



# Texas Water Development Board

## Report 333

### Joint Ground-Water Quality Project With the Texas Department of Agriculture in Parts of Haskell, Knox, and Stonewall Counties, 1990

By  
Phillip L. Nordstrom  
Geologist

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# Texas Water Development Board

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**ABSTRACT**

As part of a cooperative project with the Texas Department of Agriculture (TDA), the Seymour aquifer in parts of Haskell, Knox, and Stonewall Counties was sampled in order to provide inorganic constituent data to complement pesticide data collected by the TDA. Other objectives satisfied by the project included acquisition of water-quality data for routine monitoring of a major aquifer, evaluation of a designated critical area for water resources, and establishment of interagency cooperation as described in Groundwater Protection Committee documents.

This project was initiated in response to positive detections of pesticides by the TDA in previous surveys. Forty-seven wells were sampled: 34 in Knox County and 13 along the boundary between Haskell and Stonewall Counties during August, 1990. For the first time in this area, tests were conducted to determine the presence of 19 minor inorganic elements, five nutrients, and four radioactive elements in addition to the major cations and anions. This testing helped establish more complete base-line water quality data. Ground-water quality problems determined during this project were similar to those uncovered in previous studies.

Excessive nitrate concentration continues to be the most prevalent problem. The average nitrate concentration of 70.8 mg/l was well above the drinking water standard of 44.3 mg/l. Instances of high chloride and sulfate concentrations, along with elevated dissolved solids content, indicate pockets of contamination including several with documented oil-field type problems. Hardness in excess of 600 mg/l as calcium carbonate also poses a minor problem.



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## INTRODUCTION

The Texas Water Development Board maintains statewide programs to monitor ground-water quality and quantity and to conduct ground-water studies. As part of its water-quality monitoring effort, a network of observation well sites that covers the major ground-water producing areas in the State are sampled periodically to (1) determine if any changes in ground-water quality are occurring either naturally or as a result of man's activities, and (2) establish as accurately as possible the base-line characteristics of the dissolved constituents in ground water occurring naturally in the State's aquifers. The Board also conducts water-quality evaluations as part of its 1) ground-water studies, 2) Critical Area evaluations, 3) well development control activities, 4) cooperative agreements with other entities, 5) short term studies, and 6) responses to public inquiries.

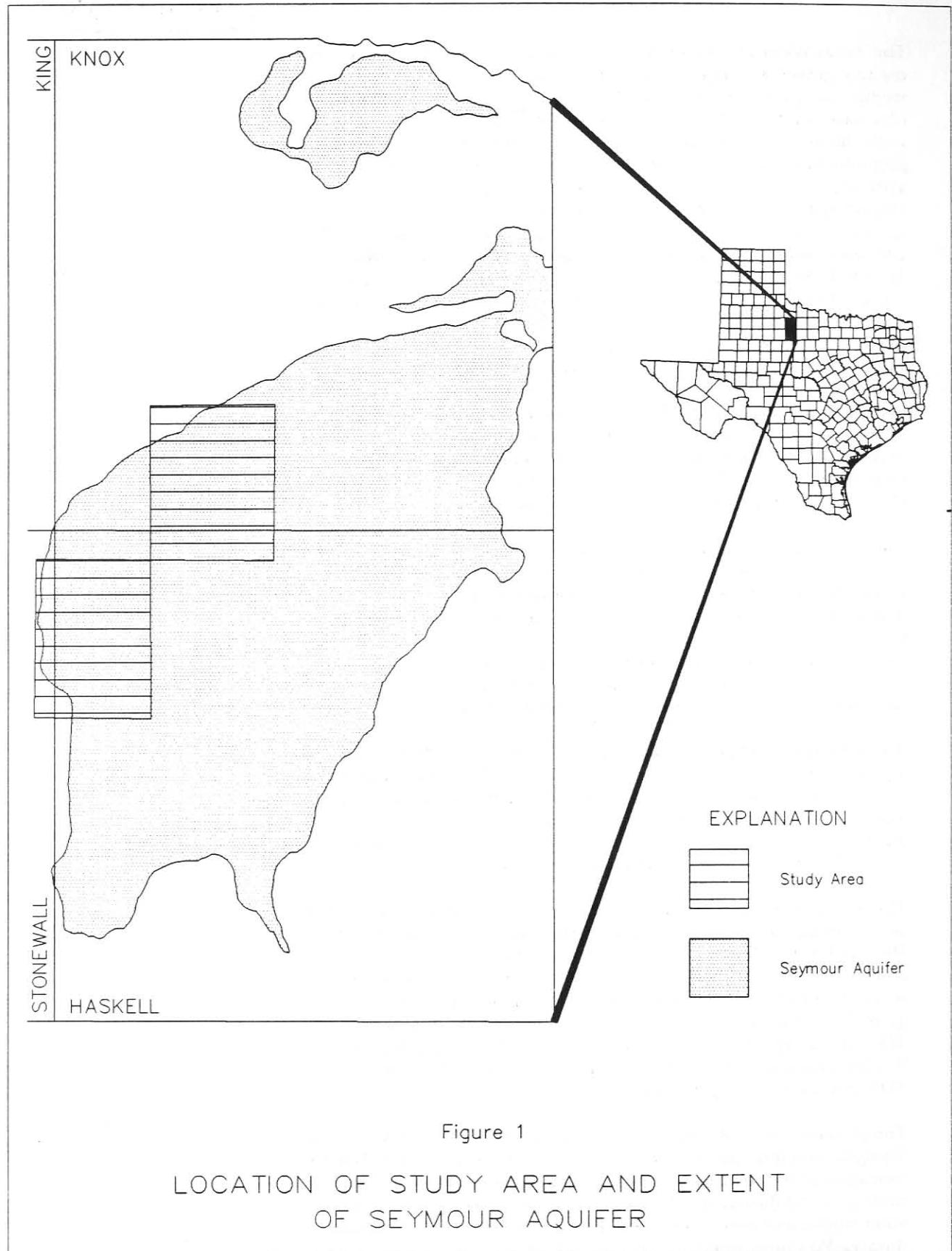
As part of a cooperative agreement with the Texas Department of Agriculture (TDA), the Seymour aquifer in parts of Haskell, Knox and Stonewall Counties (Figure 1) was sampled in order to provide inorganic constituent data to complement pesticide data collected concurrently by the TDA. This project also satisfies water-quality data acquisition for 1) routine ground-water quality monitoring of a major aquifer, 2) an evaluation of Critical Area #16, and 3) joint interagency cooperation as described in Groundwater Protection Committee documents.

The TDA is the lead agency for regulating pesticides in Texas. Mandates from the Texas Legislature and the U. S. Environmental Protection Agency charge the TDA with ensuring that pesticides used in the State do not cause significant risk to human health or the environment. One of the important elements of the Department's regulatory responsibilities is to ensure that use of pesticides does not cause unreasonable risk to ground water. Regulatory actions to correct or prevent ground-water contamination include restricting, limiting, or banning the use of a pesticide.

The TDA has conducted several surveys in the State to study the impact of agricultural chemicals on ground-water quality. The focus of the TDA's monitoring activities has primarily been on agricultural areas where aquifers supply water for private wells which are exempt from regulation and testing under the Safe Drinking Water Act and on areas considered to be more sensitive to ground-water contamination.

The survey conducted in 1990 was in response to positive detections of pesticides found in well water during earlier investigations by the TDA in 1987 and 1988. Results of the survey show the extent and sources of contamination; and data collected during the survey can be used to support regulatory actions which may be required to prevent or correct ground-water contamination problems. Analyses were performed at the TDA laboratory using methods capable of detecting over 200 pesticides. Results of the survey can be obtained by contacting the TDA (Lea Aurelius, TDA, personal communication).

The primary source of usable ground water in the study area is from the Seymour aquifer, which exists as an irregular shaped water-bearing formation in the counties monitored. Figure 1 shows the location of the study area and the extent of the Seymour aquifer. Several major ground-water studies and numerous specialized reports have been completed in this area. Previous investigations of major importance include TWC Bulletin



6209, *Ground-Water Resources of Haskell and Knox Counties, Texas*; TWDB Report 226, *The Seymour Aquifer: Ground-Water Quality and Availability in Haskell and Knox Counties, Texas*; TWC LD-0364-MR, *Investigation of Ground-Water Contamination in the Juliana and West Jud Oil Fields, Haskell and Stonewall Counties*; and Texas Water Quality Board Project 1911, *Groundwater Resources in the Seymour Formation, Haskell and Knox Counties, Texas*.

Most of the ground water used in the Haskell-Knox County area is for irrigation; however, the quantity of water and the number of operating irrigation wells has decreased over the last 10 years (TWDB, 1986). The amount of ground water pumped for livestock and household use has remained fairly constant, but deterioration in water quality has somewhat restricted its use for drinking purposes.

## GEOHYDROLOGY OF THE AQUIFER

Rocks belonging to the Clear Fork Group of Permian age underlie or are adjacent to the Seymour and younger deposits. Small quantities of typically poor quality ground water can be obtained from the Clear Fork and do not contribute significantly to well yields. The Seymour and the younger terrace and alluvial sediments occur in patterns controlled by successive cycles of terrestrial erosion and alluviation. Both the Seymour and younger deposits typically consist of a graded sequence having coarser materials at the base and increasingly finer materials toward the top.

Ground water in the Seymour occurs in unconsolidated sediments consisting primarily of interfingering zones of fine- to coarse-grained sand, silt, and clay. The sediments were deposited by streams flowing eastward and mostly represent material eroded from the High Plains. The lowermost sediments are coarser and fill the paleovalleys in the pre-Seymour, or redbed, surface. They consist of unconsolidated sands and gravels, locally cemented and sometimes conglomeratic. The basal gravel is not present consistently, and in some areas very little coarse water-bearing material is present. Also the gravels are poorly sorted at some locations and mixed with clays and silts.

The major source of water to the Seymour aquifer is precipitation on its outcrop. A small amount is derived from irrigation return flow. Most of the precipitation ends up as runoff or is lost to evapotranspiration. A small portion percolates through the soil to the water table where it is added to the saturated zone. An estimated average of 47,000 acre-feet of ground water per year is available for pumping from the Seymour in Haskell and Knox Counties under average precipitation conditions (Harden and Assoc., 1978).

Average annual water levels for four observation wells located on the 21-34 topographic map in Knox County indicate that water levels have changed little during the last 20 years. The saturated thickness of the Seymour in this area is usually 10 to 20 feet.

**WATER QUALITY**

During 1987 and 1988, the TDA sampled water from 188 wells for pesticide residues. Wells were selected in areas where ground-water vulnerability studies and field characteristics indicated the potential for ground-water contamination from the normal use of agricultural chemicals. As a result of this survey, atrazine was found in one well in Haskell County and one in Knox County; dicamba was found in one well in Haskell County; and prometon was found in three wells in Knox County (Aurelius, 1989).

In response to these positive detections, another survey was conducted by the TDA in 1990 focusing on these contaminated wells and other wells in their immediate vicinity. The TWDB and the TDA sampled most of the same wells; however, the TWDB sampled for inorganic constituents and radioactive elements, while the TDA sampled for selected pesticide residues. Results of laboratory analyses will be shared by both agencies. The TDA preselected wells and obtained permission to sample from the well owners. This allowed the TWDB to collect water samples in an expeditious manner and process the results accordingly.

Forty-seven wells were sampled for this joint project: 34 in Knox County and 13 along the boundary between Haskell and Stonewall Counties. The well locations are shown in Figures 2 and 3. All samples were analyzed for dissolved inorganic constituents including heavy metals and nutrients, and eight samples were selected for radioactive element determination. Wells were sampled in accordance with TWDB UM-51, *A Field Manual for Ground Water Sampling*, and samples were analyzed at the Texas Department of Health laboratory (TDH) following established holding times and analytical methods. Results of laboratory analyses were compared to primary and secondary drinking water standards as published by the TDH (1988) and are listed in Table 1.

**TABLE 1  
STANDARDS OF CHEMICAL QUALITY**

Primary		Secondary	
Constituent	Level	Constituent	Level
Arsenic	50 µg/l	Chloride	300 mg/l
Barium	1,000 µg/l	Copper	1,000 µg/l
Cadmium	10 µg/l	Fluoride	2 mg/l
Chromium	50 µg/l	Iron	300 µg/l
Fluoride	4 mg/l	Manganese	50 µg/l
Lead	50 µg/l	pH	> 7.0
Mercury	2 µg/l	Sulfate	300 mg/l
Nitrate (N)	10 mg/l	Dissolved Solids	1,000 mg/l
Selenium	10 µg/l	Zinc	5,000 µg/l
Silver	50 µg/l		
Gross Alpha	15 pCi/l		
Beta Particles	50 pCi/l		
Radium 226 & 228	5 pCi/l		

TDH, 1988

Level units are in micrograms per liter (µg/l), milligrams per liter (mg/l), pH units, and picocuries per liter (pCi/l).

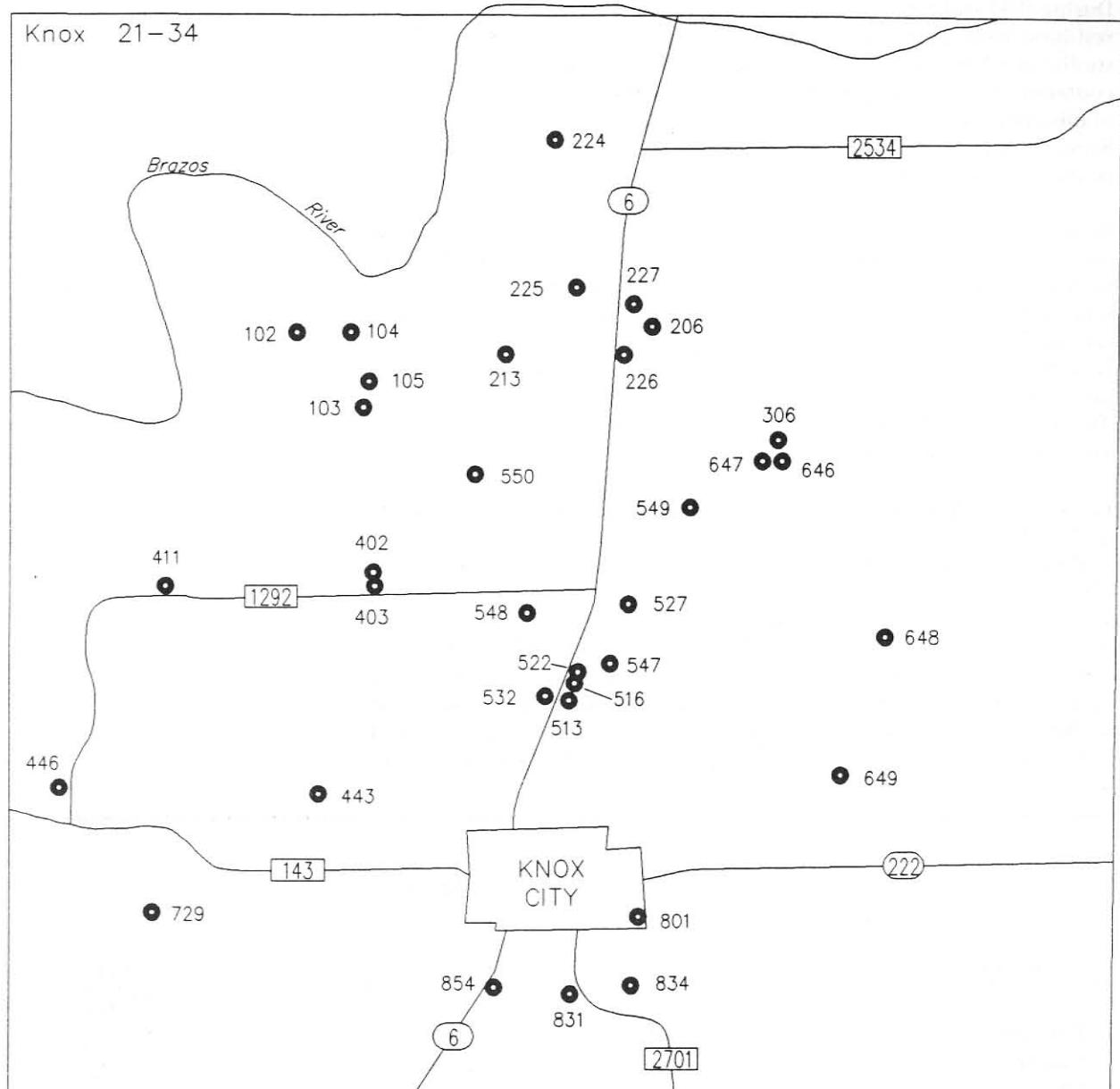


Figure 2

LOCATION OF WELLS SAMPLED IN THE 21-34  
7 1/2-MINUTE GRID IN KNOX COUNTY, TEXAS



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## Field Measurements

Certain precautions are necessary in order to obtain water samples for chemical analysis that are representative of the true hydrochemical character of the aquifer. Prior to collecting a sample from a well, the well must first be purged, which means removal of a sufficient volume of ground water stored in the well casing before a representative sample can be collected. Samples in this study were collected at the wellheads before the water had gone through a pressure tank or other treatment. Once the well was being actively pumped, the temperature, specific conductance, and pH were monitored until stabilization of the readings occurred.

In addition to the measurement of these water-quality properties, phenolphthalein and total alkalinity were also measured. As a quality control check, alkalinity was also determined from the anion subsample by the TDH. Since the pH of all samples was less than 8.3, phenol alkalinity was zero and therefore no carbonate ions were present. The mean total alkalinity as determined in the field was 260 mg/l as  $\text{CaCO}_3$ , as compared to that determined by the TDH of 261 mg/l. Not only does this suggest that there is little change in the carbonate species between the time of collection and the lab analysis, but also indicates a measure of quality control for field measurements as opposed to lab analysis. Bicarbonate ion concentration, calculated from mean total alkalinity, was 317 mg/l.

Average ground-water temperature was 21°C. Secondary drinking water standards indicate that pH should be greater than 7.0 units because acidic water (less than 7.0) will act as a solvent to release metal ions to the water. Seven samples had a pH less than 7.0, but the average pH of all analyses was 7.2 units.

Specific conductance, which is a measure of the ionized salts, gives an indication of the concentration of total ions dissolved in the ground water. It is essential to obtain an accurate field measurement within minutes of withdrawing a water sample from the well not only because it is an indication of well stabilization, but also because the conductivity could change significantly with time. The average specific conductance was 1,740  $\mu\text{mhos}$  in Knox County and 2,560 in Haskell and Stonewall Counties, indicating a much poorer quality of ground water southwest of Knox City. Specific data from each well in the form of a record of wells can be found in Appendix I. Temperature, pH, and conductivity values for each well can be found in Appendix II.

---

## Dissolved Inorganic Constituents

As soon as the well had been pumped sufficiently, the water was forced through a 102 mm backflushing 0.45  $\mu\text{m}$  filter apparatus. This process removed the suspended matter and allowed for measurement of the dissolved constituents. Subsamples (individual samples from the same well) were collected for selected anion and cation determination. Nitric acid was added to the cation subsample as a preservative. Both the anion and cation subsample were then placed on ice until delivery to the TDH laboratory. These subsamples were analyzed within the one month holding time.



The anion subsample was analyzed for alkalinity, boron, bromide, chloride, fluoride, iodide, silica, and sulfate (Table 2). Alkalinity was determined in the lab as a check against the field determinations. In a comparison of lab- and field-determined total alkalinity values, 60 percent of the lab values were higher with a mean value of only 1.4 mg/l as CaCO<sub>3</sub> higher. The average lab determined total alkalinity was 261 mg/l as CaCO<sub>3</sub>.

**TABLE 2  
AVERAGE AND RANGE OF CONCENTRATIONS OF  
CONSTITUENTS IN THE ANION SUBSAMPLES**

Constituent	Concentration Range (mg/l)	Average Concentration (mg/l)
Bicarbonate	198 - 421	319
Boron	0.25 - 2.28	0.7
Bromide	< 0.1 - 2.61	0.8
Carbonate	0	0
Chloride	3 - 2,965	408
Fluoride	0.5 - 1.8	1.1
Iodide	< 0.1	< 0.1
Silica	17 - 40	27
Sulfate	16 - 1,634	198

Bromide was detected in all but five samples, with an average concentration of 0.8 mg/l. Samples in Knox County (Figure 2) had a mean bromide concentration of 0.6 mg/l, while samples from wells sampled to the southwest (Figure 3) had a mean concentration of 1.3 mg/l. The higher concentrations of bromide in the Figure 3 area might be due to the salt water contamination as discussed in TWC LD-0364-MR (Crouch, 1964).

Even though boron is necessary for good plant growth, excessive amounts can cause severe damage or kill certain crops. Wilcox (1955, p.11) stated that concentrations of boron up to 1,000 µg/l are permissible for most crops; as high as 2,000 µg/l for semi-tolerant crops; and as great as 3,000 µg/l for tolerant crops. Boron concentrations in the 47 well samples ranged from 250 to 2,280 µg/l; the mean was 700 µg/l. Seven wells exceeded 1,000 µg/l, while only one exceeded 2,000 µg/l (see App.III).

Sulfate concentrations exceeded the 300 mg/l safe drinking water standard in eight wells, of which seven were in Knox County. The range was 16 to 1,634 mg/l, with a mean concentration of 198 mg/l. The one obviously contaminated well had a sulfate concentration of 1,634 mg/l, 900 mg/l higher than the next highest value. Though slightly elevated in several of the wells sampled, sulfate does not pose a drinking water problem in the study area.

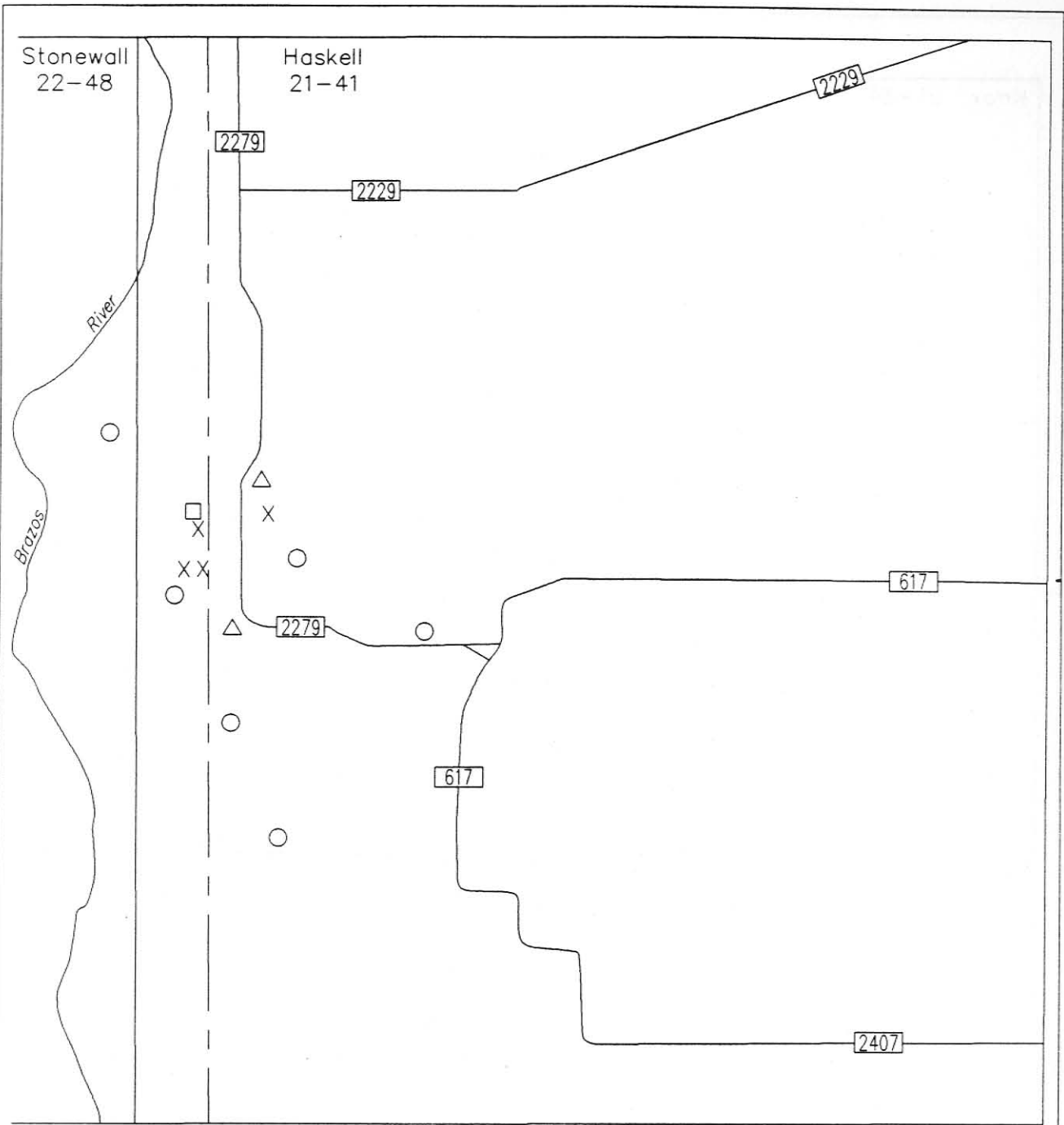
Chloride concentrations exceeded the 300 mg/l safe drinking water standard in 17 of the 47 wells sampled. The mean concentration was 408 mg/l. Figure 4 graphically portrays the high chloride content in wells 416, 437, 438, and 439, which corresponds to the contaminated wells as discussed by Crouch (1964). Figure 5 depicts high chloride levels just north of Knox City, which also correspond to the area of high sulfate concentration.

Fluoride has limits for both primary and secondary safe drinking water standards (Table 1). None of the fluoride concentrations determined in any of the samples exceeded the secondary limits of two mg/l.

The cation subsample was analyzed for aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, potassium, selenium, silver, sodium, strontium, vanadium, and zinc (Table 3). The principal cations consist of calcium, magnesium, sodium, and potassium. The mean value of the 47 samples for calcium and magnesium was 152 mg/l and 75 mg/l, respectively. Hardness, which is calculated from these data, averaged in excess of 600 mg/l as CaCO<sub>3</sub>. This water is considered as very hard. Sodium and potassium had mean values of 185 mg/l and 4.5 mg/l, respectively.

**TABLE 3**  
**AVERAGE AND RANGE OF CONCENTRATIONS OF**  
**CONSTITUENTS IN THE CATION SUBSAMPLE**

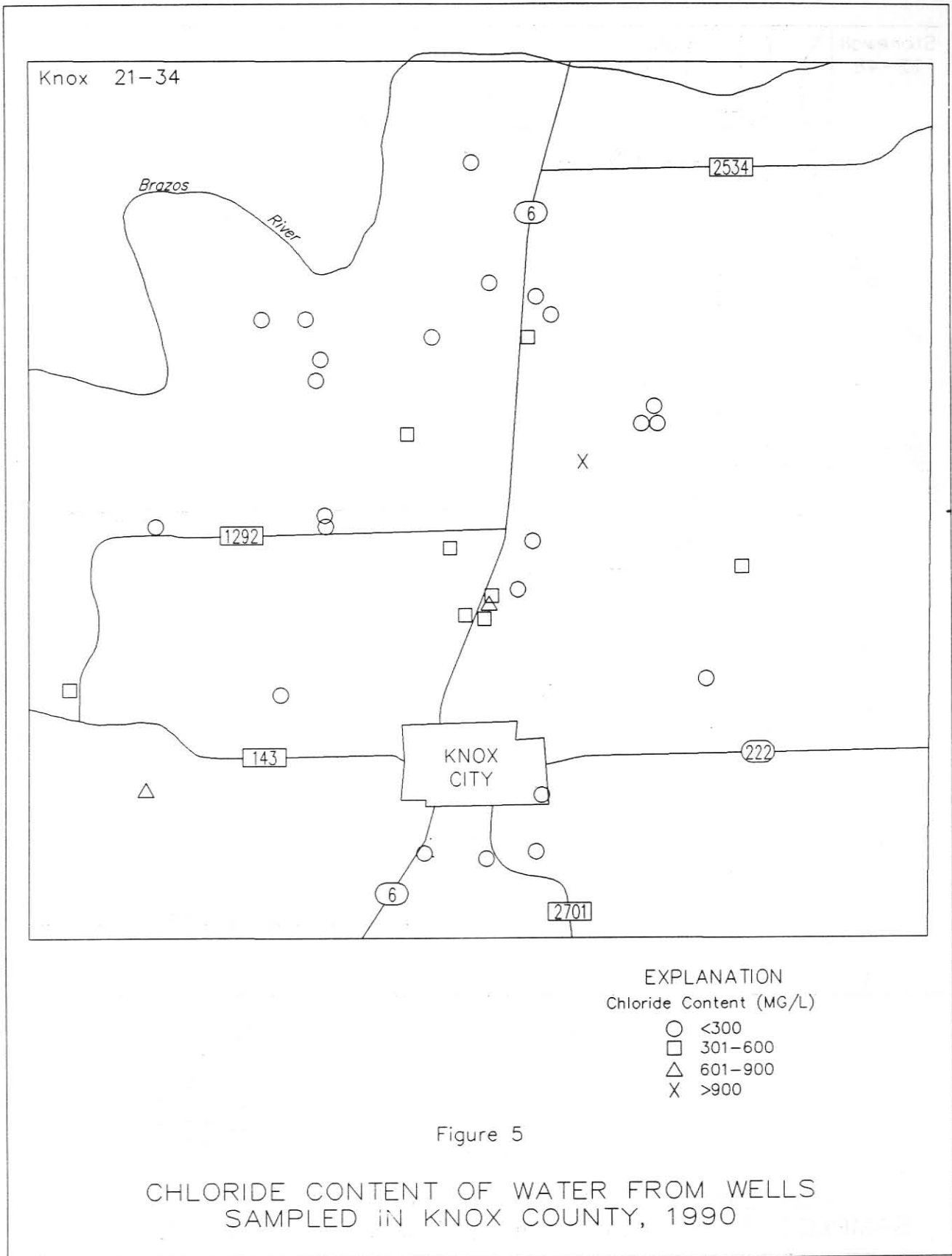
Constituent	Concentration Range	Average Concentration
Aluminum	< 50 µg/l	< 50 µg/l
Arsenic	< 10 - 11 µg/l	< 10 µg/l
Barium	< 20 - 609 µg/l	108 µg/l
Cadmium	< 10 µg/l	< 10 µg/l
Calcium	34 - 672 mg/l	152 mg/l
Chromium	< 20 µg/l	< 20 µg/l
Copper	< 20 - 21 µg/l	< 20 µg/l
Iron	< 20 - 74 µg/l	18 were > 20 µg/l
Lead	< 50 µg/l	< 50 µg/l
Magnesium	16 - 307 mg/l	75 mg/l
Manganese	< 20 - 68 µg/l	< 20 µg/l
Mercury	< 0.2 - 0.3 µg/l	< 0.2 µg/l
Molybdenum	< 20 µg/l	< 20 µg/l
Potassium	1 - 9 mg/l	4.5 mg/l
Selenium	< 2 - 35 µg/l	5 µg/l
Silver	< 10 µg/l	< 10 µg/l
Sodium	11 - 732 mg/l	185 mg/l
Strontium	600 - 11,600 µg/l	2,846 µg/l
Vanadium	< 20 - 52 µg/l	21 were > 20 µg/l
Zinc	< 20 - 112 µg/l	18 were > 20 µg/l



EXPLANATION  
Chloride Content (MG/L)  
○ <300  
□ 301-600  
△ 601-900  
X >900

Figure 4

CHLORIDE CONTENT OF WATER FROM WELLS  
SAMPLED IN HASKELL AND STONEWALL COUNTIES, 1990



Of the remaining heavy metals determined, arsenic, cadmium, chromium, copper, lead, manganese, molybdenum, silver, aluminum, and mercury were generally below detection limits. Iron was found above the detection limit in 18 samples with a range of <20 to 74 µg/l, below the secondary limit (Table 1) of 300 µg/l. Zinc was found above the detection limit in 18 samples, with a range of <20 to 112 µg/l, below the secondary limit of 5,000 µg/l.

Barium was detected in all but one sample, with a range of <20 to 609 µg/l, below the primary standard of 1,000 µg/l (Table 1). The mean value was 108 µg/l indicating that barium is well within the limits set by the safe drinking water standard. Strontium was detected in all samples ranging from 600 to 11,600 µg/l, with a mean value of 2,846 µg/l. Strontium, in conjunction with calcium, magnesium, and barium, adds to the hardness of the water. Hardness can be alleviated through ion exchange or reverse osmosis equipment. The final metal to be analyzed was selenium, which has a primary drinking water limit of only 10 µg/l. This limit is currently under study by EPA and may be increased to 50 µg/l. Selenium was detected in all but 10 samples, with a range of <2 to 35 µg/l. Three samples had selenium in excess of 10 µg/l. Selenium can be removed from water by many methods, the most common being ion exchange.

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## Nutrients

The nutrient subsample was analyzed for nitrate, nitrite, ammonia, Kjeldahl, and orthophosphate. Water was filtered at the time of collection, preserved with sulfuric acid, and placed on ice. All analyses were completed at the TDH lab prior to the one week holding time. Table 4 shows the average and range of the nutrient concentrations. Of the five constituents tested, only nitrate was found in any appreciable amount.

Safe drinking water primary standards recommend that the nitrate content in water not exceed 10 mg/l as nitrogen. The average nitrate-N content was 15.99 mg/l and clearly indicates a drinking water problem in this area. In all, 35 of the 47 samples had nitrate-N levels greater than 10 mg/l. Appendix II lists the nitrate as NO<sub>3</sub> value for each of the wells sampled and Appendix IV tabulates the nitrate (as N) value for each well. The conversion factor is nitrate (as N) x 4.427 = nitrate, so the 10 mg/l limit for nitrate-N

**TABLE 4  
AVERAGE AND RANGE OF CONCENTRATIONS OF  
CONSTITUENTS IN THE NUTRIENT SUBSAMPLES**

Constituent	Concentration Range (mg/l)	Average Concentration (mg/l)
Nitrate as N	1.03 - 38.86	15.99
Nitrite as N	< .01 - .49	14 were > .01
Ammonia as N	< .02 - .51	11 were > .02
Kjeldahl as N	< .1 - 1.2	0.3
Orthophosphate as P	< .01 - .19	0.02

equates to 44.27 mg/l as nitrate. It is important to know which form of nitrate is being discussed in relation to specific values. Figures 6 and 7 graphically show the locations and relative nitrate concentrations of the wells sampled. There are no discernible trends to the nitrate concentration; however, a higher percentage of samples contained larger amounts of nitrate in Knox County.

The dominant sources of nitrogen that result in ground-water nitrate are 1) animal wastes, 2) cultivation, 3) natural sources, and 4) surface water nitrogen. Dominant nitrate sources from animal wastes include septic tanks, barnyards and feedlots, and sewage treatment plants. Cultivation sources are the oxidation of natural organic nitrogen in soils during plowing and the addition of nitrogen fertilizer. Natural sources of nitrogen in ground water include the oxidation of atmospheric nitrogen from lightning and oxidation of organic soil nitrogen without cultivation (SCS and others, 1991).

Kjeldahl nitrogen is the total organic nitrogen plus ammonia. The very low concentrations indicate that there is very little organic nitrogen present in the ground water.

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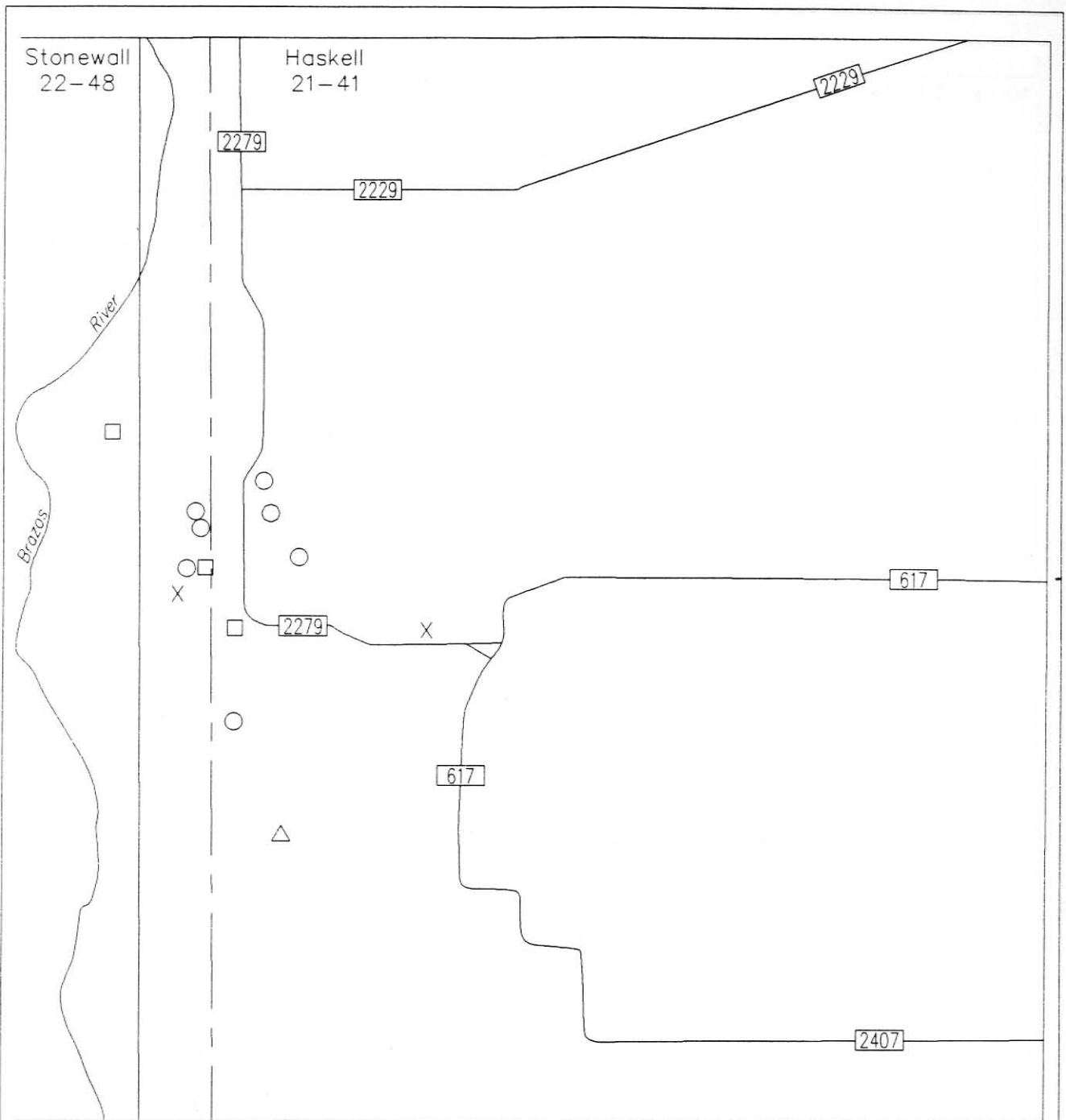
## Dissolved Solids

The dissolved-solids content is usually the main factor which limits or determines the use of ground water. The Texas Groundwater Protection Committee has adopted a ground-water classification system which is defined by four classes based on quality as determined by total dissolved-solids content. Table 5 describes the classes.

**TABLE 5.  
GROUND-WATER CLASSIFICATION SYSTEM**

<b>Class</b>	<b>Quality*</b>	<b>Examples of Use</b>
Fresh	Zero to 1000	Drinking and all other uses
Slightly Saline	More than 1000 to 3000	Drinking if fresh water is unavailable, livestock watering, irrigation, and industrial
Moderately Saline	More than 3000 to 10,000	Potential/future drinking and limited livestock watering and irrigation if fresh or slightly saline water is unavailable; industrial, mineral extraction, oil and gas production
Very Saline to Brine	More than 10,000	Mineral extraction, oil and gas production

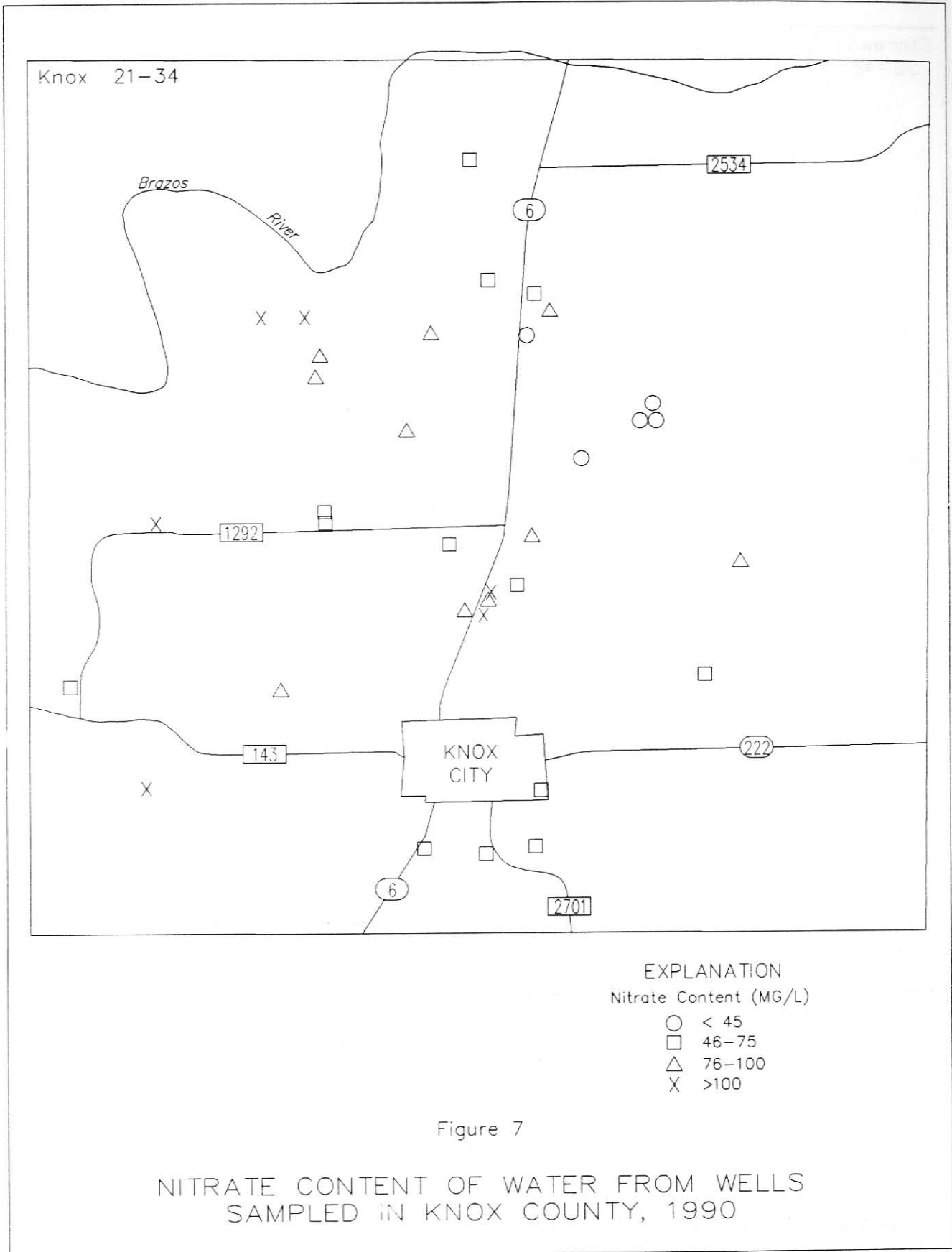
\* Concentration range of total dissolved solids in mg/l



EXPLANATION  
Nitrate Content (MG/L)  
○ < 45  
□ 46-75  
△ 76-100  
X >100

Figure 6

NITRATE CONTENT OF WATER FROM WELLS  
SAMPLED IN HASKELL AND STONEWALL COUNTIES, 1990



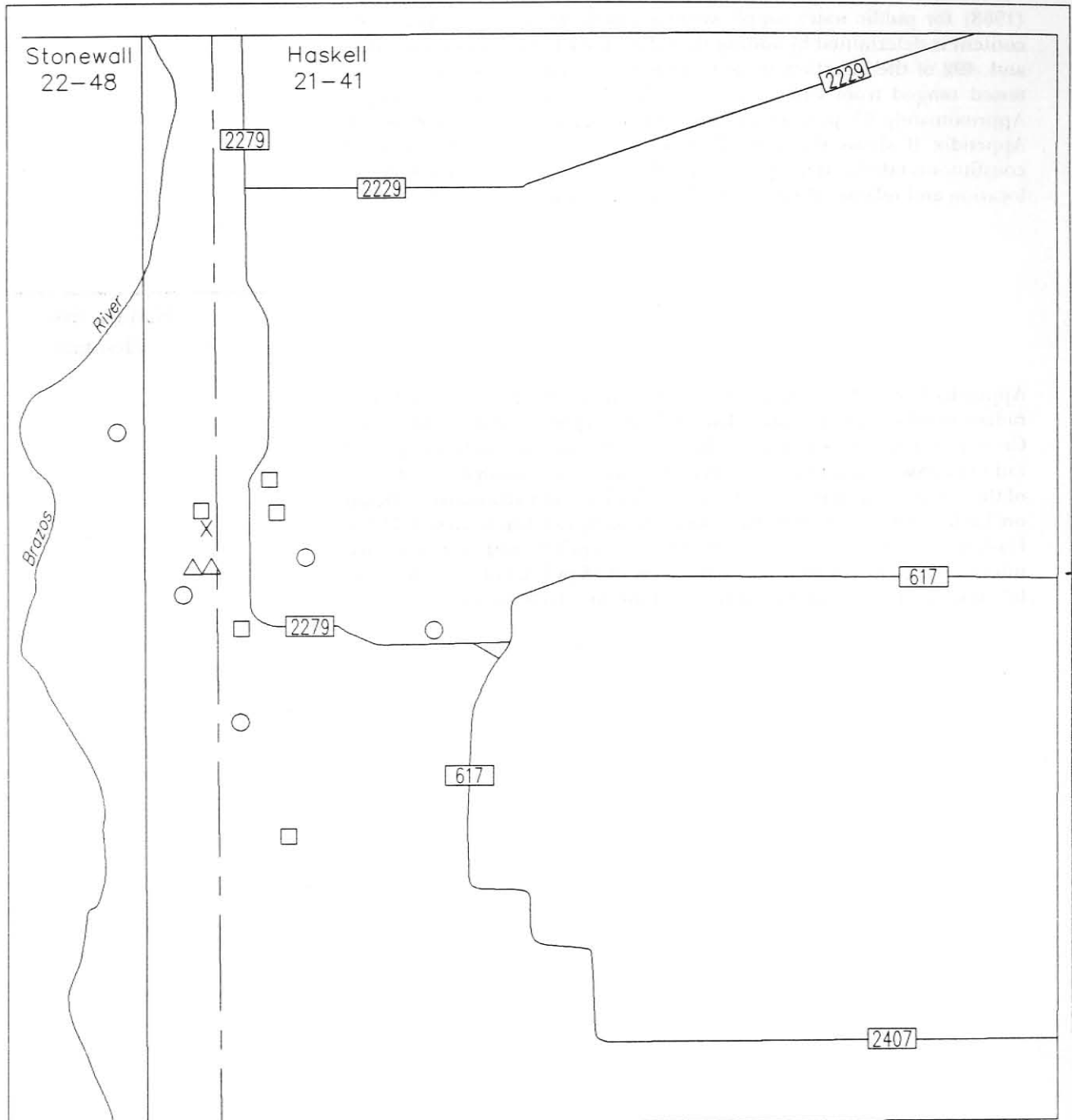


A secondary drinking water standard of 1,000 mg/l was set by the TDH (1988) for public water supply systems (Table 1). The dissolved-solids content is determined by adding the values for all anions, cations, silica, and .492 of the bicarbonate value. Dissolved-solids content of the wells tested ranged from 216 to 5,011 mg/l, with a mean of 1,275 mg/l. Approximately 47 percent of the wells tested exceeded 1,000 mg/l. Appendix II shows the sum of constituents for each well less those constituents tabulated in Appendices III and IV. Figures 8 and 9 show the location and relative dissolved-solids content of the wells tested.

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## Radioactive Elements

Appendix V lists the radioactive elements analyzed for by the TDH. The radiation subsample was filtered in the field and preserved with nitric acid. Gross alpha and beta radiation along with the isotopes radium-226 and radium-228 were determined. Only eight samples were analyzed, and none of the results were in excess of the safe drinking water standards as shown on Table 1. One gross alpha value from the sample taken from well 711 in Haskell County was 13 picocuries per liter (pCi/l) with a confidence interval of 5.0, which approaches the limit of 15 pCi/l. Other values were below or near the respective detection limit for all elements.



EXPLANATION  
Dissolved-Solids Content (MG/L)  
○ <1000  
□ 1000-2000  
△ 2001-3000  
X >3000

Figure 8

DISSOLVED-SOLIDS CONTENT OF WATER FROM WELLS  
SAMPLED IN HASKELL AND STONEWALL COUNTIES, 1990

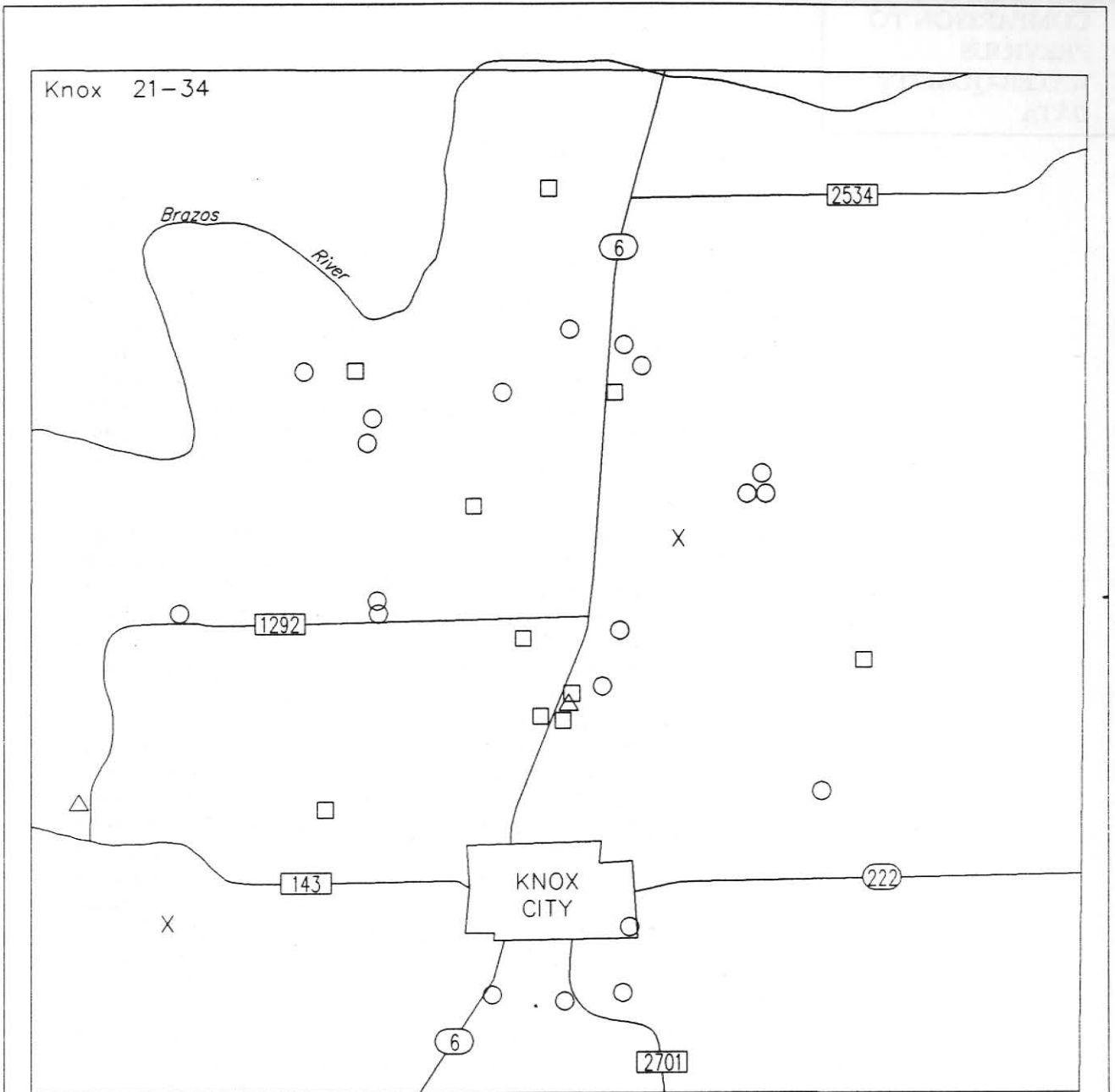


Figure 9

DISSOLVED-SOLIDS CONTENT OF WATER FROM  
WELLS SAMPLED IN KNOX COUNTY, 1990

## COMPARISON TO PREVIOUS WATER-QUALITY DATA

Crouch (1964) confirmed that some deterioration in ground-water quality has occurred in the area sampled in Figure 3. Evaluation of the chemical analyses of the ground water indicated modification of the chemical character of the native ground water by salt water. The investigation did not indicate a single source of the contaminant; however, the following possible sources were indicated: 1) past use of unlined surface pits for disposal of oil-field brine, 2) movement of brine from the Coleman Junction Limestone into the Seymour Formation, and 3) leakage from faulty injection wells. Although there was no disposal of oil-field brines into unlined surface pits at the time of this investigation, they had been used in the past. Because of the loose, permeable nature of the Seymour, a portion of the salt water that was placed in the pits undoubtedly seeped downward to the water table.

High nitrate concentrations were noted by Ogilbee and Osborne (1962); a total of 67 percent of the well water sampled for nitrate exceeded 44.28 mg/l. A subsequent study (Harden & Assoc., 1978) reaffirmed the high nitrate problem; the range of nitrate values from the 898 samples taken between 1975 and 1977 for that study was 8 mg/l to 935 mg/l. Most values were between 30 and 90 mg/l, with over 70 percent exceeding the safe drinking water standard.

Also as part of the study by Harden and Associates (1978), 37 Seymour wells were subjected to nitrogen isotope analysis. Samples were obtained from six public supply wells, 16 irrigation wells, and 15 domestic wells. The  $\delta^{15}N$  values for irrigation and public supply wells range from 2.6 to 11.4 and average 7.6. These values are in the range indicative of water containing nitrate derived from cultivated soils. The range in values for the domestic wells was 7.3 to 17.6 with an average of 10.9. This is within the range indicative of water containing nitrate derived from domestic and animal wastes. Interpretation of these data was accomplished using work done by Charles Kreitler (1979).

TWDB Report 226 (Harden & Assoc., 1978) also contained data which showed elevated levels of both chloride and dissolved solids concentrations in the same areas as illustrated in Figures 4, 5, 8, and 9. High chloride values represent either natural mineralization in the Seymour or possibly the effect of inflow from more highly mineralized Permian formations. Others represent pollution from oil-field brine or septic tanks.

Woods and Hughes (1973) collected 352 well water samples in Haskell and Knox Counties for nitrate analysis. The nitrate concentrations varied from zero to 41 mg/l with an average of approximately 12 mg/l. Most of the samples were collected from wells that were located in or adjacent to cultivated fields so that contamination from septic tanks was diminished. Nitrate was determined by a colorimetric method using reagents supplied by Hach Chemical Co. The results obtained from the Board's colorimetric nitrate meter are expressed as nitrate (as N) and a conversion to nitrate ( $NO_3$ ) would be necessary. It is possible that the low measurements recor-

ded in this publication were due to a failure to convert the nitrate values and that the 12 mg/l average is actually 52 mg/l nitrate, which would then be consistent with results obtained in other studies conducted in this area.

Because of the existing water-quality problems of excessive nitrate and pesticide detections, the Texas State Soil and Water Conservation Board, through the Section 319 agricultural and silvicultural nonpoint source pollution process, has designated the Seymour aquifer as a problem area. Hence the Seymour Aquifer Hydrologic Unit Project has been initiated along with a proposal titled "Nutrient, Pesticide and Irrigation Management Systems for Control of Nonpoint Source Pollution for the Seymour Aquifer Watershed" submitted by the Texas Agricultural Extension Service. Much of the ground-water quality data used to evaluate this area was obtained from the TWDB's ground-water database.

A review of current and historical nitrate data from the database for the Figure 1 study area reveals that 62 percent of the 200 analyses available are in excess of 44.3 mg/l, most of those being in Knox County. The average nitrate value in Knox County (Figure 2), based on 145 analyses in the database, was 70 mg/l. The average nitrate concentration described in Figure 3 was only 43 mg/l, indicating that the nitrate problem is less severe in this area.

## CONCLUSIONS

Wells were sampled in accordance with quality control and quality assurance directives established in the TWDB's sampling manual. All analyses were conducted by TDH using EPA approved procedures and were completed within the required holding times.

Of the 47 wells sampled for this project, 35 had nitrate values in excess of the primary drinking water standard. The average nitrate concentration was 70.8 mg/l, well above the recommended limit of 44.27 mg/l (10 mg/l as N). Sulfate and chloride concentrations in excess of 300 mg/l were determined in 17 and 38 percent of the analyses, respectively. The areas of high sulfate and chloride correspond to the contaminated areas described in several references. Selenium concentrations in three samples were in excess of the established drinking water standard of 10 µg/l.

The dissolved-solids content is a main factor which determines or limits the use of ground water. Approximately 47 percent of the wells tested exceeded the drinking water standard of 1,000 mg/l. The mean value was 1,275 mg/l. Hardness averaged in excess of 600 mg/l as calcium carbonate, which is considered very hard.

The results of the ground-water quality analyses taken in August of 1990 did not reveal any significant changes in the ground-water quality of the Seymour aquifer. The several water-quality problems determined during this study have been well documented in previous reports published by the TWDB and others. The testing for 19 additional minor inorganic compounds, five nutrients, and four radioactive elements was a first for this area and helped establish more comprehensive criteria for base-line water quality. Data collected during this project will be shared with all interested entities.

## REFERENCES

- Aurelius, L.A., 1989, Testing for pesticide residues in Texas well water: Texas Dept. of Agriculture, 188 p.
- Crouch, R.L., 1964, Investigation of ground-water contamination in the Juliana and West Jud oil fields, Haskell and Stonewall Counties, Texas: Texas Water Commission Report LD-0364-MR, 18 p. and 1 plate.
- Harden, R.W. and Associates, 1978, The Seymour aquifer: ground-water quality and availability in Haskell and Knox Counties: Texas Dept. of Water Resources Rept. 226, V. I, 63 p.
- Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 263 p.
- Kreitler, C. W., 1979, Nitrogen-isotope ratio studies of soil and groundwater nitrate from alluvial fan aquifers: Journal of Hydrology, v. 42, 24 p.
- Nordstrom, P.L., and Adidas, E.O., 1990, A field manual for ground water sampling: Texas Water Development Board Users Manual UM-51, 74 p.
- Ogilbee, William, and Osborne, F.L., 1962, Ground-water resources of Haskell and Knox Counties, Texas: Texas Water Commission Bulletin 6209, 174 p., 7 plates.
- Soil Conservation Service, Texas Agricultural Extension Service, Texas State Soil & Water Conservation Board, and Agricultural Stabilization and Conservation Service, 1991, Seymour aquifer hydrologic unit project, Haskell and Knox Counties, Texas: Plan of Work for Seymour Hydrologic Unit Project, 32 p.
- Texas Agricultural Extension Service, 1991, Nutrient, pesticide and irrigation management systems for control of nonpoint source pollution for the Seymour aquifer watershed: A Proposal for the 1991 Clean Water Act Section 319 Federal Funds for Implementation of Nonpoint Source Water Pollution Mitigation Projects, 17 p.
- Texas Department of Health, 1988, Drinking water standards governing drinking water quality and reporting requirements for public water supply systems, effective May 1988, 30 p.
- Texas Water Development Board, 1991, Surveys of irrigation in Texas - 1958, 1964, 1969, 1974, 1979, 1984, and 1989: Texas Water Development Board Report 329, 124 p.
- Wilcox, L.V., 1955, Classification and use of irrigation waters: U.S. Dept. Agriculture Circular 969, 19 p.
- Woods, C.E., and Hughes, J.M., 1973, Groundwater resources in the Seymour Formation, Haskell and Knox Counties, Texas: Texas Water Quality Board Project 1911 through Interagency Contract with Texas A & M University, 67 p., 4 plates, and appendices.







# **Appendix I**

## **Records of Sampled Wells**

<b>EXPLANATION OF CODES</b>
---------------------------------

Water-bearing unit: 112SYMR, Seymour Formation

Method of lift and type of power: C, centrifugal pump; E, electric motor;  
J, jet pump; L, LP gas (butane); P, piston pump; S, submersible pump; T,  
turbine; W, wind.

Use of water: C, commercial; H, domestic; I, irrigation; S, stock.

Sep 16, 1991

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RECORDS OF WELLS, SPRINGS, AND TEST HOLES  
COUNTY - Haskell

WELL	OWNER	DRILLER	DATE COM- PLETED	DEPTH OF WELL (FT.)	CASING AND SCREEN DATA			ALTITUDE OF LAND SURFACE (FT.)	WATER LEVEL MEASURE- MENT FROM LSD (FT.)	METHOD OF LIFT AND POWER	USE OF WATER	REMARKS
					DATE	DEPTH OF WELL (FT.)	TOP BOT DEPTH (FT.)					
21-41-407	Warren Short	J. M. Rhea	1958	30			112SYMR	1542	-	S E	H	
21-41-413	Danny Harris			32			112SYMR	1589	-	J E	H S	
21-41-416	Bobby Joe Helton		1959	40			112SYMR	1536	-	T E	I	Measured yield 95 gpm with pumping level of 26.2 feet on 8-6-78.
21-41-430	Bobby Joe Helton			40			112SYMR	1539	-	T E	I	
21-41-440	Bobby Joe Helton	Eddie Leonard	1987	38			112SYMR	1542	-	S E	H	
21-41-441	Butch Stephens			38			112SYMR	1540	-	S E	S	
21-41-711	David Epley		1940	60			112SCFX	1537	-	J E	H	.50

Sep 16, 1991

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RECORDS OF WELLS, SPRINGS, AND TEST HOLES  
COUNTY - Knox

WELL	OWNER	DRILLER	DATE COM- PLETED	DEPTH OF WELL (FT.)	CASING AND SCREEN DATA				WATER BEARING UNIT	ALTITUDE OF LAND SURFACE (FT.)	WATER LEVEL		METHOD OF LIFT AND POWER	USE OF WATER	REMARKS
					CASING OR SCREEN (IN.)	TOP DEPTH (FT.)	BOT DEPTH (FT.)	MEASURE- MENT FROM LSD (FT.)			DATE				
21-34-102	David Albus	J. M. Rhea		28				112SYMR	1436	-	-	T L	I		
21-34-103	Leon Henderson			35				112SYMR	1457	-	-	J E	H		
21-34-104	David Albus		1950	30				112SYMR	1455	-	-	S E	H S		
21-34-105	David Albus	Eddie Leonard	1981	35	C 5 S 5	0 23	23 35	112SYMR	1460	-	-	S E	I		
21-34-206	Clint Jones			27				112SYMR	1446	-14.00	11-13-1936	J E	H S		
21-34-213	Word Estate David Albus	John Kald	1955	29	C 14 S 14	0 19	19 29	112SYMR	1454	-18.40 -18.80	05-10-1956 01-16-1977	C E	I		
21-34-224	Clint Jones			25				112SYMR	1420	-16.50 -17.25	01-01-1937 08-23-1990	P W	S		
21-34-225	Guy Bradley		1959					112SYMR	1455	-	-	J E	H		
21-34-226	Dr. Tompson							112SYMR	1451	-	-	S E	I		
21-34-227	Dr. Tompson		1972	42	C 14 S 14	0 32	32 42	112SYMR	1449	-	-	S E	I S		
21-34-308	James Albus	John Kale	1956	40	C 14 S 14	0 25	25 40	112SYMR	1470	-25.80 -29.10	03-29-1956 05-21-1957	T E	I	Measured yield 146 gpm with pumping level of 37.5 feet on 7-26-58.	
21-34-402	Jack Langford	J. M. Rhea	1955	39	C 14 S 14	0 27	27 39	112SYMR	1483	-23.94 -26.04	05-10-1956 10-02-1990	S E	I	North well of three. Observation well.	
21-34-403	Jack Langford	J. M. Rhea	1956	38	C 14 S 14	0 26	26 38	112SYMR	1485	-25.40 -23.70	12-10-1956 03-03-1962	T E	I	South well of three. Historical observation well.	

RECORDS OF WELLS, SPRINGS, AND TEST HOLES  
COUNTY - Knox

WELL	OWNER	DRILLER	DATE COM- PLETED	DEPTH OF WELL (FT.)	CASING AND SCREEN DATA				WATER BEARING UNIT	ALTITUDE OF LAND SURFACE (FT.)	WATER LEVEL		METHOD OF LIFT AND POWER	USE OF WATER	REMARKS
					CASING OR SCREEN (IN.)	DIAM- ETER (FT.)	TOP DEPTH (FT.)	BOT DEPTH (FT.)			MEASURE- MENT FROM LSD (FT.)	DATE			
21-34-411	U. S. Department of Agriculture	J. M. Rhea	1955	31	C S	14 14	0 19	19 31	112SYMR	1489	-21.10	03-29-1958 - -	J E .75	H	
21-34-443	Joe & Dan Godsey								112SYMR	1505		- - - -	T E	I S	
21-34-448	Joe & Dan Godsey								112SYMR	1485	-13.90	01-14-1977 - -	J E	H S	
21-34-513	Allen McCoughey			50					112SYMR	1505		- - - -	J E	H I	
21-34-518	John Crownover		1963	52					112SYMR	1497		- - - -	J E	H	
21-34-522	John Crownover	J. M. Rhea	1960	50					112SYMR	1495		- - - -	S E .75	H	
21-34-527	Neil Perdue		1958	58	C S	16 16	0 50	50 58	112SYMR	1485	-40.50 -42.70	03-29-1958 12-11-1958	T E	H	
21-34-532	Christensen Aviation City of Knox City			50					112SYMR	1489		- - - -	S E	C	
21-34-547	David & Judy Perdue	W. P. Hise	1983	45	C S	5 5	0 35	35 45	112SYMR	1495	-35.00	00-00-1988 - -	S E	H	
21-34-548	Charles Escobar			40					112SYMR	1487		- - - -	J E	H	
21-34-549	Jack Stubbs								112SYMR	1473		- - - -	S E	S	
21-34-550	William Vacek			30					112SYMR	1475		- - - -	S E .50	H S	
21-34-646	Sterling Lewis								112SYMR	1470		- - - -	S E	I	
21-34-647	Sterling Lewis			45					112SYMR	1489		- - - -	J E	H	

RECORDS OF WELLS, SPRINGS, AND TEST HOLES  
COUNTY - Knox

WELL	OWNER	DRILLER	DATE COM- PLETED	DEPTH OF WELL (FT.)	CASING AND SCREEN DATA				WATER BEARING UNIT	ALTITUDE OF LAND SURFACE (FT.)	WATER LEVEL		METHOD OF LIFT AND POWER	USE OF WATER	REMARKS
					CASING OR SCREEN	DIAM- ETER (IN.)	TOP DEPTH (FT.)	BOT DEPTH (FT.)			MEASURE- MENT FROM	DATE			
21-34-648	Jimmy Ray Albus			35					112SYMR	1487	- - - -	S E .50	H		
21-34-649	James Albus	Eddie Leonard	1989	57					112SYMR	1530	-45.00 08-00-1989	S E	H		
21-34-729	J. M. Tidwell	Eddie Leonard	1982	39	C S	5 5	0 28	29 39	112SYMR	1498	- - - -	S E .50	S		
21-34-801	Cornella King		1953	54	C S C	14 14 14	0 20 35	20 35 54	112SYMR	1533	-29.43 -33.20 01-05-1954 01-19-1960	J E .33	H	Historical observation well.	
21-34-831	George McNeil		1980	40					112SYMR	1549	- - - -	J E	H		
21-34-834	C. H. Cornett								112SYMR	1550	- - - -	P W	H		
21-34-854	Samuel Tankersley		1980	45					112SYMR	1541	- - - -	J E	H		

Sep 18, 1991

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RECORDS OF WELLS, SPRINGS, AND TEST HOLES  
COUNTY - Stonewall

WELL	OWNER	DRILLER	DATE COM- PLETED	DEPTH OF WELL (FT.)	CASING AND SCREEN DATA			WATER BEARING UNIT	ALTITUDE OF LAND SURFACE (FT.)	WATER LEVEL		METHOD OF LIFT AND POWER	USE OF WATER	REMARKS
					CASING OR SCREEN (IN.)	DIAM- ETER (IN.)	TOP DEPTH (FT.)			BOT DEPTH (FT.)	MEASURE- MENT FROM LSD (FT.)			
21-41-406	Warren Short	- -	1954	38	C	14		112SYMR	1537	- -	- -	T E	I	
21-41-417	Butch Stephens	- -		45				112SYMR	1536	- -	- -	T E	I	
21-41-437	Butch Stephens	Eddie Leonard	1988	43				112SYMR	1540	- -	- -	S E	I	
21-41-438	Warren Short	- -	1980	38				112SYMR	1538	- -	- -	T E	I	
21-41-439	Warren Short	- -		38				112SYMR	1538	- -	- -	S E	I	
22-48-802	Butch Stephens	- -	1950	35	C	30		112SYMR	1500	- -	- -	J E	S	





## **Appendix II**

### **Routine Water-Quality Analysis Report**



Sep 16 1991

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

GROUND WATER QUALITY SAMPLES  
COUNTY - Haskell

Well	Aquifer	Well Depth (Feet)	Date of Collection	Agency Code	Lab Code	Reliability Code	Temp. Deg. C	pH	Silica (SiO2) MG/L	Calcium (Ca) MG/L	Magnesium (Mg) MG/L	Sodium (Na) MG/L	Potassium (K) MG/L	Carbonate (CO3) MG/L	Bicarb. (HCO3) MG/L	Sulfate (SO4) MG/L	Chloride (Cl) MG/L	Fluoride (F) MG/L	Nitrate (NO3) MG/L	Dissolved Solids MG/L	Spec. Cond. (micromhos) as CaCO3 MG/L	Hardness MG/L
21 41 407	112SVMR	30	08/22/1990	01	01	10	24	7.2	28	253	113	102	4	0	287	36	738	0.7	70.4	1482	7670	10 <sup>6</sup>
21 41 413	112SVMR	32	08/23/1990	01	01	10	22	7.1	29	104	25	82	5	0	300	65	103	0.5	100.9	681	1032	36 <sup>6</sup>
21 41 416	112SVMR	40	08/27/1990	01	01	10	19	6.9	26	195	63	370	6	0	277	39	916	0.6	37.8	1789	3330	745
21 41 430	112SVMR	40	08/27/1990	01	01	10	21	7.1	27	72	23	168	3	0	360	57	173	0.9	34.4	735	1275	274
21 41 440	112SVMR	38	08/23/1990	01	01	10	20	7.4	26	150	59	261	4	0	268	34	637	0.6	35.5	1338	2570	617
21 41 441	112SVMR	36	08/21/1990	01	01	10	21	7.3	23	67	23	84	2	0	351	29	75	1.2	30.5	507	902	281
21 41 711	112SCFX	60	08/23/1990	01	01	10	22	7.1	21	112	57	184	6	0	394	387	79	1.6	62.6	1123	1538	513

\* Depth value here reflects the bottom of the SAMPLED INTERVAL which was different from the completed well depth  
U after date of collection signifies unbalanced or partial chemical analysis

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM  
GROUND WATER QUALITY SAMPLES  
COUNTY - Knox

Sep 16 1991

Well	Aquifer	Well Depth (Feet)	Date of Collection	Agency Code	Lab Code	Reliability Code	Temp. Deg. C	pH	Silica (SiO2) MG/L	Calcium (Ca) MG/L	Magnesium (Mg) MG/L	Sodium (Na) MG/L	Potassium (K) MG/L	Carbonate (CO3) MG/L	Bicarb. (HCO3) MG/L	Sulfate (SO4) MG/L	Chloride (Cl) MG/L	Fluoride (F) MG/L	Nitrate (NO3) MG/L	Dissolved Solids MG/L	Spec. Cond. (micromhos) as CaCO3	Hardness as CaCO3 MG/L
21 34 102	112SYMR	28	08/21/1990	01	01	10	20	7.0	23	108	84	107	3	0	350	218	173	1.2	100.1	989	1343	615
21 34 103	112SYMR	35	08/22/1990	01	01	10	27	6.5	27	98	60	81	2	0	321	150	137	1.3	76.1	790	1225	491
21 34 104	112SYMR	30	08/21/1990	01	01	10	24	6.9	27	111	67	126	2	0	332	218	182	1.0	113.8	1011	1480	552
21 34 105	112SYMR	35	08/22/1990	01	01	10	20	7.0	27	99	56	90	2	0	316	162	105	1.4	94.7	792	1197	477
21 34 206	112SYMR	27	08/23/1990	01	01	10	21	7.0	31	105	62	96	3	0	375	157	146	1.1	84.0	868	1483	517
21 34 213	112SYMR	29	08/21/1990	01	01	10	20	6.7	29	101	57	92	2	0	320	127	142	1.0	79.8	788	1242	488
21 34 224	112SYMR	25	08/23/1990	01	01	10	20	7.4	19	83	67	179	4	0	421	234	166	1.3	59.1	1018	1729	482
21 34 225	112SYMR		08/23/1990	01	01	10	21	7.4	31	86	68	101	2	0	412	156	116	0.8	69.7	833	1395	494
21 34 226	112SYMR		08/23/1990	01	01	10	20	7.2	31	172	105	122	3	0	327	115	512	0.8	39.1	1260	1504	881
21 34 227	112SYMR	42	08/23/1990	01	01	10	20	7.3	31	104	75	97	3	0	368	129	227	1.0	50.8	896	1548	568
21 34 306	112SYMR	40	08/22/1990	01	01	10	20	7.5	26	60	35	27	2	0	288	41	18	0.6	36.5	387	673	293
21 34 402	112SYMR	39	08/21/1990	01	01	10	21	7.1	28	92	42	106	3	0	287	88	172	1.1	68.2	749	1185	402
21 34 403	112SYMR	38	08/27/1990	01	01	10	22	7.1	29	98	45	104	4	0	287	90	193	1.0	68.2	771	1233	429
21 34 411	112SYMR	31	08/22/1990	01	01	10	24	7.2	29	89	49	48	2	0	281	142	48	1.3	100.9	644	939	423
21 34 443	112SYMR		08/28/1990	01	01	10	20	7.2	26	88	37	210	4	0	342	262	157	0.8	80.8	1033	1510	371
21 34 448	112SYMR		08/28/1990	01	01	10	21	7.1	29	204	148	274	8	0	329	737	443	1.6	60.5	2063	2710	1109
21 34 513	112SYMR	50	08/21/1990	01	01	10	20	7.2	26	134	96	368	5	0	347	357	487	1.6	172.0	1817	2860	689
21 34 516	112SYMR	52	08/21/1990	01	01	10	20	7.0	28	323	129	324	8	0	321	482	856	0.9	93.4	2410	3530	1336
21 34 522	112SYMR	50	08/21/1990	01	01	10	19	7.1	28	181	84	268	5	0	322	414	452	1.1	113.3	1714	1720	822
21 34 527	112SYMR	58	08/22/1990	01	01	10	27	6.8	27	67	29	102	3	0	347	88	42	1.3	75.4	805	911	286

\* Depth value here reflects the bottom of the SAMPLED INTERVAL which was different from the completed well depth  
U after date of collection signifies unbalanced or partial chemical analysis

GROUND WATER QUALITY SAMPLES  
COUNTY - Knox

page 2

Well	Aquifer	Well Depth (Feet)	Date of Collection	Agency Code	Lab Code	Relia- bility Code	Temp. Deg. C	pH	Silica (SiO2) MG/L	Calcium (Ca) MG/L	Magnesium (Mg) MG/L	Sodium (Na) MG/L	Potassium (K) MG/L	Carbonate (CO3) MG/L	Bicarb. (HCO3) MG/L	Sulfate (SO4) MG/L	Chloride (Cl) MG/L	Fluoride (F) MG/L	Nitrate (NO3) MG/L	Dissolved Solids MG/L	Spec. Cond. (microhmhos) as CaCO3 MG/L	Hardness
21 34 532	112SYMR	50	08/21/1990	01	01	10	21	7.0	27	184	85	197	4	0	349	318	389	0.7	88.4	1473	2260	808
21 34 547	112SYMR	45	08/22/1990	01	01	10	21	6.7	25	56	24	81	3	0	312	86	32	1.4	70.4	522	787	238
21 34 548	112SYMR	40	08/21/1990	01	01	10	20	7.2	28	137	55	176	5	0	319	131	361	0.8	74.1	1123	1821	568
21 34 549	112SYMR		08/22/1990	01	01	10	20	6.8	30	872	307	732	9	0	243	126	2985	1.3	34.2	4998	7510	2939
21 34 550	112SYMR	30	08/22/1990	01	01	10	19	7.7	28	149	70	134	4	0	293	118	372	0.7	83.8	1111	1827	659
21 34 646	112SYMR		08/22/1990	01	01	10	20	7.8	25	43	30	18	1	0	255	27	8	1.8	14.7	284	528	230
21 34 647	112SYMR	45	08/22/1990	01	01	10	21	7.8	25	34	21	11	1	0	198	16	3	1.2	4.6	214	374	171
21 34 648	112SYMR	35	08/21/1990	01	01	10	23	6.8	38	84	114	449	4	0	372	601	422	4.2	94.0	1893	878	
21 34 648	112SYMR	57	08/28/1990	01	01	10	21	7.4	30	48	16	222	5	0	359	128	130	1.4	51.1	803	1111	180
21 34 728	112SYMR	38	08/28/1990	01	01	10	20	7.0	23	311	203	868	9	0	327	1634	684	1.4	142.6	3836	4810	1811
21 34 801	112SYMR	54	08/28/1990	01	01	10	21	7.1	31	82	28	143	5	0	371	119	119	0.9	52.1	782	1128	319
21 34 831	112SYMR	40	08/28/1990	01	01	10		7.2	30	78	25	184	5	0	358	141	157	0.8	72.7	879	1364	297
21 34 834	112SYMR		08/28/1990	01	01	10	20	7.1	40	68	23	168	3	0	382	137	85	1.0	63.0	780	1110	2640
21 34 854	112SYMR	45	08/28/1990	01	01	10	20	7.1	34	82	30	144	5	0	358	134	110	1.3	60.0	775	1185	328

\* Depth value here reflects the bottom of the SAMPLED INTERVAL which was different from the completed well depth  
U after date of collection signifies unbalanced or partial chemical analysis

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

GROUND WATER QUALITY SAMPLES  
COUNTY - Stonewall

Well	Aquifer	Well Depth (Feet)	Date of Collection	Agency Code	Lab Code	Reliability Code	Temp. Deg. C	pH	Silica (SiO2) MG/L	Calcium (Ca) MG/L	Magnesium (Mg) MG/L	Sodium (Na) MG/L	Potassium (K) MG/L	Carbonate (CO3) MG/L	Bicarb. (HCO3) MG/L	Sulfate (SO4) MG/L	Chloride (Cl) MG/L	Fluoride (F) MG/L	Nitrate (NO3) MG/L	Dissolved Solids MG/L	Spec. Cond. (micromhos)	Hardness as CaCO3 MG/L
21 41 408	112SYMR	38	08/23/1990	01	01	10	18	7.8	24	115	58	94	3	0	334	104	213	1.0	124.0	900	1493	5295
21 41 417	112SYMR	45	08/21/1990	01	01	10	19	7.5	25	132	62	175	4	0	276	39	477	0.7	36.4	1088	1864	5845
21 41 437	112SYMR	43	08/21/1990	01	01	10	19	7.1	26	488	214	304	8	0	204	29	1795	0.6	37.2	3002	5700	21005
21 41 438	112SYMR	38	08/22/1990	01	01	10	19	7.1	27	498	225	204	7	0	239	25	1754	0.7	39.7	2898	4520	2168
21 41 439	112SYMR	38	08/22/1990	01	01	10	19	7.0	25	378	148	268	6	0	245	38	1405	0.6	49.6	2468	4750	1547
22 48 602	112SYMR	35	08/21/1990	01	01	10	22	7.2	17	134	45	108	18	0	247	260	188	0.6	60.2	847	1562	518

\* Depth value here reflects the bottom of the SAMPLED INTERVAL which was different from the completed well depth  
U after date of collection signifies unbalanced or partial chemical analysis

## Appendix III

### Minor Inorganic Element Report





Sep 16 1991

TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

MINOR INORGANIC ELEMENT REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01000	ARSENIC, DISSOLVED (UG/L AS AS)	2141407	08/22/1990	1	<	10
		2141413	08/23/1990	1	<	10
		2141416	08/27/1990	1	<	10
		2141430	08/27/1990	1	<	10
		2141440	08/23/1990	1	<	10
		2141441	08/21/1990	1	<	10
		2141711	08/23/1990	1	<	10
01005	BARIUM, DISSOLVED (UG/L AS BA)	2141407	08/22/1990	1		300
		2141413	08/23/1990	1		155
		2141416	08/27/1990	1		238
		2141430	08/27/1990	1		122
		2141440	08/23/1990	1		221
		2141441	08/21/1990	1		143
		2141711	08/23/1990	1		43
01020	BORON, DISSOLVED (UG/L AS B)	2141407	08/22/1990	1		490
		2141413	08/23/1990	1		280
		2141416	08/27/1990	1		370
		2141430	08/27/1990	1		300
		2141440	08/23/1990	1		510
		2141441	08/21/1990	1		360
		2141711	08/23/1990	1		1270
01025	CADMIUM, DISSOLVED (UG/L AS CD)	2141407	08/22/1990	1	>	10
		2141413	08/23/1990	1	>	10
		2141416	08/27/1990	1	>	10
		2141430	08/27/1990	1	>	10
		2141440	08/23/1990	1	>	10
		2141441	08/21/1990	1	>	10
		2141711	08/23/1990	1	>	10
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2141407	08/22/1990	1	<	20

## MINOR INORGANIC ELEMENT REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1	<	20
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01040	COPPER, DISSOLVED (UG/L AS CU)	2141407	08/22/1990	1		21
		2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1	<	20
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01046	IRON, DISSOLVED (UG/L AS FE)	2141407	08/22/1990	1		36
		2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1		25
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01049	LEAD, DISSOLVED (UG/L AS PB)	2141407	08/22/1990	1	<	50
		2141413	08/23/1990	1	<	50
		2141416	08/27/1990	1	<	50
		2141430	08/27/1990	1	<	50
		2141440	08/23/1990	1	<	50
		2141441	08/21/1990	1	<	50
		2141711	08/23/1990	1	<	50
01056	MANGANESE, DISSOLVED (UG/L AS MN)	2141407	08/22/1990	1	<	20
		2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1	<	20
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20

MINOR INORGANIC ELEMENT REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01056	MANGANESE, DISSOLVED (UG/L AS MN)	2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01062	MOLYBDENUM, DISSOLVED (UG/L AS MO)	2141407	08/22/1990	1	<	20
		2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1	<	20
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01075	SILVER, DISSOLVED (UG/L AS AG)	2141407	08/22/1990	1	<	10
		2141413	08/23/1990	1	<	10
		2141416	08/27/1990	1	<	10
		2141430	08/27/1990	1	<	10
		2141440	08/23/1990	1	<	10
		2141441	08/21/1990	1	<	10
		2141711	08/23/1990	1	<	10
01080	STRONTIUM, DISSOLVED (UG/L AS SR)	2141407	08/22/1990	1		3830
		2141413	08/23/1990	1		750
		2141416	08/27/1990	1		3750
		2141430	08/27/1990	1		1300
		2141440	08/23/1990	1		2660
		2141441	08/21/1990	1		1680
		2141711	08/23/1990	1		4810
01085	VANADIUM, DISSOLVED (UG/L AS V)	2141407	08/22/1990	1	<	20
		2141413	08/23/1990	1	<	20
		2141416	08/27/1990	1	<	20
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1		31
01090	ZINC, DISSOLVED (UG/L AS ZN)	2141407	08/22/1990	1		59

MINOR INORGANIC ELEMENT REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01090	ZINC, DISSOLVED (UG/L AS ZN)	2141413	08/23/1990	1		53
		2141416	08/27/1990	1		57
		2141430	08/27/1990	1	<	20
		2141440	08/23/1990	1	<	20
		2141441	08/21/1990	1	<	20
		2141711	08/23/1990	1	<	20
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	2141407	08/22/1990	1	<	50
		2141413	08/23/1990	1	<	50
		2141416	08/27/1990	1	<	50
		2141430	08/27/1990	1	<	50
		2141440	08/23/1990	1	<	50
		2141441	08/21/1990	1	<	50
		2141711	08/23/1990	1	<	50
01145	SELENIUM, DISSOLVED (UG/L AS SE)	2141407	08/22/1990	1		4
		2141413	08/23/1990	1		4
		2141416	08/27/1990	1	<	2
		2141430	08/27/1990	1	<	2
		2141440	08/23/1990	1	<	2
		2141441	08/21/1990	1		3
		2141711	08/23/1990	1		7
71865	IODIDE (MG/L AS I)	2141407	08/22/1990	1	<	0.1
		2141413	08/23/1990	1	<	0.1
		2141416	08/27/1990	1	<	0.1
		2141430	08/27/1990	1	<	0.1
		2141440	08/23/1990	1	<	0.1
		2141441	08/21/1990	1	<	0.1
		2141711	08/23/1990	1	<	0.1
71870	BROMIDE, DISSOLVED, (MG/L AS BR)	2141407	08/22/1990	1		1.24
		2141413	08/23/1990	1		0.62
		2141416	08/27/1990	1		1.90
		2141430	08/27/1990	1		0.4
		2141440	08/23/1990	1		1.32

MINOR INORGANIC ELEMENT REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
71870	BROMIDE, DISSOLVED, (MG/L AS BR)	2141441	08/21/1990	1		0.57
		2141711	08/23/1990	1		0.66
71890	MERCURY, DISSOLVED (UG/L AS HG)	2141407	08/22/1990	1	<	0.2
		2141413	08/23/1990	1	<	0.2
		2141416	08/27/1990	1	<	0.2
		2141430	08/27/1990	1	<	0.2
		2141440	08/23/1990	1	<	0.2
		2141441	08/21/1990	1	<	0.2
		2141711	08/23/1990	1	<	0.2

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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01000	ARSENIC, DISSOLVED (UG/L AS AS)	2134102	08/21/1990	1	<	10
		2134103	08/22/1990	1	<	10
		2134104	08/21/1990	1	<	10
		2134105	08/22/1990	1	<	10
		2134206	08/23/1990	1	<	10
		2134213	08/21/1990	1	<	10
		2134224	08/23/1990	1	<	10
		2134225	08/23/1990	1	<	10
		2134226	08/23/1990	1	<	10
		2134227	08/23/1990	1	<	10
		2134306	08/22/1990	1	<	10
		2134402	08/27/1990	1	<	10
		2134403	08/27/1990	1	<	10
		2134411	08/22/1990	1	<	10
		2134443	08/28/1990	1	<	10
		2134446	08/28/1990	1	<	10
		2134513	08/21/1990	1	<	10
		2134516	08/21/1990	1	<	10
		2134522	08/21/1990	1	<	10
		2134527	08/22/1990	1	<	10
		2134532	08/21/1990	1	<	10
		2134547	08/22/1990	1	<	10
		2134548	08/21/1990	1	<	10
		2134549	08/22/1990	1	<	10
		2134550	08/22/1990	1	<	10
		2134646	08/22/1990	1	<	10
		2134647	08/22/1990	1	<	10
		2134648	08/21/1990	1	<	11
		2134649	08/28/1990	1	<	10
		2134729	08/28/1990	1	<	10
		2134801	08/28/1990	1	<	10
		2134831	08/28/1990	1	<	10
		2134834	08/28/1990	1	<	10

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01000	ARSENIC, DISSOLVED (UG/L AS AS)	2134854	08/28/1990	1	<	10
01005	BARIUM, DISSOLVED (UG/L AS BA)	2134102	08/21/1990	1		79
		2134103	08/22/1990	1		33
		2134104	08/21/1990	1		30
		2134105	08/22/1990	1		33
		2134206	08/23/1990	1		79
		2134213	08/21/1990	1		50
		2134224	08/23/1990	1		55
		2134225	08/23/1990	1		36
		2134226	08/23/1990	1		97
		2134227	08/23/1990	1		48
		2134306	08/22/1990	1		116
		2134402	08/27/1990	1		72
		2134403	08/27/1990	1		76
		2134411	08/22/1990	1		42
		2134443	08/28/1990	1		27
		2134446	08/28/1990	1		22
		2134513	08/21/1990	1		35
		2134516	08/21/1990	1		27
		2134522	08/21/1990	1		25
		2134527	08/22/1990	1		51
		2134532	08/21/1990	1		65
		2134547	08/22/1990	1		55
		2134548	08/21/1990	1		46
		2134549	08/22/1990	1		200
		2134550	08/22/1990	1		91
		2134646	08/22/1990	1		130
		2134647	08/22/1990	1		171
		2134648	08/21/1990	1		27
		2134649	08/28/1990	1		32
		2134729	08/28/1990	1	>	20
		2134801	08/28/1990	1		46
		2134831	08/28/1990	1		38
		2134834	08/28/1990	1		35
		2134854	08/28/1990	1		31

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01020	BORON, DISSOLVED (UG/L AS B)	2134102	08/21/1990	1		610
		2134103	08/22/1990	1		340
		2134104	08/21/1990	1		630
		2134105	08/22/1990	1		430
		2134206	08/23/1990	1		680
		2134213	08/21/1990	1		460
		2134224	08/23/1990	1		1040
		2134225	08/23/1990	1		580
		2134226	08/23/1990	1		680
		2134227	08/23/1990	1		580
		2134306	08/21/1990	1		250
		2134402	08/27/1990	1		450
		2134403	08/27/1990	1		470
		2134411	08/22/1990	1		450
		2134443	08/28/1990	1		880
		2134446	08/28/1990	1		1380
		2134513	08/21/1990	1		1040
		2134516	08/21/1990	1		790
		2134522	08/21/1990	1		980
		2134527	08/22/1990	1		440
		2134532	08/21/1990	1		930
		2134547	08/22/1990	1		480
		2134548	08/21/1990	1		800
		2134549	08/22/1990	1		660
		2134550	08/22/1990	1		540
		2134646	08/22/1990	1		530
		2134647	08/22/1990	1		450
		2134648	08/21/1990	1		2000
		2134649	08/28/1990	1		600
		2134729	08/28/1990	1		1820
		2134801	08/28/1990	1		570
		2134831	08/28/1990	1		650
		2134834	08/28/1990	1		490
		2134854	08/28/1990	1		510



MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01025	CADMIUM, DISSOLVED (UG/L AS CD)	2134102	08/21/1990	1	<	10
		2134103	08/22/1990	1	<	10
		2134104	08/21/1990	1	<	10
		2134105	08/22/1990	1	<	10
		2134206	08/23/1990	1	<	10
		2134213	08/21/1990	1	<	10
		2134224	08/23/1990	1	<	10
		2134225	08/23/1990	1	<	10
		2134226	08/23/1990	1	<	10
		2134227	08/23/1990	1	<	10
		2134306	08/22/1990	1	<	10
		2134402	08/27/1990	1	<	10
		2134403	08/27/1990	1	<	10
		2134411	08/22/1990	1	<	10
		2134443	08/28/1990	1	<	10
		2134446	08/28/1990	1	<	10
		2134513	08/21/1990	1	<	10
		2134516	08/21/1990	1	<	10
		2134522	08/21/1990	1	<	10
		2134527	08/22/1990	1	<	10
		2134532	08/21/1990	1	<	10
		2134547	08/22/1990	1	<	10
		2134548	08/21/1990	1	<	10
		2134549	08/22/1990	1	<	10
		2134550	08/22/1990	1	<	10
		2134646	08/22/1990	1	<	10
		2134647	08/22/1990	1	<	10
		2134648	08/21/1990	1	<	10
		2134649	08/28/1990	1	<	10
		2134729	08/28/1990	1	<	10
		2134801	08/28/1990	1	<	10
		2134831	08/28/1990	1	<	10
		2134834	08/28/1990	1	<	10
2134854	08/28/1990	1	<	10		
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2134102	08/21/1990	1	<	20

## MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2134103	08/22/1990	1	<	20
		2134104	08/21/1990	1	<	20
		2134105	08/22/1990	1	<	20
		2134206	08/23/1990	1	<	20
		2134213	08/21/1990	1	<	20
		2134224	08/23/1990	1	<	20
		2134225	08/23/1990	1	<	20
		2134226	08/23/1990	1	<	20
		2134227	08/23/1990	1	<	20
		2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1	<	20
		2134411	08/22/1990	1	<	20
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1	<	20
		2134513	08/21/1990	1	<	20
		2134516	08/21/1990	1	<	20
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1	<	20
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1	<	20
		2134550	08/22/1990	1	<	20
		2134646	08/22/1990	1	<	20
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1	<	20
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1	<	20
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
		2134834	08/28/1990	1	<	20
2134854	08/28/1990	1	<	20		
01040	COPPER, DISSOLVED (UG/L AS CU)	2134102	08/21/1990	1	<	20
		2134103	08/22/1990	1	<	20

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01040	COPPER, DISSOLVED (UG/L AS CU)	2134104	08/21/1990	1	<	20
		2134105	08/22/1990	1	<	20
		2134206	08/23/1990	1	<	20
		2134213	08/21/1990	1	<	20
		2134224	08/23/1990	1	<	20
		2134225	08/23/1990	1	<	20
		2134226	08/23/1990	1	<	20
		2134227	08/23/1990	1	<	20
		2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1	<	20
		2134411	08/22/1990	1	<	20
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1	<	20
		2134513	08/21/1990	1	<	20
		2134516	08/21/1990	1	<	20
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1	<	20
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1	<	20
		2134550	08/22/1990	1	<	20
		2134646	08/22/1990	1	<	20
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1	<	20
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1	<	20
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
2134834	08/28/1990	1	<	20		
2134854	08/28/1990	1	<	20		
01046	IRON, DISSOLVED (UG/L AS FE)	2134102	08/21/1990	1		46
		2134103	08/22/1990	1	<	20
		2134104	08/21/1990	1	<	20

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01046	IRON, DISSOLVED (UG/L AS FE)	2134105	08/22/1990	1	<	20
		2134206	08/23/1990	1	<	20
		2134213	08/21/1990	1	<	20
		2134224	08/23/1990	1		74
		2134225	08/23/1990	1	<	20
		2134226	08/23/1990	1		33
		2134227	08/23/1990	1	<	20
		2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1	<	20
		2134411	08/22/1990	1	<	20
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1		23
		2134513	08/21/1990	1		25
		2134516	08/21/1990	1		46
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1	<	20
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1		49
		2134550	08/22/1990	1		26
		2134646	08/22/1990	1	<	20
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1		38
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1		59
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
		2134834	08/28/1990	1	<	20
		2134854	08/28/1990	1	<	20
01049	LEAD, DISSOLVED (UG/L AS PB)	2134102	08/21/1990	1	<	50
		2134103	08/22/1990	1	<	50
		2134104	08/21/1990	1	<	50
		2134105	08/22/1990	1	<	50

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01049	LEAD, DISSOLVED (UG/L AS PB)	2134206	08/23/1990	1	<	50
		2134213	08/21/1990	1	<	50
		2134224	08/23/1990	1	<	50
		2134225	08/23/1990	1	<	50
		2134226	08/23/1990	1	<	50
		2134227	08/23/1990	1	<	50
		2134306	08/22/1990	1	<	50
		2134402	08/27/1990	1	<	50
		2134403	08/27/1990	1	<	50
		2134411	08/22/1990	1	<	50
		2134443	08/28/1990	1	<	50
		2134446	08/28/1990	1	<	50
		2134513	08/21/1990	1	<	50
		2134516	08/21/1990	1	<	50
		2134522	08/21/1990	1	<	50
		2134527	08/22/1990	1	<	50
		2134532	08/21/1990	1	<	50
		2134547	08/22/1990	1	<	50
		2134548	08/21/1990	1	<	50
		2134549	08/22/1990	1	<	50
		2134550	08/22/1990	1	<	50
		2134646	08/22/1990	1	>	50
		2134647	08/22/1990	1	>	50
		2134648	08/21/1990	1	>	50
		2134649	08/28/1990	1	>	50
		2134729	08/28/1990	1	>	50
2134801	08/28/1990	1	>	50		
2134831	08/28/1990	1	>	50		
2134834	08/28/1990	1	>	50		
2134854	08/28/1990	1	>	50		
01056	MANGANESE, DISSOLVED (UG/L AS MN)	2134102	08/21/1990	1	>	20
		2134103	08/22/1990	1	>	20
		2134104	08/21/1990	1	<	20
		2134105	08/22/1990	1	<	20
		2134206	08/23/1990	1	>	20

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01056	MANGANESE, DISSOLVED (UG/L AS MN)	2134213	08/21/1990	1	<	20
		2134224	08/23/1990	1		68
		2134225	08/23/1990	1	<	20
		2134226	08/23/1990	1	<	20
		2134227	08/23/1990	1	<	20
		2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1	<	20
		2134411	08/22/1990	1	<	20
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1	<	20
		2134513	08/21/1990	1	<	20
		2134516	08/21/1990	1	<	20
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1	<	20
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1	<	20
		2134550	08/22/1990	1	<	20
		2134646	08/22/1990	1	<	20
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1	<	20
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1	<	20
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
2134834	08/28/1990	1	<	20		
2134854	08/28/1990	1	<	20		
01062	MOLYBDENUM, DISSOLVED (UG/L AS MO)	2134102	08/21/1990	1	<	20
		2134103	08/22/1990	1	<	20
		2134104	08/21/1990	1	<	20
		2134105	08/22/1990	1	<	20
		2134206	08/23/1990	1	<	20
		2134213	08/21/1990	1	<	20

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01062	MOLYBDENUM, DISSOLVED (UG/L AS MO)	2134224	08/23/1990	1	<	20
		2134225	08/23/1990	1	<	20
		2134226	08/23/1990	1	<	20
		2134227	08/23/1990	1	<	20
		2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1	<	20
		2134411	08/22/1990	1	<	20
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1	<	20
		2134513	08/21/1990	1	<	20
		2134516	08/21/1990	1	<	20
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1	<	20
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1	<	20
		2134550	08/22/1990	1	<	20
		2134646	08/22/1990	1	<	20
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1	<	20
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1	<	20
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
2134834	08/28/1990	1	<	20		
2134854	08/28/1990	1	<	20		
01075	SILVER, DISSOLVED (UG/L AS AG)	2134102	08/21/1990	1	>	10
		2134103	08/22/1990	1	>	10
		2134104	08/21/1990	1	>	10
		2134105	08/22/1990	1	>	10
		2134206	08/23/1990	1	>	10
		2134213	08/21/1990	1	>	10
		2134224	08/23/1990	1	>	10

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE		
01075	SILVER, DISSOLVED (UG/L AS AG)	2134225	08/23/1990	1	<	10		
		2134226	08/23/1990	1	<	10		
		2134227	08/23/1990	1	<	10		
		2134306	08/22/1990	1	<	10		
		2134402	08/27/1990	1	<	10		
		2134403	08/27/1990	1	<	10		
		2134411	08/22/1990	1	<	10		
		2134443	08/28/1990	1	<	10		
		2134446	08/28/1990	1	<	10		
		2134513	08/21/1990	1	<	10		
		2134516	08/21/1990	1	<	10		
		2134522	08/21/1990	1	<	10		
		2134527	08/22/1990	1	<	10		
		2134532	08/21/1990	1	<	10		
		2134547	08/22/1990	1	<	10		
		2134548	08/21/1990	1	<	10		
		2134549	08/22/1990	1	<	10		
		2134550	08/22/1990	1	<	10		
		2134646	08/22/1990	1	<	10		
		2134647	08/22/1990	1	<	10		
		2134648	08/21/1990	1	<	10		
		2134649	08/28/1990	1	<	10		
		2134729	08/28/1990	1	<	10		
		2134801	08/28/1990	1	<	10		
		2134831	08/28/1990	1	<	10		
		2134834	08/28/1990	1	<	10		
		2134854	08/28/1990	1	<	10		
		01080	STRONTIUM, DISSOLVED (UG/L AS SR)	2134102	08/21/1990	1		3100
				2134103	08/22/1990	1		2390
				2134104	08/21/1990	1		2380
2134105	08/22/1990			1		2320		
2134206	08/23/1990			1		2250		
2134213	08/21/1990			1		1890		
2134224	08/23/1990			1		2310		
2134225	08/23/1990			1		2180		



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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01080	STRONTIUM, DISSOLVED (UG/L AS SR)	2134226	08/23/1990	1		2930
		2134227	08/23/1990	1		2190
		2134306	08/22/1990	1		1170
		2134402	08/27/1990	1		1510
		2134403	08/27/1990	1		1630
		2134411	08/22/1990	1		1820
		2134443	08/28/1990	1		1390
		2134446	08/28/1990	1		4950
		2134513	08/21/1990	1		2900
		2134516	08/21/1990	1		3370
		2134522	08/21/1990	1		2540
		2134527	08/22/1990	1		1150
		2134532	08/21/1990	1		2670
		2134547	08/22/1990	1		930
		2134548	08/21/1990	1		2410
		2134549	08/22/1990	1		11600
		2134550	08/22/1990	1		2240
		2134646	08/22/1990	1		1240
		2134647	08/22/1990	1		850
		2134648	08/21/1990	1		3720
		2134649	08/28/1990	1		600
		2134729	08/28/1990	1		6680
		2134801	08/28/1990	1		1090
		2134831	08/28/1990	1		1000
		2134834	08/28/1990	1		820
		2134854	08/28/1990	1		1150
		01085	VANADIUM, DISSOLVED (UG/L AS V)	2134102	08/21/1990	1
2134103	08/22/1990			1	>	20
2134104	08/21/1990			1	>	20
2134105	08/22/1990			1	>	20
2134206	08/23/1990			1		21
2134213	08/21/1990			1	>	20
2134224	08/23/1990			1	>	20
2134225	08/23/1990			1	>	20
2134226	08/23/1990			1	>	20

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE		
01085	VANADIUM, DISSOLVED (UG/L AS V)	2134227	08/23/1990	1	<	20		
		2134306	08/22/1990	1		22		
		2134402	08/27/1990	1		22		
		2134403	08/27/1990	1		21		
		2134411	08/22/1990	1		20		
		2134443	08/28/1990	1		20		
		2134446	08/28/1990	1		34		
		2134513	08/21/1990	1		27		
		2134516	08/21/1990	1		21		
		2134522	08/21/1990	1		22		
		2134527	08/22/1990	1		22		
		2134532	08/21/1990	1		20		
		2134547	08/22/1990	1		24		
		2134548	08/21/1990	1	<	20		
		2134549	08/22/1990	1		26		
		2134550	08/22/1990	1	<	20		
		2134646	08/22/1990	1	<	20		
		2134647	08/22/1990	1		23		
		2134648	08/21/1990	1		52		
		2134649	08/28/1990	1	<	20		
		2134729	08/28/1990	1		35		
		2134801	08/28/1990	1	<	20		
		2134831	08/28/1990	1	<	20		
		2134834	08/28/1990	1	<	20		
		2134854	08/28/1990	1	<	20		
		01090	ZINC, DISSOLVED (UG/L AS ZN)	2134102	08/21/1990	1	<	20
				2134103	08/22/1990	1		21
2134104	08/21/1990			1		71		
2134105	08/22/1990			1	<	20		
2134206	08/23/1990			1		22		
2134213	08/21/1990			1	<	20		
2134224	08/23/1990			1		31		
2134225	08/23/1990			1	<	20		
2134226	08/23/1990			1	<	26		
2134227	08/23/1990			1	<	20		

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01090	ZINC, DISSOLVED (UG/L AS ZN)	2134306	08/22/1990	1	<	20
		2134402	08/27/1990	1	<	20
		2134403	08/27/1990	1		40
		2134411	08/22/1990	1		40
		2134443	08/28/1990	1	<	20
		2134446	08/28/1990	1	<	20
		2134513	08/21/1990	1		21
		2134516	08/21/1990	1		35
		2134522	08/21/1990	1	<	20
		2134527	08/22/1990	1	<	20
		2134532	08/21/1990	1		29
		2134547	08/22/1990	1	<	20
		2134548	08/21/1990	1	<	20
		2134549	08/22/1990	1	<	20
		2134550	08/22/1990	1	<	20
		2134646	08/22/1990	1		74
		2134647	08/22/1990	1	<	20
		2134648	08/21/1990	1	<	20
		2134649	08/28/1990	1	<	20
		2134729	08/28/1990	1	<	20
		2134801	08/28/1990	1	<	20
		2134831	08/28/1990	1	<	20
		2134834	08/28/1990	1		22
		2134854	08/28/1990	1	<	20
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	2134102	08/21/1990	1	<	50
		2134103	08/22/1990	1	<	50
		2134104	08/21/1990	1	<	50
		2134105	08/22/1990	1	<	50
		2134206	08/23/1990	1	<	50
		2134213	08/21/1990	1	<	50
		2134224	08/23/1990	1	<	50
		2134225	08/23/1990	1	<	50
		2134226	08/23/1990	1	<	50
		2134227	08/23/1990	1	<	50
		2134306	08/22/1990	1	<	50

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	2134402	08/27/1990	1	<	50
		2134403	08/27/1990	1	<	50
		2134411	08/22/1990	1	<	50
		2134443	08/28/1990	1	<	50
		2134446	08/28/1990	1	<	50
		2134513	08/21/1990	1	<	50
		2134516	08/21/1990	1	<	50
		2134522	08/21/1990	1	<	50
		2134527	08/22/1990	1	<	50
		2134532	08/21/1990	1	<	50
		2134547	08/22/1990	1	<	50
		2134548	08/21/1990	1	<	50
		2134549	08/22/1990	1	<	50
		2134550	08/22/1990	1	<	50
		2134646	08/22/1990	1	<	50
		2134647	08/22/1990	1	<	50
		2134648	08/21/1990	1	<	50
		2134649	08/28/1990	1	<	50
		2134729	08/28/1990	1	<	50
		2134801	08/28/1990	1	<	50
2134831	08/28/1990	1	<	50		
2134834	08/28/1990	1	<	50		
2134854	08/28/1990	1	<	50		
01145	SELENIUM, DISSOLVED (UG/L AS SE)	2134102	08/21/1990	1		6
		2134103	08/22/1990	1		4
		2134104	08/21/1990	1		5
		2134105	08/22/1990	1		4
		2134206	08/23/1990	1		6
		2134213	08/21/1990	1		3
		2134224	08/23/1990	1		6
		2134225	08/23/1990	1		4
		2134226	08/23/1990	1		3
		2134227	08/23/1990	1		3
		2134306	08/22/1990	1	<	2
2134402	08/27/1990	1		3		

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01145	SELENIUM, DISSOLVED (UG/L AS SE)	2134403	08/27/1990	1		2
		2134411	08/22/1990	1		3
		2134443	08/28/1990	1		8
		2134446	08/28/1990	1		18
		2134513	08/21/1990	1		10
		2134516	08/21/1990	1		8
		2134522	08/21/1990	1		6
		2134527	08/22/1990	1		3
		2134532	08/21/1990	1		6
		2134547	08/22/1990	1	<	2
		2134548	08/21/1990	1		3
		2134549	08/22/1990	1		5
		2134550	08/22/1990	1		3
		2134646	08/22/1990	1	<	2
		2134647	08/22/1990	1	<	2
		2134648	08/21/1990	1		28
		2134649	08/28/1990	1		4
		2134729	08/28/1990	1		35
		2134801	08/28/1990	1		4
		2134831	08/28/1990	1		6
2134834	08/28/1990	1		6		
2134854	08/28/1990	1		6		
71865	IODIDE (MG/L AS I)	2134102	08/21/1990	1	<	0.1
		2134103	08/22/1990	1	<	0.1
		2134104	08/21/1990	1	<	0.1
		2134105	08/22/1990	1	<	0.1
		2134206	08/23/1990	1	<	0.1
		2134213	08/21/1990	1	<	0.1
		2134224	08/23/1990	1	<	0.1
		2134225	08/23/1990	1	<	0.1
		2134226	08/23/1990	1	<	0.1
		2134227	08/23/1990	1	<	0.1
		2134306	08/21/1990	1	<	0.1
		2134402	08/27/1990	1	<	0.1
		2134403	08/27/1990	1	<	0.1

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STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
71865	IODIDE (MG/L AS I)	2134411	08/22/1990	1	<	0.1
		2134443	08/28/1990	1	<	0.1
		2134446	08/28/1990	1	<	0.1
		2134513	08/21/1990	1	<	0.1
		2134516	08/21/1990	1	<	0.1
		2134522	08/21/1990	1	<	0.1
		2134527	08/22/1990	1	<	0.1
		2134532	08/21/1990	1	<	0.1
		2134547	08/22/1990	1	<	0.1
		2134548	08/21/1990	1	<	0.1
		2134549	08/22/1990	1	<	0.1
		2134550	08/22/1990	1	<	0.1
		2134646	08/22/1990	1	<	0.1
		2134647	08/22/1990	1	<	0.1
		2134648	08/21/1990	1	<	0.1
		2134649	08/28/1990	1	<	0.1
		2134729	08/28/1990	1	<	0.1
		2134801	08/28/1990	1	<	0.1
		2134831	08/28/1990	1	<	0.1
		2134834	08/28/1990	1	<	0.1
2134854	08/28/1990	1	<	0.1		
71870	BROMIDE, DISSOLVED, (MG/L AS BR)	2134102	08/21/1990	1		0.67
		2134103	08/22/1990	1		0.63
		2134104	08/21/1990	1		0.72
		2134105	08/22/1990	1		0.61
		2134206	08/23/1990	1		0.67
		2134213	08/21/1990	1		0.65
		2134224	08/23/1990	1		0.61
		2134225	08/23/1990	1		0.65
		2134226	08/23/1990	1		0.95
		2134227	08/23/1990	1		0.72
		2134306	08/21/1990	1		0.36
		2134402	08/27/1990	1		0.24
		2134403	08/27/1990	1		0.32
2134411	08/22/1990	1		0.50		

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE		
71870	BROMIDE, DISSOLVED, (MG/L AS BR)	2134443	08/28/1990	1		0.04		
		2134446	08/28/1990	1		0.56		
		2134513	08/21/1990	1		0.94		
		2134516	08/21/1990	1		0.97		
		2134522	08/21/1990	1		0.87		
		2134527	08/22/1990	1		0.53		
		2134532	08/21/1990	1		0.84		
		2134547	08/22/1990	1		0.45		
		2134548	08/21/1990	1		0.86		
		2134549	08/22/1990	1		2.42		
		2134550	08/22/1990	1		0.94		
		2134646	08/22/1990	1		0.23		
		2134647	08/22/1990	1		0.10		
		2134648	08/21/1990	1		0.88		
		2134649	08/28/1990	1	<	0.1		
		2134729	08/28/1990	1		0.82		
		2134801	08/28/1990	1	<	0.1		
		2134831	08/28/1990	1		0.3		
		2134834	08/28/1990	1	<	0.1		
		2134854	08/28/1990	1	<	0.1		
		71890	MERCURY, DISSOLVED (UG/L AS HG)	2134102	08/21/1990	1	<	0.2
				2134103	08/22/1990	1	<	0.2
				2134104	08/21/1990	1		0.2
				2134105	08/22/1990	1	<	0.2
				2134206	08/23/1990	1	<	0.2
2134213	08/21/1990			1	<	0.2		
2134224	08/23/1990			1	<	0.2		
2134225	08/23/1990			1	<	0.2		
2134226	08/23/1990			1	<	0.2		
2134227	08/23/1990			1	<	0.2		
2134306	08/22/1990			1	<	0.2		
2134402	08/27/1990			1	<	0.2		
2134403	08/27/1990			1	<	0.2		
2134411	08/22/1990			1	<	0.2		
2134443	08/28/1990			1	<	0.2		

MINOR INORGANIC ELEMENT REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
71890	MERCURY, DISSOLVED (UG/L AS HG)	2134446	08/28/1990	1	<	0.2
		2134513	08/21/1990	1	<	0.2
		2134516	08/21/1990	1	<	0.2
		2134522	08/21/1990	1	<	0.2
		2134527	08/22/1990	1	<	0.2
		2134532	08/21/1990	1		0.3
		2134547	08/22/1990	1	<	0.2
		2134548	08/21/1990	1	<	0.2
		2134549	08/22/1990	1	<	0.2
		2134550	08/22/1990	1	<	0.2
		2134646	08/22/1990	1	<	0.2
		2134647	08/22/1990	1	<	0.2
		2134648	08/21/1990	1	<	0.2
		2134649	08/28/1990	1	<	0.2
		2134729	08/28/1990	1	<	0.2
		2134801	08/28/1990	1	<	0.2
		2134831	08/28/1990	1	<	0.2
		2134834	08/28/1990	1	<	0.2
		2134854	08/28/1990	1	<	0.2



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TEXAS WATER DEVELOPMENT BOARD  
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MINOR INORGANIC ELEMENT REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01000	ARSENIC, DISSOLVED (UG/L AS AS)	2141406	08/23/1990	1	<	10
		2141417	08/21/1990	1	<	10
		2141437	08/21/1990	1	<	10
		2141438	08/22/1990	1	<	10
		2141439	08/22/1990	1	<	10
		2248602	08/21/1990	1	<	10
01005	BARIUM, DISSOLVED (UG/L AS BA)	2141406	08/23/1990	1		66
		2141417	08/21/1990	1		155
		2141437	08/21/1990	1		533
		2141438	08/22/1990	1		609
		2141439	08/22/1990	1		456
		2248602	08/21/1990	1		33
01020	BORON, DISSOLVED (UG/L AS B)	2141406	08/23/1990	1		490
		2141417	08/21/1990	1		510
		2141437	08/21/1990	1		640
		2141438	08/22/1990	1		590
		2141439	08/22/1990	1		540
		2248602	08/21/1990	1		2280
01025	CADMIUM, DISSOLVED (UG/L AS CD)	2141406	08/23/1990	1	<	10
		2141417	08/21/1990	1	<	10
		2141437	08/21/1990	1	<	10
		2141438	08/22/1990	1	<	10
		2141439	08/22/1990	1	<	10
		2248602	08/21/1990	1	<	10
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2141406	08/23/1990	1	>	20
		2141417	08/21/1990	1	>	20
		2141437	08/21/1990	1	>	20
		2141438	08/22/1990	1	>	20
		2141439	08/22/1990	1	>	20
		2141439	08/22/1990	1	>	20

## MINOR INORGANIC ELEMENT REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01030	CHROMIUM, DISSOLVED (UG/L AS CR)	2248602	08/21/1990	1	<	20
01040	COPPER, DISSOLVED (UG/L AS CU)	2141406	08/23/1990	1	<	20
		2141417	08/21/1990	1	<	20
		2141437	08/21/1990	1	<	20
		2141438	08/22/1990	1	<	20
		2141439	08/22/1990	1	<	20
		2248602	08/21/1990	1	<	20
01046	IRON, DISSOLVED (UG/L AS FE)	2141406	08/23/1990	1		23
		2141417	08/21/1990	1		22
		2141437	08/21/1990	1		48
		2141438	08/22/1990	1		40
		2141439	08/22/1990	1		43
		2248602	08/21/1990	1		25
01049	LEAD, DISSOLVED (UG/L AS PB)	2141406	08/23/1990	1	<	50
		2141417	08/21/1990	1	<	50
		2141437	08/21/1990	1	<	50
		2141438	08/22/1990	1	<	50
		2141439	08/22/1990	1	<	50
		2248602	08/21/1990	1	<	50
01056	MANGANESE, DISSOLVED (UG/L AS MN)	2141406	08/23/1990	1	<	20
		2141417	08/21/1990	1	<	20
		2141437	08/21/1990	1	<	20
		2141438	08/22/1990	1	<	20
		2141439	08/22/1990	1	<	20
		2248602	08/21/1990	1		49
01062	MOLYBDENUM, DISSOLVED (UG/L AS MO)	2141406	08/23/1990	1	<	20
		2141417	08/21/1990	1	<	20
		2141437	08/21/1990	1	<	20
		2141438	08/22/1990	1	<	20
		2141439	08/22/1990	1	<	20
		2248602	08/21/1990	1	<	20

MINOR INORGANIC ELEMENT REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01075	SILVER, DISSOLVED (UG/L AS AG)	2141406	08/23/1990	1	<	10
		2141417	08/21/1990	1	<	10
		2141437	08/21/1990	1	<	10
		2141438	08/22/1990	1	<	10
		2141439	08/22/1990	1	<	10
		2248602	08/21/1990	1	<	10
01080	STRONTIUM, DISSOLVED (UG/L AS SR)	2141406	08/23/1990	1		1750
		2141417	08/21/1990	1		2610
		2141437	08/21/1990	1		9160
		2141438	08/22/1990	1		9060
		2141439	08/22/1990	1		5730
		2248602	08/21/1990	1		3300
01085	VANADIUM, DISSOLVED (UG/L AS V)	2141406	08/23/1990	1	<	20
		2141417	08/21/1990	1	<	20
		2141437	08/21/1990	1		24
		2141438	08/22/1990	1		20
		2141439	08/22/1990	1	<	20
		2248602	08/21/1990	1	<	20
01090	ZINC, DISSOLVED (UG/L AS ZN)	2141406	08/23/1990	1		100
		2141417	08/21/1990	1		100
		2141437	08/21/1990	1		112
		2141438	08/22/1990	1	>	20
		2141439	08/22/1990	1		91
		2248602	08/21/1990	1	<	20
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	2141406	08/23/1990	1	>	50
		2141417	08/21/1990	1	>	50
		2141437	08/21/1990	1	>	50
		2141438	08/22/1990	1	>	50
		2141439	08/22/1990	1	>	50
		2248602	08/21/1990	1	>	50

## MINOR INORGANIC ELEMENT REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
01145	SELENIUM, DISSOLVED (UG/L AS SE)	2141406	08/23/1990	1		6
		2141417	08/21/1990	1	<	2
		2141437	08/21/1990	1	<	2
		2141438	08/22/1990	1	<	2
		2141439	08/22/1990	1		2
		2248602	08/21/1990	1		6
71865	IODIDE (MG/L AS I)	2141406	08/23/1990	1	<	0.1
		2141417	08/21/1990	1	<	0.1
		2141437	08/21/1990	1	<	0.1
		2141438	08/22/1990	1	<	0.1
		2141439	08/22/1990	1	<	0.1
		2248602	08/21/1990	1	<	0.1
71870	BROMIDE, DISSOLVED, (MG/L AS BR)	2141406	08/23/1990	1		0.73
		2141417	08/21/1990	1		1.10
		2141437	08/21/1990	1		2.61
		2141438	08/22/1990	1		2.31
		2141439	08/22/1990	1		2.00
		2248602	08/21/1990	1		2.28
71890	MERCURY, DISSOLVED (UG/L AS HG)	2141406	08/23/1990	1	<	0.2
		2141417	08/21/1990	1	<	0.2
		2141437	08/21/1990	1	<	0.2
		2141438	08/22/1990	1	<	0.2
		2141439	08/22/1990	1	<	0.2
		2248602	08/21/1990	1	<	0.2

## Appendix IV

# Nutrients Sample Report



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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

NUTRIENT SAMPLE REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00608	NITROGEN, AMMONIA, DISSOLVED (MG/L AS N)	2141407	08/22/1990	1	<	0.02
		2141413	08/23/1990	1	<	0.02
		2141416	08/27/1990	1		0.02
		2141430	08/27/1990	1	<	0.02
		2141440	08/23/1990	1	<	0.02
		2141441	08/21/1990	1	<	0.02
		2141711	08/23/1990	1	<	0.02
00613	NITRITE NITROGEN, DISSOLVED (MG/L AS N)	2141407	08/22/1990	1	<	0.01
		2141413	08/23/1990	1	<	0.01
		2141416	08/27/1990	1	<	0.01
		2141430	08/27/1990	1	<	0.01
		2141440	08/23/1990	1	<	0.01
		2141441	08/21/1990	1	<	0.01
		2141711	08/23/1990	1	<	0.01
00618	NITRATE NITROGEN, DISSOLVED (MG/L AS N)	2141407	08/22/1990	1		15.90
		2141413	08/23/1990	1		22.79
		2141416	08/27/1990	1		8.53
		2141430	08/27/1990	1		7.77
		2141440	08/23/1990	1		8.01
		2141441	08/21/1990	1		6.89
		2141711	08/23/1990	1		18.65
00623	NITROGEN, KJELDAHL, DISSOLVED (MG/L AS N)	2141407	08/22/1990	1		0.2
		2141413	08/23/1990	1		0.4
		2141416	08/27/1990	1		0.2
		2141430	08/27/1990	1		0.2
		2141440	08/23/1990	1		0.2
		2141441	08/21/1990	1		0.2
		2141711	08/23/1990	1		0.4
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2141407	08/22/1990	1		0.01

## NUTRIENT SAMPLE REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2141413	08/23/1990	1		0.02
		2141416	08/27/1990	1	>	0.01
		2141430	08/27/1990	1		0.01
		2141440	08/23/1990	1		0.01
		2141441	08/21/1990	1		0.02
		2141711	08/23/1990	1		0.05



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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

NUTRIENT SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00608	NITROGEN, AMMONIA, DISSOLVED (MG/L AS N)	2134102	08/21/1990	1		0.02
		2134103	08/22/1990	1	<	0.02
		2134104	08/21/1990	1	<	0.02
		2134206	08/23/1990	1		0.02
		2134213	08/21/1990	1	<	0.02
		2134224	08/23/1990	1		0.51
		2134225	08/23/1990	1	<	0.02
		2134226	08/23/1990	1	<	0.02
		2134227	08/23/1990	1	<	0.02
		2134306	08/21/1990	1	<	0.02
		2134402	08/27/1990	1	<	0.02
		2134403	08/27/1990	1	<	0.02
		2134411	08/22/1990	1	<	0.02
		2134443	08/28/1990	1	<	0.02
		2134446	08/28/1990	1		0.02
		2134513	08/21/1990	1	<	0.02
		2134516	08/21/1990	1	<	0.02
		2134522	08/21/1990	1	<	0.02
		2134527	08/22/1990	1	<	0.02
		2134532	08/21/1990	1	<	0.02
		2134547	08/22/1990	1	<	0.02
		2134548	08/21/1990	1	<	0.02
		2134549	08/22/1990	1		0.02
		2134550	08/22/1990	1	>	0.02
		2134646	08/22/1990	1	>	0.02
		2134647	08/22/1990	1	>	0.02
		2134648	08/21/1990	1		0.02
		2134649	08/28/1990	1	>	0.02
		2134729	08/28/1990	1		0.03
		2134801	08/28/1990	1	>	0.02
		2134831	08/28/1990	1	>	0.02
		2134834	08/28/1990	1		0.02
		2134854	08/28/1990	1	>	0.02

NUTRIENT SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00613	NITRITE NITROGEN, DISSOLVED (MG/L AS N)	2134102	08/21/1990	1	<	0.01
		2134103	08/22/1990	1	<	0.01
		2134104	08/21/1990	1	<	0.01
		2134206	08/23/1990	1		0.01
		2134213	08/21/1990	1		0.01
		2134224	08/23/1990	1		0.49
		2134225	08/23/1990	1	<	0.01
		2134226	08/23/1990	1		0.01
		2134227	08/23/1990	1	<	0.01
		2134306	08/21/1990	1		0.01
		2134402	08/27/1990	1	<	0.01
		2134403	08/27/1990	1	<	0.01
		2134411	08/22/1990	1		0.01
		2134443	08/28/1990	1	<	0.01
		2134446	08/28/1990	1	<	0.01
		2134513	08/21/1990	1		0.01
		2134516	08/21/1990	1		0.01
		2134522	08/21/1990	1	<	0.01
		2134527	08/22/1990	1	<	0.01
		2134532	08/21/1990	1		0.01
		2134547	08/22/1990	1	<	0.01
		2134548	08/21/1990	1	<	0.01
		2134549	08/22/1990	1		0.01
		2134550	08/22/1990	1	<	0.01
		2134646	08/22/1990	1		0.01
		2134647	08/22/1990	1		0.01
		2134648	08/21/1990	1		0.05
		2134649	08/28/1990	1	<	0.01
		2134729	08/28/1990	1	<	0.01
		2134801	08/28/1990	1	<	0.01
		2134831	08/28/1990	1	<	0.01
		2134834	08/28/1990	1	<	0.01
2134854	08/28/1990	1	<	0.01		
00618	NITRATE NITROGEN, DISSOLVED (MG/L AS N)	2134102	08/21/1990	1		22.62

NUTRIENT SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00618	NITRATE NITROGEN, DISSOLVED (MG/L AS N)	2134103	08/22/1990	1		17.19
		2134104	08/21/1990	1		25.70
		2134206	08/23/1990	1		18.97
		2134213	08/21/1990	1		18.02
		2134224	08/23/1990	1		13.34
		2134225	08/23/1990	1		15.74
		2134226	08/23/1990	1		8.84
		2134227	08/23/1990	1		11.42
		2134306	08/21/1990	1		8.25
		2134402	08/27/1990	1		14.95
		2134403	08/27/1990	1		15.40
		2134411	08/22/1990	1		22.78
		2134443	08/28/1990	1		18.20
		2134446	08/28/1990	1		13.66
		2134513	08/21/1990	1		38.86
		2134516	08/21/1990	1		21.10
		2134522	08/21/1990	1		25.59
		2134527	08/22/1990	1		17.02
		2134532	08/21/1990	1		22.22
		2134547	08/22/1990	1		15.90
		2134548	08/21/1990	1		16.74
		2134549	08/22/1990	1		7.72
		2134550	08/22/1990	1		21.22
		2134646	08/22/1990	1		3.32
		2134647	08/22/1990	1		1.03
		2134648	08/21/1990	1		21.23
		2134649	08/28/1990	1		11.54
		2134729	08/28/1990	1		32.20
2134801	08/28/1990	1		11.76		
2134831	08/28/1990	1		16.41		
2134834	08/28/1990	1		14.22		
2134854	08/28/1990	1		13.56		
00623	NITROGEN, KJELDAHL, DISSOLVED (MG/L AS N)	2134102	08/21/1990	1		0.3
		2134103	08/22/1990	1		0.4
		2134104	08/21/1990	1		0.3

NUTRIENT SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE	
00623	NITROGEN, KJELDAHL, DISSOLVED (MG/L AS N)	2134206	08/23/1990	1		0.3	
		2134213	08/21/1990	1		0.4	
		2134224	08/23/1990	1		1.0	
		2134225	08/23/1990	1		0.2	
		2134226	08/23/1990	1		0.3	
		2134227	08/23/1990	1		0.4	
		2134306	08/21/1990	1		0.1	
		2134402	08/27/1990	1		0.3	
		2134403	08/27/1990	1		0.3	
		2134411	08/22/1990	1		0.1	
		2134443	08/28/1990	1		0.7	
		2134446	08/28/1990	1		0.3	
		2134513	08/21/1990	1		0.3	
		2134516	08/21/1990	1		0.5	
		2134522	08/21/1990	1		0.4	
		2134527	08/22/1990	1		0.1	
		2134532	08/21/1990	1		0.3	
		2134547	08/22/1990	1		0.3	
		2134548	08/21/1990	1		0.1	
		2134549	08/22/1990	1		0.3	
		2134550	08/22/1990	1		0.3	
		2134646	08/22/1990	1		<	0.1
		2134647	08/22/1990	1			0.1
		2134648	08/21/1990	1			0.6
		2134649	08/28/1990	1			0.1
		2134729	08/28/1990	1			1.0
		2134801	08/28/1990	1			0.2
		2134831	08/28/1990	1			0.2
		2134834	08/28/1990	1			0.2
		2134854	08/28/1990	1			0.1
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2134102	08/21/1990	1		0.02	
		2134103	08/22/1990	1		<	0.01
		2134104	08/21/1990	1			0.01
		2134206	08/23/1990	1			0.02
		2134213	08/21/1990	1			0.01

NUTRIENT SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2134224	08/23/1990	1		0.02
		2134225	08/23/1990	1		0.02
		2134226	08/23/1990	1		0.02
		2134227	08/23/1990	1		0.02
		2134306	08/21/1990	1		0.02
		2134402	08/27/1990	1	<	0.01
		2134403	08/27/1990	1	<	0.01
		2134411	08/22/1990	1		0.01
		2134443	08/28/1990	1	<	0.01
		2134446	08/28/1990	1		0.01
		2134513	08/21/1990	1		0.01
		2134516	08/21/1990	1		0.01
		2134522	08/21/1990	1		0.02
		2134527	08/22/1990	1	<	0.01
		2134532	08/21/1990	1		0.02
		2134547	08/22/1990	1		0.01
		2134548	08/21/1990	1		0.01
		2134549	08/22/1990	1		0.01
		2134550	08/22/1990	1		0.01
		2134646	08/22/1990	1		0.01
		2134647	08/22/1990	1		0.01
		2134648	08/21/1990	1	>	0.01
		2134649	08/28/1990	1		0.05
		2134729	08/28/1990	1		0.01
		2134801	08/28/1990	1	>	0.01
		2134831	08/28/1990	1		0.01
		2134834	08/28/1990	1		0.01
		2134854	08/28/1990	1		0.01

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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

NUTRIENT SAMPLE REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00608	NITROGEN, AMMONIA, DISSOLVED (MG/L AS N)	2141406	08/23/1990	1	<	0.02
		2141417	08/21/1990	1	<	0.02
		2141427	08/23/1990	1	<	0.02
		2141437	08/21/1990	1		0.03
		2141438	08/22/1990	1	<	0.02
		2141439	08/22/1990	1	<	0.02
		2248602	08/21/1990	1		0.15
00613	NITRITE NITROGEN, DISSOLVED (MG/L AS N)	2141406	08/23/1990	1	<	0.01
		2141417	08/21/1990	1	<	0.01
		2141427	08/23/1990	1	<	0.01
		2141437	08/21/1990	1	<	0.01
		2141438	08/22/1990	1	<	0.01
		2141439	08/22/1990	1	<	0.01
		2248602	08/21/1990	1		0.02
00618	NITRATE NITROGEN, DISSOLVED (MG/L AS N)	2141406	08/23/1990	1		28.00
		2141417	08/21/1990	1		8.23
		2141427	08/23/1990	1		28.00
		2141437	08/21/1990	1		8.40
		2141438	08/22/1990	1		8.96
		2141439	08/22/1990	1		11.20
		2248602	08/21/1990	1		13.59
00623	NITROGEN, KJELDAHL, DISSOLVED (MG/L AS N)	2141406	08/23/1990	1	<	0.1
		2141417	08/21/1990	1		0.6
		2141427	08/23/1990	1	<	0.1
		2141437	08/21/1990	1		0.4
		2141438	08/22/1990	1		0.3
		2141439	08/22/1990	1		0.4
		2248602	08/21/1990	1		1.2
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2141406	08/23/1990	1		0.01

NUTRIENT SAMPLE REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE
00671	PHOSPHORUS, DISSOLVED ORTHOPHOSPHATE (MG/L AS P)	2141417	08/21/1990	1		0.01
		2141427	08/23/1990	1		0.01
		2141437	08/21/1990	1		0.01
		2141438	08/22/1990	1		0.01
		2141439	08/22/1990	1	<	0.01
		2248602	08/21/1990	1		0.19





**Appendix V**  
**Radioactivity Sample Report**



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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RADIOACTIVITY SAMPLE REPORT COUNTY - Haskell

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE	CONFIDENCE +OR-
01503	ALPHA, DISSOLVED, PC/L	2141413	08/23/1990	1		4.5	2.3
		2141711	08/23/1990	1		13	5.0
03503	BETA, DISSOLVED, PC/L	2141413	08/23/1990	1	<	4.0	
		2141711	08/23/1990	1		7.1	4.0
09503	RADIUM 226, DISSOLVED, PC/L	2141413	08/23/1990	1	<	0.2	
		2141711	08/23/1990	1	<	0.2	
81366	RADIUM 228, DISSOLVED (PC/L AS RA-228)	2141413	08/23/1990	1	<	1.0	
		2141711	08/23/1990	1	<	1.0	

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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RADIOACTIVITY SAMPLE REPORT COUNTY - Knox

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE	CONFIDENCE +OR-
01503	ALPHA, DISSOLVED, PC/L	2134104	08/21/1990	1		4.5	2.8
		2134227	08/23/1990	1		10	4.0
		2134306	08/22/1990	1		6.6	2.7
		2134411	08/22/1990	1		6.6	3.0
		2134513	08/21/1990	1		6.6	1.2
03503	BETA, DISSOLVED, PC/L	2134104	08/21/1990	1	<	4.0	
		2134227	08/23/1990	1	<	4.0	
		2134306	08/22/1990	1	<	4.0	
		2134411	08/22/1990	1		4.1	3.5
		2134513	08/21/1990	1	<	12	
09503	RADIUM 226, DISSOLVED, PC/L	2134104	08/21/1990	1		0.5	0.2
		2134227	08/23/1990	1	<	0.2	
		2134306	08/22/1990	1		0.4	0.2
		2134411	08/22/1990	1	<	0.2	
		2134513	08/21/1990	1	<	0.2	
81366	RADIUM 228, DISSOLVED (PC/L AS RA-228)	2134104	08/21/1990	1	<	1.0	
		2134227	08/23/1990	1	<	1.0	
		2134306	08/22/1990	1	<	1.0	
		2134411	08/22/1990	1	<	1.0	
		2134513	08/21/1990	1	<	1.0	

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TEXAS WATER DEVELOPMENT BOARD  
GROUND WATER DATA SYSTEM

RADIOACTIVITY SAMPLE REPORT COUNTY - Stonewall

STORET CODE	DESCRIPTION	STATE WELL NUMBER	DATE	SAMPLE #	FLAG	VALUE	CONFIDENCE +OR-
01503	ALPHA, DISSOLVED, PC/L	2141417	08/21/1990	1		3.9	2.9
03503	BETA, DISSOLVED, PC/L	2141417	08/21/1990	1	<	4.0	
09503	RADIUM 226, DISSOLVED, PC/L	2141417	08/21/1990	1	<	0.2	
81366	RADIUM 228, DISSOLVED (PC/L AS RA-228)	2141417	08/21/1990	1	<	1.0	

