium, dissolved (µg/L) (01085) | Zinc, dissolved (µg/L) (01090) |
|---|---|---|---|---|---|---|---|---|
| Threshold type | MCL-CA | MCL-US | HA-L | MCL-US | n/a | MCL-US | NL | HA-L |
| Threshold level (µg/L) | 100 | 50 | 4,000 | 2 | n/a | 30 | 50 | 2,000 |
| LRL | 0.06 | 0.4 | 0.4 | 0.04 | 0.5 | 0.04 | 0.14 | 0.6 |
| Eastern San Joaquin Basin wells | | | | | | | | |
| ESJ-06 | 0.8 | 0.5 | 340 | — | — | 3.81 | 33.4 | V0.9 |
| ESJ-08 | 0.42 | E0.2 | 169 | — | — | 0.13 | 30.4 | 2.9 |
| ESJ-10 | 0.73 | — | 304 | — | — | 1.73 | 13.2 | 5.0 |
| ESJ-12 | 0.95 | 0.5 | 240 | — | — | 0.73 | 11.5 | 12.8 |
| ESJ-13 | 0.6 | E0.4 | 179 | — | — | 0.42 | 9.4 | 4.7 |
| ESJ-14 | 0.61 | — | 265 | — | — | 0.42 | E0.1 | V1.8 |
| ESJ-15 | 1.25 | 1.3 | 799 | — | — | 7.53 | 8.8 | 12.8 |
| ESJ-16 | 0.58 | — | 267 | — | — | 0.91 | 25.1 | 7.0 |
| ESJ-17 | 0.2 | E0.3 | 163 | — | — | 0.06 | 22.7 | 25.7 |
| ESJ-18 | 0.39 | E0.3 | 169 | — | — | 0.07 | 21.9 | 6.3 |
| ESJ-19 | 1.56 | E0.3 | 449 | — | — | 2.56 | 11.2 | 4.7 |
| Upland Basin wells | | | | | | | | |
| QPC-01 | 0.76 | 1.3 | 331 | — | — | 0.98 | 3 | 21.9 |
| QPC-04 | 0.18 | — | 48 | — | — | 0.07 | 9.1 | V0.9 |
| QPC-06 | 0.13 | E0.3 | 153 | — | — | 0.15 | 14.7 | 7.9 |
| QPC-07 | 0.58 | 0.7 | 434 | — | — | 0.47 | 6.8 | V2.1 |
| QPC-08 | 0.25 | E0.3 | 193 | — | — | 0.08 | 20.7 | 11.2 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Nickel, dissolved (µg/L) (01065) | Selenium, dissolved (µg/L) (01145) | Strontium, dissolved (µg/L) (01080) | Thallium, dissolved (µg/L) (01057) | Tungsten, dissolved (µg/L) (01155) | Uranium, dissolved (µg/L) (22703) | Vanadium, dissolved (µg/L) (01085) | Zinc, dissolved (µg/L) (01090) |
|---|---|---|---|---|---|---|---|---|
| QPC-10 | 0.23 | — | 183 | — | — | 0.31 | 25.7 | 9.5 |
| Tracy Basin wells | | | | | | | | |
| TRCY-03 | 0.77 | 1.2 | 1,060 | — | — | 3.37 | 2.7 | VE2.0 |
| TRCY-07 | 5 | 1.9 | 2,320 | — | — | 1.21 | 1.2 | 4.2 |
| TRCY-09 | 0.62 | E0.2 | 342 | — | 2.3 | — | 0.7 | 3.8 |
| TRCY-11 | 1.11 | 0.7 | 664 | — | 0.6 | 0.21 | 0.3 | 10.3 |
| Flowpath wells | | | | | | | | |
| TRCYFP-01 | 3.9 | — | 2,740 | — | — | E0.07 | | 3.7 |
| TRCYFP-02 | 0.8 | 1.3 | 1,630 | — | — | 1.69 | 4.6 | 12.4 |
| TRCYFP-03 | 1.7 | 1.7 | 1,190 | — | — | 1.05 | 8.3 | 17.2 |
| TRCYFP-04 | 1.05 | 1.6 | 1,310 | — | — | 3.68 | 3.1 | 2.8 |
| TRCYFP-05 | 1.44 | 3.2 | 1,590 | — | — | 0.97 | 6.3 | 3.1 |
| ESJFP-07 | 0.8 | 0.4 | 252 | — | — | 0.6 | 16.3 | 23.1 |
| ESJFP-08 | 1.23 | 0.6 | 401 | — | — | 2.14 | 3.8 | 7.6 |
| ESJFP-09 | 1.66 | 0.9 | 589 | — | — | 9.43 | 27.4 | 9.8 |
| ESJFP-10 | 0.3 | 0.8 | 352 | — | — | 2.64 | 26.1 | 4.7 |
| Monitoring wells | | | | | | | | |
| ESJMW-01 | 1.19 | 0.5 | 226 | 0.04 | — | 0.66 | 20.7 | V0.8 |
| ESJMW-02 | 0.49 | 0.5 | 241 | — | — | 0.86 | 29.9 | V1.1 |
| ESJMW-03 | 0.79 | 1.1 | 321 | — | — | 1.61 | 30.2 | V1.0 |

*See footnote at end of table.*

**Table 19.** Summary of trace elements detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. Concentrations preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. Although listed as an LRL, tungsten is reported as the MRL (Timme, 1995). E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); LRL, laboratory reporting level; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MRL, Minimum Reporting Level (Timme, 1995); n/a, not applicable; nc, not collected; NL, notification level (California Department of Health Services, 2005d; nq, constituent detected but not quantified; QPC, Uplands Basin; SMCL-US, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Nickel, dissolved (µg/L) (01065) | Selenium, dissolved (µg/L) (01145) | Strontium, dissolved (µg/L) (01080) | Thallium, dissolved (µg/L) (01057) | Tungsten, dissolved (µg/L) (01155) | Uranium, dissolved (µg/L) (22703) | Vanadium, dissolved (µg/L) (01085) | Zinc, dissolved (µg/L) (01090) |
|---|---|---|---|---|---|---|---|---|
| Depth-dependent samples | | | | | | | | |
| ESJDD-01 | 0.68 | 0.7 | 360 | — | — | 2.66 | 24.9 | 50.6 |
| ESJDD-02 | 0.65 | 0.5 | 257 | — | — | 0.98 | 30.6 | 50.6 |
| ESJDD-03 | 0.7 | 0.7 | 312 | — | — | 1.61 | 28.1 | 7.0 |
| ESJDD-04 | 3.09 | E0.3 | 441 | — | — | 2.82 | 13.7 | 17.6 |
| ESJDD-05 | 3.67 | E0.3 | 449 | — | — | 3.89 | 16.3 | 2.8 |
| ESJDD-06 | 4.77 | E0.3 | 416 | — | — | 2.96 | 15.3 | 4.4 |

[1]Values referred to as MCLs for lead and copper are "notification levels" under the lead and copper rule (California Department of Health Services, 2005a).

**Table 20.** Summary of chromium, arsenic, and iron speciation data from the U.S. Geological Survey's (USGS) Trace Metal Laboratory, Boulder, Colorado, for ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Bold numbers indicate ground-water detections above the threshold level. Values preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. DLR, detection level for the purpose of reporting (California Department of Health Services, 2005a); E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MDL, method detection level; n/a, not applicable; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Inorganic arsenic, dissolved (µg/L) (99033) | Inorganic arsenic(III), dissolved (µg/L) (99034) | Chromium, dissolved (µg/L) (01030) | Hexavalent chromium (chromium(VI)) dissolved (µg/L) (01032) | Iron, dissolved (µg/L) (01046) | Iron(II), dissolved (µg/L) (01047) |
|---|---|---|---|---|---|---|
| Threshold type | MCL-US | n/a | MCL-CA | DLR | HA-L | n/a |
| Threshold level (µg/L) | 10 | n/a | 50 | 1 | 300 | n/a |
| MDL | 0.5 | 1 | 1 | 1 | 2 | 2 |
| Eastern San Joaquin Basin wells | | | | | | |
| ESJ-06 | 5.7 | — | V5 | **E6** | — | — |
| ESJ-08 | 4.2 | — | V5 | V5 | — | — |
| ESJ-10 | 8.4 | 1 | — | — | 8 | — |
| ESJ-12 | 1.9 | — | V6 | V5 | 5 | 4 |
| ESJ-13 | 1.5 | — | V4 | V3 | 6 | — |
| ESJ-14 | **28.0** | 22 | — | — | 57 | 38 |
| ESJ-15 | 3.9 | — | — | — | V3 | — |
| ESJ-16 | 6.7 | — | V2 | V1 | V3 | 2 |
| ESJ-17 | 1.8 | — | V6 | **E6** | V3 | — |
| ESJ-18 | 2.1 | — | V5 | V4 | — | — |
| ESJ-19 | 7 | — | E9 | **E9** | — | — |
| Upland Basin wells | | | | | | |
| QPC-01 | 0.7 | — | V2 | V2 | 5 | — |
| QPC-04 | 1.9 | — | V2 | V1 | 57 | 34 |
| QPC-06 | 2.8 | — | — | — | V4 | — |
| QPC-07 | 1.2 | — | — | — | 5 | — |
| QPC-08 | 1.7 | — | V4 | V4 | V3 | — |
| QPC-10 | 2.3 | — | V3 | V3 | V3 | — |
| Tracy Basin wells | | | | | | |
| TRCY-03 | 1.1 | — | E15 | E13 | V4 | — |
| TRCY-07 | **18.7** | 19 | V5 | V2 | **22,650** | 22,650 |
| TRCY-09 | 4.5 | 3 | V3 | V1 | **3,876** | 3,744 |
| TRCY-11 | 6.4 | 4 | V3 | V4 | V4 | — |
| Flowpath wells | | | | | | |
| TRCYFP-01 | 9.9 | 9 | V6 | V5 | **1,133** | 1,067 |
| TRCYFP-02 | 1.5 | — | E13 | **E12** | V3 | — |

**Table 20.** Summary of chromium, arsenic, and iron speciation data from the U.S. Geological Survey's (USGS) Trace Metal Laboratory, Boulder, Colorado, for ground-water samples collected in the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[[Bold numbers indicate ground-water detections above the threshold level. Values preceded by a "V" indicate detections potentially biased by contamination. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. DLR, detection level for the purpose of reporting (California Department of Health Services, 2005a); E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; HA-L, lifetime health advisory (U.S. Environmental Protection Agency, 2004b); MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); MDL, method detection level; n/a, not applicable; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; µg/L, microgram per liter; —, analyzed but not detected]

| GAMA well identification number | Inorganic arsenic, dissolved (µg/L) (99033) | Inorganic arsenic(III), dissolved (µg/L) (99034) | Chromium, dissolved (µg/L) (01030) | Hexavalent chromium (chromium(VI)) dissolved (µg/L) (01032) | Iron, dissolved (µg/L) (01046) | Iron(II), dissolved (µg/L) (01047) |
|---|---|---|---|---|---|---|
| TRCYFP-03 | 3.2 | — | V1 | — | 9 | 6 |
| TRCYFP-04 | 1 | — | E14 | **E12** | 14 | 4 |
| TRCYFP-05 | 1.8 | — | V2 | V2 | V4 | 3 |
| ESJFP-07 | 2.8 | — | V5 | V4 | V4 | 3 |
| ESJFP-08 | **16.4** | — | V1 | — | 10 | — |
| ESJFP-09 | 3 | — | V6 | **E6** | V3 | 2 |
| ESJFP-10 | 3.4 | — | E7 | **E7** | V3 | — |
| Monitoring wells | | | | | | |
| ESJMW-01 | 4 | — | E11 | **E10** | 18 | — |
| ESJMW-02 | 3.9 | — | E15 | **E14** | V2 | — |
| ESJMW-03 | 3 | — | E10 | **E10** | 5 | — |
| Depth-dependent samples | | | | | | |
| ESJDD-01 | 3.3 | — | V5 | **E9** | V3 | — |
| ESJDD-02 | 3.4 | — | E9 | **E9** | V3 | — |
| ESJDD-03 | 3.4 | — | E8 | V5 | V2 | 2 |
| ESJDD-04 | 7.4 | — | E9 | **E9** | V4 | 3 |
| ESJDD-05 | 8.3 | — | E10 | **E9** | V3 | 3 |
| ESJDD-06 | 8.1 | — | E10 | **E9** | V3 | 3 |

**Table 21.** Summary of stable isotopes and radioactive constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[Bold numbers indicate ground-water detections above the threshold level. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; SSMDC, sample-specific minimum detectable concentration; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Alpha radioactivity, 72-hour count (pCi/L) (62636) | Alpha radioactivity, 30-day count (pCi/L) (62639) | Beta radioactivity, 72-hour count (pCi/L) (62642) | Beta radioactivity, 30-day count (pCi/L) (62645) | Carbon isotopes | | Radium-226 (pCi/L) (09511) | Radium-228 (pCi/L) (81366) | Radon-222 (pCi/L) (82303) | Stable isotopes of water | | Tritium (pCi/L) (07000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Result | Result | Result | Result | Carbon-13/carbon-12 ratio (per mill) (82081) | Carbon-14 (percent modern) (49933) | Result | Result | Result | Deuterium/protium ratio (per mill) (82082) | Oxygen-18/oxygen-16 ratio (per mill) (82085) | Result |
| Threshold type | MCL-US | MCL-US | MCL-CA | MCL-CA | n/a | n/a | MCL-US | MCL-US | Proposed MCL-US[1] | n/a | n/a | MCL-CA |
| Threshold level | 15 | 15 | 50 | 50 | n/a | n/a | 3 | 2.00 | 300 | n/a | n/a | 20,000 |
| Cosumnes Basin wells | | | | | | | | | | | | |
| COS-01 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –60.8 | –8.57 | — |
| COS-02 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –60.6 | –8.26 | — |
| COS-03 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –55.2 | –7.61 | 1 |
| COS-04 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –56.6 | –7.94 | 3 |
| COS-05 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –78 | –10.86 | 28 |
| COS-06 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –79.1 | –10.62 | 13 |
| COS-07 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –43.0 | –5.6 | 3 |
| COS-08 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –53.7 | –7.33 | — |
| COS-09 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –49.5 | –6.8 | 1 |
| COS-10 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –52.9 | –7.54 | 2 |
| Eastern San Joaquin Basin wells | | | | | | | | | | | | |
| ESJ-01 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –67.6 | –9.31 | 20 |
| ESJ-02 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –53.6 | –7.13 | 1 |
| ESJ-03 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –60.3 | –8.15 | 12 |

*See footnotes at end of table.*

**Table 21.** Summary of stable isotopes and radioactive constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; SSMDC, sample-specific minimum detectable concentration; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Alpha radioactivity, 72-hour count (pCi/L) (62636) | Alpha radioactivity, 30-day count (pCi/L) (62639) | Beta radioactivity, 72-hour count (pCi/L) (62642) | Beta radioactivity, 30-day count (pCi/L) (62645) | Carbon isotopes | | Radium-226 (pCi/L) (09511) | Radium-228 (pCi/L) (81366) | Radon-222 (pCi/L) (82303) | Stable isotopes of water | | Tritium (pCi/L) (07000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Result | Result | Result | Result | Carbon-13/carbon-12 ratio (per mill) (82081) | Carbon-14 (percent modern) (49933) | Result | Result | Result | Deuterium/protium ratio (per mill) (82082) | Oxygen-18/oxygen-16 ratio (per mill) (82085) | Result |
| ESJ-04 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –81.1 | –11.21 | 14 |
| ESJ-05 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –52.3 | –7.1 | — |
| ESJ-06 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –63.5 | –8.86 | 7 |
| ESJ-07 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –71.4 | –9.85 | 27 |
| ESJ-08 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –52.7 | –7.4 | 1 |
| ESJ-09 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –49.5 | –6.7 | 4 |
| ESJ-10 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –59.9 | –8.46 | 3 |
| ESJ-11 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –74.6 | –10.13 | 2 |
| ESJ-12 | E0.6 | <1.1 | E3.9 | 4.2 | –17.51 | 92.06 | 0.06 | <0.48 | **640** | –60.5 | –8.58 | — |
| ESJ-13 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –59.2 | –8.44 | — |
| ESJ-14 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –69.6 | –9.36 | 1 |
| ESJ-15 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –58.8 | –8.08 | 4 |
| ESJ-16 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –56.4 | –7.59 | 16 |
| ESJ-17 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –49.9 | –6.63 | — |
| ESJ-18 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –48.8 | –6.43 | — |
| ESJ-19 | 2.5 | E1.0 | E4.8 | 5.9 | –15.7 | 85.03 | 0.09 | <0.47 | nc | –59.5 | –8.1 | 15 |

*See footnotes at end of table.*

**Table 21.** Summary of stable isotopes and radioactive constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; SSMDC, sample-specific minimum detectable concentration; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Alpha radioactivity, 72-hour count (pCi/L) (62636) | Alpha radioactivity, 30-day count (pCi/L) (62639) | Beta radioactivity, 72-hour count (pCi/L) (62642) | Beta radioactivity, 30-day count (pCi/L) (62645) | Carbon isotopes | | Radium-226 (pCi/L) (09511) | Radium-228 (pCi/L) (81366) | Radon-222 (pCi/L) (82303) | Stable isotopes of water | | Tritium (pCi/L) (07000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Result | Result | Result | Result | Carbon-13/carbon-12 ratio (per mill) (82081) | Carbon-14 (percent modern) (49933) | Result | Result | Result | Deuterium/protium ratio (per mill) (82082) | Oxygen-18/oxygen-16 ratio (per mill) (82085) | Result |
| **Uplands Basin wells** | | | | | | | | | | | | |
| QPC-01 | E1.3 | <1.9 | E2.8 | E2.8 | –15.73 | 117.1 | E0.04 | <0.50 | **390** | –54.4 | –7.55 | 14 |
| QPC-02 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –77.5 | –10.6 | 37 |
| QPC-03 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –51.7 | –6.84 | — |
| QPC-04 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –55.4 | –7.12 | 5 |
| QPC-05 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –57.4 | –8.13 | — |
| QPC-06 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –51.2 | –6.93 | — |
| QPC-07 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –55.5 | –7.58 | 3 |
| QPC-08 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –57.8 | –8.05 | — |
| QPC-09 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –59.1 | –7.91 | — |
| QPC-10 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –65.6 | –8.9 | 3 |
| QPC-11 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –52.4 | –7.0 | — |
| **Tracy Basin wells** | | | | | | | | | | | | |
| TRCY-01 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –64.5 | –8.76 | — |
| TRCY-02 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –49.2 | –5.78 | 2 |
| TRCY-03 | E1.4 | <2.3 | <5.4 | E3.0 | –12.76 | 69.03 | 0.06 | <0.43 | **790** | –55.9 | –7.5 | — |
| TRCY-04 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –48.4 | –6.95 | — |
| TRCY-05 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –68.3 | –9.26 | — |

*See footnotes at end of table.*

**Table 21.** Summary of stable isotopes and radioactive constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; SSMDC, sample-specific minimum detectable concentration; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Alpha radioactivity, 72-hour count (pCi/L) (62636) | Alpha radioactivity, 30-day count (pCi/L) (62639) | Beta radioactivity, 72-hour count (pCi/L) (62642) | Beta radioactivity, 30-day count (pCi/L) (62645) | Carbon isotopes | | Radium-226 (pCi/L) (09511) | Radium-228 (pCi/L) (81366) | Radon-222 (pCi/L) (82303) | Stable isotopes of water | | Tritium (pCi/L) (07000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Result | Result | Result | Result | Carbon-13/carbon-12 ratio (per mill) (82081) | Carbon-14 (percent modern) (49933) | Result | Result | Result | Deuterium/protium ratio (per mill) (82082) | Oxygen-18/oxygen-16 ratio (per mill) (82085) | Result |
| TRCY-06 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –45.9 | –6.78 | — |
| TRCY-07 | 2E6.7 | 2E3.1 | 2E6.0 | [2]4.8 | –16.6 | 90.01 | 0.46 | E1.29 | 290 | –72.0 | –9.25 | 9 |
| TRCY-08 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –59.7 | –7.65 | — |
| TRCY-09 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –67.7 | –8.84 | 12 |
| TRCY-10 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –49.4 | –6.88 | — |
| TRCY-11 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –67.1 | –8.94 | — |
| Flowpath wells | | | | | | | | | | | | |
| TRCYFP-01 | <7.9 | <9.8 | 13.4 | E6.8 | –18.58 | 7.84 | 1.13 | 1.24 | **760** | –70.0 | –9.27 | — |
| TRCYFP-02 | <1.1 | <2.4 | <2.3 | E3.6 | –12.56 | 35.95 | 0.05 | <0.44 | **560** | –60.1 | –8.08 | 2 |
| TRCYFP-03 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –63.1 | –8.36 | 2 |
| TRCYFP-04 | <3.2 | <3.3 | E4.1 | E3.1 | –13.02 | 62.1 | 0.08 | <0.51 | **740** | –56.0 | –7.4 | 1 |
| TRCYFP-05 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –65.2 | –8.61 | 1 |
| TRCYFP-06 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –75.9 | –10.07 | — |
| ESJFP-07 | <1.9 | <1.7 | 5.3 | 4.6 | –16.49 | 71.76 | E0.04 | <0.50 | **380** | –60.6 | –8.7 | — |
| ESJFP-08 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –62.7 | –8.49 | 10 |
| ESJFP-09 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –68.8 | –9.51 | 34 |

*See footnotes at end of table.*

**Table 21.** Summary of stable isotopes and radioactive constituents in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[Bold numbers indicate ground-water detections above the threshold level. The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. COS, Cosumnes Basin; E, estimated value; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; SSMDC, sample-specific minimum detectable concentration; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Alpha radioactivity, 72-hour count (pCi/L) (62636) | Alpha radioactivity, 30-day count (pCi/L) (62639) | Beta radioactivity, 72-hour count (pCi/L) (62642) | Beta radioactivity, 30-day count (pCi/L) (62645) | Carbon isotopes | | Radium-226 (pCi/L) (09511) | Radium-228 (pCi/L) (81366) | Radon-222 (pCi/L) (82303) | Stable isotopes of water | | Tritium (pCi/L) (07000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Result | Result | Result | Result | Carbon-13/carbon-12 ratio (per mill) (82081) | Carbon-14 (percent modern) (49933) | Result | Result | Result | Deuterium/protium ratio (per mill) (82082) | Oxygen-18/oxygen-16 ratio (per mill) (82085) | Result |
| ESJFP-10 | E2.0 | 2 | 5.1 | 6.3 | –15.97 | 88.42 | 0.09 | <0.40 | **980** | –61.8 | –8.61 | 9 |
| Monitoring wells | | | | | | | | | | | | |
| ESJMW-01 | <2.6 | E1.0 | 5.4 | 6.1 | –16.04 | 66.66 | E0.04 | E0.22 | **680** | –60.5 | –8.46 | 3 |
| ESJMW-02 | E0.5 | <0.8 | 4.9 | 6.4 | –16.24 | 79.43 | 0.06 | <0.46 | **1,600** | –60.6 | –8.49 | 6 |
| ESJMW-03 | <1.9 | E0.8 | 4.8 | 5.1 | –15.66 | 110.5 | 0.12 | <0.54 | **880** | –59.3 | –8.17 | 33 |
| Depth-dependent samples | | | | | | | | | | | | |
| ESJDD-01 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –62.2 | –8.73 | 12 |
| ESJDD-02 | nc | nc | nc | nc | nc | nc | nc | nc | nc | –61.2 | –8.68 | 2 |
| ESJDD-03 | nc | nc | nc | nc | nc | nc | nc | nc | **900** | –61.1 | –8.61 | 3 |
| ESJDD-04 | nc | nc | nc | nc | –16.5 | 79.5 | nc | nc | nc | –58.8 | –8.01 | 13 |
| ESJDD-05 | nc | nc | nc | nc | –16.1 | 86.4 | nc | nc | nc | –56.8 | –7.81 | 11 |
| ESJDD-06 | nc | nc | nc | nc | –16.0 | 84.01 | nc | nc | nc | –56.4 | –7.59 | 10 |

[1]U.S. Environmental Protection Agency, 2006.

[2]Sample affected by high solid concentration.

**Table 22.** Summary of tritium and noble gas analysis performed at Lawrence Livermore National Laboratory for ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. $cm^3$ STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); mm/dd/yy, month/day/year; n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Collection date (mm/dd/yy) | Tritium, pCi/L (07000) | Tritium measurment uncertaintity (pCi/L) (07001) | Dissolved gas analysis date (mm/dd/yy) | Helium-3/ helium-4 (atom ratio) (61040) | Helium-4 ($cm^3$ STP/g) (85561) | Neon ($cm^3$ STP/g) (61046) | Argon ($cm^3$ STP/g) (85563) | Krypton ($cm^3$ STP/g) (85565) | Xenon ($cm^3$ STP/g) (85567) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $\times 10^{-6}$ | $\times 10^{-8}$ | $\times 10^{-7}$ | $\times 10^{-4}$ | $\times 10^{-8}$ | $\times 10^{-8}$ |
| Threshold type | n/a | MCL-CA | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Threshold level | n/a | 20,000 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Eastern San Joaquin Basin wells | | | | | | | | | | |
| ESJ-06 | 01/10/05 | 6.9 | 0.3 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJ-08 | 01/11/05 | <1.0 | 0.1 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJ-10 | 01/12/05 | 3.05 | 0.2 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJ-12 | 01/13/05 | <1.0 | 0.1 | 04/27/05 | 1.39 | 6.51 | 2.68 | 4.10 | 9.04 | 1.12 |
| ESJ-13 | 01/13/05 | <1.0 | 0.1 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJ-14 | 01/13/05 | 1.88 | 0.2 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJ-19 | 02/18/05 | 14.45 | 0.6 | 04/26/05 | 2.58 | 7.77 | 2.84 | 4.15 | 9.08 | 1.20 |
| Upland Basin wells | | | | | | | | | | |
| QPC-01 | 01/11/05 | 14.26 | 0.6 | 03/22/05 | 1.20 | 12.65 | 2.23 | 3.71 | 8.33 | 1.13 |
| QPC-04 | 01/24/05 | 5.37 | 0.3 | n/a | n/a | nc | nc | nc | nc | nc |
| Tracy Basin wells | | | | | | | | | | |
| TRCY-03 | 01/06/05 | 1.18 | 0.2 | 04/25/05 | 1.34 | 7.66 | 3.08 | 4.13 | 8.65 | 1.11 |
| TRCY-07 | 02/08/05 | 9.90 | 0.4 | 04/26/05 | 0.77 | 20.68 | 1.92 | 3.44 | 7.88 | 1.08 |
| Flowpath wells | | | | | | | | | | |
| TRCYFP-01 | 01/03/05 | <1.0 | 0.1 | 03/22/05 | 0.46 | 665.02 | 2.95 | 4.25 | 9.29 | 1.31 |
| TRCYFP-02 | 01/04/05 | 1.44 | 0.1 | 03/21/05 | 1.08 | 9.93 | 3.17 | 4.29 | 9.06 | 1.21 |
| TRCYFP-03 | 01/05/05 | 2.64 | 0.2 | n/a | n/a | nc | nc | nc | nc | nc |
| TRCYFP-04 | 01/05/05 | 1.28 | 0.1 | 03/21/05 | 1.21 | 9.13 | 3.25 | 4.26 | 9.03 | 1.12 |

**Table 22.** Summary of tritium and noble gas analysis performed at Lawrence Livermore National Laboratory for ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005—Continued.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. $cm^3$ STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; ESJ, Eastern San Joaquin Basin; ESJDD, Eastern San Joaquin Basin depth dependent; ESJFP, Eastern San Joaquin Basin flowpath; ESJMW, Eastern San Joaquin Basin monitoring well; MCL-CA, California Department of Health Services Maximum Contaminant Level (California Department of Health Services, 2005a); mm/dd/yy, month/day/year; n/a, not applicable; nc, sample not collected; pCi/L, picocurie per liter; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Collection date (mm/dd/yy) | Tritium, pCi/L (07000) | Tritium measurment uncertaintity (pCi/L) (07001) | Dissolved gas analysis date (mm/dd/yy) | Helium-3/ helium-4 (atom ratio) (61040) | Helium-4 ($cm^3$ STP/g) (85561) | Neon ($cm^3$ STP/g) (61046) | Argon ($cm^3$ STP/g) (85563) | Krypton ($cm^3$ STP/g) (85565) | Xenon ($cm^3$ STP/g) (85567) |
|---|---|---|---|---|---|---|---|---|---|---|
| TRCYFP-05 | 01/05/05 | 1.67 | 0.2 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJFP-07 | 01/10/05 | — | 0.7 | 03/22/05 | 1.32 | 6.85 | 2.72 | 4.19 | 9.19 | 1.24 |
| ESJFP-08 | 01/12/05 | 10.23 | 0.4 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJFP-09 | 01/12/05 | 31.81 | 1.2 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJFP-10 | 01/28/05 | 8.96 | 0.4 | 04/27/05 | 2.00 | 6.75 | 2.69 | 4.10 | 8.86 | 1.19 |
| Monitoring wells | | | | | | | | | | |
| ESJMW-01 | 02/01/05 | 2.62 | 0.2 | 04/26/05 | 1.53 | 7.27 | 2.70 | 4.12 | 9.14 | 1.18 |
| ESJMW-02 | 02/02/05 | 5.78 | 0.3 | 04/26/05 | 2.61 | 6.70 | 2.79 | 4.07 | 8.80 | 1.10 |
| ESJMW-03 | 02/03/05 | 31.06 | 1.2 | 04/26/05 | 3.25 | 6.28 | 2.72 | 3.97 | 8.50 | 1.08 |
| Depth-dependent samples | | | | | | | | | | |
| ESJDD-03 | 01/26/05 | 12.64 | 0.5 | n/a | n/a | nc | nc | nc | nc | nc |
| ESJDD-04 | 02/17/05 | 9.81 | 0.4 | 04/26/05 | 1.46 | 3.70 | 1.78 | 3.98 | 8.97 | 1.27 |
| ESJDD-05 | 02/17/05 | 11.07 | 0.5 | 04/26/05 | 1.53 | 1.24 | 0.88 | 3.06 | 7.25 | 1.06 |
| ESJDD-06 | 02/16/05 | 11.63 | 0.6 | 04/26/05 | 1.62 | 1.44 | 0.96 | 3.26 | 7.52 | 1.07 |

**Table 23.** Summary of microbial indicators detected in ground-water samples collected for the Northern San Joaquin Basin Ground-Water Ambient Monitoring and Assessment (GAMA) study, California, December 2004 to February 2005.

[The five digit number below the constituent name is the USGS parameter code used to uniquely identify a specific constituent or property. The threshold type identifies the source of the comparison threshold. The threshold level is the level with which ground-water detections are compared. E, estimated value; ESJ, Eastern San Joaquin Basin; ESJFP, Eastern San Joaquin Basin flowpath; MCL-US, U.S. Environmental Protection Agency Maximum Contaminant Level (U.S. Environmental Protection Agency, 2005); mL, milliliter; nc, sample not collected; QPC, Uplands Basin; TRCY, Tracy Basin; TRCYFP, Tracy Basin flowpath; TT, treatment technique—a required process intended to reduce the level of a contaminant in drinking water (U.S. Environmental Protection Agency, 2005); USGS, U.S. Geological Survey; —, analyzed but not detected]

| GAMA well identification number | Coliphage F-specific (99335) | Coliphage somatic (99332) | *E. coli* colonies/100 mL (90901) | Total coliforms colonies/100 mL (90900) |
|---|---|---|---|---|
| Threshold type | TT | TT | TT | MCL-US |
| Threshold level | 99.9% killed/inactive | 99.9% killed/inactive | No fecal coliforms are allowed | 5% |
| ESJ-12 | — | — | — | — |
| ESJ-19 | nc | nc | nc | nc |
| QPC-01 | — | — | — | E3 |
| TRCY-03 | — | — | — | — |
| TRCY-07 | — | — | — | — |
| TRCYFP-01 | — | — | — | — |
| TRCYFP-02 | — | — | — | — |
| TRCYFP-04 | — | — | — | — |
| ESJFP-07 | — | — | — | — |
| ESJFP-10 | nc | nc | nc | nc |

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