Evaluation of the Hickory Aquifer and Its Relationship to Katemcy Creek and Its Major Tributaries for Beneficial Artificial Recharge, McCulloch and Mason Counties, Texas

Memorandum Report
Prepared by the
Texas Water Development Board
for the
Hickory Underground Water Conservation District No. 1
through TWDB Contract No. 8-REC-003

February, 1988

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Background and Purpose of the Study

The Hickory Underground Water Conservation District No. 1 (HUWCD) has been investigating and considering artificial recharge of the Hickory aquifer within the HUWCD's boundaries for the last several years. Through coordination with the Soil Conservation Service (SCS), the HUWCD tentatively selected a site for a retention-recharge dam and lake on the Clifford Sherwood, Jr., property about 500 feet upstream from Katemcy Creek on a small western flowing tributary (Structure Creek in this report) which enters Katemcy Creek about one (1) mile north of the Katemcy Post Office in northcentral Mason County. The HUWCD intended to construct the dam and lake, release retained water to Katemcy Creek and recharge the Hickory aquifer beneath the stream bed of Katemcy Creek downstream of Structure Creek. Before spending large funds for the construction and monitoring of the Structure Creek retention-recharge dam, the HUWCD desired to know where the recharge waters would go, and if such recharge would be physically beneficial to local and regional Hickory water users. Consequently, the HUWCD asked the Texas Water Development Board (TWDB) to conduct a study of the Katemcy Creek basin to answer these questions and address the same conditions for the entire basin. Since the requested study was directly related to the TWDB's regional study of the Paleozoic aquifers of the Llano Uplift Region, the TWDB agreed to conduct the study. The TWDB and HUWCD initiated a contract (TWDB Contract No. 8-REC-003) in September 1987 to conduct the study. This report is intended as the final product of the agreement.

The purpose of this report is to provide the HUWCD with information 1) on the hydrogeology of the Structure Creek site and its suitability for recharge, 2) on the hydrogeologic relationship of the Hickory aquifer and Katemcy Creek and its major tributaries, and 3) to describe evaluations and concepts and make recommendations on the areas most favorable, sources of suitable waters, and suitable methods for beneficial artificial recharge of the Hickory aquifer within the Katemcy Creek basin.

Artificial recharge is the process of replenishing ground water through man's activities (O'Hare, et al., 1986). The intention of artificial recharge in this report is to determine if additional sources and amounts of water could be beneficially developed and placed into ground-water storage of the Hickory aquifer using an amount of water that would not have otherwise naturally replenished that specific area of aquifer storage. Beneficial artificial recharge for the purpose of this report is intended in a physically practical sense, that is, if the amount of water recharged would appear to hydrologically increase the supply for a significant number of wells or water users, then recharge would be considered physically beneficial. This report does not specifically evaluate and determine the economic benefits of artificial recharge in the Katemcy Creek basin study area.

General Geography, Geology, and Hydrology of the Study Area

The study area covered in this report is the Katemcy Creek basin, which is located in northcentral Mason and southcentral McCulloch Counties. A perspective on the general location and extent of the basin within the State and Mason and McCulloch Counties is shown in Figure 1. The basin has a "water drop" shape, consists of about 45.2 square miles (28,927 acres), and has a maximum north-south length of about 11.5 miles and a maximum east-west width of about 6.5 miles. The lowest land-surface elevation in the basin is about 1,525 feet above mean sea level at the location where Katemcy Creek enters the San Saba River. The approximate highest land-surface elevation of 2,065 feet occurs at two locations on the basin boundary with one located about 3.5 miles southwest of Camp Air and the other located about 4.5 miles southeast of Camp Air. The basin is served by U.S. Highway 87 & 377 and Farm to Market Highway 1222, and includes the communities of Katemcy and Camp Air.

In 1984, sprinkler irrigation, mostly of peanuts and grassland, with Hickory ground water occurred on about 2,318 acres within the basin. Ranching is the other agricultural activity within the basin.

The major streams which drain the basin are Katemcy Creek and its two primary tributaries, Dry Prong Creek and Dry Fork Creek. Drainage in these streams is generally to the north into the San Saba River. Other important streams include Structure Creek and Nobles Creek which are tributaries of Katemcy Creek, and Camp Air Creek which is a tributary of Dry Prong Creek.

The average annual rainfall for the Katemcy Creek basin is about 24.7 inches. The average annual amount of unit runoff for the basin is about 69.8 acre-feet per square mile per year. This unit runoff was determined from two gages on the San Saba River with 71 years of record (Buckner, et al., 1985). Application of this unit runoff to the Katemcy Creek basin indicates that the average annual runoff for the basin is about 3,155 acre-feet per year.

The geological units and faults which occur at the surface within the Katemcy Creek basin are shown on Figure 2. The nomenclature, ages, thicknesses, general lithology, position, and relationships of the geological units at the surface and in the subsurface of the basin are provided in Table 1.

The Katemcy Creek basin has three (3) principal aquifers; namely the Hickory aquifer, the Ellenburger-San Saba aquifer, and the Mid-Cambrian aquifers undifferentiated. The Edwards-Trinity (Plateau) aquifer which occurs in the very upper, southern part of the basin, is not considered a principal aquifer in the basin. These aquifers and related confining beds, their position and relationships, and their water-bearing properties, etc., are described in Table 1.

The most important and only aquifer that will be addressed in this report is the Hickory aquifer. Within the Katemcy Creek basin, the Hickory aquifer is bounded at its base by the confining rocks of the Town Mountain granite, and at its top by the confining limestone and well cemented sandstone of the Cap Mountain limestone (Table 1).

Figure 1 - Location of the Katemcy Creek Basin Study Area in Mason and McCulloch Counties, Texas.

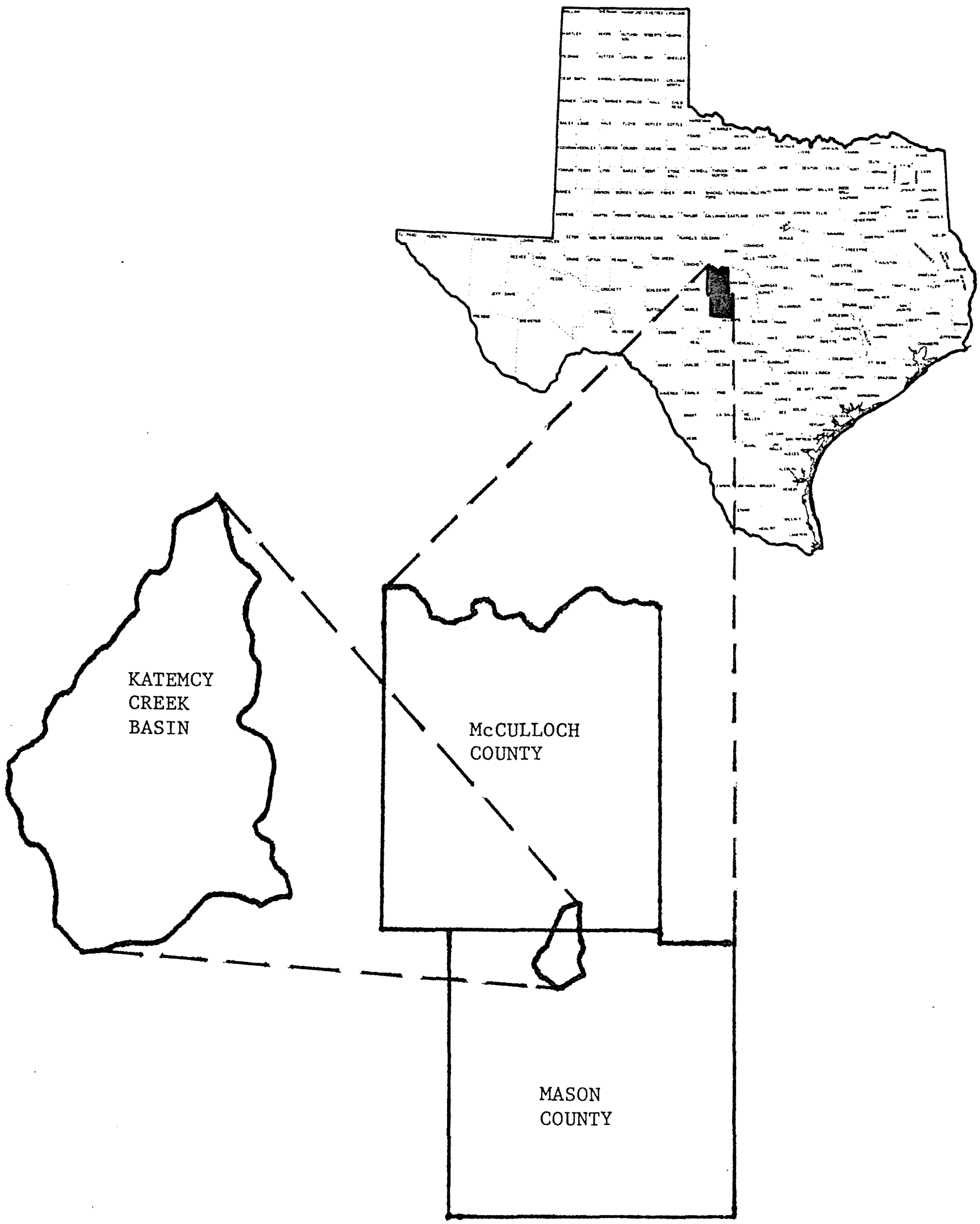


Figure 2 - Geological Map of the Katemcy Creek Basin, Mason and McCulloch Counties, Texas.

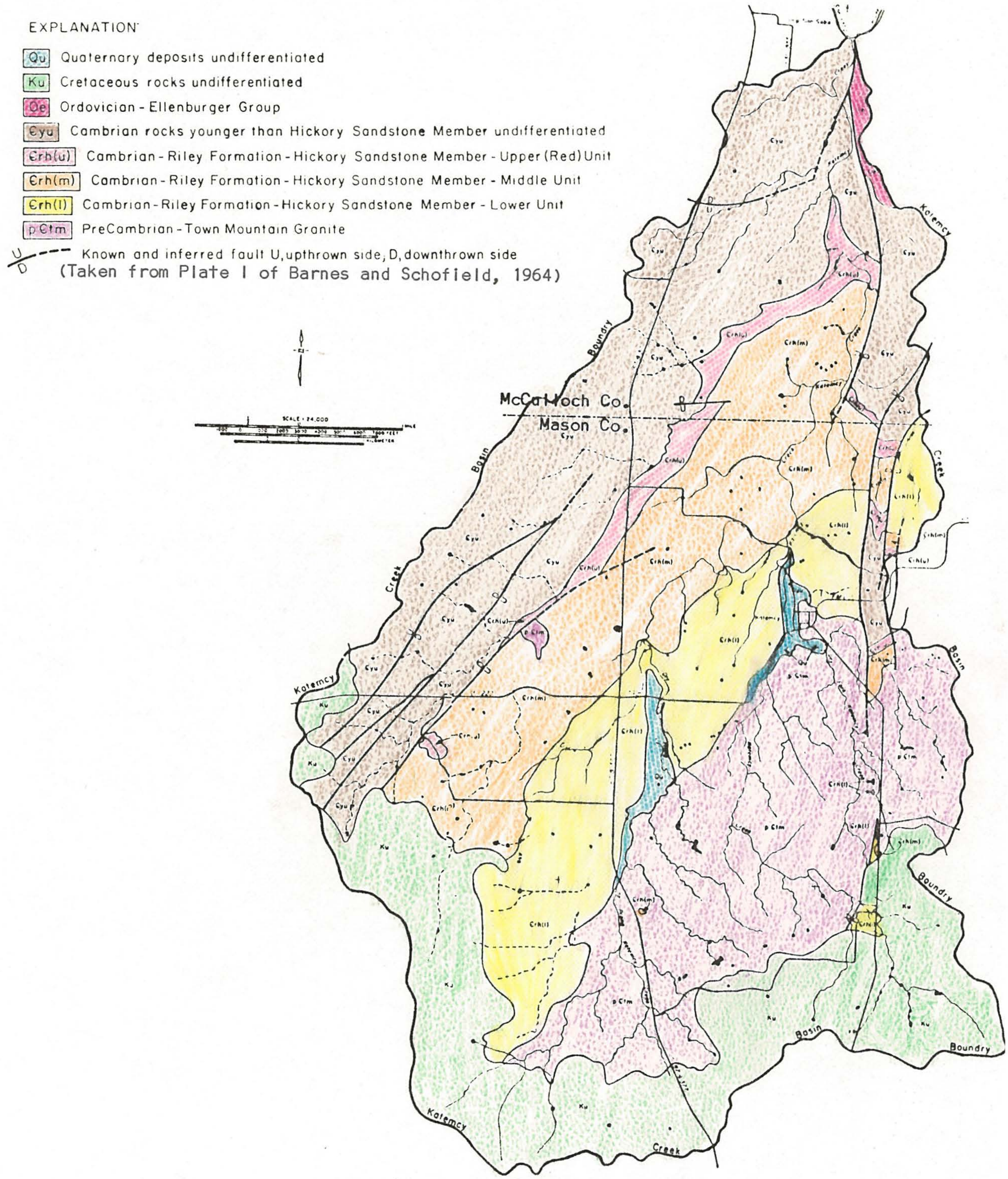


Table 1.--Geological Units and Aquifers in the Katemcy Creek Basin, McCulloch and Mason Counties, Texas.

Geological Units					Range of Total Thickness (Ft.)	General Lithology	Map and Profile Symbol	Aquifers and Confining Beds	Water-Bearing Properties and Remarks
Era	System (Age in Years)	Group	Formation	Member					
Cenozoic	Quaternary (Recent to 1.8 million)	Undifferentiated	Undifferentiated	Undifferentiated	Probably Less Than 30	Terrace Deposits of Gravel, Sand and Clay	Qu	Not Delineated	Probably yields small amounts of water to wells for domestic and livestock purposes in basin. Is hydrologically connected to Hickory Aquifer where it occurs along Katemcy and Dry Prong Creeks within the basin.
Mesozoic	Cretaceous (65 to 140 million)	Fredericksburg and Trinity Groups	Undifferentiated	Undifferentiated	Unknown	Limestone, Dolomite, Sandstone, Sand and Clay	Ku	Edwards-Trinity (Plateau) Aquifer	Probably yields small amounts of water to wells for domestic and livestock purposes in and near basin. "Trinity sands" probably recharge Hickory sandstone in upper (southern) part of basin.
Paleozoic	Ordovician (435 to 500 million)	Ellenburger Group	Gorman and Tanyard Formations	Undifferentiated	949-1,148*	Dolomite and Limestone	Oe	Ellenburger-San Saba Aquifer	Known to yield small amounts of water to wells for livestock purposes and has numerous springs and seeps near the basin.
Paleozoic	Cambrian (500 to 650 million)		Wilberns Formation	San Saba lms.	193-324*	Limestone	Ꞓyu	Ellenburger-San Saba Aquifer	
Paleozoic	Cambrian (500 to 650 million)		Wilberns Formation	Point Peak sh.	25-214*	Siltstone and Shale	Ꞓyu	Confining Bed	Not known to yield water to wells.
Paleozoic	Cambrian (500 to 650 million)		Wilberns Formation	Morgan Creek lms.	113-143*	Limestone	Ꞓyu	Mid-Cambrian Aquifers Undifferentiated	Known to yield small amounts of water to wells for domestic and livestock purposes in and near basin.
Paleozoic	Cambrian (500 to 650 million)		Wilberns Formation	Welge ss.	11-27*	Sandstone	Ꞓyu	Mid-Cambrian Aquifers Undifferentiated	
Paleozoic	Cambrian (500 to 650 million)		Riley Formation	Lion Mountain ss.	29-78*	Sandstone and Limestone	Ꞓyu	Mid-Cambrian Aquifers Undifferentiated	
Paleozoic	Cambrian (500 to 650 million)		Riley Formation	Cap Mountain lms.	165-497*	Limestone and Well Cemented Sandstone	Ꞓyu	Confining Bed	Not known to yield water to wells. May contain lead and zinc minerals.
Paleozoic	Cambrian (500 to 650 million)		Riley Formation	Hickory ss. Upper (Red) Unit	50-90	Iron-Bearing, Cemented Sandstone	Ꞓrh(u)	Hickory Aquifer	Least porous and permeable unit which probably yields small amounts of water to wells. Contains about 10 percent elemental iron.
Paleozoic	Cambrian (500 to 650 million)		Riley Formation	Hickory ss. Middle Unit	200-225	Discontinuous Beds of Slightly Cemented Sandstone, Siltstone, and Claystone	Ꞓrh(m)	Hickory Aquifer	Sandstones are porous and moderately to highly permeable, and probably yield moderate amounts of water to wells. Siltstone and claystone beds act as confining beds.
Paleozoic	Cambrian (500 to 650 million)		Riley Formation	Hickory ss. Lower Unit	75-245	Cross-bedded, Slightly Cemented Sandstone	Ꞓrh(l)	Hickory Aquifer	Most porous and permeable unit which yields most of the water to irrigation wells in the basin. Sandstone is mined in areas northeast of basin for "frac" sand used to enhance the production of oil and gas wells.
Pre-Cambrian	Town Mountain Granite (Over 700 million)				Unknown	Consists of Granite Which is Composed of Feldspar, Biotite, Quartz and Radioactive Minerals	pꞒtm	Confining Bed	Not known to yield water to wells. Radioactive minerals eroded from the granite were redeposited and con- concentrated in the Hickory sandstone and are probably the cause of the Hickory water having high radioactivity (radium).

* Range of thickness taken from Bureau of Economic Geology Report of Investigation No. 53 and represents range in thickness of units on the northwestern flank of the Llano Uplift.

Locally, major faults within the basin act as totally or partially confining lateral boundaries of the Hickory aquifer, and more or less laterally compartmentalize the aquifer within the basin. Four (4) local fault systems or faults which do this are shown on Figure 2. The western fault system consists of four (4) major northeast-southwest striking faults which intersect Highway 1222 in an area about 1.5 to 2.5 miles west of Camp Air. An eastern fault system consisting of two (2) main faults (forming a graben or downthrown block) striking generally north-south occurs across Highway 1222 near and just outside the eastern basin boundary. Another eastern fault which generally strikes north-south occurs from about the McCulloch-Mason county line to the mouth of Katemcy Creek at the San Saba River. A fourth fault, which generally strikes west to east and then north to south, occurs in and west (outside) of the northern portion of the basin, crossing Highways 87 and 377 at the western basin boundary about one (1) mile north of the McCulloch-Mason County Line.

Within the Katemcy Creek basin, the Hickory sandstone has an outcrop area at the land surface of about 17.0 square miles (10,850 acres). The Hickory sandstone can be subdivided into three (3) units as described in Table 1 (Barnes and Schofield, 1964). The lower unit is the most porous and permeable, while the upper (red) unit is the least porous and permeable.

Natural recharge enters the Hickory aquifer by direct infiltration of rainfall on the outcrop and by infiltration of runoff in the floodplain and channels of Katemcy Creek and Dry Prong Creek and their tributaries where the creeks and tributaries cross the outcrop of the Hickory sandstone. The amount of annual natural recharge to the Hickory aquifer from rainfall and runoff in the Katemcy Creek basin is probably about 2,200 to 2,400 acre-feet per year.

The direction of ground-water flow is generally from areas of recharge to areas of discharge. The main general direction of flow in the Hickory aquifer in the Katemcy Creek basin is from north to south in a direction which generally parallels the outcrop of the Hickory sandstone and the surface drainage in the basin. Under current hydraulic gradients within the aquifer, the velocity or rate of ground-water movement probably ranges from about 107 to 439 feet per year. These directions and velocities of flow are altered considerably when local hydraulic gradients are influenced and changed by pumpage, particularly by pumpage from irrigation wells. Also, the directions and velocities of flow within the aquifer are altered naturally by 1) abrupt changes of relief at the base of the aquifer represented by buried, high relief, upward protruding "granite hills," 2) faults which disrupt the Hickory sandstone (especially the four local fault systems and faults previously mentioned), and 3) the large variances of porosity and vertical and horizontal permeability of the Hickory sandstone; even within the lower unit which is considered the most porous and permeable.

Ground-water discharges naturally from the Hickory aquifer within the Katemcy Creek basin by seeps and springs, as baseflow to Katemcy Creek, and by evapotranspiration mostly along the banks of Katemcy Creek where the roots of vegetation (trees and shrubs, etc.) have reached the water table. Currently, most of the natural ground-water discharge from the aquifer occurs in and near Katemcy Creek in the McCulloch County portion of the basin (Figure 2).

Before irrigation development in the basin, recharge entered the aquifer in the outcrop of the Hickory sandstone, ground water moved generally north and discharged by evapotranspiration, springs, seeps and into Katemcy Creek as baseflow in an area of the creek that probably had a beginning at or near the community of Katemcy in Mason County. Since irrigation development began in the late 1940's, water levels in the Hickory aquifer have significantly declined; probably as much as 20 feet (totally) in many areas of the water-table condition portion of the aquifer. This gradual removal of water from water-table storage has caused the location of the beginning of baseflow to Katemcy Creek to migrate northward (downstream) to the current location about one (1) mile north of the McCulloch-Mason County Line.

Ground water is discharged from the Hickory aquifer by wells. In 1984, within the Katemcy Creek basin, approximately 4,046 acre-feet of ground water was withdrawn by wells from the Hickory aquifer. Approximately 99 percent or 4,010 acre-feet of this withdrawal was for irrigation purposes. The small remaining amount, one (1) percent or 36 acre-feet, was pumped for domestic and livestock purposes. Based on irrigation inventories conducted by the SCS and TWDB and on TWDB water use estimates for planning purposes, the approximate average annual pumpage by Hickory wells within the Katemcy Creek basin from 1947 to 1987 is estimated to be about 2,750 acre-feet per year. Therefore, the total amount of pumpage for the 40-year period was probably about 110,000 acre-feet.

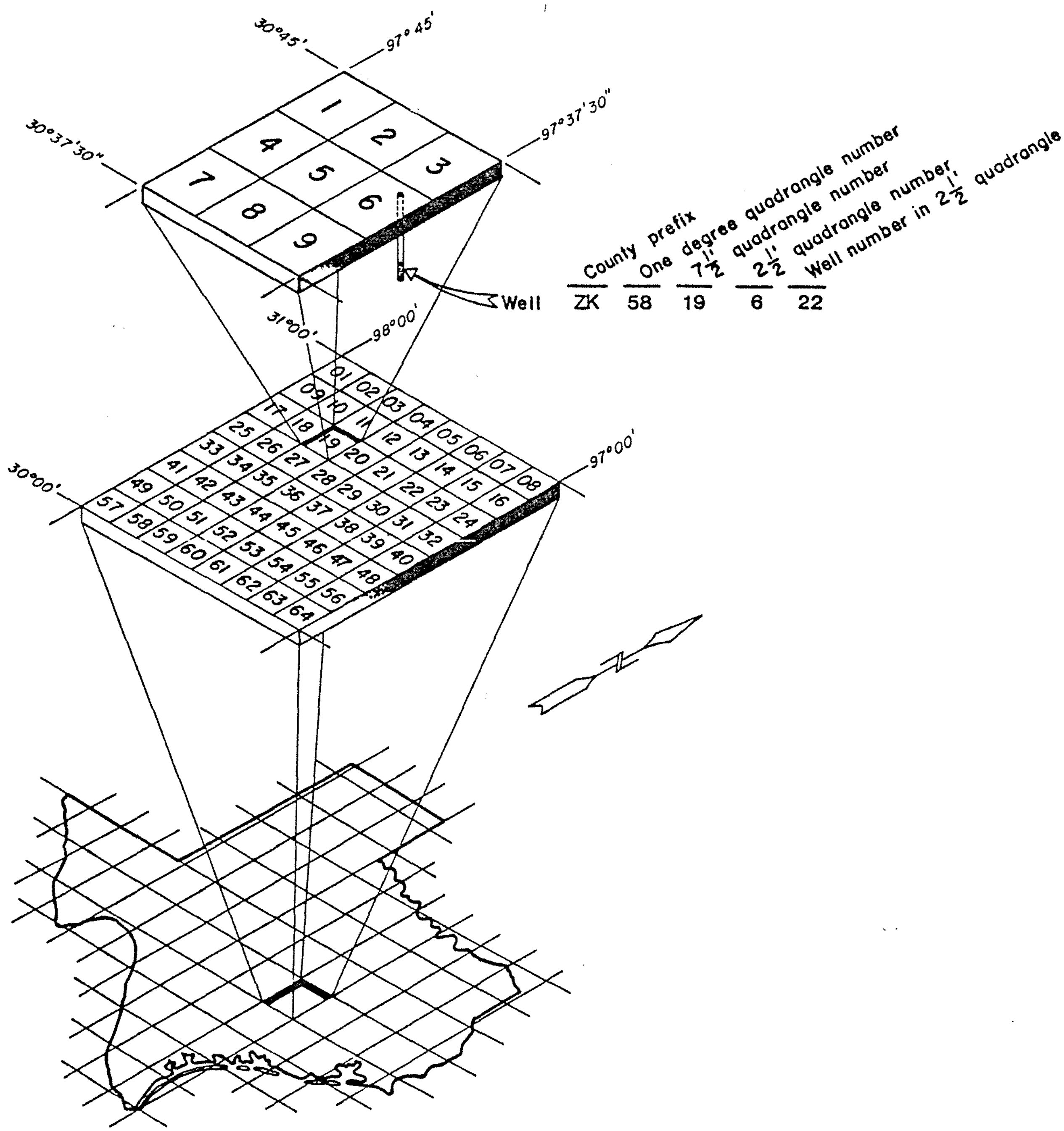
In the winter-spring of 1987, approximately 271,800 acre-feet of ground water was in water-table storage in the Hickory aquifer within the Katemcy Creek basin. Based on an approximate net water-table decline of 0.5 feet per year, about 26,850 acre-feet of water has been removed from water-table storage in the Hickory aquifer within the basin in the last 40 years (water-table storage was probably about 298,650 acre-feet in 1947). Therefore, about 670 acre-feet of ground water probably has been removed on an average annual basis from the aquifer within the Katemcy Creek Basin.

Basic Data Collection Program

The well-numbering system (location number) that is used in this report (Figure 3) for the identification of wells and springs was developed by the Texas Water Development Board for use throughout the State. It is based on latitude and longitude and consists of a two-letter county-designation prefix plus a seven-digit well number. The two-letter prefix for McCulloch County is SS, and for Mason County the prefix is SZ.

Each one-degree quadrangle in the State is given a number consisting of two digits from 01 through 89. These are the first two digits of the well number. Each one-degree quadrangle is divided into 7 1/2-minute quadrangles which are given two-digit numbers from 01 through 64. These are the third and fourth digits of the well number. Each 7 1/2-minute quadrangle is divided into 2 1/2-minute quadrangles which are given a single-digit number from 1 through 9. This is the fifth digit of the well number. Each well or spring that is located within a 2 1/2-minute quadrangle is given a two-digit number beginning with 01. These are the last two digits of the well number and the well-numbering system.

Figure 3 .--Explanation of State Well Numbering System



Only the last three digits of the well numbering system are shown as the location number for each of the wells and springs located on the well and spring location map of this report (Figure 4). The first four digits of the well-numbering system are shown in larger numbers near the grid-line boundary of each 7 1/2-minute quadrangle on the well and spring location map (Figure 4). For example, a well that is numbered as well SS-56-06-601 is shown on Figure 4 with the number 601 beside the well symbol in the 7 1/2-minute quadrangle with the number 56-06.

To help characterize the ground-water conditions within the Katemcy Creek basin and to accurately make reasonable evaluations for this report, it was necessary to collect and compile the following basic hydrogeologic field data which was collected from January 1987 to September 1987.

1. Scheduled and inventoried 214 wells and springs which consist of 89 irrigation wells, 71 domestic and/or livestock wells, three (3) TWDB test hole-monitor wells, 46 abandoned wells and five (5) springs. This information is presented in Table 2 (located after "Selected References" section of this report) as records of wells and springs. Locations of the wells and springs are presented on Figure 4 (in Packet).

2. Measured water levels in 167 of the above wells in the winter-spring of 1987. Historical water-level measurements were also collected and compiled from TWDB files, which included one well having a continuous water-level recorder. This information is presented in Table 2 and Table 3 (located after "Selected References" section and following Table 2 of this report), and on Figures 5 and 6 (in Packet).

3. Collected and analyzed 110 water samples from wells and springs. This included 49 samples to determine the concentrations of routine chemical constituents, 28 samples to determine iron content, and 33 samples to determine selected radionuclides (gross alpha, radium 226 and radium 228). Historical chemical analyses of ground waters were also obtained and compiled from TWDB files. This information is presented in Tables 4 and 6 (located after "Selected References" section and following Table 3 and Table 5 of this report), and on Figure 12 (in Packet).

4. Collected and analyzed 29 water samples from sample sites along Katemcy Creek. This included 15 samples to determine routine chemical constituents, seven (7) samples to determine iron content, and seven (7) samples to determine selected radionuclides (gross alpha, radium 226 and radium 228). This information is presented in Tables 5 and 6 (located after "Selected References" section and following Table 4 of this report), and on Figure 12 (in Packet).

5. Measured field conductivity and temperature of water from four (4) wells and 12 sites on Katemcy Creek. This information is presented in Tables 4 and 5 (located after "Selected References" section and following Table 3 of this report), and on Figure 12 (in Packet).

6. Borehole geophysical logs were obtained with the TWDB's Logging Unit from six (6) wells in and near the Katemcy Creek basin.

7. Core description logs and laboratory tests on the cores taken in 1974 from three (3) TWDB test hole-monitor wells were collected from TWDB files.

Data on ground-water pumpage, ground-water recharge, irrigated acres, and irrigated crops were obtained from TWDB water planning files. The base map for this report consists of parts of four (4) USGS 7 1/2-minute quadrangle maps consisting of the Katemcy, the Spyrock, the Grit, and the Purdy Hill quadrangles. The geology shown on Figure 2 and other maps in this report was taken from Plate I of Bureau of Economic Geology Report of Investigation No. 53 (Barnes and Schofield, 1964).

The authors wish to thank the irrigation farmers, ranchers, and other landowners in and near the Katemcy Creek basin in McCulloch and Mason Counties for their valuable cooperation during the collection of field data from January 1987 to September 1987. Special thanks is extended to the Manager and Board of Directors of the Hickory Underground Water Conservation District No. 1, and to Mrs. Marie Brook, Mr. Clifford Sherwood, Jr., Mr. Vernon Nobles, Mr. Jerry Kruse, Mr. Jerry Gamel, Mr. Phil White, and Mr. Gene Kidd for their extra efforts, cooperation, and guidance during the fieldwork phase of this investigation. Also, special thanks is extended to personnel of the U.S. Department of Agriculture's, SCS offices in Brady and Mason for their help in locating landowners in and near the Katemcy Creek basin. Special thanks is also extended to Mr. Ridge Kaiser, of R.W. Harden and Associates, for his valuable help and guidance during this investigation.

Evaluations of the Hydrogeological Conditions in the Katemcy Creek Basin

The elevations of the water levels of the Hickory aquifer within the Katemcy Creek basin range from about 1,568 feet above mean sea level in the area where Katemcy Creek enters the San Saba River to about 1,700 feet above mean sea level in a southern area of the basin about 3.0 miles southwest of Camp Air. The elevations of the Hickory water levels within the basin during the winter-spring of 1987 are shown on Figure 5 (in Packet). Water-level contours and related control on Figure 5 were used to determine 1) the direction of ground-water flow within the Hickory aquifer (direction of flow is assumed to be perpendicular to contours as indicated by arrows on Figure 13-in packet), 2) where the Hickory aquifer is discharging to Katemcy Creek in the northern portion of the basin in McCulloch County (indicated on Figure 13-in Packet), and 3) the depths to the Hickory water table below the stream beds of Katemcy Creek and its tributaries (indicated on Figure 13-in Packet). Evaluation of the water-level elevations on Figure 5 (in Packet) were used for gaining a hydrogeological perspective for determination of the areas where the Hickory aquifer is under water-table and artisan conditions, and for selection of areas most and least favorable, sources of water suitable, and methods suitable for beneficial artificial recharge (Figure 13-in Packet).

Figure 6 (in Packet) shows hydrographs of the depths to water below land surface in five (5) selected TWDB observation wells within the Katemcy Creek basin. "Aquifer 100" on each of these hydrographs means that the observation well is completed in the Hickory aquifer. The hydrographs for wells 56-06-610, 56-06-611, 56-06-910, and 56-07-404 generally demonstrate the water-level changes and net water-level declines which have occurred within the water-table condition area of the Hickory aquifer. The hydrograph for well 56-06-614 demonstrates the seasonal water-level fluctuations and the general net water-level decline that has occurred in the artisan condition area of the Hickory aquifer within the basin. The spacing between these wells (Figure 4-in Packet) are such that they demonstrate that water-level declines have been widespread throughout the basin since the early and mid-1970's. Other water-level data in Table 2 from other widely spaced wells within the basin indicate that in the last 40 years the average annual net water-level decline may have been about 0.5 feet per year for a total net decline of about 20 feet in most water-table areas of the aquifer in the basin.

Long-term net water-level declines which have occurred within the Hickory aquifer within the basin are as follows as determined from water-level data in Table 2:

Location Number	Approximate Period of Years	Total Net Decline (Ft.)	Net Annual Decline (Ft.)
56-06-602	1957-1987	14.89	0.50
56-06-603	1957-1987	6.78	0.23
56-06-604	1954-1987	19.94	0.60
56-06-605	1957-1987	15.60	0.52
56-06-606	1958-1987	9.90	0.34
56-06-607	1958-1987	18.17	0.63
56-06-608	1957-1987	16.73	0.56
56-06-610	1957-1987	4.60	0.15
56-06-802	1959-1987	13.80	0.49
56-06-805	1958-1987	15.25	0.53
56-06-902	1956-1987	28.90	0.93
56-06-903	1946-1987	25.56	0.62
56-06-904	1947-1987	26.82	0.67
56-06-906	1956-1987	8.70	0.28
56-06-907	1956-1987	15.75	0.51

Note: The average net annual decline is about 0.50 feet per year. However, since 1946-47, the net annual decline may be about 0.1 foot per year greater as indicated by wells 56-06-903 and 904 above.

Figure 7 (in Packet) provides a general perspective on the elevation of the base of the Hickory aquifer within the Katemcy Creek basin. This map was constructed from limited available data. The elevation of the base of the aquifer was determined from available drillers logs and estimates of well depth and depth to top of the granite provided by well owners and users. Figure 7 (in Packet) adequately demonstrates the highly irregular relief on the Precambrian granite surface which significantly affects the direction and velocity of ground-water flow and the saturated thickness of the Hickory aquifer. Two significant "granite highs" are indicated on Figure 7 (in Packet). The most significant one occurs around the granit outcrop (p€tm on Figure 7) about one (1) mile northwest of Camp Air. This "granite high" has about 255 feet of relief. The other significant "granite high" occurs in the subsurface beneath an area about two (2) miles north-northeast of Camp Air. This "granite high" has about 50 to 160 feet of relief.

Figure 8 (in Packet) shows the approximate saturated thickness of the water-table condition area of the Hickory aquifer within the basin. This map was constructed by overlaying Figure 5 (water-level map in Packet) and Figure 7 (base of aquifer map in Packet), marking the intersection of the contours on Figures 5 and 7, locating and labeling wells having water levels and base of aquifer, and then contouring the saturated thickness. Figure 8 (in Packet) was used to calculate the amount of water in water-table storage in the Hickory aquifer within the Katemcy Creek basin. Calculations determined that in the winter-spring of 1987, approximately 271,800 acre-feet of ground water was in water-table storage. Figure 8 (in Packet) can be used to determine the areas most favorable and areas least favorable for future ground-water development in the basin. Areas most favorable for future development are areas which had about 200 to 400 feet of saturated thickness in the winter-spring of 1987.

To obtain another dimensional perspective of the subsurface hydrogeological relationships of the stream bed of the creeks, the land surface, the winter-spring 1987 water level, the base and top of the Hickory aquifer, the three units of the Hickory sandstone, the saturated thickness, and the position and effects of faults within the Katemcy Creek basin, five (5) subsurface hydrogeological profiles were constructed using information from the area's four 7 1/2-minute topographical maps, and Figure 5, 7, and 8 (in Packet). These hydrogeological profiles are presented on Figures 9, 10, and 11 (in Packet).

Profile A-A' (Figure 9-in Packet) is a side view (looking west) of the subsurface beneath the stream beds of Dry Prong Creek and Katemcy Creek from the headwaters of Dry Prong Creek to the point where Katemcy Creek enters the San Saba River (see inset map on Figure 9). This profile is oriented generally north-south and parallels the general direction of flow of ground water in the Hickory aquifer within the basin. The profile clearly shows: 1) the depths to water below the stream beds, particularly in an area most favorable for beneficial artificial recharge on Dry Prong Creek, 2) the elevation where the water-table intersects the Katemcy Creek stream bed (at Katemcy Creek site SS-KCS-7), 3) the area where the Hickory aquifer is discharging to Katemcy Creek in the water-table condition area (outcrop) of the aquifer, and 4) the area further downstream where the aquifer is discharging under artisan conditions to seeps and springs and to Katemcy Creek through the Wawbansee Springs Fault and its related fracture system. Profile A-A' shows the relationship and position of the Hickory sandstone and its lower, middle, and upper units and the relationship and position of the Hickory aquifer and its confining beds; namely, the Pre-cambrian Town Mountain granite (p€tm) at the base of the aquifer and the Cap Mountain limestone and other younger Cambrian rocks (€yu) at the top of the aquifer. One thing that really stands out on Profile A-A' is the great relief on the Precambrian granite surface; especially beneath the locations of Katemcy Creek sites SS-KCS-4 and 5 and the site of the proposed retention dam and lake on the Sherwood property (this is where Structure Creek enters Katemcy Creek from the east). It appears that at this location, the water table and flow of ground water has not only been affected by pumpage, but is also affected by the "granite high." The depths (vertical distance) from faulting has more or less laterally compartmentalized the Hickory aquifer within the Katemcy Creek basin.

The next illustration prepared for evaluation was a map showing the distribution of selected water-quality parameters of ground and surface waters within the basin (Figure 12-in Packet). The map on Figure 12 has a twofold purpose: 1) to verify, by water-quality determinations, the approximate location of the beginning of ground-water discharge of the Hickory aquifer to Katemcy Creek as determined by the approximate intersection of the Hickory water-level elevation and stream bed elevation indicated to be occurring downstream of Katemcy Creek sample site SS-KCS-7 (or KCS-7) on Figures 5 and 9, and 2) to show the distribution of selected chemical constituents and properties of waters from wells, springs, and Katemcy Creek to indicate water-quality problems with Hickory water in the Katemcy Creek basin.

During April 21-23, 1987, seven (7) water sample-analyses were obtained from seven (7) sample sites on Katemcy Creek (Table 5 and Figure 12-in Packet), and two (2) springs and two (2) wells (Table 4 and Figure 12-in Packet) near Katemcy Creek. The results of this April 1987 sample-analyses set are summarized as follows (going downstream):

Location Number on Figure 12 (in Packet)			Taken From Table 4 or Table 5	
Katemcy Creek	Spring	Well	Dissolved Solids (mg/l)	Specific Conductance (Micromhos)
KCS-6	--	--	83	149
KCS-10	--	--	137	243
KCS-12	--	--	185	334
KCS-14	--	--	217	400
--	315	--	361	715
KCS-15	--	--	259	480
--	309	--	398	765
--	--	311	377	740
--	310	--	352	705
KCS-16	--	--	280	528
KCS-17	--	--	233	441
--	--	308	340	661

The summary above indicates the following:

1. Dissolved solids determinations from sites on Katemcy Creek indicate that there was a marked increase of 54 mg/l from sample site KCS-6 to KCS-10. This is an increase of about 90 mg/l per stream mile. This condition indicates that the aquifer was starting to discharge to Katemcy Creek somewhere between sites KCS-6 and KCS-10.

2. Between KCS-10 and KCS-16 there was a more gradual increase of dissolved solids of 143 mg/l or an increase of about 31 mg/l per stream mile. This information indicates that going downstream from KCS-10 there is a

continued increase in dissolved solids due to ground-water discharge to the creek.

3. Dissolved solids concentrations determined from the wells and springs are very similar (spring water averages about 370 mg/l dissolved solids and well water averages about 359 mg/l dissolved solids), and are indicative of the Hickory aquifer discharge water in the lower, northern part of the basin.

4. Spring and well water are not similar to Katemcy Creek water because ground-water discharged to Katemcy Creek was being diluted by "rainwater" which was in "bank" storage and which flowed in and out of the shallow alluvial deposits in the stream channel of Katemcy Creek.

5. Going generally north and downstream on Katemcy Creek, there was a 37 mg/l decrease in the dissolved solids of ground waters from well 311 and well 308. Similarly, there is a 47 mg/l decrease in the dissolved solids of surface waters from Katemcy Creek sample site KCS-16 and KCS-17. This may be a change correlation between change in the ground water flowing in the aquifer with a change in the ground water discharging from the aquifer into Katemcy Creek.

During July 21-24, 1987, seven (7) water sample-analyses were obtained from seven (7) sample sites on Katemcy Creek (Tables 5 and 6, and Figure 12-in Packet) and from one (1) spring and seven (7) wells near Katemcy Creek (Tables 4 and 6, and Figure 12-in Packet). The results of this July 1987 sample-analyses set are summarized as follows (going downstream):

Location Number on Figure 12 (in Packet)			Taken From Table 4, 5, or 6			
Katemcy Creek	Spring	Well	Dissolved Solids (mg/1)	Specific Conductance (Micromhos)	Gross Alpha (pC/1)	Ra226 + Ra228 (pC/1)
--	--	657	262	468	2.1	--
KCS-2	--	--	128	228	<2.0	--
--	--	649	273	468	5.5	4.4
KCS-5	--	--	143	260	<2.0	--
--	--	606	213	380	6.9	6.3
--	--	655	141	238	2.6	--
KCS-6	--	--	116	195	<2.0	--
--	--	418	291	542	8.3	6.6
KCS-12	--	--	268	492	2.1	--
KCS-15	--	--	278	521	5.2	1.8
--	309	--	389	755	6.9	<2.0
--	--	311	381	745	6.6	2.4
KCS-17	--	--	272	518	3.5	--
--	--	308	337	657	13.0	3.1
KCS-18	--	--	269	521	<2.0	--

The summary above indicates the following:

1. Dissolved solids determinations from sites KCS-2 and KCS-5 indicate a slight increase of 15 mg/l which might be indicating some discharge of ground water to Katemcy Creek between sites KCS-2 and KCS-5.

2. Dissolved solids determinations from sites KCS-5 and KCS-6 indicate a slight decrease of 27 mg/l which might be indicating a decrease or lack of ground-water discharge to Katemcy Creek between sites KCS-5 and KCS-6. Ground-water recharge from Katemcy Creek may be indicated by lower dissolved solids at wells 606 and 655 between KCS-5 and KCS-6 as compared to dissolved solids at wells 649 and 657 near sites KCS-2 and KCS-5. Therefore, Katemcy Creek between KCS-2 and KCS-5 may be a gaining stream from ground-water discharge, while Katemcy Creek between KCS-5 and KCS-6 may be a losing stream; consequently recharging the aquifer.

3. Dissolved solids determinations from sites KCS-6 and KCS-12 in July 1987, indicate an increase of 152 mg/l of dissolved solids which is somewhat comparable with the increase of 102 mg/l determined in April 1987 between the same two sites. In July 1987, the increase was about 127 mg/l per stream mile. In April 1987, the increase was about 85 mg/l per stream mile. As in April 1987, this condition indicates that the aquifer is starting to discharge to Katemcy Creek somewhere downstream of site KCS-6 and somewhere upstream of site KCS-12.

4. The gross alpha determinations between site KCS-6 (<2.0 picocuries per liter or pC/l) and KCS-12 (2.1 pC/l) give some support to the beginning of ground-water discharge downstream of KCS-6.

5. The gross alpha determinations between site KCS-12 (2.1 pC/l) and KCS-15 (5.2 pC/l) show a marked increase in gross alpha, and the gross alpha from well 311 (6.6 pC/l) and spring 309 (6.9 pC/l) reasonably correlate with the gross alpha at KCS-15 (5.2 pC/l). KCS-15's gross alpha may be indicative of ground-water discharge entering Katemcy Creek through fractures and small faults associated with the fault paralleling Katemcy Creek on the east and the Wawbansee Springs Fault at spring 309 (Wawbansee Springs, Figure 12-in Packet).

6. The ground-water and surface-water condition changes that were indicated at wells 311 and 308 and sites KCS-16 and KCS-17, respectively, in April 1987 were similarly indicated in July 1987 at wells 311 and 308 and sites KCS-15 and KCS-17, respectively (see No. 5 under the discussion for the April 1987 sample-analyses set).

On September 24, 1987, the field conductivity and temperature of waters were measured at 12 sites on Katemcy Creek and at four wells near Katemcy Creek (Tables 4 and 5, and Figure 12-in Packet). The results of this September 1987 set of data are as follows (going downstream):

Location Number on Figure 12 (in Packet)		Taken From Table 4 or Table 5	
Katemcy Creek	Well	Field Conductivity (Micromhos)	Temperature (F)
KCS-1	--	210	73
KCS-3	--	200	67
--	607	245	68
KCS-5	--	180	72
--	655	230	69
KCS-6	--	115	85
KCS-7	--	305	73
--	418	560	70
KCS-8	--	400	74
KCS-9	--	440	78
KCS-10	--	330	74
KCS-11	--	370	73
KCS-12	--	450	77
KCS-13	--	430	79
KCS-17	--	455	81
--	308	640	70

The summary above indicates that ground-water discharge in September 1987 was beginning to enter Katemcy Creek at site KCS-7 where a small seep was sampled in the stream channel. Site KCS-7 has an elevation of about 1,600 feet which is approximately equal to the water-level elevations of the Hickory aquifer shown on Figures 5 and 9 (in Packet).

Analyses of ground water from Hickory wells and springs (Tables 4 and 6, and Figure 12-in Packet) in the Katemcy Creek basin indicate that the aquifer has water-quality problems with high concentrations of iron, nitrate and total radium (radium 226 + radium 228).

Of 43 samples analyzed for iron (Table 4), 18.6 percent or eight (8) iron analyses exceeded the 0.30 mg/l maximum allowable for iron. The range in iron concentrations for the 43 sample-analyses was <0.02 to 2.90 mg/l. The average iron concentrations for the 43 sample-analyses was 0.23 mg/l. The range in iron concentrations for the eight (8) sample-analyses that exceeded 0.30 mg/l was 0.40 to 2.90 mg/l, and the average was about 0.99 mg/l. The iron content in the Hickory water in the basin is probably mostly derived from the water saturated, iron-bearing, upper unit of the Hickory sandstone. However, iron also maybe derived from iron pipes, pumps, and other well or irrigation equipment. On exposure to air, iron in ground water oxidizes to form a reddish-brown precipitate. Iron concentrations that exceed 0.30 mg/l stain laundry and utensils reddish-brown and are objectionable for food processing, textile processing, making and brewing of beverages, and ice making. The Texas Department of Health 1977 drinking-water standards state that iron should not exceed 0.30 mg/l. Iron concentrations larger than 0.30 mg/l cause unpleasant taste and favor the growth of iron bacteria.

Of 60 samples analyzed for nitrate (Table 4), only 3.3 percent or two (2) nitrate analyses exceeded the 45 mg/l maximum allowable for nitrate. The range in nitrate concentrations for the 60 sample-analyses was 0.04 to 67.34 mg/l. The average nitrate concentrations for the 60 sample-analyses was 16.14 mg/l. Only two (2) sample-analyses exceeded the 45 mg/l allowable for nitrate. These sample-analyses were from well 56-06-920 (67.34 mg/l nitrate) and well 56-07-413 (51.12 mg/l nitrate). However, the Hickory waters within the Katemcy Creek basin seem to have unusually high concentrations of nitrate. Of the 58 sample-analyses that do not exceed the 45 mg/l allowable for nitrate, 34.5 percent or 20 nitrate analyses exceeded the average concentration of 16.14 mg/l. The nitrate content of Hickory ground water is formed from decaying organic matter, sewage, fertilizers and the nitrates in soil and bedrock. Nitrate concentrations much greater than the local average (16.14 mg/l given above) may strongly suggest ground-water pollution. Texas Department of Health 1977 drinking-water standards suggest a limit of 45 mg/l. Waters having high nitrate content have been reported to be the cause of methemoglobinemia which is an often fatal disease in infants, and therefore, such waters should not be used in infant feeding. Nitrate content has been shown to be helpful in reducing intercrystalline cracking of boiler steel. Nitrate content encourages the growth of algae and other organisms which produce undesirable tastes and odors. R.W. Harden and Associates (1978) made a study for the TWDB (then TDWR) of the nitrate pollution of the Seymour aquifer in Haskell and Knox Counties, Texas. The conclusions of this study were that most of the nitrate in the ground water results from leaching of natural soil nitrate due to cultivation at the land surface. This is probably the same cause of unusually high nitrate concentrations in the Hickory ground water within the Katemcy Creek basin.

During July 20-24, 1987, 33 sample-analyses for selected radionuclides were obtained for waters from 32 Hickory wells and one (1) Hickory spring (Table 6) within the Katemcy Creek basin. As indicated in Table 6 and on Figure 12 (in Packet), determinations of gross alpha, radium 226 and radium 228 were made. If the gross alpha content of the water was determined to be greater than 3.5 picocuries per liter (pC/l), the total radium (radium 226 + radium 228) was determined. Total radium was determined in 30 of the 33 samples analyzed for radionuclides. Of the 30 determinations for total radium, 66.6 percent or 20 determinations exceeded the Texas Department of Health and EPA interim primary drinking water standard of 5.0 pC/l for total radium. One source of this high radioactivity of Hickory ground water may be from high concentrations of radioactive minerals derived from the Town Mountain granite (Table 1) and deposited in channel type beds within the lower and/or middle units of the Hickory sandstone. Another source may be from the Town Mountain granite itself which is in contact with the Hickory aquifer at the base of the lower unit of the Hickory sandstone in the Katemcy Creek basin. The radium which is created from radioactive decay of uranium and thorium enters ground water through hydrolysis chemical reactions.

The effects on humans of total radium which exceeds 5.0 pC/l is really not known, Radium in drinking water is known to migrate to human and animal bone. Radioactivity in general causes various genetic effects, leukemia and other types of cancers. Radioactivity from high ionic radiation from radium may cause bone cancer.

Since radium is chemically similar to calcium and barium, the radium content of raw waters can be removed by two basic types of water treatment units. The most common water treatment unit for the home uses an ion exchange method by using zeolite and synthetic resins to exchange sodium for heavy metals (radium included). This ion exchange unit may include a separate softener unit which reduces hardness and softens the water. The ion exchange unit can be regenerated with common table salt. When this is done, the resulting rinsate or effluent water will be very high in radium. This rinsate water should be diluted with distilled water or other water having little or no radium and then discharged to conventional waste disposal facilities (septic tank or sewer). The discharged water should not have a radium concentration that exceeds 30 pC/l. Water purification plants usually use the lime softening method which adds calcium oxide or calcium hydroxide to increase the pH (lower the acidity) of the water to a level where the metals (including radium) will precipitate out and then are removed from the water and disposed of properly in a safe concentration.

Using information from Figure 2 and Figures 4, 5, 7, and 8 (in Packet), and the four (4) topographical, 7 1/2-minute quadrangle maps which cover the Katemcy Creek basin, Figure 13 (in Packet) was constructed to help evaluate and determine 1) the areas most favorable, 2) the sources and amounts of water most suitable, and 3) the methods most suitable for beneficial recharge of the Hickory aquifer within the Katemcy Creek basin. Detailed discussions of the evaluations and determinations on these three (3) items are presented in the following discussions using the information on Figure 13 (in Packet).

Areas Most Favorable for Beneficial Artificial Recharge in the Katemcy Creek Basin

The three (3) areas most favorable for beneficial artificial recharge of the Hickory aquifer in the Katemcy Creek basin are identified in red on Figure 13 (in Packet). Favorable Area No. 1 has the greatest favorability, Favorable Area No. 2 has less favorability than Area No. 1, and Favorable Area No. 3 has less favorability than Areas Nos. 1 and 2.

Favorable Area No. 1 (Figure 13-in Packet) has the greatest favorability for the following reasons:

1. Favorable Area No. 1 is the furthest area from the ground-water discharge area to Katemcy Creek in the northern part of the basin in McCulloch County. Therefore, recharged waters would be more available for recovery by local water users, and have the least chance of discharging to Katemcy Creek or being lost by evapotranspiration.

2. Favorable Area No. 1 is on the outcrop of the lower unit of the Hickory sandstone which is the most porous and permeable unit of the Hickory aquifer. The lower unit composed of massive, cross-bedded, slightly cemented sandstone is the best unit of the Hickory to receive and store artificially recharged waters for later recovery by water users.

3. The depths to water below the stream bed of Camp Air Creek in Favorable Area No. 1 range from about 75 to 130 feet. This indicates that there is a large volume of unsaturated and dewatered volume of the lower unit of the Hickory sandstone in Area No. 1. Within Area No. 1, approximately 8.7 to 15.7 feet of the lower Hickory unit has been dewatered since the late 1950's, and approximately 25.6 to 26.8 feet may have been dewatered since the late 1940's. Therefore, about 3,800 acre-feet of water could be recharged to the dewatered lower Hickory in Area No. 1. The current direction of ground-water flow in Area No. 1 is from the southeast to the northwest. Therefore, water users in Area No. 1 would have availability to recharged waters, and any recharged waters escaping to Favorable Area No. 3 could be available for recovery by water users in Area No. 3.

4. Currently, there are about 13 active irrigation wells in Favorable Area No. 1 that could intercept recharged waters. In addition, there are currently about 14 active irrigation wells in Favorable Area No. 3 that could possibly intercept recharged waters that may move from Area No. 1 to Area No. 3. These 27 active irrigation wells are about 34 percent of the total active irrigation wells (80 wells) that currently withdraw large amounts of ground water from the aquifer for beneficial purposes (irrigation) in the Katemcy Creek basin.

5. There are several reasonably good, potential sources of water from existing and proposed retention dams and lakes, which are located outside of Favorable Area No. 1 that could capture and supply additional water for artificial recharge in Area No. 1. These retention dams and lakes (RD&Ls) include existing RD&Ls B and possibly A, and proposed RD&Ls D, E, F, and G shown on Figure 13 (in Packet).

Favorable Area No. 2 (Figure 13-in Packet) has the next greatest favorability for beneficial artificial recharge for the following reasons:

1. Favorable Area No. 2 is sufficiently far enough from the ground-water discharge area to Katemcy Creek in the northern part of the basin in McCulloch County.

2. Favorable Area No. 2 is on the outcrop of the lower unit of the Hickory sandstone which is the most porous and permeable unit, and therefore, the best unit for intake of artificial recharge waters.

3. The depths to water below the stream bed of Dry Prong Creek in Favorable Area No. 2 range from about 50 to 75 feet. Within Area No. 2, as much as 25.6 feet of the lower Hickory unit has been dewatered since the late 1940's. Therefore, about 3,400 acre-feet of water could be recharged to the dewatered lower Hickory sandstone in Area No. 2.

4. The current general directions of ground-water flow in Favorable Area No. 2 are to the north and northwest, generally into the northernmost part of Favorable Area No. 3 which could benefit from recharged waters that move from Area No. 2.

5. Currently, there are about 11 active irrigation wells in Area No. 2 that could possibly intercept recharged waters. In addition, there are currently about eight (8) active irrigation wells in Area No. 3 that could

possibly intercept recharged waters that move from Area No. 2 to Area No. 3. These 19 active irrigation wells are about 24 percent of the total active irrigation wells (80 wells) that currently withdraw large amounts of ground water from the aquifer for beneficial purposes (irrigation) in the Katemcy Creek basin.

6. Readily available sources of water to Favorable Area No. 2 are existing RD&Ls A and B (via Dry Prong Creek drainage), and proposed RD&L E (via Dry Prong Creek drainage), and proposed RD&L C (via diversions by pipeline from the Katemcy Creek drainage to the Dry Prong Creek drainage) (Figure 13-in Packet).

Favorable Area No. 3 (Figure 13-in Packet) has the least favorability for artificial recharge of the Hickory Aquifer because it occurs on the outcrop of the middle unit of the Hickory sandstone which has discontinuous lenses or beds of sandstone, siltstone, and claystone. Therefore, the direction of, and amount of flow of recharged waters introduced on the outcrop of the middle Hickory unit may not be readily and beneficially available to water users in the area. However, there are about 28 currently active irrigation wells in and just adjacent to Area No. 3, which might benefit from artificial recharge activities in Area No. 3. Artificial recharge activities on the land surface in Area Nos. 1 and/or 2 would probably benefit Area No. 3 more than artificial recharge activities on the land surface in Area No. 3. Area No. 3's favorability for beneficial recharge will be further discussed in the methods of beneficial artificial recharge presented later in this report.

The remaining areas of the lower and middle Hickory sandstone outcrops in the basin, which are northeast of Favorable Area Nos. 2 and 3 (Figure 13-in Packet), are not favorable for artificial recharge because they are too near the area of ground-water discharge to Katemcy Creek in the northern portion of the basin in McCulloch County. Also, the depth to the water table in these areas is about 20 feet or less, consequently, there are smaller volumes of unsaturated and dewatered sandstones available for receiving and storing recharged waters.

Application of the criteria used for determining the favorability of Favorable Area Nos. 1, 2, and 3 (Figure 13-in Packet) to the proposed Sherwood RD&L on Structure Creek (Figure 11, Profile E-E'-in Packet), indicates a very low favorability for the Sherwood Structure as a suitable beneficial artificial recharge facility. The lack of favorability for the Sherwood Structure is explained as follows:

1. The proposed Sherwood Structure is only about 1.7 miles from the beginning of the current ground-water discharge area to Katemcy Creek in McCulloch County. There has been some indication that at and near the Structure Creek entrance to Katemcy Creek, Katemcy Creek has been at times a gaining stream and then at times a losing stream. This erratic gain-loss may be due to temporary "perched water table" conditions caused by discontinuous siltstone and/or claystone layers of the middle unit Hickory sandstone which may occur locally under part of the Katemcy Creek stream bed in the area. Therefore, at times recharge waters released from the Sherwood Structure may enter the aquifer while at other times releases would flow down Katemcy Creek and not reach the aquifer. Also, any water recharged to

the aquifer would very likely end up in Katemcy Creek, since the current ground-water discharge area is relatively close-by and accessible.

2. The proposed Sherwood Structure is located at the contact between the lower and middle units of the Hickory sandstone, and very little lower unit Hickory sandstone is available for effective entrance of recharge waters; especially any waters released for recharge in the stream bed of Katemcy Creek.

3. The maximum depths to the water table below the Sherwood Structure have been about 14 to 24 feet. This is not a very significant amount of unsaturated and dewatered lower unit Hickory for recharge directly from the structure lake. The 14 to 24 feet depths to water were measured in wells completed in the lower unit Hickory sandstone and do not reflect the water levels of the "perched water table" that may be present directly beneath the proposed Sherwood Structure and the stream bed of Katemcy Creek.

4. Current ground-water flow directions at and near the Sherwood Structure indicate that recharged waters might move northeast rather than to the northwest. As indicated on Figure 13 (in Packet), the location of the Sherwood Structure (located 500 feet up Structure Creek from Katemcy Creek) falls on a local ground-water divide.

5. If recharged water from the Sherwood Structure moved northeast, only about three or four currently active irrigation wells might benefit from the recharged waters. If recharged water moved northwest, only two irrigation wells might benefit from the recharged water. If the recharged water moved northwest, it is very probable that such recharged waters might readily bypass the two irrigation wells and be discharged into Katemcy Creek or be lost by evapotranspiration.

Sources and Amounts of Water Suitable for Beneficial Artificial Recharge in the Katemcy Creek Basin

Figure 13 (in Packet) shows some existing and proposed locations of retention dams and lakes (RD&Ls) that may be considered for storage and releases of runoff waters for beneficial artificial recharge of the Hickory aquifer in the Katemcy Creek basin. Each of these RD&Ls are indicated by a letter identification (A through M) on Figure 13 (in Packet). The general characteristics and suitability of each of these RD&L's is provided as follows:

RD&L ID Letter (Figure 13)	In or Out of HUWCD	Size of Lake in Acres, Drainage Area in Acres, & Annual Runoff in Acre-Feet	As Presented in Figure 13 Approximate Elevations (Ft.)		Favorable Area(s) To Be Served	Remarks Suitability
			Stream Bed at Dam	Top of Pool		
A Existing North Lake	Out	2.7 84.9 9.3	1,750	1,758	No. 2 and Possibly No. 1	Both existing lakes at A are located on granite and probably receive runoff waters having very low suspended solids and excellent quality for recharge. These existing lakes could be used for testing recharge of aquifer in Favorable Area No. 2 and possibly Area No.1 via Dry Prong Creek.
A Existing South Lake	Out	(For Both Lakes)	1,780	1,788	(For North Lake and South Lake)	
B Existing North Lake	Out	2.4 384.5 41.9	1,835	1,838	No. 1 and No. 2	Both existing lakes at B are located on granite and probably receive runoff waters having very low suspended solids and excellent quality for recharge. These lakes and existing lakes at A (above) could be used for testing recharge of aquifer in Favorable Area Nos. 1 and 2 via Dry Prong Creek.
B Existing South Lake	Out	(For Both Lakes)	1,860	1,865	(For North Lake and South Lake)	
C Proposed	Out	21.0 2,302.4 251.1	1,760	1,800	No. 2	Located on granite in the Katemcy Creek watershed. Would have large amount of runoff water with very low suspended solids and very good quality. Water released for recharge would have to be diverted by pipeline to small tributary of Dry Prong Creek (Figure 13). Water delivered and recharged into Favorable Area No. 2 (Dry Prong Creek watershed) would be additional water that otherwise would have never entered Favorable Area No. 2 as potential recharge waters. Facilities for recharge very suitable, but would be very costly. Also, this RD&L would be located outside of current boundary of the HUWCD No. 1 which could make it unsuitable for consideration.

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RD&L ID Letter (Figure 13)	In or Out of HUWCD	Size of Lake in Acres, Drainage Area in Acres, & Annual Runoff in Acre-Feet	As Presented in Figure 13 Approximate Elevations (Ft.)		Favorable Area(s) To Be Served	Remarks Suitability
			Stream Bed at Dam	Top of Pool		
D Proposed	Out	10.5 167.1 18.2	1,780	1,810	No. 2 and Possibly No. 1	Located on granite in the Dry Prong Creek watershed. Would have a small amount of runoff water with very low suspended solids and very good quality. Water released for recharge could reach Dry Prong Creek bed in Favorable Area No. 2 by natural drainage along tributary to Dry Prong Creek. Facility would not provide additional water to Favorable Area No. 2 because it does not provide water from outside Dry Prong Creek watershed. Would provide additional water to Favorable Area No. 1; especially through pipeline to appropriate location in Camp Air Creek watershed. Facilities for recharge would be suitable, but would be very costly. This RD&L would be located outside of the HUWCD No. 1 which could make it unsuitable for consideration.
E Proposed	Out	57.8 3,180.6 346.9	1,775	1,800	No. 1 and No. 2	Probably same as remarks and suitability for RD&L D , except it would have a very large amount of runoff with possibly more suspended solids from Cretaceous rocks (Ku) in upper part of its drainage area. Dam for such a large structure and the pipeline diverting water to Camp Air Creek watershed in Favorable Area No. 1 would make this RD&L very expensive. Since facility would catch a very large amount of runoff, it probably could effectively provide adequate amounts of recharge water for both Favorable Area No. 1 and Favorable Area No. 2.

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RD&L ID Letter (Figure 13)	In or Out of HUWCD	Size of Lake In Acres, Drainage Area In Acres, & Annual Runoff In Acre-Feet	As Presented In Figure 13 Approximate Elevations (Ft.) Stream Bed at Dam	Top of Pool	Favorable Area(s) To Be Served	Remarks Suitability
F Proposed	In	18.3 389.9 42.5	1,857	1,880	No. 1 and No. 3	Located on Cretaceous rocks (Ku). Probably would have moderate amount of runoff waters with possible high suspended solids and possible water quality that may not be chemically compatible with Hickory water. A relatively short pipeline could be used to divert water to Camp Air Creek water shed for recharge of Favorable Area No. 1. This would provide an additional amount of water to Favorable Area No. 1 that does not currently reach it under natural drainage conditions. This RD&L would provide recharge water for a large part of Favorable Area No. 3 via releases to downstream natural drainage. Dam and pipeline for this RD&L may be provided at a relatively moderate cost. This RD&L could be built and operated with RD&L G . Except for high suspended solids and possible water-quality problems, this would be a very suitable RD&L for beneficial artificial recharge of the Hickory aquifer in Favorable Area No. 1 and possibly Favorable Area No. 3.
G Proposed	In	37.8 555.7 60.6	1,775	1,800	No. 1 and No. 3	Located on middle unit of Hickory sandstone. Probably would have moderate amount of runoff waters with moderate amounts of suspended solids. A relatively short pipeline could be used to divert water to Camp Air Creek watershed for recharge of Favorable Area No. 1. This would provide an additional amount of water to Favorable Area No. 1 that does not

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RD&L ID Letter (Figure 13)	In or Out of HUWCD	Size of Lake In Acres, Drainage Area In Acres, & Annual Runoff In Acre-Feet	As Presented In Figure 13 Approximate Elevations (Ft.) Stream Bed at Dam	Top of Pool	Favorable Area(s) To Be Served	Remarks Suitability
G Proposed (continued)						currently reach it under natural drainage conditions. This RD&L would provide recharge water for a large part of Favorable Area No. 3 via releases to downstream natural drainage. Also, some runoff waters retained by this RD&L would naturally infiltrate downward into the middle unit of Hickory sandstone. Dam and pipeline for this RD&L may be provided at a relatively moderate cost. This RD&L could be built and operated with RD&L F which could serve to retain significant amounts of suspended solids which may be in runoff waters from Cretaceous rocks (Ku). This is probably the most suitable RD&L for beneficial artificial recharge of the Hickory aquifer in Favorable Area No. 1 and possibly Favorable Area No. 3.
H Proposed	In	61.1 1,149.7 125.4	1,788	1,820	No. 3	Located in faulted and fractured outcrop of Cap Mountain limestone, Lion Mountain sandstone, and Welge sandstone (Table 1). Together, these geological units are shown as geological unit Cyu on Figure 13. Probably would have moderate to large amount of runoff waters with very small amounts of suspended solids. Would hold and store runoff waters, except for amount that might escape through faults and fractures. However, escaped waters could possibly eventually reach downstream drainage or flow downward into the Hickory aquifer. This RD&L would provide recharge waters only to Favorable Area No. 3 unless a long

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RD&L ID Letter (Figure 13)	In or Out of HUWCD	Size of Lake in Acres, Drainage Area in Acres, & Annual Runoff in Acre-Feet	As Presented in Figure 13 Approximate Elevations (Ft.)		Favorable Area(s) To Be Served	Remarks Suitability
			Stream Bed at Dam	Top of Pool		
H Proposed (continued)						and relatively expensive pipeline and lifting system were used to divert recharge water to Favorable Area No. 1. This RD&L is only suitable if Favorable Area No. 3 is capable of effectively receiving and storing recharged waters.
I Proposed	In	25.9 360.5 39.3	1,758	1,780	No. 3	Same remarks and suitability as proposed RD&L H .
J Proposed	In	19.3 388.4 42.4	1,728	1,750	No. 3	Same remarks and suitability as proposed RD&L H ; except this RD&L would be on outcrop of Cap Mountain limestone only, and faults and fractures probably would not be present to cause leakage.
K Proposed	In	24.1 458.9 50.0	1,709	1,730	No. 3	Same remarks and suitability as proposed RD&L J .
L Proposed	In	11.5 607.8 66.3	1,696	1,710	No. 3	Same remarks and suitability as proposed RD&L J .
M Proposed	In	64.9 575.3 62.8	1,685	1,720	No. 3	Same remarks and suitability as proposed RD&L J ; except costly pipeline would be needed to divert waters to Nobles Creek watershed for recharge of Favorable Area No. 3

RD&L G and/or F would be the most suitable source of additional recharge waters for Favorable Area No. 1. RD&L C would be the most suitable source of additional recharge waters for Favorable Area No. 2. If Favorable Area No. 3 through additional studies is found to be more suitable for artificial recharge, then possibly RD&Ls E, G, and/or F or some other RD&L outside and west of the Katemcy Creek basin might be considered for introduction of additional waters for artificial recharge of Favorable Area No. 3.

To assure a good quality and quantity of supply of recharge waters from an RD&L, it will be necessary to: 1) periodically maintain the catchment area of the RD&L by removing settled suspended solids and silt, and 2) have a program to avoid the growth of algae and unwanted water plants. A good supply of good clean, high-quality water that is compatible with the Hickory aquifer water is necessary for successful beneficial artificial recharge.

The approximate net total amount of ground water removed from storage in the Hickory Aquifer in the Katemcy Creek basin from 1947 to 1987 is about 26,850 acre-feet or a net of about 670 acre-feet per year. The approximate corresponding amounts for Favorable Areas 1, 2, and 3 are 3,800 acre-feet or 95 acre-feet per year, 3,400 acre-feet or 85 acre-feet per year, and 9,000 acre-feet or 225 acre-feet per year, respectively. If the respective annual amounts above (acre-feet per year) were artificially recharged annually in the three (3) Favorable Areas, only about 0.5 foot per year of net water-level rise would occur. To gain a better perspective on the amounts of artificial recharge water needed annually to give a specific equivalent increase in storage (water-level rise) during a specific time period (years), the following summary is offered for consideration for the three (3) Favorable Areas.

Favorable Area/Area in Acres (Figure 13)	Time Period in Years	Approximate Annual Acre-Feet of Recharge Water Needed to Increase Storage (Raise the Water Level) an Equivalent Amount of Feet in the Hickory Aquifer				
		0.5 Foot	1.0 Foot	5.0 Feet	10.0 Feet	20.0 Feet
No. 1/1,275	1	95.0	190.0	950.0	1,900.0	3,800.0
	2	47.5	95.0	475.0	950.0	1,900.0
	3	31.7	63.4	317.0	634.0	1,268.0
	4	23.8	47.6	238.0	476.0	952.0
	5	19.0	38.0	190.0	380.0	760.0
No. 2/1,135	1	85.0	170.0	850.0	1,700.0	3,400.0
	2	42.5	85.0	425.0	850.0	1,700.0
	3	28.3	56.6	283.0	566.0	1,132.0
	4	21.3	42.6	213.0	426.0	852.0
	5	17.0	34.0	170.0	340.0	680.0
No. 3/3,019	1	225.0	450.0	2,250.0	4,500.0	9,000.0
	2	112.5	225.0	1,125.0	2,250.0	4,500.0
	3	75.0	150.0	750.0	1,500.0	3,000.0
	4	56.3	112.6	563.0	1,126.0	2,252.0
	5	45.0	90.0	450.0	900.0	1,800.0

This summary was developed using a specific yield of 0.15 (or 15 percent) for the Hickory aquifer and the stipulation that the increase in water-table storage (water-level rise) will occur uniformly beneath the area (acreage) of each Favorable Area. Three (3) examples of how the above summary can provide a perspective on the amounts of recharge water needed to give an equivalent increase in storage for a specific time period in years is as follows:

1. In Favorable Area No. 1, approximately 190.0 acre-feet per year of recharge water would be needed during a one (1) year period to increase water-table storage (raise the water level) 1.0 foot evenly over the 1,275 acres of Favorable Area No. 1. Under the same conditions, the approximate amounts would be 170.0 acre-feet per year for Favorable Area No. 2 and 450.0 acre-feet per year for Favorable Area No. 3.

2. In Favorable Area No. 2, approximately 283.0 acre-feet per year of recharge water would be needed during a three (3) year period to increase water-table storage (raise the water level) 5.0 feet evenly over the 1,135 acres of Favorable Area No. 2. Under the same conditions, the approximate amounts would be 317.0 acre-feet per year for Favorable Area No. 1 and 750.0 acre-feet per year for Favorable Area No. 3.

3. In Favorable Area No. 3, approximately 900.0 acre-feet per year of recharge water would be needed during a five (5) year period to increase water-table storage (raise the water level) 10.0 feet evenly over the 3,019 acres of Favorable Area No. 3. Under the same conditions, the approximate amounts would be 380.0 acre-feet per year for Favorable Area No. 1 and 340.0 acre-feet per year for Favorable Area No. 2.

Recharge projects installed may not provide results that agree with the above listed examples because specific yield of the three units of the Hickory sandstone varies, both vertically and laterally. It is estimated that the range of specific yield is from 0.05 to 0.25 (5 to 25 percent) with an average of 0.15 (15 percent). Also, the above summary and results are based on a uniform distribution of recharge which could only be achieved by installing a very large number of properly spaced, completed, and equipped recharge wells, which would be very costly. Therefore, the above summary and examples are presented only to obtain a reasonable perspective on the amounts of water needed for artificial recharge from the proposed RD&Ls that may be capable of supplying the amount of recharge water needed within the three (3) Favorable Areas (Figure 13-in Packet).

Methods Suitable for Beneficial Artificial Recharge in the Katemcy Creek Basin

The best method or methods for artificial recharge of an aquifer should use proper amounts of waters with appropriate quality, and recharge facilities that are capable of delivering the waters into the saturated thickness in a timely and physically efficient manner in an area or areas where the recharged water can be effectively recovered for beneficial uses. As indicated previously in this report, the location and method of recharge intended at the Sherwood

Structure (Figure 11, Profile E-E') would not benefit local water users, and because of the hydrogeological conditions in the area, potential recharge waters released into Katemcy Creek would probably escape by discharge to the creek or by evapotranspiration.

Ground-water augmentation by direct methods include injection by wells into the zone of saturation or by spreading of water at the land surface with the use of special facilities and means such as pits, trenches and basins, stream channel modifications, flooding, irrigation, and ditch and furrow (O'Hare, et al., 1986). All of the above direct methods of artificial recharge could be used for recharge of the Hickory aquifer in the three (3) Favorable Areas (Figure 13) within the Katemcy Creek basin. However, because of the hydrogeological conditions within the three (3) Favorable Areas (Figure 13); namely, the relatively deep depths to the water table below the land surface and the geologic and hydraulic properties of the lower and middle units of the Hickory sandstone, the use of artificial recharge wells would be the most suitable method to physically, and therefore beneficially, recharge the aquifer.

Application of artificial recharge waters onto the land surface by one or more of the various spreading methods is not advisable, because significant amounts of waters intended for effective recharge may escape by evapotranspiration and by flow paths that would not permit the recharged waters to effectively reach the zone of saturation.

Since artificial recharge by wells is recommended as being the most suitable, the HUWCD and local irrigators are encouraged to coordinate and implement a program to convert existing irrigation wells and design future irrigation wells to function as both recharge and discharge wells (dual purpose wells). Also, specifically designed and constructed recharge wells (single purpose) wells could be strategically located at appropriate sites that would provide more efficient artificial recharge. By the use of dual purpose wells, waters could be artificially recharged, preferably by gravity flow, through wells during periods of non-irrigation, and more readily and efficiently recovered during periods of irrigation. The amounts of waters that could possibly be supplied by the existing and proposed RD&Ls shown on Figure 13 are relatively small; therefore, these waters should be placed into the aquifer in the most efficient and beneficial manner in order to avoid escape and waste. This can be done more effectively by properly located, completed and equipped recharge wells.

Some of the problems with this recommended direct method of artificial recharge by wells may be as follows:

1. The waters to be recharged must have practically no suspended solids and have a quality compatible with the Hickory ground water. Concerted steps should be taken to avoid permanent clogging of the aquifer around the well bore of the recharge well.

2. Potential existing recharge wells and future recharge wells should have equipment installed that eliminates entrapment of air when the wells are being used for artificial recharge purposes. Entrapment of air can cause air clogging of the aquifer around the well bore of the recharge well.

3. The injection of waters into the recharge wells should be by gravity flow. Fuel and equipment required to inject the waters under pressure will be expensive.

4. Delivery of waters from the RD&Ls to the recharge wells should be by gravity flow. Fuel and equipment for pumping the waters from the existing and proposed RD&Ls can make artificial recharge operations very expensive.

5. The equipment and facilities needed locally to effectively deliver water to an appropriate number of properly spaced recharge wells which will use gravity flow may be very expensive.

6. The selection of the locations and the spacing for appropriate potential existing and/or future recharge wells using the waters from the RD&Ls for artificial recharge purposes should be done in such a manner to assure that recharge operations will be beneficial to an equitable number of water users. To do this also may be very expensive.

If artificial recharge operations that use a surface-water supply (RD&Ls in this case) are planned in Texas, the entity or individual planning such operations are required to submit an application to the Texas Water Commission (TWC) for a water rights permit to use surface water for artificial recharge purposes. Also, if wells are intended as a means of artificial recharge, the TWC's injection well regulations should be reviewed and followed.

Conclusions

The following conclusions are offered as a result of this evaluation:

1. Before 1947, the beginning of ground-water discharge to Katemcy Creek was probably at a location on Katemcy Creek at or near the community of Katemcy. Currently, the beginning of ground-water discharge to Katemcy Creek is at a location on Katemcy Creek at sample site SS-KCS-7 (or KCS-7) (Figures 5, 9, 12, and 13-in Packet) which is about 0.6 mile north of the McCulloch-Mason county line. This migration of the beginning of ground-water discharge to the creek was caused by the net removal of about 26,850 acre-feet of ground water from water-table storage in the Hickory aquifer since about 1947.

2. The net removal of 26,850 acre-feet of ground water from water-table storage has caused about 20 feet of Hickory water-table decline throughout most of the basin. This total amount of decline which is supported by long-term water-level data collected in the basin in the last 40 years indicates an average annual net water-level decline of about 0.5 foot. Therefore, there is a considerable volume of dewatered Hickory within the basin that is available for beneficial artificial recharge.

3. Currently, ground-water flow in the Hickory aquifer within the basin is generally from south to north to the ground-water discharge area at and near Katemcy Creek in McCulloch County. Ground-water flow velocities in the Hickory probably range from about 107 to 439 feet per year. This

general flow path and other local flow paths in the aquifer are shown on Figure 13 (in Packet). Within the area of natural discharge in McCulloch County, ground water from the Hickory aquifer is being discharged by seeps and springs (generally associated with faults and fractures), as baseflow to Katemcy Creek in the outcrop of the Hickory sandstone, and by evapotranspiration. The total of this natural discharge is probably about 2,400 acre-feet per year. This amount is also the approximate amount of average annual recharge to the Hickory aquifer within the Katemcy Creek basin.

4. Ground-water flow paths and velocities in the Hickory aquifer are not only affected by pumpage and variances of porosity and permeability of the Hickory sandstone, but are significantly affected by "granite highs" on the Hickory-Precambrian surface and by faults and fault systems which hydrologically compartmentalize the aquifer within the basin.

5. In 1984, about 4,046 acre-feet of ground water was withdrawn by Hickory wells. About 99 percent or 4,010 acre-feet of this withdrawal was for irrigation purposes. The historical average annual discharge by Hickory wells in the basin since about 1947 has probably been about 2,750 acre-feet per year.

6. The areas most favorable for beneficial recharge of the Hickory aquifer within the Katemcy Creek basin are shown in red on Figure 13 as Favorable Area No. 1, Favorable Area No. 2, and Favorable Area No. 3. Favorable Area No. 1 has the greatest favorability, while Favorable Area No. 3 has the least favorability of the three (3) areas. The remaining parts of the basin are not favorable for beneficial artificial recharge of the Hickory aquifer; mainly because they are at or too near the natural ground-water discharge area of the aquifer in McCulloch County.

7. The proposed retention dams and lakes (RD&Ls) for providing waters for beneficial artificial recharge of the Hickory aquifer in the three (3) Favorable Areas is presented in priority order by Favorable Area as follows (Figure 13):

Favorable Area	(RD&L ID Letter) (Delivery of Water)
No. 1	G and F (with pipeline from G)
No. 1	G (with pipeline)
No. 1	F (with pipeline)
No. 1	E (with pipeline)
No. 1	C (with pipeline)
No. 2	C (with pipeline)
No. 2	D (natural drainage)
No. 2	E (natural drainage)
No. 3	G and F (natural drainage)
No. 3	G (natural drainage)
No. 3	F (natural drainage)
No. 3	E (with pipeline)

Favorable Area	(RD&L ID Letter) (Delivery of Water)
No. 3	H (natural drainage)
No. 3	I (natural drainage)
No. 3	J (natural drainage)
No. 3	K (with pipeline)
No. 3	L (natural drainage)
No. 3	M (with pipeline)
No. 3	RD&L Outside of Basin (with pipeline)

The most suitable RD&Ls to consider for Favorable Area No. 1 is G and F which should be operated together using a relatively short pipeline from G. With this combination, F could serve as a catchment basin for settled suspended solids and silt in some of the runoff waters. RD&Ls G and F would be capable of delivering about 103 acre-feet per year of water to Favorable Area No. 1. This approximate annual amount is water that would not have runoff into Favorable Area No. 1 under existing drainage conditions. The most suitable RD&L to consider for Favorable Area No. 2 is C using a relatively short pipeline and a natural drainage way in the Dry Prong Creek watershed. RD&L C could deliver about 251 acre-feet per year of good quality runoff waters from the Katemcy Creek watershed to the Dry Prong Creek watershed. This amount of runoff water would not have runoff into Favorable Area No. 2 under existing drainage conditions. The most suitable RD&Ls to consider for Favorable Area No. 3 is G and F which should be operated together using the natural drainage ways below RD&L G .

8. The most efficient suitable method to use for beneficial artificial recharge of the Hickory aquifer in the three (3) Favorable Areas of the basin (Figure 13) is direct recharge by wells using gravity flow from the RD&Ls located on Figure 13. Such method of artificial recharge could use potential existing wells (dual purpose wells), new wells specially completed and equipped for artificial recharge purposes only, and/or future irrigation wells (dual purpose wells) that probably will be completed for irrigation of lands within the three (3) Favorable Areas. Artificial recharge by wells would help make Favorable Area No. 3 more favorable, because special recharge wells and/or future dual purpose wells could be specifically constructed to place recharge waters into the lower unit of the Hickory sandstone.

9. At this time, with the hydrogeological conditions that exist within the Hickory aquifer within the Katemcy Creek basin, only local water users (mainly irrigators) within the basin would physically benefit from artificial recharge in the three (3) Favorable Areas. It is very unlikely that water users outside of the basin would benefit from beneficial recharge in the basin. However, it is possible that if enough funds were available for catching significantly large amounts of runoff in the RD&Ls within the basin (Figure 13-in Packet) that artesian water levels outside of the basin may be made to rise enough by recharging wells in, west and northwest of Favorable Area No. 3. Under these conditions, perhaps Hickory water users in the regional downdip artesian area west and

northwest of the Katemcy Creek basin might be benefitted with some additional water from the Hickory aquifer.

Recommendations

Based on the evaluations and conclusions stated herein, and if the HUWCD desires to continue with an artificial recharge program of the Hickory aquifer within the Katemcy Creek basin, the HUWCD should consider and follow the following recommendations:

1. The proposed Sherwood Structure on Structure Creek, which is an eastern tributary of Katemcy Creek about 1.0 mile north of the Katemcy Post Office (Figure 11-Profile E-E') should not be built, because the waters the structure would provide could not be beneficially recharged to the Hickory aquifer.

2. Hydrological evaluations should be made on the proposed RD&Ls presented in this report; especially RD&Ls C , G and F and perhaps D and E. These evaluations should more accurately determine the possible amounts and quality of runoff to be retained by these RD&Ls, and the more exact location, size and materials needed to construct the dams for these RD&Ls. These hydrological evaluations should be made by the SCS, U.S. Army Corps of Engineers or perhaps the Surface Water Unit of the TWDB.

3. After hydrological evaluations are completed and if the selected RD&Ls are found to be physically feasible, estimates of the cost of construction and monitoring of the retention-recharge structures (RD&Ls) should be obtained.

4. To determine if the land surface and/or potential existing wells are effective for artificial recharge in the three (3) Favorable Areas, the HUWCD should have additional field studies conducted as follows:

    a. For Favorable Area No. 1, existing irrigation wells 56-06-818, 827, 828, and 830 (Figures 4 and 13-in Packet) should be pumped and their combined waters diverted to depth marker 196 on Figure 13. At depth marker 196, water would be released to the Camp Air Creek watershed. The combined pumpage from the wells should be measured at depth marker 196, and the flow of the water in the stream channel of Camp Air Creek should be appropriately measured at various points from depth marker 196 to at least depth marker 76 near Highway 87 & 377 (Figure 13-in Packet). This should be done twice, once in January or February and once in August or September. This investigation would determine the infiltration capacity of the Camp Air Creek stream bed within Favorable Area No. 1. A third such test should be conducted by delivering pumpage from existing wells 56-06-818, 827, 828, 829, and 830 to wells 56-06-805, 811, and/or 816 (Figures 4 and 13-in Packet) where the water should be injected under gravity flow into at least one of the wells (805, 811, or 816). Proper measurements of water levels, pumpage and recharge of each used existing well and any surrounding existing wells should be made during this test to gain a perspective on artificial recharge by wells in Favorable Area No. 1. The TWDB Core Drill should be used to drill and complete several temporary monitor wells near wells 805, 811, and/or 816 to monitor movement of water in the lower unit of the Hickory sandstone near the recharged well(s). Three (3) tests similar to the three (3) described above should be conducted on Dry Prong Creek and wells in Favorable Area No. 2 using wells 56-06-901, 903, 904, 916, 917, 918, 929, and 931 (Figures 4 and 13-in Packet).

b. Using water releases from existing RD&Ls at A and/or B (Figure 13-in Packet) make appropriate gain-loss measurements and take water sample-analyses of releases as they flow down Dry Prong Creek and its tributaries. This study should be conducted twice when RD&Ls A and/or B have water available for releases. This study should be conducted as far as water remains in the channel of Dry Prong Creek or as far as depth marker 19 on Dry Prong Creek at the eastern boundary of Favorable Area No. 3. Perhaps a third test could be conducted using water releases from RD&Ls A and/or B as recharge water into wells 56-06-916, 917, 918, 929, and/or 931 (Figures 4 and 13-in Packet).

5. Drill, complete and test, perhaps using the TWDB's Core Drill Unit, one and possibly two clusters of monitor wells within the Katemcy creek basin to determine the vertical and horizontal hydraulic properties of each of the three (3) units of the Hickory sandstone (Table 1). At this time, no such wells exist to conduct such hydraulic tests, because practically all existing wells completed in the basin have open hole completion. These tests would determine if the three (3) units of the Hickory aquifer have different heads and how their heads react to pumpage stresses. These tests will help determine the artificial recharge capabilities of the Hickory aquifer; particularly the saturated portions of the middle and lower Hickory units.

6. Drill, complete, and test, perhaps using TWDB's Core Drill Unit, an appropriate cluster of monitor wells to determine the role of faults as hydrological boundaries in the Katemcy Creek basin.

7. Drill, complete and test, perhaps using the TWDB's Core Drill Unit, an appropriate number of permanent monitor wells at and near all proposed RD&Ls to be constructed for artificial recharge purposes within the Katemcy Creek basin, and at or near reaches of stream beds to be recharged and wells to be recharged within the basin. Also, rain gages, evaporation pans, thermometers, continuous water stage recorders, stilling wells, and other equipment should be provided and installed to properly monitor artificial recharge operations within the basin.

8. Whichever entity conducts the investigations recommended above, such group should be required to document their evaluations and findings in appropriate type reports. In this way the HUWCD can make reasonable and sound decisions on future artificial recharge programs within the Katemcy Creek basin and other areas within the boundaries of the HUWCD.

Selected References

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3. Doll, W.L. et al., 1963, Water resources of West Virginia: West Virginia Department of Natural Resources, Division of Water Resources, pages 39-43.

4. Harden, R.W. and Associates, 1978, The Seymour Aquifer, ground-water quality and availability in Haskell and Knox Counties, Texas: Texas Department of Water Resources Report 226, Volumes I and II.

5. Mason, C.C., 1961, Ground-water geology of the Hickory sandstone member of the Riley Formation, McCulloch County, Texas: Texas Board of Water Engineers Bulletin 6017, 84 pages.

6. O'Hare, M.P., et al., 1986, Artificial recharge of ground water, status and potential in the contiguous United States: Lewis Publishers, Inc., Chelsea, Michigan, 419 pages.

7. Texas Department of Health, 1977, Drinking water standards governing drinking water quality and reporting requirements for public water supply system: 17 pages.

8. Texas Water Development Board, 1986, Surveys of irrigation in Texas, 1958, 1964, 1969, 1974, 1979, and 1984: TWDB Report 294, 243 pages.

9. U.S. Environmental Protection Agency, 1981, Radioactivity in drinking water: EPA 570/9-81-002, 74 pages.

Table 2.-- Record of Wells and Springs

[Location Numbers - For explanation of State well numbering system see explanation text of report and appropriate figure. Wells and springs located on location map in report.
Aquifer - Crh means Hickory Aquifer, MCu means Mid-Cambrian Aquifers undifferentiated, OES means Ellenburger-San Saba Aquifer.
Method of Lift - N means no pump installed, C means cylinder pump, W means pump powered by wind, S means submersible pump, E means pump powered by electricity,
F means water flows at surface, T means turbine pump, B means pump powered by butane, H means pump powered by hand, G means pump powered by gasoline,
D means pump powered by diesel.
Use of Water - N means not used, S means livestock, D means domestic, Irr means irrigation.]

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SS 42-62-902	State of Texas	TWDB	1974	786	6	507	Crh	1,580	Flows 9.40	12-19-74 09-17-87	N	N	Test hole. Open hole 507-786. Observation well. 1/ 2/
SS 56-06-302	Tommy Brook Estate	--	--	224	6	--	do	1,715	134.96 112.08	03-10-87 04-23-87	C,W	S	--
SS 56-06-303	do	--	--	348	6	--	do	1,650	63.20	04-23-87	C,W	S	--
SS 56-06-304	do	--	--	170	6	--	do	1,627	50.59 40.69	03-10-87 04-23-87	C,W	S	--
SS 56-06-305	do	--	--	--	--	--	do	1,568	+16.01	04-14-87	S,E,F	D,S	--
SS 56-06-306	do	--	--	--	--	--	do	1,561	--	04-14-87	F	S	--
SS 56-06-307	do	--	--	483	--	--	do	1,572	+0.03 +1.16	03-11-87 04-14-87	S,E,F	D	--
* SS 56-06-308	do	--	--	430	11	--	do	1,559	+19.58	04-14-87	F	Irr, S	Estimated flow 50 gpm in 1987.
* SS 56-06-309	R. Kinnon Coleman	--	--	Spring	--	--	do	1,565	Flows	04-21-87	F	D,S	Wawbansee Spring. Estimated flow 100-200 gpm in 1970's. Esimated flow 15 gpm in 1987.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SS 56-06-310	R. Kinnon Goleman	--	--	Spring	--	--	Crh	1,570	+0.08	04-21-87	--	S	Cow Spring. Estimated flow 15 gpm in 1982. Not flowing in 1987.
* SS 56-06-311	do	--	--	300	6	--	do	1,590	9.97	04-21-87	S,E	D,S	--
SS 56-06-312	do	--	--	135	6	--	do	1,610	18.01	04-24-87	C,W	S	--
SS 56-06-313	do	--	--	10	48	6	do	1,580	6.50	04-21-87	N	N	Formerly a Spring.
SS 56-06-314	do	--	--	15	48	15	do	1,580	5.04	04-21-87	N	N	--
* SS 56-06-315	Mrs. Thelma Box	--	--	Spring	--	--	Crh?	1,570	0.0	04-21-87	--	S	Box Spring. Not flowing in 1987.
SS 56-06-316	Tommy Brook Estate	--	--	194	6	--	Crh	1,679	76.92	04-23-87	N	N	--
SS 56-06-317	Mrs. Thelma Box	--	1967	--	10	--	Crh?	1,650	64.15	04-24-87	C,W	S	--
SS 56-06-318	do	--	--	--	6	--	MCu?	1,756	138.18	04-24-87	C,W	S	--
SS 56-06-319	Jerry Gamel	J. Vater	1984	230	6	10	do	1,803	136.70	05-01-87	C,W	S	--
SS 56-06-320	Tommy Brook Estate	--	--	Spring	--	--	do	1,590	0.0	05-14-87	--	S	Cemetary Spring. Not flowing in 1987.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SS 56-06-321	Olson Childs	--	--	--	6	--	MCu?	1,760	--	--	C,W	S	--
SS 56-06-322	do	--	--	75	6	--	OES?	1,805	49.90	06-01-87	S,E	D,S	--
SS 56-06-323	Henry Turner	M.M. Virdell	1976	300	8	--	MCu?	1,675	77.35	06-01-87	S,E	D	1/
* SS 56-06-324	John T. Morgeson	do	--	475	6	7	Crh	1,578	5.25	09-30-87	S,E	D	Open hole completion from 7 feet to 475 feet.
SS 56-06-325	D.B. Williams	do	--	450	6	--	do	1,569	Flowing	09-30-87	N	D,S	Estimated flow at 2 gpm.
SZ 56-06-503	Burt Nesloney	--	1900+	227	--	--	do	1,791	164.5	03-06-87	S,E	S	--
SS 56-06-505	Bill Hall	J. Vater	1979	500	8	7	do	1,808	189.46	04-16-87	S,E	D	Open hole from 7 feet to 500 feet. Reported yield 20 gpm. 1/
SS 56-06-507	Harold Schmidt	--	1887	300	10	--	do	1,779	150.14	02-11-87	C,W	N	--
* SS 56-06-601	do	M. Vater	1954	800	10	6	do	1,752	121.80 123.83	06-24-58 09-12-58	T,B	Irr	Open hole from 6 feet to 800 feet. Estimated yield 800 gpm. Pumping test. Well R-23 in Bulletin 6017.
SS 56-06-602	Tommy Brook Estate	F. Wilson	1955	275	12	12	do	1,685	63.46 60.95 78.35	11-08-57 10-03-73 03-10-87	C,W	S	Open hole from 12 feet to 275 feet. Measured yield in 1955 was 850 gpm. Originally drilled as an irrigation well. Additional water levels in Bulletin 6017.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SS 56-06-603	Arthur Hurley Estate	M. Vater	1954	370	10	15	Crh	1,680	55.50 57.70 52.57 61.78	11-13-57 10-03-73 05-07-74 02-05-87	T,B	Irr	Open hole completion from 15 to 370 feet. Reported yield 725 gpm. Pumping test. 1/
* SZ 56-06-604	Clifford Sherwood, Jr.	--	1930	297	8	50	do	1,685	50 59.36 64.12 69.94	1954 10-06-58 08-02-72 02-04-87	S,E	Irr	Open hole completion from 50 to 300 feet. Reported yield 650 gpm in 1954. Observation well.
* SZ 56-06-605	Vernon Nobles	D. Clary	1957	343	10	3	do	1,675	40 39.08 45.05 55.60	02-57 09-30-58 01-29-59 02-04-87	T,E	Irr	Open hole completion from 3 to 343 feet. Pump set at 110 feet. Reported yield 600 gpm. Pumping test.
* SZ 56-06-606	Harold Schmidt	M. Vater	1955	180	10	10	do	1,670	50 49.78 56.90 59.10 59.68	03-55 04-02-58 05-30-85 03-26-86 02-05-87	T,E	Irr	Open hole completion from 10 to 180 feet. Reported yield 500 gpm.
* SZ 56-06-607	Clifford Sherwood, Jr.	D. Clary	1958	74	12	--	do	1,645	1.19 19.36	10-07-58 01-30-87	C,H	N	--
SZ 56-06-608	Eric Probst	M.M. Virdell	1957	355	12	21	do	1,706	60 60.88 76.33	05-57 03-14-58 03-03-87	T,E	Irr	Open hole completion from 21 to 355 feet. Measured yield 557 gpm in 1957. Pump setting at 230 feet.
* SS 56-06-609	Tommy Brook Estate	F. Wilson	--	224	6	--	do	1,674	27.95 68.05	06-05-72 04-23-87	C,W	S	Observation well. Well No. R-29 in Bulletin 6017.
SS 56-06-610	do	J. Davies	1956	360	12	12	do	1,646	44.93 49.53	11-08-57 04-23-87	N	N	Open hole completion from 12 to 360 feet. Reported yield 300 gpm. Observation well. Well No. R-13 in Bulletin 6017. 2/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-611	Clifford Sherwood, Jr.	B. Euen	1971	93	14	20	Crh	1,645	14.49 18.96	08-02-72 03-03-87	N	N	Open hole completion from 20 to 93 feet. Recorder observation well. 2/
* SS 56-06-612	Harold Schmidt	--	1967	620	10	7	do	1,775	149.74	01-14-87	T,E	Irr	Open hole completion from 7 to 620 feet. 1/
* SZ 56-06-613	Dortha White	TWDB	1974	312	6.6	40	do	1,675	63.30 63.21	09-13-74 03-03-87	N	N	Test hole. Open hole completion from 40 to 312 feet. Observation well. 1/ 2/
* SS 56-06-614	State of Texas	do	1974	641	6	198	do	1,743	118.67 129.72	11-05-74 01-14-87	N	N	Test hole. Open hole completion from 198 to 641 feet. Recorder observation well. Formation samples. 1/ 2/
SS 56-06-615	Arthur Hurley Estate	--	1960	395	--	--	do	1,694	69.27 91.95 77.73	05-07-74 01-15-87 02-05-87	T,B	Irr	--
SS 56-06-616	do	M. Vater	1969	300	12	--	do	1,661	38.61 54.80 47.58	05-07-74 01-15-87 02-05-87	T,B	Irr	--
* SZ 56-06-617	Dortha White	M.M. Virdell	1966	280	12	--	do	1,692	54 54.55 61.00 64.00 65.05	1966 05-07-74 03-13-85 02-05-87 03-03-87	T,E	Irr	Pump set at 204 feet. Average yield measured 534 gpm. Pump test available.
* SZ 56-06-618	do	T. Virdell	1963	380	12	--	do	1,678	55.81	02-05-87	T,B	Irr	--

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SZ 56-06-619	Clifford Sherwood, Jr.	D. Wilson	1967	134	6	--	Crh	1,682	58.90 59.74	03-13-85 02-04-87	C,W	S	--
SZ 56-06-620	do	D. Clary	1958	66	14	10	do	1,660	23.07	01-30-87	N	N	--
SZ 56-06-621	Dortha White	J. Vater	1978	248	12	7	do	1,675	75 69.26	07-12-78 02-05-87	S,E	Irr	Open hole completion from 7 to 248 feet. 1/
SZ 56-06-623	Clifford Sherwood, Jr.	D. Wilson	1955	600	12	20	do	1,683	61.59	02-04-87	T,E	Irr	Open hole completion from 20 to 600 feet.
SZ 56-06-624	Vernon Nobles	M. Vater	--	333	10	--	do	1,690	71.10	02-04-87	T,E	Irr	--
* SZ 56-06-625	do	J. Vater	1979	310	10	12	do	1,714	155 94.68	02-02-79 02-04-87	S,E	Irr	Open hole completion from 12 to 310 feet. Observation well. 1/
SZ 56-06-626	do	M.M. Virdell	1966	295	10	8	do	1,698	76.03	02-04-87	T,E	Irr	Open hole completion from 8 to 295 feet. 1/
SZ 56-06-627	do	J. Vater	--	150	10	--	do	1,670	50.03 54.13	06-03-85 02-04-87	T,E	Irr	--
SZ 56-06-628	Jerry Gamel	M.M. Virdell	1968	131	12.25	6	do	1,685	50 54.13	12-68 02-05-87	T,E	Irr	Open hole completion from 6 to 131 feet.
* SZ 56-06-629	do	do	1967	157	12	5	do	1,690	55 61.90	03-67 02-05-87	T,B	Irr	Open hole completion from 5 to 157 feet. Average 210 gpm.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SZ 56-06-630	Vernon Nobles	M.M. Virdell	1973	274	12.75	16	Crh	1,680	63.80	02-04-87	T,E	Irr	Open hole completion from 16 to 274 feet. 1/
SZ 56-06-631	J.M. McLemore	--	1968	60	12	20	do	1,655	27.74	02-02-87	T,E	Irr	Open hole completion from 20 to 60 feet. Pump settting 56 feet. Reported yield 70 gpm.
SZ 56-06-632	Emily Probst Estate	M.M. Virdell	1972	380	14	14	do	1,688	66.60	03-03-87	T,B	Irr	Open hole completion from 14 to 380 feet. 1/
* SZ 56-06-635	Drew Tallent	--	1965	440	14	14	do	1,721	94.30	03-03-87	T,E	Irr	Open hole completion from 14 to 440 feet.
SS 56-06-638	Tommy Brook Estate	--	--	--	6	--	do	1,696	--	--	C,W	S	--
SS 56-06-639	do	--	--	--	6	--	do	1,731	115.58	04-23-87	C,W	S	--
SS 56-06-640	Bill Hall	--	--	--	10	--	Crh?	1,748	185.08	03-10-87	C,W	D,S	--
SS 56-06-641	Tommy Brook Estate	--	--	220	6	--	Crh	1,657	58.38 57.23	03-10-87 04-23-87	C,W	S	--
SS 56-06-642	Harold Schmidt	--	--	52	10	10	do	1,625	18.20	01-15-87	C,W	S	Open hole completion from 10 to 52 feet.
SS 56-06-643	do	--	--	283	12	--	do	1,661	50.82	02-05-87	S,E	Irr	--

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SS 56-06-644	Bill Hall	--	--	500	8	--	MCu?	1,781	195.89	04-16-87	S,E	S	--
SZ 56-06-645	Emily Probst Estate	--	1960+	91	6	20	Crh	1,695	--	--	C,W	S	Open hole completion from 20 to 91 feet.
SZ 56-06-646	Clifford Sherwood, Jr.	D. Wilson	1955	430	12	20	do	1,700	86.43	02-04-87	T,G	Irr	Open hole completion from 20 to 430 feet.
SZ 56-06-647	do	--	--	92	12.5	--	do	1,640	17.77	01-30-87	N	N	--
SZ 56-06-648	J.M. McLemore	M.M. Virdell	1967	58	12	17	do	1,653	26.64 25.64	02-02-87 09-17-87	N	N	Open hole completion from 17 to 58 feet. Observation well. 1/
* SZ 56-06-649	do	do	1967	69	12	8	do	1,660	28.52	02-02-87	T,E	Irr	Open hole completion from 8 to 69 feet. Reported yield 230 gpm. Pump setting at 65 feet.
SZ 56-06-650	do	do	1966	80	12	10	do	1,683	53.50	02-02-87	S,E	D,S	Open hole completion from 10 to 80 feet. Reported yield 40 gpm. Pump set at 74 feet.
SZ 56-06-651	Dortha White	--	--	100	8	--	do	1,650	35.72	02-02-87	S,E	D,S	--
* SZ 56-06-652	do	--	--	130	8	--	do	1,674	53.80	02-05-87	S,E	D	--
SZ 56-06-653	do	--	--	84	8	--	do	1,681	62.31	02-05-87	C,W	N	--

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SZ 56-06-654	Vernon Nobles	--	--	100	8	--	Crh	1,670	48.40 51.47	02-04-87 09-30-87	S,E	D,S	--
* SZ 56-06-655	Harold W. Schmidt	--	--	103	8	--	do	1,650	43.35 45.01	02-05-87 09-24-87	S,E	D,S	--
SZ 56-06-656	Jerry Gamel	M.M. Virdell	1972	276	12	5	do	1,692	62.60 71.30	1973 02-05-87	T,B	Irr	Open hole completion from 5 to 276 feet. Pump set at 220 feet. Average measured yield 592 gpm. 1/
* SZ 56-06-657	do	--	--	71	6	--	do	1,668	42.24	02-05-87	C,W	S	--
SZ 56-06-658	do	--	--	152	8	5	do	1,680	14.98	02-05-87	S,E	D,S	Open hole completion from 5 to 152 feet.
* SZ 56-06-659	Vernon Nobles	M.M. Virdell	--	100	8	5	do	1,678	63.76	09-30-87	S,E	D,S	Open hole completion from 5 to 100 feet.
SZ 56-06-660	Gerald Tallent	J. Vater	1976	184	9	10	do	1,725	90	01-76	S,E	D	Open hole completion from 10 to 184 feet. Reported yield 30 gpm. 1/
* SZ 56-06-661	A.J. and Mike Probst	M.M. Virdell	1966	363	12	20	do	1,696	71.38	03-03-87	T,E	Irr	Open hole completion from 20 to 363 feet. Pump set at 180 feet. 1/
SZ 56-06-662	Eric Probst	S. Magill	1977	190	7	17	do	1,740	122.41	03-03-87	S,E	S	Open hole completion from 17 to 190 feet. Reported yield 30 gpm. 1/
* SZ 56-06-801	Tim Schmidt	H.C. Harris	1936	548	8	20	do	1,899	199.10 264.65	11-22-39 08-03-73	S,E	D,S	Open hole completion from 20 to 548 feet. Reported yield 4 gpm.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SZ 56-06-802	Tim Schmidt	D. Clary	1927	475	8	10	Crh	1,808	153.60 129.50 167.40	01-22-59 08-08-73 03-09-87	C,W	S	Open hole completion from 10 to 475 feet.
* SZ 56-06-804	Mrs. B.H. Nobles	do	1955	245	10	3	do	1,780	105	08-55	T,E	Irr	Open hole completion from 3 to 245 feet. Reported yield 500 gpm.
* SZ 56-06-805	Mrs. Clint Nobles	M.M. Virdell	1957	200	12	5	do	1,778	109.18 119.74 124.43	03-14-58 07-16-73 03-11-87	T,E	Irr	Open hole completion from 5 to 200 feet. Reported yield 400 gpm.
* SZ 56-06-806	Tim Schmidt	do	1971	716	12	10	do	1,830	70.70 172.60	12-19-74 03-09-87	T,E	Irr	Open hole completion from 10 to 716 feet. Reported yield 700 gpm. 1/
SZ 56-06-807	do	do	1968	440	12	10	do	1,746	106.20 103.40 103.80	04-19-85 03-10-86 03-09-87	T,E	Irr,S	Open hole completion from 10 to 440 feet. Reported yield 700 gpm.
SZ 56-06-808	do	do	1968	420+	12	10	do	1,758	105.5	03-09-87	T,E	N	Open hole completion from 10 to 420 feet. Reported yield 400 gpm.
* SZ 56-06-809	B.H. Nobles	M. Vater	1974	381	12	20	do	1,759	70.45 113.60	12-19-74 03-09-87	T,E	Irr,S	Open hole completion from 20 to 381 feet.
* SZ 56-06-810	Dow Nobles	do	1972	414	10	20	do	1,862	--	--	T,E	Irr	Open hole completion from 20 to 414 feet. 1/
SZ 56-06-811	Walter Curren	M.M. Virdell	1967	206	12	18	do	1,781	132.53	03-11-87	T,E	Irr	Open hole completion from 18 to 206 feet. 1/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-812	Edwin Ince	J. Vater	1979	269	12.75	7	Crh	1,830	40	08-13-79	T,B	Irr	Open hole completion from 7 to 269 feet. 1/
SZ 56-06-813	J.R. Morgan	M.M. Virdell	1967	444	12	38	do	1,875	186.90	03-06-87	T,E	Irr	Open hole completion from 38 to 444 feet. 1/
SZ 56-06-815	Troy Sorrells	do	1966	441	12	13	do	1,809	126.7	03-06-87	N	N	Open hole completion from 13 to 441 feet. 1/
SZ 56-06-816	Walter Curren	do	1965	156	12	--	do	1,769	119.00	03-11-87	T,E	Irr	Reported yield 300 gpm.
SZ 56-06-817	do	do	1965	188	12	--	do	1,788	137.40	03-11-87	S,E	Irr,S	Reported yield 100 gpm.
SZ 56-06-818	do	Vater	--	321	12	--	do	1,848	--	--	S,E	Irr,S	--
SZ 56-06-819	Dow Nobles	do	1985	255	8	28	do	1,862	--	--	S,E	D,S	1/
SZ 56-06-820	J.R. Morgan	--	--	199	6	--	do	1,823	177.3	03-06-87	C,W	S	--
SZ 56-06-821	do	J.R. Morgan	1979	440	6	50	do	1,870	--	--	S,E	D,S	Open hole from 50 to 440 feet.
SZ 56-06-822	Troy Sorrells	--	1900	250	--	--	do	1,870	--	--	S,E	S	--
SZ 56-06-823	do	T. Virdell	1983	240	6	19	do	1,785	--	--	S,E	D	Open hole completion from 19 to 240 feet. Reported yield 100 gpm. 1/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-824	Edwin Ince	J. Vater	1979	305	12	10	Crh	1,830	178.80	03-10-87	N	N	Open hole completion from 10 to 305 feet. 1/
SZ 56-06-825	do	do	1980	250	6	--	do	1,842	--	--	S,E	D	--
SZ 56-06-826	Burt Nesloney	S. McGill	1984	300	8	--	do	1,780	--	--	S,E	D	--
SZ 56-06-827	Craig Talent	J. Vater	1975	268	12	10	do	1,875	205 219.39	1975 05-14-87	S,E	Irr,S	Open hole completion from 10 to 268 feet. 1/
* SZ 56-06-828	do	do	1975	294	10	10	do	1,865	195 205.5	1975 05-14-87	S,E	Irr	Open hole completion from 10 to 294 feet. 1/
SZ 56-06-829	do	do	1975	293	10.75	11	do	1,881	218.0 221.44	11-14-75 04-15-87	S,E	Irr	Open hole completion from 11 to 293 feet. 1/
SZ 56-06-830	do	do	--	270	--	--	do	1,875	221.44	05-14-87	S,E	Irr	--
* SZ 56-06-901	Jerry Kruse	M.M. Virdell	1957	122	12	3	do	1,718	58 57.71	1957 03-29-58	T,B	Irr	Open hole completion from 3 to 122 feet. Reported yield 360 gpm.
* SZ 56-06-902	Kelly Davenport	D. Clary	1956	189	12	4	do	1,716	62 90.90	08-56 03-12-87	N	N	Open hole completion from 4 to 189 feet. Reported yield 600 gpm.
* SZ 56-06-903	Arthur Hurley Estate	M. Vater	1946	149	10	15	do	1,723	60 85.56	1946 02-06-87	T,E 66.00	Irr 03-14-58	Open hole completion from 15 to 149 feet. Reported yield 228 gpm.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-904	Arthur Hurley Estate	M. Vater	1947	120	10	15	Crh	1,730	60	1947	T,E	Irr	Open hole completion from 15 to 120 feet. Reported yield 210 gpm.
									70.13	03-14-58			
									72.70	05-06-74			
									86.82	02-02-87			
* SZ 56-06-905	Drew Tallent	D. Clary	1956	131	15	5	do	1,734	68	1956	T,E	Irr	Open hole completion from 5 to 131 feet. Reported yield 280 gpm.
									72.35	04-04-58			
									77.70	04-16-74			
* SZ 56-06-906	Edwin Ince	M.M. Virdell	1956	139	15	5	do	1,765	105	1956	T,E	Irr	Open hole completion from 5 to 139 feet. Measured yield 180 gpm in 1956.
									101.44	03-28-58			
									102.75	07-17-73			
									97.55	12-12-74			
									113.70	03-10-87			
* SZ 56-06-907	do	do	1956	139	15	5	do	1,787	105	10-56	N	N	Open hole completion from 5 to 139 feet. Reported yield 70 gpm.
									112.21	03-28-58			
									111.23	07-17-73			
									120.75	03-10-87			
SZ 56-06-908	Morris Kidd	D. Clary	1955	165	15	6	do	1,761	90	08-55	T,D	Irr	Open hole completion from 6 to 165 feet. Measured yield 379 gpm in 1955.
									95.48	03-28-58			
SZ 56-06-909	do	do	1956	117	15	7	do	1,749	87	12-56	T,E	Irr	Open hole completion from 7 to 117 feet. Measured yield 175 gpm in 1956.
									85.83	03-28-58			
									84.60	07-16-73			
SZ 56-06-910	Arthur Hurley Estate	M.M. Virdell	1965	116	12	--	do	1,719	68.60	06-22-67	N	N	Observation well. 1/
									75.95	03-10-87			
* SZ 56-06-911	L.F. Nobles	do	1965	232	15	15	do	1,759	117.41	12-19-74	T,E	Irr	Open hole completion from 15 to 232 feet. Reported yield 200 gpm.
									130.29	03-09-87			

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-912	E. Elliot	--	--	149	--	--	Crh	1,722	79.10 82.12	04-15-85 02-06-87	T	N	--
SZ 56-06-913	Drew Tallent	M.M. Virdell	1969	135	12	6	do	1,695	76.82	03-05-87	T,E	Irr	Open hole completion from 6 to 135 feet. 1/
SZ 56-06-914	Kelly Davenport	do	1960+	166	12	--	do	1,700	--	--	T,E	Irr	Reported yield 400 gpm.
SZ 56-06-915	do	J. Vater	1980	212	12	13	do	1,709	90 81.76	01-09-80 03-12-87	T,E	Irr	Open hole completion from 13 to 212 feet. Reported yield 650 gpm. 1/
* SZ 56-06-916	Jerry Kruse	M.M. Virdell	--	130	12	--	do	1,711	--	--	T,D	Irr	--
SZ 56-06-917	do	--	--	155	12	10	do	1,708	--	--	T,E	N	Open hole completion from 10 to 155 feet.
SZ 56-06-918	G.W. Evans	Vater	1970+	130	12	10	do	1,712	78.96	03-13-87	T,D	Irr	Open hole completion from 10 to 130 feet.
SZ 56-06-919	A.J. & Mike Probst	M.M. Virdell	1968	304	12	6	do	1,722	89.72	03-03-87	T,E	Irr	Open hole completion from 6 to 304 feet. 1/
* SZ 56-06-920	Drew Tallent	--	1965	414	12	--	do	1,710	79.66	03-03-87	T,E	Irr	Reported yield 100 gpm.
SZ 56-06-921	do	--	1962	390	14	--	do	1,710	81.18	03-03-87	T,E	Irr	--
SZ 56-06-922	do	--	1963	360	12	--	do	1,718	85.19	03-03-87	T,E	Irr	Reported yield 1,000 gpm.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-923	Mrs. Clint Nobles	--	--	218	--	--	Crh	1,758	--	--	T,E	Irr	--
SZ 56-06-924	Edwin Ince	--	--	140	--	--	do	1,765	--	--	S,E	D,S	--
SZ 56-06-925	do	--	--	119	12	--	do	1,761	97.70	03-10-87	N	N	--
SZ 56-06-926	do	--	1955	105	--	--	do	1,760	95.90	03-10-87	S	N	--
SZ 56-06-927	Drew Tallent	--	1960+	225	12	--	do	1,742	99.46	03-09-87	T,E	Irr	Reported yield 585 gpm.
SZ 56-06-928	do	--	--	100	41	--	do	1,761	95.00	03-10-87	C,W	S	--
SZ 56-06-929	G.W. Evans	M.M. Virdell	1974	173	12.75	10	do	1,723	87.40	03-13-87	N	N	Open hole completion from 10 to 173 feet. 1/
SZ 56-06-930	do	Vater	1970+	135	12	10	do	1,723	86.30	03-13-87	N	N	Open hole completion from 10 to 135 feet.
SZ 56-06-931	do	M.M. Virdell	1970+	150	12	10	do	1,709	76.00	03-13-87	N	N	Open hole completion from 10 to 150 feet.
SZ 56-06-932	A.J. & Mike Probst	--	--	126	8	--	do	1,722	94.70	03-03-87	C,W	S	--
* SZ 56-06-933	Edwin Ince	M.M. Virdell	1965	148	12	5	do	1,771	113.80	03-10-87	T,E	Irr	Open hole completion from 5 to 148 feet. 1/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-934	Edwin Ince	--	1950+	130	--	--	Crh	1,780	114.65	03-10-87	T,E	Irr	--
SZ 56-06-935	Drew Talent	M.M. Virdell	--	122	12	--	do	1,704	77.00	03-05-87	N	N	--
SZ 56-06-936	Kelly Davenport	--	--	104	12	5	do	1,717	88.32	03-12-87	S,E	D	Open hole completion from 5 to 104 feet.
SZ 56-06-937	Gene Kidd	M.M. Virdell	1967	125	12.5	7	do	1,729	99.60	03-11-87	S,E	Irr	Open hole completion from 7 to 125 feet. Reported yield 65 gpm. 1/
SZ 56-06-938	do	do	1969	115	12	5	do	1,736	105.20	03-11-87	N	N	Open hole completion from 5 to 115 feet. 1/
SZ 56-06-939	Jerry Kruse	do	1968	78	7	30	do	1,710	74.10	03-11-87	C,W	S	Open hole completion from 30 to 78 feet. 1/
* SZ 56-06-940	do	J. Vater	1980	85	8	8	do	1,705	55	01-21-80	S,E	D	Open hole completion from 8 to 85 feet. 1/
SZ 56-06-941	Mrs. Vernon Kruse	--	--	119	8	--	do	1,712	--	--	S,E	D	--
SZ 56-06-942	do	--	--	120	--	--	do	1,712	86.68	03-10-87	S,E	S	--
SZ 56-06-943	Clifford Sherwood, Jr.	--	--	30	42	30	do	1,680	20.35	01-30-87	C,W	N	Rock and motar to bottom.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-06-944	Arthur Hurley Estate	M.M. Virdell	1967	108	12	12	Crh	1,708	75.94	02-06-87	N	N	Open hole completion from 12 to 108 feet. 1/
SZ 56-06-945	do	--	--	83	7	--	do	1,725	78.97	02-06-87	C,W	D,S	--
SZ 56-06-946	do	--	--	54	6	--	do	1,732	50.92	02-06-87	C,H	N	--
SZ 56-06-947	Bethel Cemetary	M.M. Virdell	1967	105	7	12	do	1,720	--	--	S,E	Irr	Open hole completion from 12 to 105 feet. 1/
SZ 56-06-948	do	--	--	96	7	--	do	1,720	92.38	02-02-87	N	N	--
SZ 56-06-949	G.W. Evans	--	--	80	12.5	--	do	1,717	71.54	02-06-87	N	N	--
SZ 56-06-950	William Edmiston	--	--	31	11	1	do	1,690	26.68	02-03-87	N	N	Open hole completion from 1 to 31 feet.
SZ 56-06-951	Jerry Kruse	M.M. Virdell	1962	110	12	--	do	1,729	95.74	05-21-87	T,E	Irr	--
* SZ 56-06-952	Vernon Nobles	M. Vater	--	102	6	--	do	1,728	91.51	08-30-87	S,E	D	--
SS 56-07-113	Tommy Brook Estate	--	--	Spring	--	--	MCu?	1,545	--	03-13-87	N	S	Highline Spring. Estimated flow 50 gpm.
SS 56-07-401	Jesse Dobbs	D. Wilson	1953	210	6	3	Crh	1,711	85.69 111.40	11-13-57 08-21-73	C,W	S	Open hole completion from 3 to 210 feet. This well is R-32 in bulletin 6017.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
* SZ 56-07-403	Gene Kidd	M.M. Virdell	1957	235	12	10	Crh	1,711	78 77.19 115.35 112.48 118.62	02-57 10-07-58 02-02-87 05-13-87 09-23-87	N	N	Open hole completion from 10 to 235 feet. Reported yield 400 gpm. 2/
* SZ 56-07-404	A.M. Harkey, Inc.	do	1966	450	12	14	do	1,752	68.83 143.80	08-02-72 02-05-87	T,E	Irr	Open hole completion from 14 to 450 feet. Observation well. 1/
* SS 56-07-406	W.G. Evans	--	1967	192	10	160	do	1,674	70	1967	T,B	Irr	Open hole completion from 160 to 192 feet. Reported yield 240 gpm. 1/
SS 56-07-407	do	M.M. Virdell	1969	175	12	11	do	1,665	88.82	03-13-87	T,B	Irr	Open hole completion from 11 to 175 feet. 1/
SZ 56-07-409	Clifford Sherwood, Jr.	J. Vater	1982	82	12	--	do	1,666	56.87 60.20	01-30-87 03-13-87	T,D	Irr	Reported yield 150 gpm. Pump setting 100 feet.
SZ 56-07-410	W.G. Evans	W. G. Evans	--	25	18	--	do	1,657	15.70	03-13-87	N	N	--
* SZ 56-07-411	Gene Kidd	M.M. Virdell	1969	245	12	15	do	1,702	--	--	T,B	Irr	Open hole completion from 15 to 245 feet. 1/
SZ 56-07-412	Jesse Dobbs	M. Vater	1975	200	11	100	do	1,697	--	--	T,D	Irr	Open hole completion from 100 to 200 feet.
* SS 56-07-413	James Durst	J. Vater	--	191	12.5	14	do	1,706	129.23 115.04	04-08-87 05-13-87	T,D	Irr	Open hole completion from 14 to 191 feet. 2/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing		Aquifer	Elevation of land surface (ft)	Water Level		Method of Lift	Use of Water	Remarks
					Diameter (in.)	Depth (ft)			Above (+) or below land surface datum (ft)	Date of Measurement			
SS 56-07-414	Jesse Dobbs	M. Vater	1978	206	11	100	Crh	1,710	--	--	T,D	Irr	Open hole completion from 100 to 206 feet.
SS 56-07-415	do	do	1978	200	11	100	do	1,680	--	--	T,D	Irr	Open hole completion from 100 to 200 feet.
SS 56-07-416	do	do	1974	262	12	14	do	1,717	112	1974	T,D	Irr	Open hole completion from 14 to 262 feet. 1/
SS 56-07-417	do	do	1974	225	18	10	do	1,688	113.89	04-16-87	N	N	Open hole completion from 10 to 225 feet. 1/
* SS 56-07-418	Tommy Brook Estate	--	--	144	6	--	do	1,636	42.09 38.77	03-10-87 04-16-87	C,W	S	--
SS 56-07-420	W.G. Evans	--	--	60	--	--	do	1,672	--	--	N	N	--
SS 56-07-421	do	--	--	100	8	--	do	1,655	--	--	S,E	D	--
SZ 56-07-422	James Durst	J. Vater	--	173	12.5	10	do	1,711	117.71 116.20	04-08-87 05-13-87	N	N	Open hole completion from 10 to 173 feet.
SS 56-07-423	do	do	1982	180	12.5	10	do	1,705	116.21	05-13-87	S,E	Irr,S	Open hole completion from 10 to 180 feet.
SZ 56-07-424	Jacky Sallee	M.M. Virdell	1966	254	12	6	do	1,710	110.90 111.60	02-03-87 05-13-87	N	N	Open hole completion from 6 to 254 feet. 1/

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-07-425	Jacky Sallee	--	--	348	12	--	Crh	1,685	99.83 101.98 112.00 106.97	02-03-87 05-06-87 05-12-87 05-13-87	N	N	2/
* SZ 56-07-426	Gene Kidd	Virdell Drlg., Inc.	1986	650	12	19	do	1,740	128 114.33 128.08	03-15-86 02-02-87 09-23-87	T,D	Irr	Open hole completion from 19 to 650 feet. Pump setting 315 feet. Reported yield 500 gpm. 1/
* SZ 56-07-427	do	M.M. Virdell	1974	230	18	6	do	1,718	122.78 126.36	02-02-87 09-23-87	T,D	Irr	Open hole completion from 6 to 230 feet. Pump setting 200 feet. Reported yield 600 gpm. 1/
SZ 56-07-428	Clifford Sherwood, Jr.	J. Vater	1982	299	14	--	do	1,696	95.40 102.37	03-13-85 01-30-87	T,D	Irr	Open hole completion from 14 to 299 feet. Pump setting 210 feet. Reported yield 250 gpm.
SZ 56-07-429	do	do	1982	125	12.5	--	do	1,675	78.51	01-30-87	N	N	--
SZ 56-07-430	do	do	1976	291	12.75	15	do	1,668	90 73.56	03-76 01-30-87	N	N	Open hole completion from 15 to 291 feet. 1/
SZ 56-07-431	do	do	1982	100	12.5	--	do	1,691	77.25	01-30-87	N	N	--
SZ 56-07-432	do	D. Wilson	1967	110	6	--	do	1,669	54.14	01-30-87	C,W	N	--
* SZ 56-07-433	Gene Kidd	M.M. Virdell	1960	224	12	--	MCu	1,770	42.12 34.81	02-03-87 09-23-87	S,E	D,S	Pump setting 100 feet.

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-07-434	James Durst	--	--	301	12	--	Crh	1,678	95.56	02-03-87	T,D	Irr	--
SZ 56-07-435	do	J. Vater	1979	255	8	9	do	1,735	155	01-16-79	S,E	D,S	Open hole completion from 9 to 255 feet. 1/
SZ 56-07-436	do	--	--	88	8	--	do	1,655	43.13	02-03-87	C,W	S	--
SZ 56-07-437	A.M. Harkey, Inc.	M.M. Virdell	1966	352	12	9	do	1,746	--	--	T,E	Irr	Open hole completion from 9 to 352 feet. 1/
SZ 56-07-438	do	do	1967	329	12	10	do	1,750	147.40	02-05-87	S,E	Irr	Open hole completion from 10 to 329 feet. 1/
SZ 56-07-439	do	--	--	115	14	--	do	1,720	111.10	02-05-87	N	N	--
SZ 56-07-440	do	--	--	228	12	--	do	1,713	112.20	02-05-87	S,E	D,S	--
SZ 56-07-441	do	--	--	30	42	30	do	1,730	15.08	02-03-87	N	N	--
SZ 56-07-442	do	--	--	31	32	31	do	1,732	15.57	02-03-87	C,W	S	--
* SZ 56-07-443	James Durst	J. Vater	1987	362	12.5	12	do	1,687	104.91 115.28	05-06-87 05-21-87	T,D	Irr	Open hole completion from 12 to 362 feet. 2/
* SZ 56-07-444	Terry Kidd	--	--	100	6	--	MCu	1,780	39.66	09-23-87	S,E	D,S	--

See footnotes at end of table.

Table 2.-- Records of Wells and Springs (Continued).

Location Number	Owner	Driller	Date Completed	Depth of Well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Aquifer	Elevation of land surface (ft)	Water Level: Above (+) or below land surface datum (ft)	Water Level: Date of Measurement	Method of Lift	Use of Water	Remarks
SZ 56-07-701	Kelly Davenport	J. Vater	1980+	505	6	5	Crh	1,740	99.60	03-13-87	S,E	S	Open hole completion from 5 to 505 feet.
* SZ 56-07-702	Mrs. G. E. Kidd	T. Virdell	1976	340	6	3	do	1,760	--	--	S,E	D,S	Open hole completion from 3 to 340 feet. Reported yield 250 gpm. 1/
SZ 56-14-201	L. B. Haines	L. Dodd	1986	301	7	130	do	1,920	248.98	04-16-87	S,E	S	Open hole completion from 130 to 301 feet.
SZ 56-14-202	do	M.M. Virdell	1967	188	--	--	do	1,858	--	--	N	N	Test hole. Dry. 1/
SZ 56-14-203	do	do	1967	163	12	7	do	1,843	145.71	04-16-87	S,E	D,S	Open hole completion from 7 to 163 feet. 1/
SZ 56-14-301	Ted Lee	J. Vater	1978	54	7	20	do	1,781	35	10-23-78	S,E	S	Open hole completion from 20 to 54 feet. Reported yield 20 gpm. 1/
SZ 56-15-101	Federal Land Bank	S. Magill	--	274	10	--	do	1,860	56 76.16	1979 09-22-87	T,D	Irr	Pump setting 260 feet. Measured yield 584 gpm.
SZ 56-15-102	Mike Dall	J. Vater	--	260	12	--	do	1,870	74.3 86.91	02-80 09-22-87	T,B	Irr	Pump setting 250 feet. Measured yield 430 gpm.

1/ Drillers logs available in TWDB Files.
2/ Geophysical log(s) available in TWDB Files.

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells.

[State Well Number - Location number for observation well. Well located on well location map.
Aquifer Code - "100" means well completed in Hickory Aquifer.
Depth of Well - Given in Feet.
Elevation of Land Surface - Given in Feet.
Measurement - Given in Feet. "+" means water level is above land surface. All other measurements below land surface. * means measurement affected by pumping.
Elevation of Water Level - Given in Feet
Change in Water Level, etc. - Given in Feet]

McCulloch County

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
42-62-902	100	786	1580.00	03-25-75	+ 0.80	1580.80		
				04-17-87	7.38	1572.62	8.18	
				09-17-87	9.14	1570.86	1.76	
				12-16-87	8.80	1571.20		0.34
56-06-609	100	224	1674.00	06-05-72	27.95	1650.05		
				12-06-72	62.07	1615.93	34.12	
				12-04-73	60.42*	1617.58		
				12-10-74	62.40	1615.60	0.33	
				03-23-76	63.75*	1614.25		
				03-10-77	61.85	1616.15		0.55
				03-14-78	62.22	1615.78	0.37	
				04-03-79	59.78	1618.22		2.44
				11-19-80	68.10	1609.90	8.32	
				10-18-83	70.63*	1607.37		
				10-29-86	70.06	1607.94	1.96	
				04-23-87	68.05	1609.95		2.01
56-06-610	100	360	1646.00	11-08-57	44.93	1601.07		
				01-08-58	44.23	1601.77		0.70
				02-20-58	43.87	1602.13		0.36
				03-17-58	43.40	1602.60		0.47
				04-22-58	43.10	1602.90		0.30
				05-19-58	43.10	1602.90		
				06-18-58	43.29	1602.71	0.19	
				07-17-58	44.00	1602.00	0.71	
				08-18-58	44.61	1601.39	0.61	
				09-17-58	43.77	1602.23		0.84
				10-15-58	43.36	1602.64		0.41
				11-13-58	43.23	1602.77		0.13
				12-15-58	43.20	1602.80		0.03
				06-05-72	40.38	1605.62		2.82
				12-06-72	41.80	1604.20	1.42	
				12-04-73	40.97	1605.03		0.83
				12-10-74	41.80	1604.20	0.83	
				03-23-76	42.00	1604.00	0.20	
				03-10-77	42.40	1603.60	0.40	
				03-14-78	43.93	1602.07	1.53	
				04-03-79	44.63	1601.37	0.70	
				11-19-80	46.72	1599.28	2.09	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASUREMENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-610	CONT.			10-18-83	49.04	1596.96	2.32	
				10-29-86	50.95	1595.05	1.91	
				04-23-87	49.53	1596.47		1.42
56-06-614	100	641	1743.00	11-05-74	117.21	1625.79		
				11-05-74	117.66	1625.34	0.45	
				11-05-74	118.67	1624.33	1.01	
				09-26-75	122.44	1620.56	3.77	
				09-30-75	121.72	1621.28		0.72
				10-05-75	122.00	1621.00	0.28	
				10-10-75	121.48	1621.52		0.52
				10-15-75	121.21	1621.79		0.27
				10-20-75	121.17	1621.83		0.04
				10-25-75	121.17	1621.83		
				10-30-75	120.81	1622.19		0.36
				11-05-75	120.47	1622.53		0.34
				11-10-75	120.32	1622.68		0.15
				11-13-75	120.57	1622.43	0.25	
				11-15-75	120.11	1622.89		0.46
				11-20-75	120.78	1622.22	0.67	
				11-25-75	121.65	1621.35	0.87	
				11-30-75	121.18	1621.82		0.47
				12-05-75	120.58	1622.42		0.60
				12-10-75	120.25	1622.75		0.33
				12-15-75	120.19	1622.81		0.06
				12-20-75	120.22	1622.78	0.03	
				12-25-75	120.38	1622.62	0.16	
				12-30-75	120.63	1622.37	0.25	
				01-05-76	120.51	1622.49		0.12
				01-10-76	120.03	1622.97		0.48
				01-15-76	120.11	1622.89	0.08	
				01-20-76	120.16	1622.84	0.05	
				01-25-76	119.47	1623.53		0.69
				01-30-76	119.58	1623.42	0.11	
				02-05-76	119.76	1623.24	0.18	
				02-10-76	119.85	1623.15	0.09	
				02-15-76	119.89	1623.11	0.04	
				02-20-76	119.98	1623.02	0.09	
				02-25-76	120.22	1622.78	0.24	
				03-05-76	119.93	1623.07		0.29
				03-10-76	119.94	1623.06	0.01	
				03-15-76	119.67	1623.33		0.27

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			03-20-76	119.84	1623.16	0.17	
				03-23-76	121.32	1621.68	1.48	
				03-25-76	120.43	1622.57		0.89
				03-30-76	120.05	1622.95		0.38
				04-05-76	119.79	1623.21		0.26
				04-10-76	119.78	1623.22		0.01
				04-15-76	119.34	1623.66		0.44
				04-20-76	119.48	1623.52	0.14	
				04-25-76	119.51	1623.49	0.03	
				04-30-76	119.55	1623.45	0.04	
				05-05-76	119.31	1623.69		0.24
				05-06-76	119.40	1623.60	0.09	
				05-10-76	119.36	1623.64		0.04
				05-15-76	119.18	1623.82		0.18
				05-20-76	119.33	1623.67	0.15	
				05-25-76	119.05	1623.95		0.28
				05-30-76	119.77	1623.23	0.72	
				06-05-76	122.00	1621.00	2.23	
				06-10-76	121.05	1621.95		0.95
				06-15-76	121.00	1622.00		0.05
				06-20-76	121.56	1621.44	0.56	
				06-25-76	122.90	1620.10	1.34	
				06-30-76	121.54	1621.46		1.36
				07-05-76	120.22	1622.78		1.32
				07-10-76	120.93	1622.07	0.71	
				07-15-76	119.68	1623.32		1.25
				07-20-76	118.82	1624.18		0.86
				07-25-76	118.62	1624.38		0.20
				07-30-76	119.35	1623.65	0.73	
				08-05-76	123.29	1619.71	3.94	
				08-10-76	124.82	1618.18	1.53	
				08-15-76	126.38	1616.62	1.56	
				08-20-76	127.17	1615.83	0.79	
				08-25-76	127.65	1615.35	0.48	
				08-30-76	128.54	1614.46	0.89	
				09-05-76	124.37	1618.63		4.17
				09-10-76	123.42	1619.58		0.95
				09-15-76	123.94	1619.06	0.52	
				09-20-76	123.44	1619.56		0.50
				09-25-76	122.39	1620.61		1.05
				09-30-76	122.17	1620.83		0.22
				10-05-76	121.73	1621.27		0.44

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASUREMENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			10-10-76	121.65	1621.35		0.08
				10-15-76	121.33	1621.67		0.32
				10-20-76	121.44	1621.56	0.11	
				10-25-76	121.11	1621.89		0.33
				10-30-76	120.80	1622.20		0.31
				11-05-76	120.17	1622.83		0.63
				11-10-76	119.89	1623.11		0.28
				11-15-76	119.87	1623.13		0.02
				11-20-76	119.70	1623.30		0.17
				11-25-76	119.65	1623.35		0.05
				11-30-76	120.05	1622.95	0.40	
				12-05-76	119.75	1623.25		0.30
				12-10-76	119.88	1623.12	0.13	
				12-15-76	119.78	1623.22		0.10
				12-20-76	119.83	1623.17	0.05	
				12-25-76	119.51	1623.49		0.32
				12-30-76	119.32	1623.68		0.19
				01-05-77	119.58	1623.42	0.26	
				01-10-77	119.80	1623.20	0.22	
				01-15-77	119.45	1623.55		0.35
				01-20-77	119.65	1623.35	0.20	
				01-25-77	119.50	1623.50		0.15
				01-30-77	119.51	1623.49	0.01	
				02-05-77	119.53	1623.47	0.02	
				02-10-77	119.43	1623.57		0.10
				02-15-77	119.55	1623.45	0.12	
				02-20-77	119.48	1623.52		0.07
				02-25-77	119.09	1623.91		0.39
				03-05-77	119.51	1623.49	0.42	
				03-10-77	119.24	1623.76		0.27
				03-15-77	119.45	1623.55	0.21	
				03-20-77	119.41	1623.59		0.04
				03-25-77	119.48	1623.52	0.07	
				03-30-77	119.40	1623.60		0.08
				04-05-77	119.60	1623.40	0.20	
				04-10-77	119.68	1623.32	0.08	
				04-15-77	119.33	1623.67		0.35
				04-20-77	118.25	1624.75		1.08
				04-25-77	117.36	1625.64		0.89
				04-30-77	115.98	1627.02		1.38
				05-05-77	115.02	1627.98		0.96
				05-10-77	114.44	1628.56		0.58

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			05-15-77	113.98	1629.02		0.46
				05-20-77	114.30	1628.70	0.32	
				05-25-77	114.79	1628.21	0.49	
				05-30-77	115.05	1627.95	0.26	
				06-05-77	116.42	1626.58	1.37	
				06-10-77	117.47	1625.53	1.05	
				06-15-77	118.90	1624.10	1.43	
				06-20-77	119.25	1623.75	0.35	
				06-25-77	118.85	1624.15		0.40
				06-30-77	119.34	1623.66	0.49	
				07-05-77	121.28	1621.72	1.94	
				07-10-77	123.79	1619.21	2.51	
				07-15-77	125.20	1617.80	1.41	
				07-20-77	126.12	1616.88	0.92	
				07-25-77	126.80	1616.20	0.68	
				07-30-77	128.24	1614.76	1.44	
				08-04-77	129.02	1613.98	0.78	
				08-05-77	129.10	1613.90	0.08	
				08-10-77	129.76	1613.24	0.66	
				08-15-77	128.58	1614.42		1.18
				08-20-77	129.83	1613.17	1.25	
				08-25-77	127.73	1615.27		2.10
				08-30-77	126.50	1616.50		1.23
				09-05-77	128.84	1614.16	2.34	
				09-10-77	129.24	1613.76	0.40	
				09-15-77	127.85	1615.15		1.39
				09-20-77	129.09	1613.91	1.24	
				09-25-77	129.42	1613.58	0.33	
				09-30-77	129.70	1613.30	0.28	
				10-05-77	130.31	1612.69	0.61	
				10-10-77	128.70	1614.30		1.61
				10-15-77	126.84	1616.16		1.86
				10-20-77	126.65	1616.35		0.19
				10-25-77	125.17	1617.83		1.48
				10-30-77	124.44	1618.56		0.73
				11-05-77	124.13	1618.87		0.31
				11-10-77	124.10	1618.90		0.03
				11-15-77	123.52	1619.48		0.58
				11-16-77	123.52	1619.48		
				11-20-77	123.37	1619.63		0.15
				11-25-77	123.35	1619.65		0.02
				11-30-77	123.08	1619.92		0.27

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			12-05-77	122.92	1620.08		0.16
				12-10-77	123.30	1619.70	0.38	
				12-15-77	122.76	1620.24		0.54
				12-20-77	122.96	1620.04	0.20	
				12-25-77	122.82	1620.18		0.14
				12-30-77	122.70	1620.30		0.12
				01-05-78	122.66	1620.34		0.04
				01-10-78	122.75	1620.25	0.09	
				01-15-78	122.42	1620.58		0.33
				01-20-78	122.60	1620.40	0.18	
				01-25-78	122.38	1620.62		0.22
				01-30-78	122.53	1620.47	0.15	
				02-05-78	122.58	1620.42	0.05	
				02-10-78	122.26	1620.74		0.32
				02-15-78	122.35	1620.65	0.09	
				02-20-78	122.27	1620.73		0.08
				02-25-78	122.18	1620.82		0.09
				03-05-78	122.19	1620.81	0.01	
				03-10-78	121.98	1621.02		0.21
				03-14-78	122.19	1620.81	0.21	
				03-15-78	122.15	1620.85		0.04
				03-20-78	122.09	1620.91		0.06
				03-25-78	122.31	1620.69	0.22	
				03-30-78	122.36	1620.64	0.05	
				04-05-78	122.18	1620.82		0.18
				04-10-78	122.64	1620.36	0.46	
				04-12-78	122.46	1620.54		0.18
				04-15-78	122.30	1620.70		0.16
				04-20-78	122.29	1620.71		0.01
				04-25-78	122.47	1620.53	0.18	
				04-30-78	122.14	1620.86		0.33
				05-05-78	122.15	1620.85	0.01	
				05-10-78	122.52	1620.48	0.37	
				05-15-78	123.65	1619.35	1.13	
				05-18-78	123.79	1619.21	0.14	
				05-20-78	124.07	1618.93	0.28	
				05-25-78	123.65	1619.35		0.42
				05-30-78	123.62	1619.38		0.03
				06-05-78	122.59	1620.41		1.03
				06-10-78	122.20	1620.80		0.39
				06-15-78	122.20	1620.80		
				06-20-78	122.23	1620.77	0.03	

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			06-25-78	125.50	1617.50	3.27	
				06-30-78	127.94	1615.06	2.44	
				07-05-78	129.47	1613.53	1.53	
				07-10-78	130.53	1612.47	1.06	
				07-15-78	131.74	1611.26	1.21	
				07-20-78	132.63	1610.37	0.89	
				07-25-78	132.90	1610.10	0.27	
				07-30-78	132.78	1610.22		0.12
				08-05-78	128.52	1614.48		4.26
				08-10-78	125.77	1617.23		2.75
				08-15-78	125.04	1617.96		0.73
				08-20-78	128.90	1614.10	3.86	
				08-24-78	130.18	1612.82	1.28	
				08-25-78	130.30	1612.70	0.12	
				08-30-78	130.38	1612.62	0.08	
				09-05-78	127.26	1615.74		3.12
				09-10-78	126.48	1616.52		0.78
				09-15-78	125.75	1617.25		0.73
				09-20-78	125.53	1617.47		0.22
				09-25-78	125.38	1617.62		0.15
				09-30-78	125.01	1617.99		0.37
				10-05-78	124.78	1618.22		0.23
				10-10-78	124.58	1618.42		0.20
				10-15-78	124.70	1618.30	0.12	
				10-20-78	124.77	1618.23	0.07	
				10-25-78	124.87	1618.13	0.10	
				10-30-78	124.75	1618.25		0.12
				11-05-78	124.63	1618.37		0.12
				11-06-78	124.25	1618.75		0.38
				11-10-78	124.40	1618.60	0.15	
				11-15-78	124.52	1618.48	0.12	
				11-20-78	124.54	1618.46	0.02	
				11-25-78	124.20	1618.80		0.34
				11-30-78	124.16	1618.84		0.04
				12-05-78	123.96	1619.04		0.20
				12-10-78	124.32	1618.68	0.36	
				12-15-78	123.95	1619.05		0.37
				12-20-78	123.85	1619.15		0.10
				12-25-78	123.88	1619.12	0.03	
				12-30-78	123.99	1619.01	0.11	
				01-05-79	124.08	1618.92	0.09	
				01-10-79	123.95	1619.05		0.13

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			01-15-79	123.90	1619.10		0.05
				01-20-79	123.60	1619.40		0.30
				01-25-79	123.60	1619.40		
				01-30-79	123.78	1619.22	0.18	
				02-05-79	123.58	1619.42		0.20
				02-10-79	123.40	1619.60		0.18
				02-15-79	123.05	1619.95		0.35
				02-20-79	122.98	1620.02		0.07
				02-25-79	123.25	1619.75	0.27	
				03-05-79	123.21	1619.79		0.04
				03-10-79	123.15	1619.85		0.06
				03-15-79	123.17	1619.83	0.02	
				03-20-79	122.85	1620.15		0.32
				03-25-79	122.68	1620.32		0.17
				03-30-79	122.62	1620.38		0.06
				04-03-79	122.44	1620.56		0.18
				04-05-79	122.56	1620.44	0.12	
				04-10-79	121.97	1621.03		0.59
				04-15-79	122.44	1620.56	0.47	
				04-19-79	122.46	1620.54	0.02	
				04-20-79	122.40	1620.60		0.06
				04-25-79	122.20	1620.80		0.20
				04-30-79	122.37	1620.63	0.17	
				05-05-79	121.68	1621.32		0.69
				05-10-79	121.31	1621.69		0.37
				05-15-79	121.66	1621.34	0.35	
				05-20-79	121.58	1621.42		0.08
				05-25-79	121.88	1621.12	0.30	
				05-30-79	121.72	1621.28		0.16
				06-05-79	121.73	1621.27	0.01	
				06-10-79	122.00	1621.00	0.27	
				06-15-79	121.86	1621.14		0.14
				06-20-79	121.98	1621.02	0.12	
				06-25-79	123.84	1619.16	1.86	
				06-30-79	123.68	1619.32		0.16
				07-05-79	125.59	1617.41	1.91	
				07-10-79	127.61	1615.39	2.02	
				07-15-79	129.32	1613.68	1.71	
				07-19-79	121.96	1621.04		7.36
				07-20-79	130.00	1613.00	8.04	
				07-25-79	129.23	1613.77		0.77
				07-30-79	130.25	1612.75	1.02	

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			08-02-79	129.84	1613.16		0.41
				08-05-79	127.55	1615.45		2.29
				08-10-79	129.62	1613.38	2.07	
				08-15-79	126.89	1616.11		2.73
				08-20-79	127.05	1615.95	0.16	
				08-25-79	129.71	1613.29	2.66	
				08-30-79	128.15	1614.85		1.56
				09-05-79	130.53	1612.47	2.38	
				09-10-79	131.40	1611.60	0.87	
				09-15-79	131.74	1611.26	0.34	
				09-20-79	132.16	1610.84	0.42	
				09-25-79	132.14	1610.86		0.02
				09-30-79	131.91	1611.09		0.23
				10-05-79	131.54	1611.46		0.37
				10-10-79	130.73	1612.27		0.81
				10-15-79	130.44	1612.56		0.29
				10-20-79	129.41	1613.59		1.03
				10-25-79	128.13	1614.87		1.28
				10-30-79	128.57	1614.43	0.44	
				11-05-79	128.84	1614.16	0.27	
				11-10-79	129.03	1613.97	0.19	
				11-15-79	128.47	1614.53		0.56
				11-16-79	126.98	1616.02		1.49
				11-20-79	127.23	1615.77	0.25	
				11-25-79	126.85	1616.15		0.38
				11-30-79	127.46	1615.54	0.61	
				12-05-79	126.38	1616.62		1.08
				12-10-79	126.54	1616.46	0.16	
				12-15-79	126.46	1616.54		0.08
				12-20-79	126.27	1616.73		0.19
				12-25-79	126.29	1616.71	0.02	
				12-30-79	126.12	1616.88		0.17
				01-05-80	126.05	1616.95		0.07
				01-10-80	125.84	1617.16		0.21
				01-15-80	125.87	1617.13	0.03	
				01-20-80	126.02	1616.98	0.15	
				01-25-80	125.60	1617.40		0.42
				01-30-80	125.80	1617.20	0.20	
				02-05-80	125.77	1617.23		0.03
				02-10-80	125.70	1617.30		0.07
				02-11-80	125.60	1617.40		0.10
				02-15-80	125.57	1617.43		0.03

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			02-20-80	125.49	1617.51		0.08
				02-25-80	125.87	1617.13	0.38	
				03-05-80	125.63	1617.37		0.24
				03-10-80	126.20	1616.80	0.57	
				03-15-80	125.82	1617.18		0.38
				03-20-80	125.72	1617.28		0.10
				03-25-80	125.75	1617.25	0.03	
				03-30-80	125.84	1617.16	0.09	
				04-05-80	125.78	1617.22		0.06
				04-10-80	125.63	1617.37		0.15
				04-15-80	125.71	1617.29	0.08	
				04-20-80	126.33	1616.67	0.62	
				04-25-80	125.94	1617.06		0.39
				04-30-80	125.63	1617.37		0.31
				05-05-80	125.75	1617.25	0.12	
				05-09-80	125.55	1617.45		0.20
				05-10-80	125.38	1617.62		0.17
				05-15-80	125.30	1617.70		0.08
				05-20-80	125.30	1617.70		
				05-25-80	125.09	1617.91		0.21
				05-30-80	125.25	1617.75	0.16	
				06-05-80	125.38	1617.62	0.13	
				06-10-80	125.45	1617.55	0.07	
				06-15-80	125.37	1617.63		0.08
				06-20-80	125.67	1617.33	0.30	
				06-25-80	126.01	1616.99	0.34	
				06-30-80	125.98	1617.02		0.03
				07-05-80	129.78	1613.22	3.80	
				07-10-80	131.53	1611.47	1.75	
				07-15-80	132.70	1610.30	1.17	
				07-20-80	134.27	1608.73	1.57	
				07-25-80	135.00	1608.00	0.73	
				07-30-80	135.34	1607.66	0.34	
				08-05-80	135.57	1607.43	0.23	
				08-10-80	135.27	1607.73		0.30
				08-15-80	136.27	1606.73	1.00	
				08-20-80	136.63	1606.37	0.36	
				08-25-80	137.72	1605.28	1.09	
				08-30-80	137.57	1605.43		0.15
				09-05-80	137.28	1605.72		0.29
				09-10-80	132.77	1610.23		4.51
				09-15-80	130.10	1612.90		2.67

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			09-20-80	129.30	1613.70		0.80
				09-25-80	129.67	1613.33	0.37	
				09-30-80	127.22	1615.78		2.45
				10-05-80	126.67	1616.33		0.55
				10-10-80	126.51	1616.49		0.16
				10-15-80	126.62	1616.38	0.11	
				10-20-80	126.78	1616.22	0.16	
				10-25-80	126.75	1616.25		0.03
				10-30-80	126.98	1616.02	0.23	
				11-05-80	126.88	1616.12		0.10
				11-10-80	127.20	1615.80	0.32	
				11-15-80	126.99	1616.01		0.21
				11-19-80	126.99	1616.01		
				11-20-80	126.96	1616.04		0.03
				11-25-80	126.83	1616.17		0.13
				11-30-80	126.55	1616.45		0.28
				12-05-80	126.46	1616.54		0.09
				12-10-80	126.61	1616.39	0.15	
				12-15-80	126.15	1616.85		0.46
				12-20-80	126.40	1616.60	0.25	
				12-25-80	126.07	1616.93		0.33
				12-30-80	126.00	1617.00		0.07
				01-05-81	125.94	1617.06		0.06
				01-10-81	126.17	1616.83	0.23	
				01-15-81	125.89	1617.11		0.28
				01-20-81	125.70	1617.30		0.19
				01-25-81	125.68	1617.32		0.02
				01-30-81	125.98	1617.02	0.30	
				02-05-81	125.90	1617.10		0.08
				02-10-81	125.50	1617.50		0.40
				02-15-81	125.85	1617.15	0.35	
				02-20-81	125.60	1617.40		0.25
				02-25-81	125.73	1617.27	0.13	
				03-05-81	125.57	1617.43		0.16
				03-10-81	125.44	1617.56		0.13
				03-15-81	124.13	1618.87		1.31
				03-20-81	123.45	1619.55		0.68
				03-25-81	124.10	1618.90	0.65	
				03-30-81	124.24	1618.76	0.14	
				04-03-81	123.67	1619.33		0.57
				04-05-81	124.24	1618.76	0.57	
				04-10-81	124.18	1618.82		0.06

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASUREMENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			04-15-81	124.50	1618.50	0.32	
				04-20-81	124.24	1618.76		0.26
				04-25-81	123.95	1619.05		0.29
				04-30-81	123.59	1619.41		0.36
				05-05-81	123.65	1619.35	0.06	
				05-10-81	123.90	1619.10	0.25	
				05-15-81	123.72	1619.28		0.18
				05-20-81	123.80	1619.20	0.08	
				05-25-81	123.27	1619.73		0.53
				05-30-81	122.99	1620.01		0.28
				06-05-81	123.00	1620.00	0.01	
				06-10-81	122.98	1620.02		0.02
				06-15-81	122.95	1620.05		0.03
				06-20-81	121.43	1621.57		1.52
				06-25-81	121.56	1621.44	0.13	
				06-30-81	121.66	1621.34	0.10	
				07-05-81	121.94	1621.06	0.28	
				07-10-81	122.43	1620.57	0.49	
				07-15-81	124.09	1618.91	1.66	
				07-17-81	125.91	1617.09	1.82	
				07-20-81	127.08	1615.92	1.17	
				07-25-81	128.43	1614.57	1.35	
				07-30-81	129.11	1613.89	0.68	
				08-05-81	131.30	1611.70	2.19	
				08-10-81	132.86	1610.14	1.56	
				08-15-81	133.05	1609.95	0.19	
				08-20-81	129.25	1613.75		3.80
				08-25-81	127.60	1615.40		1.65
				08-30-81	127.71	1615.29	0.11	
				09-05-81	127.12	1615.88		0.59
				09-10-81	127.77	1615.23	0.65	
				09-15-81	126.10	1616.90		1.67
				09-20-81	128.58	1614.42	2.48	
				09-25-81	126.15	1616.85		2.43
				09-30-81	125.84	1617.16		0.31
				10-05-81	124.98	1618.02		0.86
				10-10-81	127.67	1615.33	2.69	
				10-15-81	126.81	1616.19		0.86
				10-20-81	125.98	1617.02		0.83
				10-25-81	125.33	1617.67		0.65
				10-30-81	125.31	1617.69		0.02
				11-05-81	125.33	1617.67	0.02	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			11-10-81	125.58	1617.42	0.25	
				11-15-81	125.20	1617.80		0.38
				11-20-81	125.33	1617.67	0.13	
				11-25-81	125.10	1617.90		0.23
				11-30-81	125.06	1617.94		0.04
				12-05-81	125.52	1617.48	0.46	
				12-10-81	125.38	1617.62		0.14
				12-15-81	125.27	1617.73		0.11
				12-20-81	125.30	1617.70	0.03	
				12-25-81	125.37	1617.63	0.07	
				12-30-81	125.30	1617.70		0.07
				01-05-82	126.13	1616.87	0.83	
				01-10-82	125.65	1617.35		0.48
				01-11-82	125.68	1617.32	0.03	
				01-15-82	125.20	1617.80		0.48
				01-20-82	125.18	1617.82		0.02
				01-25-82	125.12	1617.88		0.06
				01-30-82	124.92	1618.08		0.20
				02-05-82	125.23	1617.77	0.31	
				02-10-82	125.11	1617.89		0.12
				02-15-82	125.22	1617.78	0.11	
				02-20-82	125.33	1617.67	0.11	
				02-25-82	125.13	1617.87		0.20
				03-05-82	124.86	1618.14		0.27
				03-10-82	125.03	1617.97	0.17	
				03-15-82	124.85	1618.15		0.18
				03-20-82	124.86	1618.14	0.01	
				03-25-82	124.78	1618.22		0.08
				03-30-82	124.86	1618.14	0.08	
				04-05-82	124.70	1618.30		0.16
				04-10-82	124.90	1618.10	0.20	
				04-15-82	124.88	1618.12		0.02
				04-16-82	124.90	1618.10	0.02	
				04-20-82	124.90	1618.10		
				04-25-82	124.70	1618.30		0.20
				04-30-82	124.83	1618.17	0.13	
				05-05-82	124.70	1618.30		0.13
				05-10-82	124.60	1618.40		0.10
				05-15-82	124.45	1618.55		0.15
				05-20-82	124.38	1618.62		0.07
				05-25-82	124.33	1618.67		0.05
				05-30-82	124.35	1618.65	0.02	

Table 3.--Records of Water-Level Measurements
in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			06-05-82	124.49	1618.51	0.14	
				06-10-82	124.43	1618.57		0.06
				06-15-82	124.40	1618.60		0.03
				06-20-82	124.42	1618.58	0.02	
				06-25-82	124.41	1618.59		0.01
				06-30-82	124.17	1618.83		0.24
				07-05-82	124.10	1618.90		0.07
				07-10-82	124.52	1618.48	0.42	
				07-15-82	126.82	1616.18	2.30	
				07-20-82	129.39	1613.61	2.57	
				07-25-82	131.31	1611.69	1.92	
				07-30-82	132.79	1610.21	1.48	
				08-05-82	134.20	1608.80	1.41	
				08-10-82	134.60	1608.40	0.40	
				08-15-82	134.69	1608.31	0.09	
				08-20-82	134.03	1608.97		0.66
				08-25-82	134.74	1608.26	0.71	
				08-30-82	134.97	1608.03	0.23	
				09-05-82	134.64	1608.36		0.33
				09-10-82	134.02	1608.98		0.62
				09-15-82	135.25	1607.75	1.23	
				09-20-82	130.67	1612.33		4.58
				09-25-82	129.97	1613.03		0.70
				09-30-82	129.47	1613.53		0.50
				10-05-82	134.64	1608.36	5.17	
				10-06-82	134.97	1608.03	0.33	
				10-10-82	134.02	1608.98		0.95
				10-15-82	131.32	1611.68		2.70
				10-20-82	130.67	1612.33		0.65
				10-25-82	129.97	1613.03		0.70
				10-30-82	129.47	1613.53		0.50
				11-05-82	129.35	1613.65		0.12
				11-10-82	129.13	1613.87		0.22
				11-15-82	128.98	1614.02		0.15
				11-20-82	128.75	1614.25		0.23
				11-25-82	128.83	1614.17	0.08	
				11-30-82	128.40	1614.60		0.43
				12-05-82	128.35	1614.65		0.05
				12-10-82	128.21	1614.79		0.14
				12-15-82	128.22	1614.78	0.01	
				12-20-82	128.01	1614.99		0.21
				12-25-82	127.93	1615.07		0.08

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			12-30-82	127.92	1615.08		0.01
				01-05-83	127.91	1615.09		0.01
				01-10-83	127.76	1615.24		0.15
				01-15-83	127.79	1615.21	0.03	
				01-20-83	127.48	1615.52		0.31
				01-25-83	127.50	1615.50	0.02	
				02-05-83	127.37	1615.63		0.13
				02-10-83	127.32	1615.68		0.05
				02-15-83	127.24	1615.76		0.08
				02-20-83	127.11	1615.89		0.13
				02-25-83	127.15	1615.85	0.04	
				03-05-83	126.79	1616.21		0.36
				03-10-83	127.15	1615.85	0.36	
				03-15-83	126.70	1616.30		0.45
				03-20-83	126.90	1616.10	0.20	
				03-25-83	126.70	1616.30		0.20
				03-30-83	126.86	1616.14	0.16	
				04-05-83	126.70	1616.30		0.16
				04-10-83	126.84	1616.16	0.14	
				04-15-83	127.05	1615.95	0.21	
				04-20-83	126.62	1616.38		0.43
				04-25-83	126.70	1616.30	0.08	
				04-30-83	126.68	1616.32		0.02
				05-05-83	127.20	1615.80	0.52	
				05-10-83	128.96	1614.04	1.76	
				05-15-83	127.95	1615.05		1.01
				05-20-83	127.24	1615.76		0.71
				05-25-83	127.10	1615.90		0.14
				05-30-83	126.80	1616.20		0.30
				06-05-83	126.83	1616.17	0.03	
				06-10-83	126.78	1616.22		0.05
				06-15-83	126.80	1616.20	0.02	
				06-20-83	126.66	1616.34		0.14
				06-25-83	126.62	1616.38		0.04
				06-30-83	126.71	1616.29	0.09	
				07-05-83	126.82	1616.18	0.11	
				07-10-83	127.76	1615.24	0.94	
				07-15-83	131.35	1611.65	3.59	
				07-20-83	132.06	1610.94	0.71	
				07-25-83	133.20	1609.80	1.14	
				07-30-83	134.10	1608.90	0.90	
				08-05-83	134.79	1608.21	0.69	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			08-10-83	131.75	1611.25		3.04
				08-15-83	130.37	1612.63		1.38
				08-20-83	131.25	1611.75	0.88	
				08-25-83	131.29	1611.71	0.04	
				08-30-83	133.37	1609.63	2.08	
				09-05-83	134.66	1608.34	1.29	
				09-10-83	135.39	1607.61	0.73	
				09-15-83	134.87	1608.13		0.52
				09-20-83	134.19	1608.81		0.68
				09-25-83	134.22	1608.78	0.03	
				09-30-83	134.60	1608.40	0.38	
				10-05-83	134.80	1608.20	0.20	
				10-10-83	133.73	1609.27		1.07
				10-15-83	132.78	1610.22		0.95
				10-18-83	132.54	1610.46		0.24
				10-18-83	132.54	1610.46		
				10-20-83	131.77	1611.23		0.77
				10-25-83	130.92	1612.08		0.85
				10-30-83	130.35	1612.65		0.57
				11-05-83	129.83	1613.17		0.52
				11-10-83	129.80	1613.20		0.03
				11-15-83	129.62	1613.38		0.18
				11-20-83	129.45	1613.55		0.17
				11-25-83	129.33	1613.67		0.12
				11-30-83	129.39	1613.61	0.06	
				12-05-83	129.14	1613.86		0.25
				12-10-83	129.11	1613.89		0.03
				12-15-83	129.09	1613.91		0.02
				12-20-83	128.97	1614.03		0.12
				12-25-83	129.20	1613.80	0.23	
				12-30-83	129.50	1613.50	0.30	
				01-05-84	129.59	1613.41	0.09	
				01-10-84	129.65	1613.35	0.06	
				01-15-84	129.20	1613.80		0.45
				01-20-84	129.06	1613.94		0.14
				01-25-84	128.81	1614.19		0.25
				01-30-84	128.79	1614.21		0.02
				02-05-84	128.70	1614.30		0.09
				02-10-84	128.84	1614.16	0.14	
				02-15-84	128.66	1614.34		0.18
				02-20-84	128.99	1614.01	0.33	
				02-25-84	128.77	1614.23		0.22

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			03-05-84	128.86	1614.14	0.09	
				03-10-84	129.42	1613.58	0.56	
				03-15-84	129.09	1613.91		0.33
				03-20-84	128.72	1614.28		0.37
				03-25-84	129.22	1613.78	0.50	
				03-30-84	129.40	1613.60	0.18	
				04-13-84	129.94	1613.06	0.54	
				04-15-84	129.90	1613.10		0.04
				04-20-84	129.52	1613.48		0.38
				04-25-84	130.39	1612.61	0.87	
				04-30-84	131.47	1611.53	1.08	
				05-05-84	130.60	1612.40		0.87
				05-10-84	131.23	1611.77	0.63	
				05-15-84	133.08	1609.92	1.85	
				05-20-84	133.26	1609.74	0.18	
				05-25-84	135.04	1607.96	1.78	
				05-30-84	133.89	1609.11		1.15
				06-05-84	135.14	1607.86	1.25	
				06-10-84	134.33	1608.67		0.81
				06-15-84	133.20	1609.80		1.13
				06-20-84	134.82	1608.18	1.62	
				06-25-84	136.01	1606.99	1.19	
				06-30-84	134.40	1608.60		1.61
				07-05-84	135.86	1607.14	1.46	
				07-10-84	136.74	1606.26	0.88	
				07-15-84	137.84	1605.16	1.10	
				07-19-84	137.96	1605.04	0.12	
				07-20-84	138.07	1604.93	0.11	
				07-25-84	136.13	1606.87		1.94
				07-30-84	133.32	1609.68		2.81
				08-05-84	133.22	1609.78		0.10
				08-10-84	136.80	1606.20	3.58	
				08-15-84	135.83	1607.17		0.97
				08-20-84	136.57	1606.43	0.74	
				08-25-84	136.44	1606.56		0.13
				08-30-84	138.18	1604.82	1.74	
				09-05-84	136.25	1606.75		1.93
				09-10-84	137.39	1605.61	1.14	
				09-15-84	139.10	1603.90	1.71	
				09-20-84	139.05	1603.95		0.05
				09-25-84	136.47	1606.53		2.58
				09-30-84	135.15	1607.85		1.32

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			10-05-84	133.69	1609.31		1.46
				10-10-84	133.22	1609.78		0.47
				10-15-84	132.45	1610.55		0.77
				10-20-84	132.21	1610.79		0.24
				10-25-84	132.24	1610.76	0.03	
				10-30-84	131.34	1611.66		0.90
				11-05-84	131.03	1611.97		0.31
				11-10-84	130.80	1612.20		0.23
				11-15-84	130.89	1612.11	0.09	
				11-20-84	131.14	1611.86	0.25	
				11-25-84	130.64	1612.36		0.50
				11-30-84	130.49	1612.51		0.15
				12-05-84	130.54	1612.46	0.05	
				12-10-84	130.45	1612.55		0.09
				12-15-84	130.39	1612.61		0.06
				12-20-84	130.27	1612.73		0.12
				12-25-84	130.62	1612.38	0.35	
				12-30-84	130.32	1612.68		0.30
				01-05-85	128.56	1614.44		1.76
				01-10-85	127.99	1615.01		0.57
				01-15-85	127.80	1615.20		0.19
				01-20-85	127.70	1615.30		0.10
				01-25-85	127.69	1615.31		0.01
				01-30-85	127.48	1615.52		0.21
				02-05-85	127.73	1615.27	0.25	
				02-10-85	127.86	1615.14	0.13	
				02-15-85	128.06	1614.94	0.20	
				02-20-85	127.95	1615.05		0.11
				02-25-85	128.14	1614.86	0.19	
				03-05-85	128.16	1614.84	0.02	
				03-10-85	128.01	1614.99		0.15
				03-15-85	128.13	1614.87	0.12	
				03-20-85	127.75	1615.25		0.38
				03-25-85	127.63	1615.37		0.12
				03-30-85	126.90	1616.10		0.73
				04-05-85	126.20	1616.80		0.70
				04-18-85	127.36	1615.64	1.16	
				04-20-85	127.27	1615.73		0.09
				04-25-85	127.36	1615.64	0.09	
				04-30-85	127.66	1615.34	0.30	
				05-05-85	127.75	1615.25	0.09	
				05-10-85	127.82	1615.18	0.07	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			05-15-85	128.07	1614.93	0.25	
				05-20-85	127.93	1615.07		0.14
				05-25-85	128.17	1614.83	0.24	
				05-30-85	128.03	1614.97		0.14
				06-05-85	128.30	1614.70	0.27	
				06-10-85	128.63	1614.37	0.33	
				06-15-85	128.47	1614.53		0.16
				06-20-85	129.85	1613.15	1.38	
				06-25-85	132.52	1610.48	2.67	
				06-30-85	130.82	1612.18		1.70
				07-05-85	132.02	1610.98	1.20	
				07-10-85	134.13	1608.87	2.11	
				07-15-85	135.15	1607.85	1.02	
				07-20-85	134.90	1608.10		0.25
				07-25-85	132.96	1610.04		1.94
				07-26-85	134.58	1608.42	1.62	
				07-30-85	135.93	1607.07	1.35	
				08-05-85	136.45	1606.55	0.52	
				08-10-85	137.22	1605.78	0.77	
				08-15-85	137.22	1605.78		
				08-20-85	138.35	1604.65	1.13	
				08-25-85	138.95	1604.05	0.60	
				08-30-85	138.75	1604.25		0.20
				09-05-85	138.65	1604.35		0.10
				09-10-85	139.13	1603.87	0.48	
				09-15-85	139.13	1603.87		
				09-20-85	132.50	1610.50		6.63
				09-25-85	133.08	1609.92	0.58	
				09-30-85	133.06	1609.94		0.02
				10-05-85	132.65	1610.35		0.41
				10-09-85	133.00	1610.00	0.35	
				10-10-85	131.52	1611.48		1.48
				10-15-85	131.52	1611.48		
				10-20-85	131.95	1611.05	0.43	
				10-25-85	131.47	1611.53		0.48
				10-30-85	131.22	1611.78		0.25
				11-05-85	131.23	1611.77	0.01	
				11-10-85	131.17	1611.83		0.06
				11-15-85	131.17	1611.83		
				11-20-85	131.40	1611.60	0.23	
				11-25-85	131.07	1611.93		0.33
				11-30-85	131.03	1611.97		0.04

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			12-05-85	131.35	1611.65	0.32	
				12-10-85	131.00	1612.00		0.35
				12-15-85	131.00	1612.00		
				12-20-85	131.15	1611.85	0.15	
				12-25-85	131.15	1611.85		
				12-30-85	130.88	1612.12		0.27
				01-05-86	131.15	1611.85	0.27	
				01-10-86	131.08	1611.92		0.07
				01-15-86	130.97	1612.03		0.11
				04-10-86	131.78	1611.22	0.81	
				04-14-86	131.50	1611.50		0.28
				06-25-86	130.30	1612.70		1.20
				06-30-86	130.65	1612.35	0.35	
				07-05-86	131.35	1611.65	0.70	
				07-10-86	132.53	1610.47	1.18	
				07-15-86	134.10	1608.90	1.57	
				07-20-86	134.46	1608.54	0.36	
				07-25-86	134.06	1608.94		0.40
				07-30-86	135.32	1607.68	1.26	
				08-05-86	136.50	1606.50	1.18	
				08-10-86	137.13	1605.87	0.63	
				08-15-86	131.75	1611.25		5.38
				08-20-86	133.78	1609.22	2.03	
				08-25-86	135.00	1608.00	1.22	
				08-30-86	134.74	1608.26		0.26
				09-05-86	133.60	1609.40		1.14
				09-10-86	133.00	1610.00		0.60
				09-15-86	132.90	1610.10		0.10
				09-20-86	132.78	1610.22		0.12
				09-25-86	133.68	1609.32	0.90	
				09-30-86	134.10	1608.90	0.42	
				10-05-86	134.12	1608.88	0.02	
				10-10-86	132.77	1610.23		1.35
				10-15-86	132.48	1610.52		0.29
				10-20-86	132.30	1610.70		0.18
				10-25-86	132.10	1610.90		0.20
				10-30-86	132.09	1610.91		0.01
				11-05-86	131.90	1611.10		0.19
				11-10-86	131.71	1611.29		0.19
				11-15-86	131.60	1611.40		0.11
				11-20-86	131.47	1611.53		0.13
				11-25-86	131.50	1611.50	0.03	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASUREMENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-614	CONT.			11-30-86	131.34	1611.66		0.16
				12-05-86	131.62	1611.38	0.28	
				12-10-86	131.44	1611.56		0.18
				12-15-86	131.32	1611.68		0.12
				12-20-86	131.00	1612.00		0.32
				12-25-86	129.72	1613.28		1.28
				12-30-86	129.32	1613.68		0.40
				01-05-87	129.29	1613.71		0.03
				01-10-87	129.42	1613.58	0.13	
				01-15-87	129.25	1613.75		0.17
				01-20-87	129.52	1613.48	0.27	
				01-25-87	129.47	1613.53		0.05
				01-30-87	129.66	1613.34	0.19	
				02-05-87	129.64	1613.36		0.02
				02-10-87	129.75	1613.25	0.11	
				02-15-87	129.23	1613.77		0.52
				02-20-87	129.75	1613.25	0.52	
				02-25-87	129.67	1613.33		0.08
				03-05-87	128.98	1614.02		0.69
				03-10-87	128.76	1614.24		0.22
				03-15-87	128.28	1614.72		0.48
				03-20-87	128.25	1614.75		0.03
				03-25-87	128.27	1614.73	0.02	
				03-30-87	128.60	1614.40	0.33	
				04-05-87	128.60	1614.40		
				04-10-87	128.48	1614.52		0.12
				04-15-87	128.66	1614.34	0.18	
				04-20-87	128.85	1614.15	0.19	
				04-25-87	129.12	1613.88	0.27	
				04-30-87	129.03	1613.97		0.09
				05-05-87	129.30	1613.70	0.27	
				05-10-87	129.27	1613.73		0.03
				05-15-87	129.48	1613.52	0.21	
				05-20-87	129.35	1613.65		0.13
				05-25-87	128.54	1614.46		0.81
				05-30-87	127.97	1615.03		0.57
				06-05-87	126.14	1616.86		1.83
				06-10-87	124.74	1618.26		1.40
				06-15-87	123.37	1619.63		1.37
				06-20-87	123.91	1619.09	0.54	
				06-25-87	124.72	1618.28	0.81	
				06-30-87	125.38	1617.62	0.66	

Table 3 .--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

McCulloch County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-06-614	CONT.			07-05-87	126.47	1616.53	1.09	
				07-10-87	128.18	1614.82	1.71	
				07-15-87	129.13	1613.87	0.95	
				07-20-87	127.97	1615.03		1.16
				07-25-87	127.87	1615.13		0.10
				07-30-87	130.67	1612.33	2.80	
				08-05-87	132.52	1610.48	1.85	
				08-10-87	133.34	1609.66	0.82	
				08-15-87	134.48	1608.52	1.14	
				08-20-87	136.61	1606.39	2.13	
				08-25-87	136.92	1606.08	0.31	
				08-30-87	133.54	1609.46		3.38
				09-05-87	131.56	1611.44		1.98
				09-10-87	133.98	1609.02	2.42	
				09-15-87	133.85	1609.15		0.13

Table 3 .--Records of Water-Level Measurements
in TWDB Observation Wells (Continued).

Mason County

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-604	100	297	1685.00	10-06-58	59.86	1606.14		
				08-02-72	64.62	1603.38	4.76	
				12-06-72	58.57	1609.43		6.05
				02-04-87	69.94	1598.06	11.37	
56-06-611	100	98	1645.00	08-02-72	14.49	1630.51		
				12-06-72	12.38	1632.62		2.11
				12-06-73	12.83	1632.17	0.45	
				12-05-74	12.80	1632.20		0.03
				03-24-76	13.05	1631.95	0.25	
				03-11-77	12.14	1632.86		0.91
				03-15-78	14.80	1630.20	2.66	
				04-03-79	13.95	1631.05		0.85
				03----80				
				11-20-80	16.19	1628.81	2.24	
				10-21-81	15.35	1629.65		0.84
				10-07-82	18.61	1626.39	3.26	
				10-17-83	19.77	1625.23	1.16	
				10-02-84	20.75	1624.25	0.98	
				03-13-85	17.70	1627.30		3.05
				10-10-85	21.10	1623.90	3.40	
				10-30-86	20.35	1624.65		0.75
				01-30-87	19.07	1625.93		1.28
				03-03-87	18.96	1626.04		0.11
				04-10-87	18.53	1626.47		0.43
				05-26-87	18.00	1627.00		0.53
				07-09-87	17.41	1627.59		0.59
				09-17-87	20.32	1624.68	2.91	
				12-16-87	19.18	1625.82		1.14
56-06-613	100	312	1675.00	09-13-74	63.30	1611.70		
				09-19-74	57.96	1617.04		5.34
				03-25-75	53.61	1621.39		4.35
				02-05-87	62.80	1612.20	9.19	
				03-03-87	63.21	1611.79	0.41	
				04-10-87	62.17	1612.83		1.04
				09-17-87	69.92	1605.08	7.75	
				12-16-87	64.35	1610.65		5.57
56-06-625	100	310	1714.00	02-04-87	94.68	1619.32		

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

Mason County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASUREMENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT DECLINE	RISE
56-06-625	CONT.			09-17-87	106.81*	1607.19	12.13	
				12-16-87	96.76	1617.24		10.05
56-06-648	100	58	1653.00	02-02-87	26.64	1626.36		
				09-17-87	26.60	1626.40		0.04
56-06-910	100	116	1719.00	06-22-67	68.60	1650.40		
				08-10-67	70.60	1648.40	2.00	
				09-13-67	72.05	1646.95	1.45	
				11-13-67	69.20	1649.80		2.85
				03-05-68	67.20	1651.80		2.00
				06-03-68	65.90	1653.10		1.30
				09-10-68	69.60	1649.40	3.70	
				02-28-69	69.20	1649.80		0.40
				01-15-70	68.71	1650.29		0.49
				07-09-70	68.60	1650.40		0.11
				08-04-72	67.50	1651.50		1.10
				12-06-72	65.76	1653.24		1.74
				12-06-73	68.06	1650.94	2.30	
				12-05-74	65.36	1653.64		2.70
				03-24-76	64.20	1654.80		1.16
				03-11-77	64.08	1654.92		0.12
				03-15-78	67.67	1651.33	3.59	
				04-03-79	68.85	1650.15	1.18	
				11-20-80	69.35	1649.65	0.50	
				10-21-81	73.95	1645.05	4.60	
				10-07-82	76.60*	1642.40	2.65	
				10-17-83	75.82	1643.18		0.78
				10-02-84	77.30	1641.70	1.48	
				10-10-85	78.42	1640.58	1.12	
				10-30-86	79.72	1639.28	1.30	
				02-06-87	77.56	1641.44		2.16
				03-10-87	76.95	1642.05		0.61
				12-16-87	78.14	1640.86	1.19	
56-07-404	100	450	1752.00	08-02-72	68.83	1683.17		
				12-06-72	70.30	1681.70	1.47	
				12-06-73	82.30	1669.70	12.00	
				03-11-77	88.20	1663.80	5.90	
				03-15-78	101.57	1650.43	13.37	
				04-03-79	106.42	1645.58	4.85	

Table 3.--Records of Water-Level Measurements in TWDB Observation Wells (Continued).

Mason County (Continued).

STATE WELL NUMBER	AQUIFER CODE	DEPTH OF WELL	ELEVATION OF LAND SURFACE	DATE	MEASURE-MENT	ELEVATION OF WATER LEVEL	CHANGE IN WATER LEVEL FROM PREVIOUS MEASUREMENT	
							DECLINE	RISE
56-07-404	CONT.			11-20-80	124.95	1627.05	18.53	
				10-21-81	102.43	1649.57		22.52
				10-17-83	127.61	1624.39	25.18	
				10-02-84	103.85	1648.15		23.76
				10-10-85	118.50	1633.50	14.65	
				10-30-86	152.10	1599.90	33.60	
				02-05-87	142.80	1609.20		9.30

Table 4.--Chemical Analyses of Ground-Waters from Wells and Springs

[Analyses given are in milligrams per liter except Percent Sodium, Specific Conductance, pH, SAR (Sodium-Adsorption Ratio) and RSC (Residual Sodium Carbonate). Under Location Number, SZ means location of sample site is in Mason County and SS means location of sample site is in McCulloch County. All wells completed in the Hickory Aquifer except Wells SZ-56-07-433 and SZ-56-07-444 which are completed in the Mid-Cambrian Aquifers undifferentiated.]

Location Number	Depth of Well (ft)	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Total Hardness as $CaCO_3$	Percent Sodium	Specific Conductance (Micromhos at 25 °C)	pH	SAR	RSC
SS-42-62-902	786	12-19-74	8	4.00	73	30	37	--	282	50	66	0.2	9.00	--	416	306	21	800	7.6	0.9	0
SS-42-62-902	786	06-19-79	3	--	14	27	9	--	166	2	21	0.4	0.10	--	158	144	12	328	8.2	0.3	0
SS-42-62-902	786	06-14-86	13	0.93	6	21	9	3.0	120	1	19	0.4	0.04	--	132	102	16	254	6.7	0.3	0
SS-56-06-308	430	04-22-87	16	--	66	35	8	0.3	336	23	20	0.6	5.71	--	340	309	5	661	7.9	0.2	0
SS-56-06-308	430	07-21-87	14	0.04	65	36	8	0.3	332	24	20	0.6	5.58	0.24	337	310	5	657	8.1	0.2	0
SS-56-06-308	430	09-24-87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	640 1/	--	--	--
SS-56-06-309	Spr.	04-21-87	15	--	80	32	21	0.3	336	41	40	0.5	2.97	--	398	331	12	765	8.0	0.5	0
SS-56-06-309	Spr.	07-24-87	14	0.07	81	28	20	0.3	328	40	41	0.5	3.06	0.22	389	320	12	755	8.0	0.4	0
SS-56-06-310	Spr.	04-21-87	10	--	64	37	16	0.3	340	25	32	0.6	0.04	--	352	313	10	705	8.1	0.3	0
SS-56-06-311	300	04-21-87	15	--	77	30	19	0.3	337	33	34	0.5	2.79	--	377	319	12	740	7.9	0.4	0
SS-56-06-311	300	07-24-87	15	0.06	80	28	19	0.2	333	33	38	0.5	2.88	0.33	381	314	12	745	8.0	0.4	0
SS-56-06-315	Spr.	04-21-87	7	--	89	21	19	0.3	346	25	29	0.5	0.04	--	361	308	12	715	8.1	0.4	0
SS-56-06-324	475	09-30-87	9	--	66	37	14	3.0	343	22	23	0.6	1.77	--	349	320	9	688	8.7	0.3	0
SS-56-06-601	800	07-22-58	15	--	88	16	14	2.0	322	23	21	0.3	2.50	--	344	286	10	596	7.1	0.4	0
SZ-56-06-604	297	07-21-87	17	0.25	86	3	12	0.2	249	12	21	0.3	14.26	0.24	289	228	10	528	8.0	0.3	0
SZ-56-06-605	343	01-29-59	22	--	72	6	24	2.3	251	11	28	0.5	6.20	--	295	206	20	513	7.4	0.7	0
SZ-56-06-605	343	07-20-73	20	<0.02	65	8	24	--	234	13	28	0.8	4.70	--	279	195	21	496	7.6	0.7	0
SZ-56-06-605	343	06-20-79	22	--	70	7	26	--	234	16	36	0.5	8.50	--	301	205	22	548	7.5	0.7	0
SZ-56-06-605	343	07-20-87	22	<0.02	85	3	37	0.2	210	24	64	0.4	35.09	0.18	374	226	26	700	8.0	1.0	0
SZ-56-06-606	180	07-12-73	21	0.04	42	6	29	--	127	16	42	0.7	15.00	--	234	130	33	420	7.1	1.1	0
SZ-56-06-606	180	07-23-87	24	0.08	38	4	26	0.2	117	14	38	0.6	9.92	0.21	213	114	34	380	7.6	1.0	0
SZ-56-06-607	74	02-04-87	11	--	21	3	12	3.0	63	22	13	1.2	0.49	--	124	68	27	207	7.3	0.6	0
SZ-56-06-607	74	09-24-87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	245 1/	--	--	--
SS-56-06-609	224	06-05-72	15	--	81	8	17	--	275	9	24	0.4	3.50	--	293	236	14	536	7.4	0.4	0
SS-56-06-609	224	08-21-73	15	0.58	85	2	16	--	265	7	24	0.4	3.90	--	284	223	14	532	7.6	0.4	0
SS-56-06-609	224	06-19-79	18	--	85	6	19	--	279	10	26	0.4	3.90	--	305	238	15	483	7.7	0.5	0
SS-56-06-612	620	10-05-73	13	0.06	64	53	15	--	416	20	31	0.8	8.00	--	409	381	8	822	7.8	0.3	0
SS-56-06-612	620	05-16-85	15	--	76	35	16	0.2	372	22	29	0.5	12.98	--	390	333	9	760	7.7	0.3	0
SS-56-06-612	620	07-21-87	9	0.04	84	29	16	0.2	366	23	30	0.5	12.76	0.14	385	332	10	755	7.9	0.3	0

1/ Field conductivity taken on date indicated.

Table 4.--Chemical Analyses of Ground-Waters from Wells and Springs (Continued).

Location Number	Depth of Well (ft)	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Total Hardness as $CaCO_3$	Percent Sodium	Specific Conductance (Micromhos at 25 °C)	pH	SAR	RSC
SZ-56-06-613	312	09-19-74	26	--	24	3	65	--	178	35	24	0.9	2.90	--	269	72	66	430	7.2	3.3	1.5
SS-56-06-614	641	12-16-74	7	--	59	12	37	--	259	24	32	0.6	0.40	--	299	196	29	580	7.7	1.1	0.3
SZ-56-06-617	280	09-19-74	25	1.50	44	6	23	0.2	148	13	35	0.5	6.07	0.14	227	134	27	400	7.6	0.8	0
SZ-56-06-618	380	07-22-87	19	0.02	99	4	41	0.3	243	26	72	0.3	43.28	0.21	425	265	25	797	7.8	1.1	0
SZ-56-06-619	134	01-30-87	22	--	45	6	66	2.0	113	38	86	<0.1	28.22	--	354	136	51	632	7.2	2.5	0
SZ-56-06-625	310	07-20-87	23	0.14	48	8	18	0.2	189	11	21	0.7	1.86	0.11	225	155	20	400	7.8	0.6	0
SZ-56-06-629	157	07-23-87	22	0.46	86	14	116	0.3	204	74	193	0.6	23.39	0.31	630	274	48	1,232	7.4	3.0	0
SZ-56-06-630	274	07-21-87	30	0.17	121	17	122	0.3	398	70	156	0.8	44.88	0.34	758	373	42	1,431	7.8	2.7	0
SZ-56-06-635	440	07-22-87	22	0.02	76	12	28	0.2	288	20	33	0.8	6.38	0.24	340	240	20	632	7.8	0.7	0
SZ-56-06-649	69	07-23-87	27	0.70	49	1	39	0.3	126	36	41	1.3	15.86	0.22	273	124	40	468	7.3	1.5	0
SZ-56-06-652	130	09-30-87	22	--	51	9	35	0.2	124	25	74	0.5	8.95	--	287	164	32	552	7.8	1.1	0
SZ-56-06-654	100	09-30-87	21	--	65	10	17	0.3	161	24	46	0.3	31.63	--	294	207	15	549	7.9	0.5	0
SZ-56-06-655	103	07-21-87	20	0.02	26	3	14	0.2	83	15	17	0.6	4.08	0.19	141	79	28	238	7.8	0.6	0
SZ-56-06-655	103	09-24-87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	230 1/	--	--	-
SZ-56-06-657	71	07-23-87	25	0.12	47	4	39	0.2	163	28	36	1.4	0.62	0.21	262	132	39	468	7.6	1.4	0
SZ-56-06-659	100	09-30-87	18	--	85	4	21	0.2	242	12	36	0.4	21.62	--	317	231	17	592	8.1	0.6	0
SZ-56-06-661	363	07-12-73	21	0.10	57	8	18	--	196	9	19	0.6	20.00	--	250	176	18	438	7.1	0.6	0
SZ-56-06-801	548	08-03-73	14	2.90	72	48	19	--	399	36	32	0.6	0.80	--	448	377	10	816	7.9	0.4	0
SZ-56-06-801	548	06-25-86	16	--	72	48	20	0.2	414	40	31	0.5	1.46	--	433	377	10	830	7.5	0.4	0
SZ-56-06-802	475	08-08-73	15	--	128	17	15	--	418	17	28	0.4	31.00	--	457	392	8	870	7.3	0.3	0
SZ-56-06-804	245	08-07-73	25	--	10	20	59	--	228	35	87	1.7	26.00	--	427	234	35	804	8.4	1.7	0
SZ-56-06-805	200	07-30-73	28	0.04	85	25	74	--	289	61	111	1.6	30.00	--	560	314	34	1,016	7.2	1.8	0
SZ-56-06-806	716	07-21-87	17	0.03	132	21	20	0.1	403	45	44	0.4	42.88	0.26	521	417	9	972	7.7	0.4	0
SZ-56-06-809	381	07-23-87	26	0.02	83	23	26	0.3	312	48	35	0.5	18.83	0.22	414	305	16	770	7.5	0.6	0

1/ Field conductivity taken on date indicated.

Table 4.--Chemical Analyses of Ground-Waters from Wells and Springs (Continued).

Location Number	Depth of Well (ft)	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Total Hardness as $CaCO_3$	Percent Sodium	Specific Conductance (Micromhos at 25° C)	pH	SAR	RSC
SZ-56-06-810	414	07-22-87	17	0.03	80	31	19	0.2	384	21	28	0.7	4.08	0.22	390	329	11	755	7.9	0.4	0
SZ-56-06-828	294	07-21-87	18	<0.02	59	34	35	0.2	339	20	45	0.6	9.57	0.27	388	287	21	755	8.0	0.9	0
SZ-56-06-901	122	07-12-73	20	<0.02	34	8	16	--	121	11	21	0.8	12.00	--	182	119	23	322	6.7	0.6	0
SZ-56-06-902	189	04-16-74	22	<0.02	48	9	57	--	124	29	84	0.5	30.00	--	340	156	44	566	6.8	1.9	0
SZ-56-06-903	149	07-12-73	28	<0.04	48	13	41	--	171	30	49	1.0	26.00	--	320	174	34	568	7.1	1.3	0
SZ-56-06-903	149	07-22-87	29	<0.02	56	12	41	0.2	185	41	56	1.2	13.16	0.17	341	189	32	620	7.8	1.3	0
SZ-56-06-905	131	04-16-74	24	--	63	16	42	--	189	45	63	1.1	35.00	0.10	382	226	29	700	7.0	1.2	0
SZ-56-06-906	139	01-28-59	29	--	66	21	56	2.9	230	59	85	1.5	8.70	--	442	251	32	761	6.8	1.5	0
SZ-56-06-906	139	07-17-73	24	0.16	74	23	65	--	227	74	107	1.6	15.00	--	497	282	34	938	7.1	1.6	0
SZ-56-06-907	139	07-17-73	27	0.10	79	31	54	--	272	72	102	1.9	8.00	--	510	326	27	969	7.1	1.3	0
SZ-56-06-911	232	07-22-87	28	<0.02	52	15	45	0.2	190	30	60	0.9	24.85	0.09	349	193	34	643	7.6	1.4	0
SZ-56-06-916	130	07-21-87	20	<0.02	33	6	24	0.2	110	21	31	0.7	13.82	0.08	204	110	33	370	7.4	1.0	0
SZ-56-06-920	414	07-22-87	25	0.03	104	5	25	0.4	233	28	53	0.3	67.34	0.24	423	282	16	765	7.8	0.6	0
SZ-56-06-933	148	07-22-87	28	0.10	70	22	71	0.3	249	80	90	1.8	1.09	0.21	487	268	37	930	7.7	1.9	0
SZ-56-06-940	85	07-21-87	26	<0.02	42	7	44	0.2	156	29	43	0.8	22.99	0.15	292	135	42	521	7.5	1.6	0
SZ-56-06-952	102	09-30-87	26	--	63	18	65	0.2	264	39	59	1.1	44.92	--	446	231	38	814	7.9	1.8	0
SZ-56-07-403	235	07-12-73	23	--	70	9	28	--	237	12	37	2.1	12.00	--	310	214	22	560	7.2	0.8	0
SZ-56-07-404	450	07-12-73	24	0.13	47	6	25	--	160	14	27	1.3	11.00	--	235	142	28	396	7.1	0.9	0
SZ-56-07-404	450	05-16-85	23	--	62	7	28	0.2	207	12	37	0.9	9.79	--	282	183	25	516	7.3	0.9	0
SZ-56-07-404	450	07-21-87	23	0.04	67	5	31	0.3	214	11	48	0.8	12.45	0.25	304	190	26	564	7.8	0.9	0
SS-56-07-406	192	08-21-73	27	0.40	41	7	43	--	123	24	48	1.4	36.00	--	292	133	42	495	7.3	1.6	0
SZ-56-07-411	245	07-20-87	26	0.05	50	4	40	0.2	150	21	48	1.1	21.22	0.15	285	141	38	507	7.7	1.4	0
SS-56-07-413	191	07-21-87	28	0.06	58	9	65	0.3	142	43	90	1.2	51.12	0.25	416	184	44	750	7.5	2.1	0
SS-56-07-418	144	07-21-87	17	0.12	74	6	23	0.2	254	11	28	0.4	6.51	0.12	291	213	19	542	7.8	0.6	0
SS-56-07-418	144	09-24-87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	560 1/	--	--	--
SZ-56-07-426	650	07-20-87	30	0.43	49	7	24	0.2	198	11	23	2.4	0.35	0.17	245	153	26	435	7.7	0.8	0.2

1/ Field conductivity taken on date indicated.

Table 4.--Chemical Analyses of Ground-Waters from Wells and Springs (Continued).

Location Number	Depth of Well (ft)	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Total Hardness as $CaCO_3$	Percent Sodium	Specific Conductance (Micromhos at 25° C)	pH	SAR	RSC
SZ-56-07-426	650	09-23-87	27	---	51	6	25	0.2	203	11	23	2.3	0.49	---	246	156	26	444	8.2	0.8	0.3
SZ-56-07-427	230	07-20-87	25	0.07	72	6	24	0.2	229	13	29	1.3	15.59	0.13	299	203	20	539	7.9	0.7	0
SZ-56-07-427	230	09-23-87	23	---	67	5	24	0.2	207	16	29	1.4	20.29	---	288	190	22	518	8.2	0.7	0
SZ-56-07-433	224	09-23-87	10	---	102	5	8	0.2	292	14	20	0.3	22.33	---	325	277	6	620	8.0	0.2	0
SZ-56-07-443	362	07-21-87	23	0.02	77	6	24	0.2	257	10	34	0.1	3.81	0.18	305	217	19	564	7.9	0.7	0
SZ-56-07-444	100	09-23-87	13	---	116	15	12	0.2	371	17	26	0.4	28.84	---	411	352	7	792	7.5	0.2	0
SZ-56-07-702	340	09-23-87	17	---	77	5	18	0.1	262	8	21	0.6	2.44	---	279	213	15	504	8.1	0.5	0.04

1/ Field conductivity taken on date indicated.

Table 5.--Chemical Analyses of Surface Water from Katemcy Creek

[Analyses given are in milligrams per liter except Percent Sodium, Specific Conductance, pH, SAR (Sodium-Adsorption Ratio), RSC (Residual Sodium Carbonate) and Temperature. Under Location Number, SZ means location of sample site is in Mason County and SS means location of sample site is in McCulloch County.]

Location Number	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Total Hardness as $CaCO_3$	Percent Sodium	Specific Conductance (Micromhos at 25° C)	pH	SAR	RSC	Temp. °F
SZ-KCS-1	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	210 1/	—	—	-	73
SZ-KCS-2	7-24-87	13	0.22	25	3	14	1	82	14	17	0.9	0.13	0.06	128	74	29	228	7.9	0.71	0	75
SZ-KCS-3	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	200 1/	—	—	-	67
SZ-KCS-4	2-04-87	10	—	15	2	9	1	44	13	11	0.8	<0.04	—	86	46	30	144	7.4	0.58	0	55
SZ-KCS-5	7-23-87	12	0.06	30	3	14	2	106	13	15	0.9	<0.04	0.10	143	89	26	260	8.2	0.65	0	81
SZ-KCS-5	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	180 1/	—	—	-	72
SS-KCS-6	4-23-87	8	—	15	2	9	1	46	14	10	0.6	0.04	—	83	48	29	149	7.7	0.56	0	78
SS-KCS-6	7-21-87	15	0.04	22	2	11	3	70	14	11	0.7	0.04	<0.01	116	65	27	195	8.6	0.60	0	93
SS-KCS-6	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	115 1/	—	—	-	85
SS-KCS-7	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	305 1/	—	—	-	73
SS-KCS-8	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	400 1/	—	—	-	74
SS-KCS-9	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	440 1/	—	—	-	78
SS-KCS-10	4-23-87	10	—	29	3	13	2	89	21	14	0.6	0.04	—	137	87	25	243	8.0	0.61	0	75
SS-KCS-10	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	330 1/	—	—	-	74
SS-KCS-11	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	370 1/	—	—	-	73
SS-KCS-12	4-23-87	10	—	48	5	12	1	150	21	14	0.5	<0.40	—	185	140	16	334	8.1	0.44	0	72
SS-KCS-12	7-21-87	13	0.05	74	7	12	2	249	22	14	0.4	1.02	0.15	268	215	11	492	8.2	0.35	0	82
SS-KCS-12	9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	450 1/	—	—	-	77
SS-KCS-13	,9-24-87	—	—	—	-	—	-	—	—	—	—	—	—	—	—	—	430 1/	—	—	-	79
SS-KCS-14	4-23-87	10	—	55	7	13	2	181	23	17	0.5	<0.04	—	217	167	15	400	8.3	0.44	0	77
SS-KCS-15	4-21-87	10	—	67	7	15	2	216	28	22	0.5	<0.04	—	259	199	14	480	8.2	0.46	0	62
SS-KCS-15	7-21-87	14	0.24	64	12	17	3	229	30	24	0.5	0.58	0.15	278	210	15	521	8.2	0.51	0	81
SS-KCS-16	4-21-87	10	—	70	11	16	2	232	31	25	0.5	<0.04	—	280	222	14	528	8.2	0.47	0	61
SS-KCS-17	4-22-87	10	—	56	10	14	2	193	26	20	0.5	<0.04	—	233	181	14	441	8.3	0.45	0	65
SS-KCS-17	7-21-87	13	0.02	57	14	18	3	212	34	27	0.6	0.13	0.16	272	202	16	518	8.3	0.55	0	90
SS-KCS-17	9-24-87	—	—	—	—	—	-	—	—	—	—	—	—	—	—	—	455 1/	—	—	-	81
SS-KCS-18	7-21-87	16	0.16	52	23	14	2	256	13	22	0.2	0.35	0.11	269	227	12	521	8.3	0.40	0	81

1/ Field conductivity taken on date indicated

Table 6.--Selected Radionuclide Determinations For Hickory Ground Water and Surface Water in Katemcy Creek, Katemcy Creek Basin, McCulloch and Mason Counties, Texas.

[SS and SZ followed by seven digit hyphinated numbers are location numbers for sampled water wells and springs. SZ-KCS-5, SS-KCS-6, etc., are location numbers for sampled waters from Katemcy Creek and San Saba River. SS means location is in McCulloch County. SZ means location is in Mason County. Under "Well Depth", Spr. means spring, SC means seepage in stream channel, SFC means small flow in stream channel, and MFC means moderate flow in stream channel. Gross Alpha, Radium (Ra) 226, and Radium (Ra) 228 are given in picocuries per liter. Accuracy of determination of radionuclide is expressed as ± an amount in picocuries per liter. < means less than. An asterisk (*) means Ra 226 + Ra 228 exceeds standard of 5.0 picocuries per liter.]

Location Number	Well Depth (ft)	Date Sampled	Gross Alpha	Ra 226	Ra 228	Ra 226 + Ra 228
SS 56-06-308	500	07-21-87	13.0 ± 3.0	1.2 ± 0.1	1.9 ± 0.4	3.1 ± 0.5
SS 56-06-309	Spr.	07-24-87	6.9 ± 2.0	1.0 ± 0.1	<1.0	<2.0 ± 0.1
SS 56-06-311	300	07-24-87	6.6 ± 2.0	1.2 ± 0.1	1.2 ± 0.5	2.4 ± 0.6
SZ 56-06-604	300	07-21-87	3.5 ± 1.4	---	---	---
SZ 56-06-605	343	07-20-87	11.0 ± 3.0	2.1 ± 0.2	4.9 ± 0.5	7.0 ± 0.7 *
SZ 56-06-606	180	07-23-87	6.9 ± 1.8	2.6 ± 0.2	3.7 ± 0.6	6.3 ± 0.8 *
SS 56-06-612	620	07-21-87	4.5 ± 1.7	0.5 ± 0.1	1.1 ± 0.5	1.6 ± 0.6
SZ 56-06-617	280	07-23-87	10.0 ± 3.0	1.9 ± 0.2	6.0 ± 0.8	7.9 ± 1.0 *
SZ 56-06-618	380	07-22-87	5.6 ± 1.8	1.0 ± 0.1	3.1 ± 0.8	4.1 ± 0.9
SZ 56-06-625	310	07-20-87	8.4 ± 2.0	2.6 ± 0.2	5.7 ± 0.6	8.3 ± 0.8 *
SZ 56-06-629	157	07-23-87	6.2 ± 1.9	3.6 ± 0.2	13.0 ± 1.0	16.6 ± 1.2 *
SZ 56-06-630	274	07-21-87	3.8 ± 1.7	2.8 ± 0.2	5.1 ± 0.6	7.9 ± 0.8 *
SZ 56-06-635	440	07-22-87	12.0 ± 3.0	2.4 ± 0.2	5.5 ± 0.7	7.9 ± 0.9 *
SZ 56-06-649	69	07-23-87	5.5 ± 1.7	1.1 ± 0.1	3.3 ± 0.5	4.4 ± 0.6

Table 6.--Selected Radionuclide Determinations For Hickory Ground Water and Surface Water in Katemcy Creek, Katemcy Creek Basin, McCulloch and Mason Counties, Texas. (continued)

Location Number	Well Depth (ft)	Date Sampled	Gross Alpha	Ra 226	Ra 228	Ra 226 + Ra 228
SZ 56-06-655	103	07-21-87	2.6 ± 1.1	---	---	---
SZ 56-06-657	71	07-23-87	2.1 ± 1.1	---	---	---
SZ 56-06-806	716	07-21-87	4.5 ± 1.8	1.5 ± 0.1	3.3 ± 0.8	4.8 ± 0.9
SZ 56-06-809	381	07-23-87	5.3 ± 1.7	1.3 ± 0.2	3.1 ± 0.6	4.4 ± 0.8
SZ 56-06-810	414	07-22-87	9.9 ± 2.3	1.3 ± 0.1	5.4 ± 0.6	6.7 ± 0.7 *
SZ 56-06-828	294	07-21-87	12.0 ± 3.0	3.0 ± 0.2	8.1 ± 0.7	11.1 ± 0.9 *
SZ 56-06-903	149	07-22-87	15.0 ± 3.0	2.3 ± 0.2	12.0 ± 1.0	14.3 ± 1.2 *
SZ 56-06-911	232	07-22-87	13.0 ± 3.0	2.2 ± 0.2	9.1 ± 0.9	11.3 ± 1.1 *
SZ 56-06-916	130	07-21-87	5.9 ± 1.7	1.5 ± 0.2	5.1 ± 0.5	6.6 ± 0.7 *
SZ 56-06-920	414	07-22-87	8.1 ± 2.1	1.1 ± 0.1	5.2 ± 0.8	6.3 ± 0.9 *
SZ 56-06-933	148	07-22-87	15.4 ± 4.0	2.5 ± 0.2	7.1 ± 0.9	9.6 ± 1.1 *
SZ 56-06-940	85	07-21-87	11.0 ± 3.0	2.4 ± 0.2	5.9 ± 1.0	8.3 ± 1.2 *
SZ 56-07-404	450	07-21-87	6.3 ± 1.9	1.8 ± 0.2	6.2 ± 0.7	8.0 ± 0.9 *
SZ 56-07-411	245	07-20-87	5.8 ± 1.7	1.1 ± 0.1	2.8 ± 0.5	3.9 ± 0.6
SS 56-07-413	191	07-21-87	12.0 ± 3.0	3.4 ± 0.2	8.1 ± 0.8	11.5 ± 1.0 *
SS 56-07-418	144	07-21-87	8.3 ± 2.0	1.3 ± 0.1	5.3 ± 0.7	6.6 ± 0.8 *
SZ 56-07-426	650	07-20-87	4.5 ± 1.5	0.9 ± 0.1	2.3 ± 0.5	3.2 ± 0.6
SZ 56-07-427	242	07-20-87	7.0 ± 1.8	1.2 ± 0.1	4.5 ± 0.6	5.7 ± 0.7 *
SZ 56-07-443	362	07-20-87	8.6 ± 2.3	1.8 ± 0.2	4.5 ± 0.6	6.3 ± 0.8 *
SZ-KCS-2	SC	07-24-87	<2.0	---	---	---
SZ-KCS-5	SC	07-23-87	<2.0	---	---	---
SS-KCS-6	SFC	07-21-87	<2.0	___	___	---

Table 6.--Selected Radionuclide Determinations For Hickory Ground Water and Surface Water in Katemcy Creek, Katemcy Creek Basin, McCulloch and Mason Counties, Texas. (continued)

Location Number	Well Depth (ft)	Date Sampled	Gross Alpha	Ra 226	Ra 228	Ra 226 + Ra 228
SS-KCS-12	SFC	07-21-87	2.1 ± 1.2	---	---	---
SS-KCS-15	SFC	07-21-87	5.2 ± 1.7	0.2 ± 0.1	1.6 ± 0.4	1.8 ± 0.5
SS-KCS-17	SFC	07-21-87	3.5 ± 1.3	---	---	---
SS-KCS-18	MFC	07-21-87	<2.0	---	---	---