CAPITAL AREA GROUND WATER CONSERVATION COMMISSION

BULLETIN NO. 1

SALTWATER-FRESHWATER INTERFACES IN THE "2,000-" AND "2,800-FOOT" SANDS IN THE CAPITAL AREA GROUND WATER CONSERVATION DISTRICT

BY

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OCTOBER 1976

FOREWORD

This report is the first study financed by and accomplished under the direction of the Capital Area Ground Water Conservation Commission. This study is in addition to data collection activities and interpretive studies being done by the U.S. Geological Survey in our cooperative effort with that agency. We believe that this report is a contribution to the knowledge of the ground-water resources in our district, will be useful to the user and planner, and will complement cooperative studies being made by the U.S. Geological Survey.

One of the conclusions is encouraging in that the movement of salt water in the "2,000-foot" sand in the area north of the Baton Rouge fault is minimal. In addition, it was learned that the Baton Rouge fault, as mapped by the U.S. Geological Survey, and which controls the northward movement of salt water in the "2,000-foot" sand in the immediate Baton Rouge area, also effectively retards the rate of movement of salt water in the western part of the district.

Although the "2,800-foot" sand contains salt water north of the fault in the district, the information in this report will be useful to those users planning the location of fresh water wells in this aquifer.

Those who share with the Commission the desire and need to make wise use of our valuable ground-water resources will recognize that this report is an initial effort to provide the user with information that will assist in planning and development. However, we also encourage the users in our district to adopt programs and water use practices that will minimize the effects of ground water use and consequently reduce the possible contamination of the fresh-water aquifers by salt water. To assure us of a long-term supply of water of good quality, each user and consumer of ground water should consider the adoption of programs that will include:

I. Plans to discourage the location of wells near the Baton Rouge fault in order to reduce the head differential across the Baton Rouge fault and thus decrease the rate of movement of salt water across the fault.

II. Plans and controls for preventing the waste of water.

III. Use of surface water in place of ground water where practicable and feasible.

IV. Plans for the reuse of water.

Austin F. Anthis
Chairman

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INTRODUCTION

Purpose and Background

The purpose of this study of the "2000-foot" and "2800-foot" sands, undertaken by the Capital Area Groundwater Conservation Commission, was to determine the origin and potential effect of saltwater found north of the Baton Rouge fault in these aquifers, and to determine the hydrologic significance of this and other faults in the district.

In an extensive study of saltwater in the Baton Rouge area aquifers, Rollo (1969) reported that saltwater was present in both the "2000-foot" and "2800-foot" sands north of the Baton Rouge fault. The "2800-foot" sand was known to contain saltwater as far north as the Baton Rouge industrial area. Saltwater in the "2000-foot" sand in a U.S. Geological Survey (USGS) test well (EB 781), located just north of the Baton Rouge fault on South Acadian Thruway, was a possible indication of saltwater encroachment in this most important aquifer. Rollo calculated that significant saltwater encroachment would not occur unless the saltwater was moving northward across the fault in response to the head differential across the fault. Water-level and quality-of-water data collected from monitor wells since Rollo's report (1969) have been evaluated in this report.

Saltwater

In this report saltwater is defined as having a chloride content in excess of 250 mg/l (milligrams per liter). This is equivalent to a dissolved solids content of approximately 750 mg/l in the Baton Rouge area. In addition to water-quality data, estimates of water salinity were made from electric logs of water wells and oil and gas wells using the method described by Turcan (1966). Baton Rouge aquifers having a resistivity of less than 20 ohm meter^2/meter on the long normal curve of an electric log are considered to contain water with a chloride content in excess of 250 mg/l.

Acknowledgments

Water-level and water-quality data were supplied by the USGS in Baton Rouge, Louisiana. Electric logs of wells were obtained from the USGS, and from the Louisiana Departments of Conservation and Public Works. Charles Whiteman of the USGS provided valuable advice concerning the utilization and interpretation of data collected by the USGS in the area. C. O. Durham, Jr., conferred with the author concerning his investigations of the Denham Springs and Baton Rouge faults. The author is particularly grateful for the suggestions of R. G. Kazmann during discussions of several aspects of this investigation.

SUMMARY AND CONCLUSIONS

The "2000- and 2800-foot" sands are important aquifers in the Capital Area Groundwater Conservation District and both contain freshwater and saltwater. The average daily pumpage during 1976 was approximately 36 million gallons from the "2000-foot" sand and 23 million gallons from the "2800-foot" sand. Northward movement of the freshwater-saltwater interface in the "2000-foot" sand is restricted--but not totally prevented--by the Baton Rouge fault. Because the freshwater-saltwater interface in the "2800-foot" sand is north of the fault, the Baton Rouge fault does not limit northward movement of salt water in this aquifer. This investigation was undertaken to study further the effects of the Baton Rouge fault on these aquifers and to determine whether the freshwater resources of these aquifers, particularly of the "2000-foot" sand, are threatened by salt-water encroachment.

Saltwater was discovered north of the Baton Rouge fault in the "2000-foot" sand in an observation well completed by the U.S. Geological Survey. The U.S. Geological Survey (Rollo, 1969) calculated this water could reach public supply wells at the Lafayette and Government Street pumping stations by the mid-1980's and, therefore, recommended monitoring in an effort to determine whether the saltwater was originating from saline aquifers south of the fault. Calculations made in this study indicate that under present hydrologic circumstances salt water will not reach public supply wells for at least 100 years.

The situation has changed only slightly since 1966. Salt water north of the fault has not reached additional wells. However, the chloride content has increased in the original salt "discovery" well (EB 781) and water level records of observation wells indicate the "2000-foot" sand north of the fault and the "1500-foot" sand south of the fault are hydraulically connected at the Baton Rouge fault. However, as Rollo (1969) inferred, the head difference (see Fig. 5) in wells completed at similar depths north and south of the fault zone indicate that the fault zone has a low permeability. Consequently the rate of northward movement of salt water at the Baton Rouge fault is very slow. The following conclusions are based on well-log correlations made while mapping the aquifers and faults west of the Mississippi River, and on interpretations of data from observation wells along the Baton Rouge fault.

1. The Baton Rouge fault is a regional fault crossing the entire Capital Area Groundwater Conservation District in a sinuous east-west line. This fault creates a major hydrologic discontinuity in the "2000-foot" sand which greatly restricts the northward movement of saltwater. The fault probably causes a hydrologic discontinuity in the "2800-foot" sand but the northward movement of salt water of the interface is not significantly restricted because the salt-water-freshwater interface is already north of the fault in this aquifer.

2. Saltwater is apparently moving slowly across the Baton Rouge fault into the base of the "2000-foot" sand near USGS observation well EB 781. This is the only well in the "2000-foot" sand north of the fault which yields

saltwater. Evidence for saltwater movement across the fault is:

a) The salinity increase in EB 781 (Fig. 4).

b) The similarity in water-level fluctuations across the fault in response to pumping changes in the Baton Rouge area (Fig. 5).

3. The volume of saltwater crossing the fault is estimated to be 450,000 gallons per day. For comparison, this is slightly more than one percent of the average daily pumpage from the "2000-foot" sand in East Baton Rouge Parish (about 36 million gallons/day in 1976). At this rate, it is estimated that more than 100 years are required to advance saltwater to the vicinity of the public supply wells at the Lafayette Street and Government Street pumping stations.

4. The Tepetate and Denham Springs faults are not significant barriers to groundwater flow in the "2000-foot" sand. One of the Tepetate faults appears to control the position of the freshwater-saltwater interface in the "2800-foot" sand over a distance of a few miles. Regionally, however, the distribution of saltwater and freshwater in the "2800-foot" sand does not appear to be fault controlled. Thus, pumping centers developed near the broad freshwater-saltwater interface in the "2800-foot" sand (Fig. 6) may be subject to saltwater encroachment or saltwater coning.

RECOMMENDATIONS

In an effort to gain maximum information from existing observation wells concerning saltwater movement and the boundary effects of the Baton Rouge fault in the "2000-foot" sand, the following recommendations are offered.

1. Continuous water-level recorders installed in wells in the "2000- and 1500-foot" sands on both sides of the fault are recommended for a period of at least one year. Such records of subtle changes in water level south of the fault, in response to changes in offtake north of the fault, could provide significant data to help determine more conclusively and precisely the hydrologic effects of the fault. Continuous water-level records of the following wells (see figure 4 for location of wells) are desirable:

"1500-foot" sand	EB 780-B, 782-B and 789-B
"2000-foot" sand	EB 778, 781 and 803-B

2. The chemical composition of saltwater, which has crossed the fault, may be sufficiently unique to identify its source south of the fault. Changes in the composition of groundwater north of the fault due to saltwater movement across the fault since the first USGS observation wells were installed may help quantify the amount of water crossing the fault. Complete chemical analyses of the following wells (see figure 4 for location of wells) is recommended:

"1500-foot" sand	EB 780-B, 782-B, 789-B and 807A
"2000-foot" sand	EB 778, 781 and 807-B

GEOHYDROLOGY

The Aquifers

The "2000-foot" and "2800-foot" sands, named on the basis of their depth of occurrence in the industrial area of Baton Rouge, were selected for evaluation because both are important sources of groundwater in the Capital Area Groundwater Conservation District. The "2000-foot" sand can be readily mapped as a single aquifer unit throughout most of the area. Figure 1 combines, and modifies, the geologic structure maps of Winner and others (1968, pl. 8) and Rollo (1969, pl. 5). Winner and others (1968, p. 26) reported that the "2000-foot" and the 1700-foot" sands operate as a single hydrologic unit over a large part of the southern half of Pointe Coupee Parish. But Morgan (1961) reported the "2000-foot" sand had no known hydrologic connection with other aquifers in the Baton Rouge area.

The "2800-foot" sand has been described in the Baton Rouge area by Meyer and Turcan (1955), Morgan (1961), Morgan and Winner (1964), and Rollo (1969). Morgan and Winner mapped the position of the saltwater-freshwater interface through the industrial area. Rollo (1969, p. 38) stated that groundwater pumpage north of the interface was not sufficient at that time to cause "appreciable movement northward from its 1967 position".

As part of the present study, the base of the "2800-foot" sand was mapped (Fig. 2). This aquifer dips southward at a rate of approximately 60 to 100 feet per mile. The only major structural displacement shown in Figure 2 is along the Baton Rouge fault. Smaller vertical displacements along the Tepetate faults, and the stratigraphic correlations of this aquifer with other sands and clays, are demonstrated in the cross sections in Figure 3.* The "2800-foot" sand is areally extensive and has a thickness of 100 feet or more, especially in those areas where the aquifer coalesces with underlying sands. Potential connections with deeper sands are indicated in cross section D-D' near Lottie (well 3), and near Port Allen (wells 8 and 9, Fig. 3). Potential areas for hydraulic connection between the "2800-foot" sand and the overlying "2400-foot" sand exist in the vicinity of Erwinville (cross sections B-B', wells 5 and 6, and D-D', well 6, Fig. 3).

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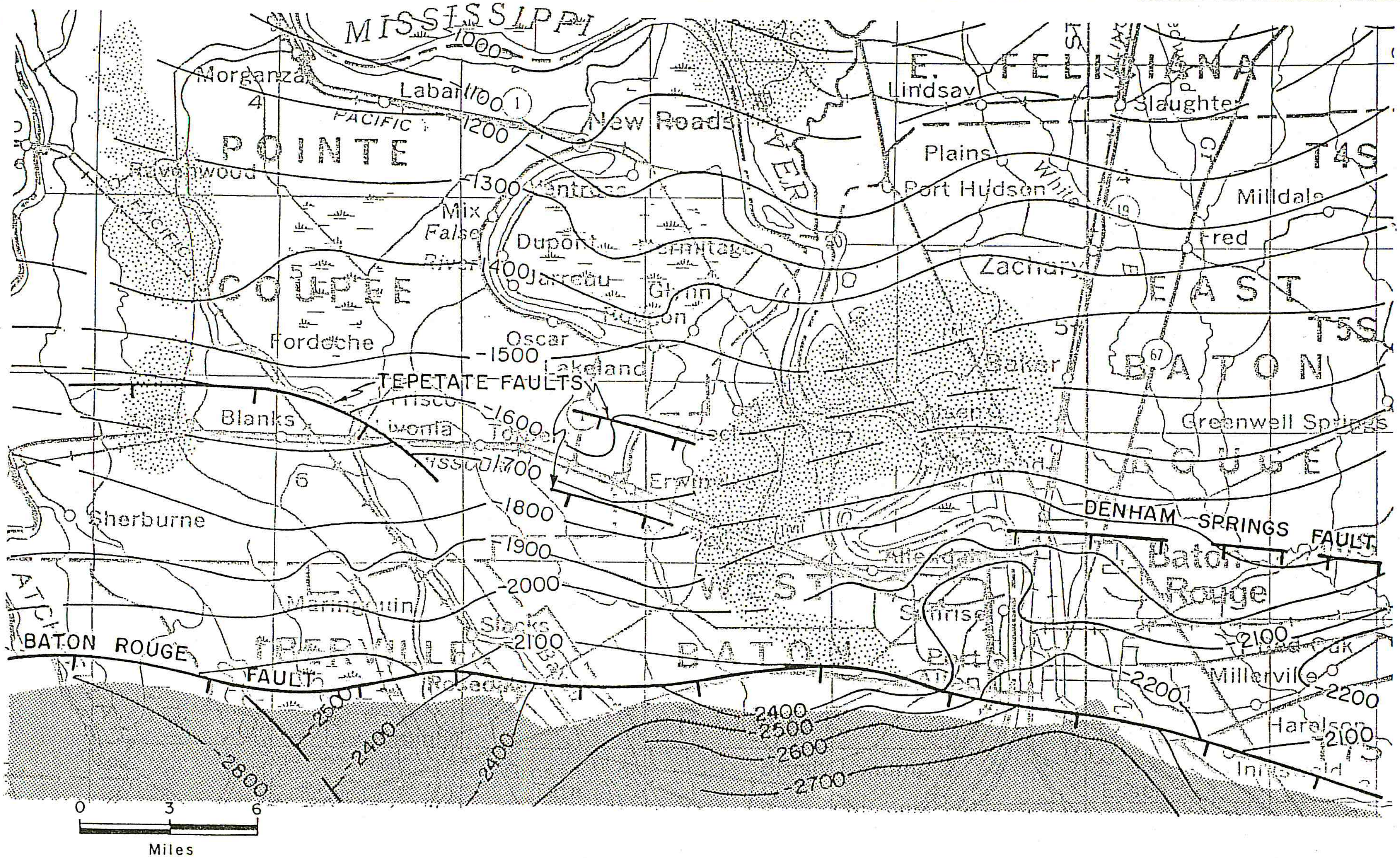
*Wells used in cross sections in Figure 3 are listed in the Appendix.



— -2000 — Contour elevation below MSL (feet)

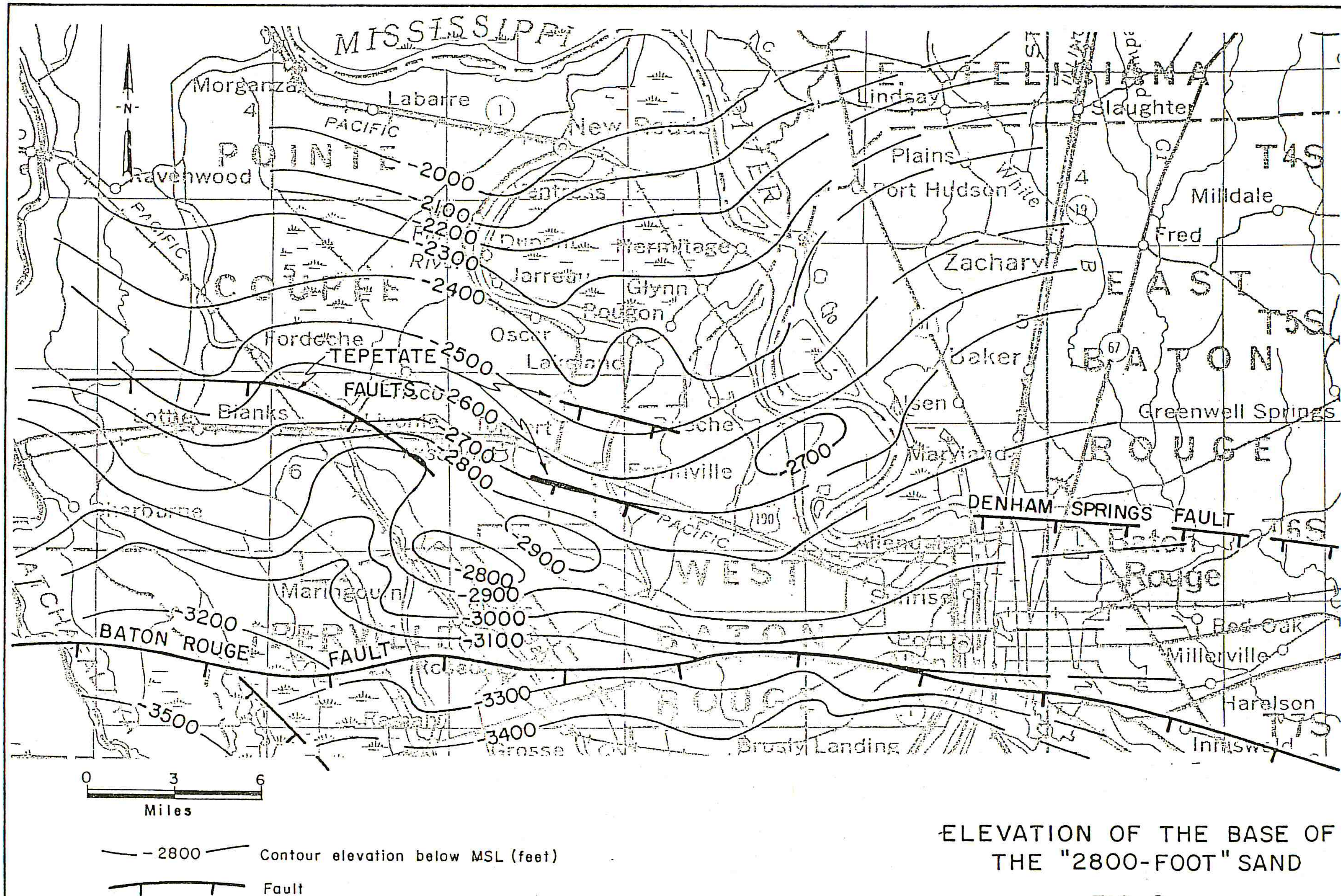
Fault

Area where "2000-Foot" Sand is less than 20 feet thick (After Rollo, 1969 and Morgan et al, 1968)

Area where "2000-Foot" Sand contains salt water

ELEVATION OF THE BASE OF THE "2000-FOOT" SAND

FIG. 1



ELEVATION OF THE BASE OF THE "2800-FOOT" SAND

FIG. 2

Faulting

In this study, electric logs of wells in West Baton Rouge, Iberville and Pointe Coupee Parishes were correlated to better define the location of and effect of faults in the Capital Area Groundwater Conservation District and adjacent areas. Generally, the faults are oriented east-west and result in the downward movement of sediments south of the fault trace. Most are growth faults which developed during the slow accumulation of the sediments. Common features of growth faults in the Gulf Coast area as listed by Carver (1968) are:

1. Fault traces are arcuate and normally concave toward the coast.

2. The average dip of the fault plane is 45°, being steeper near the surface and diminishing with depth.

3. Displacement tends to increase at some depth to a maximum, and then decrease at greater depths.

The Baton Rouge fault is the most extensive, significant, and thoroughly investigated fault in the local aquifer system. It was traced by Durham and Peeples (1956, p. 65) "from the Mississippi floodplain in south Baton Rouge eastward into Livingston Parish, a distance of twenty-five miles". Its hydrologic effects on the Baton Rouge aquifers were investigated by Rollo (1969). This regional fault has been mapped in the "2000-foot" and "2800-foot" sands westward through Iberville Parish, in this investigation, using oil and gas well logs (Fig. 1). The position of the fault or fault zone is not as well known west of the Mississippi River as in East Baton Rouge Parish because (1) the prominent fault escarpment at the surface east of the Mississippi River is not developed west of the river and (2) wells drilled by the USGS to investigate the fault are concentrated primarily in the Baton Rouge metropolitan area. However, sufficient electric log control now exists to map the fault west of the Mississippi River. The trend of the fault in West Baton Rouge Parish is south of the position inferred by Rollo (1969, p. 1-6). The Baton Rouge fault possibly bifurcates into two faults a few miles west of Port Allen, each accounting for part of the total displacement. Another bifurcation occurs in Iberville Parish creating a southeast extension of the fault.

Vertical displacement of the "2000- and 2800-foot" sands along the fault varies from approximately 350 feet in East Baton Rouge Parish to less than 150 feet at Port Allen (the southern part of the bifurcation mentioned above) to more than 600 feet in Iberville Parish. The position of the fault in this report is based on extrapolation of deep data collected in the development of oil and gas fields aligned south of the fault, and on interpretations of well logs at the depth interval of the aquifers of interest. Because the location of the fault and the amount of displacement it produces are hydrologically significant, new data should be periodically evaluated to complement that now available.

Although the Baton Rouge fault is considered by many to be a nearly "impermeable" barrier to groundwater, the hydrologic data indicate some movement--probably at a very slow rate--across the fault into the "2000-foot" sand in the vicinity of EB 781 in the south Baton Rouge area. However, west of the Mississippi River, salinity estimates from electric logs show that the freshwater-saltwater interface lies consistently south of the fault.

Localized faults, which have little or no effect on the regional geohydrology, occur in the aquifers north of the Baton Rouge fault. Winner and others (1968, p. 10) grouped the faults in their study area into the Tepetate-Baton Rouge Fault Zone and the Bancroft Fault Zone. In the present study, three faults, or fault systems, are recognized (Fig. 1): (1) the Baton Rouge fault, the regional east-west fault described above; (2) the Tepetate fault system, three local faults lying north of the Baton Rouge fault and west of the Mississippi River; and (3) the Denham Springs fault, north of the Baton Rouge industrial area. The displacement created by the Bancroft Fault Zone of Winner and others (1968) apparently occurs only at depths greater than the principal aquifers of the area.

Certainly not all the faults that exist, and will eventually be mapped in the area, are shown in Figure 1. Only the more obvious ones which cause abrupt, apparent increases in the normal gulfward slope of the aquifers are included. Most of these faults are shallower parts of deep growth faults which form the traps of the oil and gas fields of West Baton Rouge, Iberville and Pointe Coupee Parishes. A good example is the fault of the Tepetate system bounding the Lottie oil and gas field, two miles north of Lottie. At depths of about 10,000 feet, a sufficient amount of subsurface data exists to map this fault. It causes approximately 100 feet of displacement in the "2000-foot" and "2800-foot" sands shown between wells 5 and 6 in section A-A' (Fig. 3). The southern limit of fresh water in the "2800-foot" sand parallels the fault, indicating that the fault is a local barrier limiting movement of water in the aquifer. The remaining Tepetate faults appear to have no hydrologic effects.

The Denham Springs fault lies just north of the industrial area of Baton Rouge. C. O. Durham, Jr. has studied this fault, noting particularly its movement, surface expression and the damage associated with structures located on the surface trace (Durham, 1964; personal communication, 1976). Subsurface displacement on this fault is less than that of the Baton Rouge fault (Smith, 1969, Fig. 3). A comparison of observation well hydrographs across the fault in the "400-foot" and "600-foot" sands and in the "1500-foot" sand indicate this fault is not hydrologically significant. Comparisons of hydrographs could not be made for the "2000-foot" and "2800-foot" sands. With one exception, observation wells for the "2000-foot" sand are located exclusively south of the fault, and observation wells in the "2800-foot" sand are located exclusively north of the fault. Rollo's (1969, pl. 5) map of water levels in the "2000-foot" sand gives no indication that the Denham Springs fault is hydrologically significant.

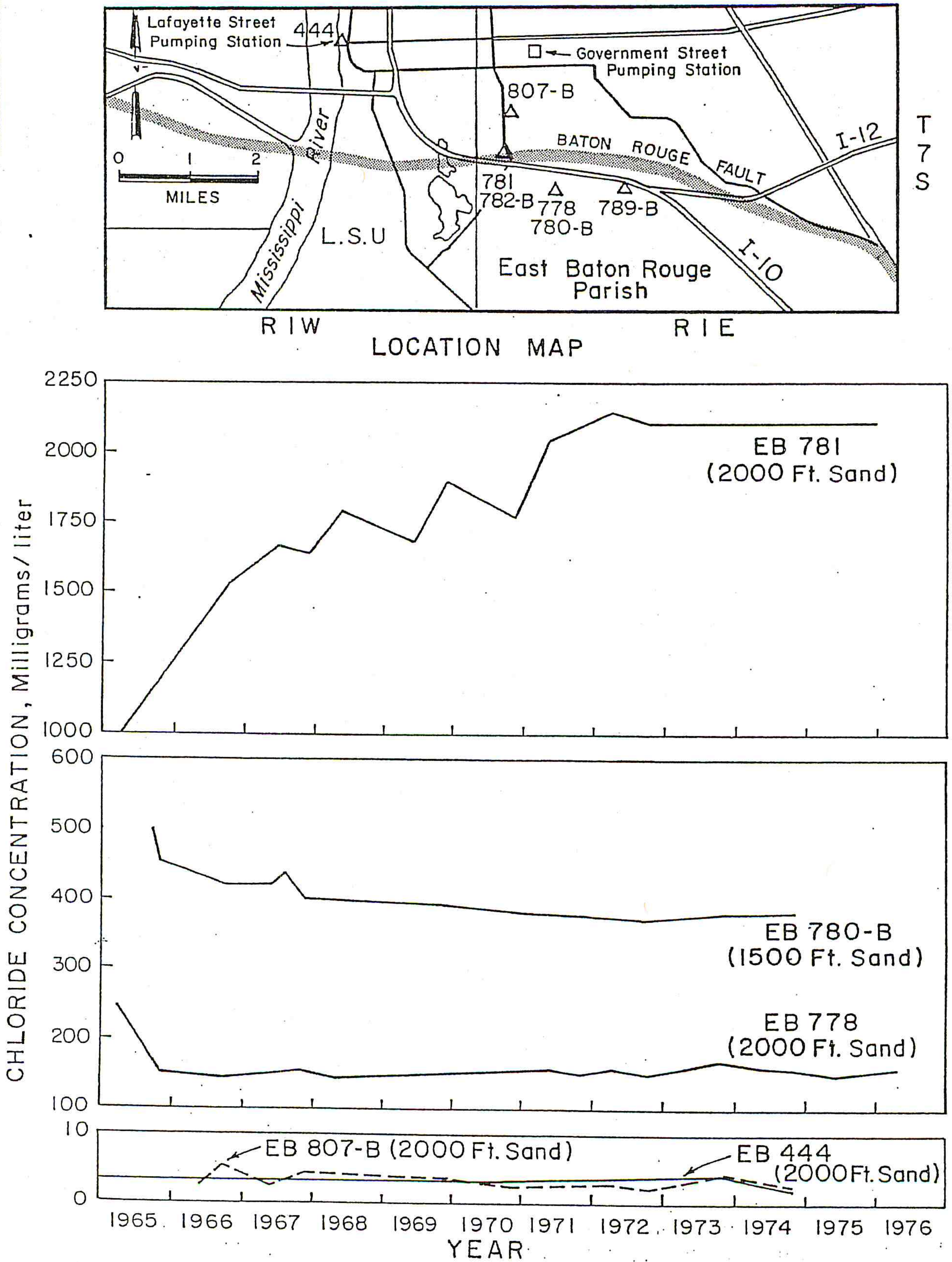
Saltwater in the "2000-Foot" Sand

When Rollo (1969, pl. 5) mapped the "2000-foot" sand, saltwater had been detected in the base of this aquifer north of the Baton Rouge fault in only one well, EB 781. He showed that the "1500-foot" sand contained saltwater locally south of the fault and was possibly in contact with the "2000-foot" sand at the fault in the vicinity of well EB 781, at South Acadian Thruway. He concluded (p. 33) that the saltwater in this area could have two possible origins: (1) it could be a limited body of saltwater originally trapped in the "2000-foot" sand by the fault or (2) it could be saltwater moving across the fault, possibly from the "1500-foot" sand. In either case the saltwater did not appear to be a serious and immediate threat to freshwater users north of the fault. The saltwater was limited in volume because it had been trapped north of the fault, or because the fault severely restricted the northward rate of movement of saltwater. Rollo (1969, pp. 32 and 33) predicted that the saltwater would move westward at a slow rate and could possibly reach wells at the Lafayette Street pumping station in 10 to 15 years. Water level and water quality records collected by the USGS since Rollo's report indicate that the fault restricts, but does not prevent, groundwater movement across the fault into the "2000-foot" sand. However, the rate of northward advancement of salt water, calculated in this report, indicates salt water will not reach the Lafayette pumping station for more than 100 years.

Chloride variations measured in observation wells near the Baton Rouge fault offer clues to the groundwater flow system at the fault in South Baton Rouge (Fig. 4). In general, an increase in chloride content in a groundwater sample is an indication that a wedge of dense saltwater is advancing along the base of the aquifer in the vicinity of the sampled well. Just north of the fault, EB 781 has shown an increase in chloride content from 1000 mg/l in 1965 to 2100 mg/l in 1972, and has remained at that level through 1975. The source of saltwater may be the "1500-foot" sand south of the fault (Rollo, 1969, pl. 5). The increase in chloride content at EB 781 is not reflected in other wells completed in the "2000-foot" sand north of the fault. Note the consistently low chloride levels of EB 444 at Lafayette Street pumping station and at EB 807-B, less than a mile north of EB 781 (Fig. 4).

South of the fault EB 780-B, screened in the "1500-foot" sand, and located on College Drive near Perkins has decreased in chloride content since its completion. This activity is puzzling. One possible explanation is that during pumping to develop the well, saltwater was drawn into the well, and only after a period of years has the local groundwater returned to its normal chloride level of less than 400 mg/l. The slight increase in chloride content in well EB 778 may be the result of northward movement of increasingly saline water from the "2000-foot" sand across the fault.

Hydrographs of wells in the "1500-foot" sand south of the fault were compared with the hydrographs of wells in the "2000-foot" sand north of the fault to check for correspondence of water-level changes across the fault (Fig. 5). The following features are significant:



CHLORIDE CONCENTRATIONS OF SELECTED OBSERVATION WELLS

FIG. 4

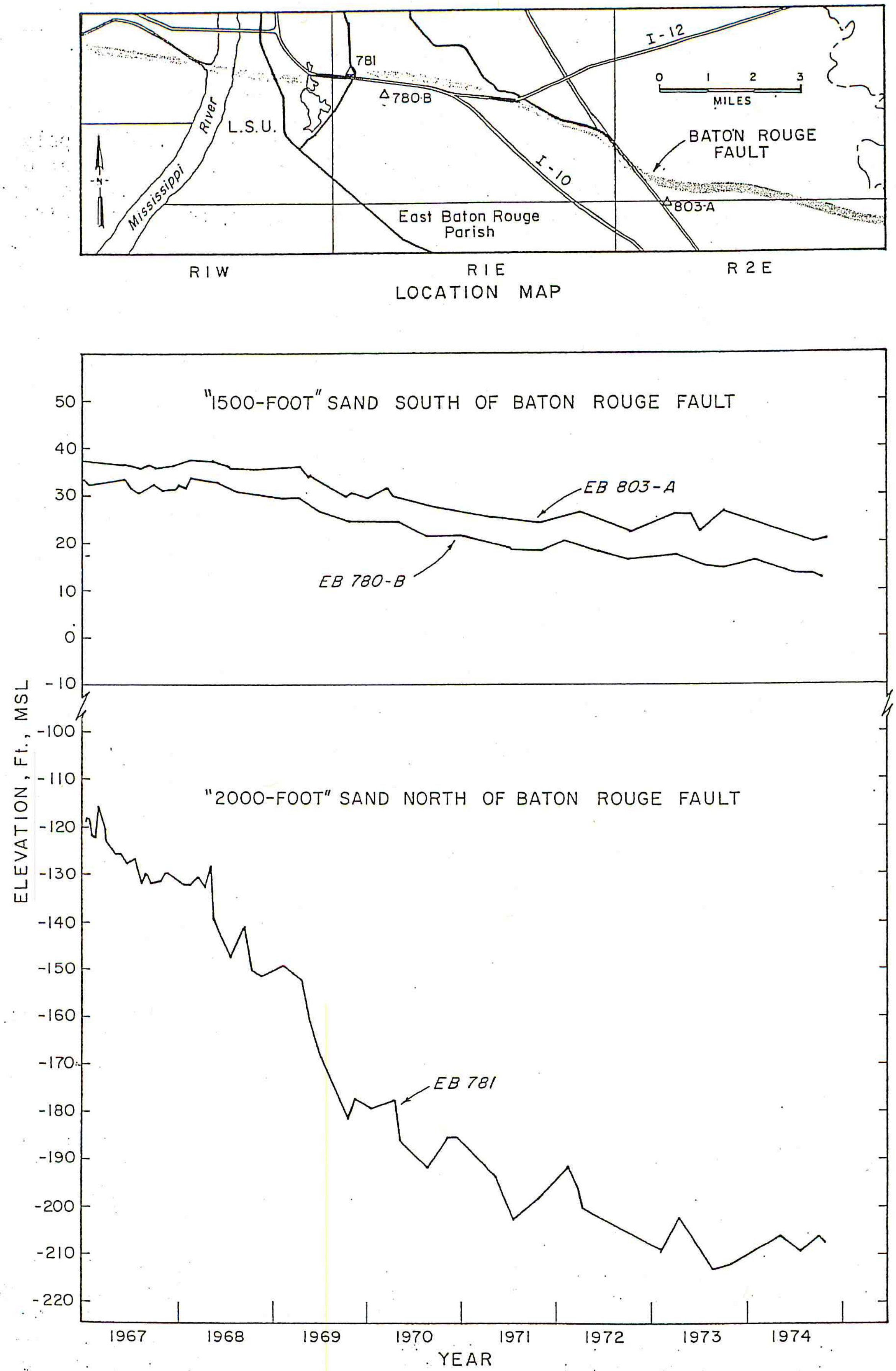
1. Water levels south of the fault have continually declined in response to offtake in the industrial area of Baton Rouge, indicating that the fault does not completely block groundwater movement. Rollo reported this effect (1969, p. 13).

2. Water levels in the "1500-foot" sand south of the fault are approximately 200 to 250 feet higher than water levels from wells at the same depths north of the fault. This head difference is the result of the very low permeability of the fault (Rollo, 1969, p. 39).

3. The cycles of highs and lows in hydrographs on either side of the fault are similar because the "1500-foot" sand and the "2000-foot" sand are hydraulically connected across the fault. Note particularly the steep water-level decline during 1969 in well EB 781, and corresponding declines in wells south of the fault during the same period. The magnitudes of declines south of the fault are less, but they represent the most pronounced declines for the entire period of record of these wells.

The saltwater increase in EB 781, and the transmission of water-level changes across the fault, are evidence that the fault is not a complete hydrologic barrier. Because some movement of water across the fault is indicated, assessment of the amount of saltwater that may be intruding the "2000-foot" sand was made based on the following assumptions: (1) the chloride increase in EB 781 is due to an increase in the volume of saltwater in the base of the aquifer north of the fault, (2) the saltwater increase results from water moving into the "2000-foot" sand from the "1500-foot" sand south of the fault, and (3) the saltwater wedge in the base of the "2000-foot" sand has increased by a volume of roughly 1.3×10^8 cubic feet between 1965 and 1972 (the period of chloride increase in EB 781). Such an increase would be sufficient to raise the freshwater-saltwater interface 10 feet at EB 781, effectively inundating the well screen with water of a constant salinity. The resulting saltwater wedge would cover an area of approximately 3 square miles. Based on these calculations, the amount of saltwater entering the "2000-foot" sand from the Baton Rouge fault is 450,000 gallons per day. If this flow rate is maintained, more than 100 years are required before the dense saltwater will fill the base of the "2000-foot" sand to the -2200 foot contour (Fig. 1), thus reaching the pumping wells at Lafayette Street and Government Street.

The results of the above calculations must be recognized as estimates, which are dependent on the assumptions made. If the chloride increase at EB 781 is due to coning of saltwater during water sampling or due to diffusion of saltwater from the base of the aquifer north of the fault, the estimate of the rate of saltwater movement across the fault is much too high. On the other hand, if the increase in the volume of salt water north of the fault is greater than assumed above, the northward movement of salt water will be more rapid than expected. It is clear that after 10 years of observation, saltwater has not reached observation wells beyond EB 781. The saltwater-freshwater interface has risen possibly 10 feet in EB 781. A rise of another 50 feet is required to advance the denser saltwater northward along the base of



SELECTED OBSERVATION WELL HYDROGRAPHS
NORTH AND SOUTH OF THE BATON ROUGE FAULT

FIG. 5

the aquifer to the -2200 foot contour. At some future time, public-supply wells at Government Street and Lafayette Street may begin to yield water of increasing salinity. However, this situation is not expected to develop for nearly 100 years, and before saltwater reaches the pumping wells, chloride increases at EB 807 (Fig. 4) will indicate the rate of movement and salinity of the advancing saltwater wedge.

Saltwater in the "2800-Foot" Sand

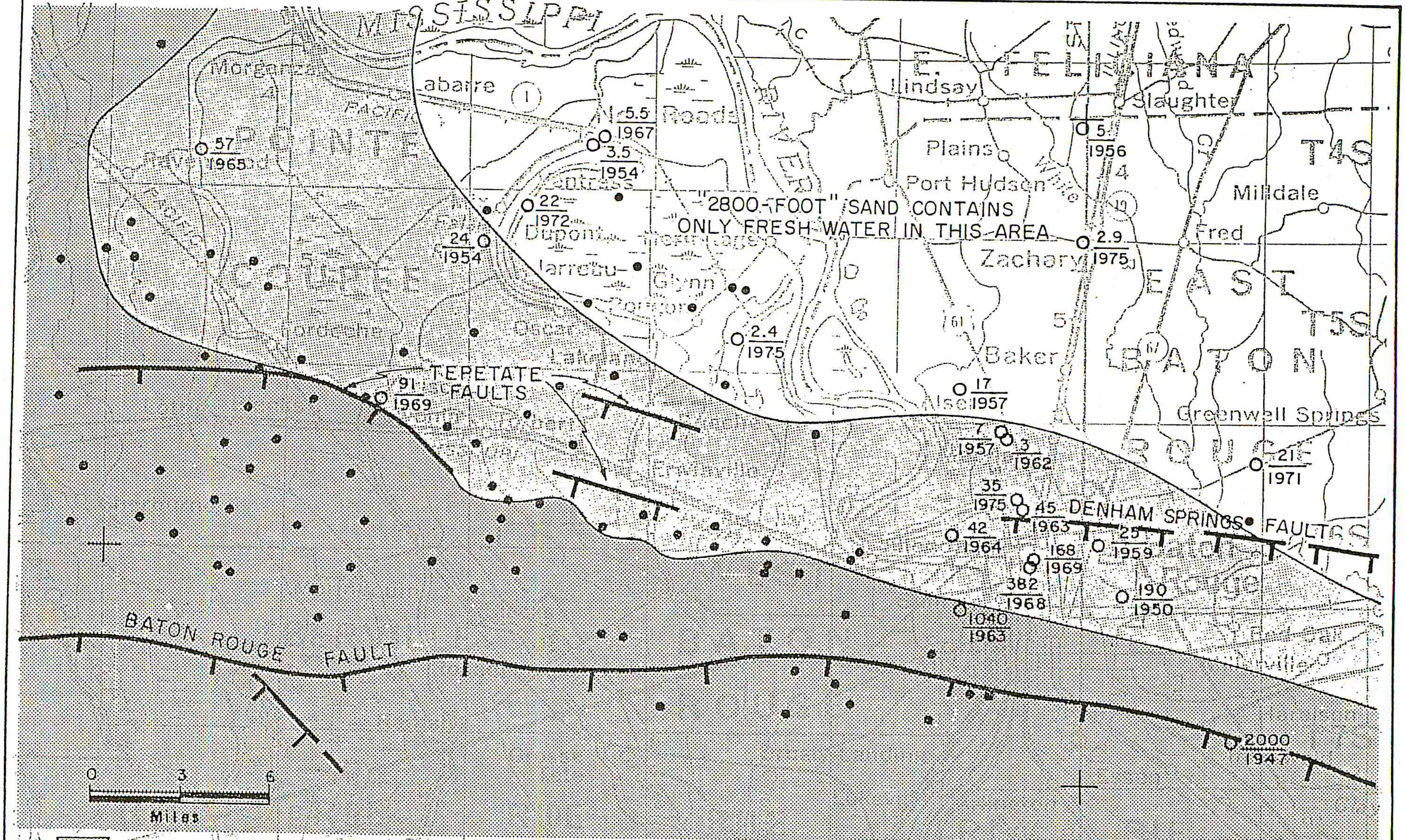
The saltwater-freshwater interface in the "2800-foot" sand (Fig. 6) was mapped largely on the basis of determinations from electric logs. Indicated in Figure 6 are electric log control points and the most recent chloride concentrations for wells completed in the "2800-foot" sand. The northernmost boundary of the interface marks the northern limit of saltwater in the "2800-foot" sand. Hence, in the northeastern third of the area shown, the "2800-foot" sand yields only freshwater. South of this area the wedge of saltwater in the base of the aquifer thickens until the aquifer contains only saltwater (see also Fig. 3).

The Baton Rouge fault and the faults of the Tepetate system cause displacements in the "2800-foot" sand. The Baton Rouge fault probably creates a hydrologic discontinuity in the "2800-foot" sand similar to that in the "2000-foot" sand. Northward movement of the freshwater-saltwater interface in the "2800-foot" sand is not restricted by the Baton Rouge fault as in the "2000-foot" sand. The arcuate pattern of the freshwater-saltwater interface near Livonia parallels the northwesternmost Tepetate fault, indicating that this fault may limit water movement in this aquifer.

The contrast between the broad saltwater-freshwater interface in the "2800-foot" sand and the abrupt interface in the "2000-foot" sand is a result of the hydrologic discontinuity created by the Baton Rouge fault which controls the position of saltwater and freshwater in the "2000-foot" sand. The lack of extensive hydrologic barriers associated with faulting in the "2800-foot" sand allows saltwater and freshwater to mix over a broad area. The result is a broad, gently sloping interface separating a thickening wedge of freshwater to the north from the wedge of saltwater to the south.

The apparent lack of hydrologic boundaries controlling the position of saltwater in the "2800-foot" sand north of the Baton Rouge fault has significance for future groundwater development. Centers of pumping located near the saltwater interface may be subject to saltwater coning and encroachment.

Important pumping centers in the "2800-foot" sand are located at New Roads (Winner and others, 1969) and in the northwestern portion of East Baton Rouge Parish. Adequate water-level data were not available to map in detail the potentiometric surface of the "2800-foot" sand. However, the trend of water-level declines at two observation wells is shown in Figure 7. Expansion of



- Area where "2800-Foot" Sand contains only salt water

- Area of Fresh Water/Salt Water interface

O - Water sample point

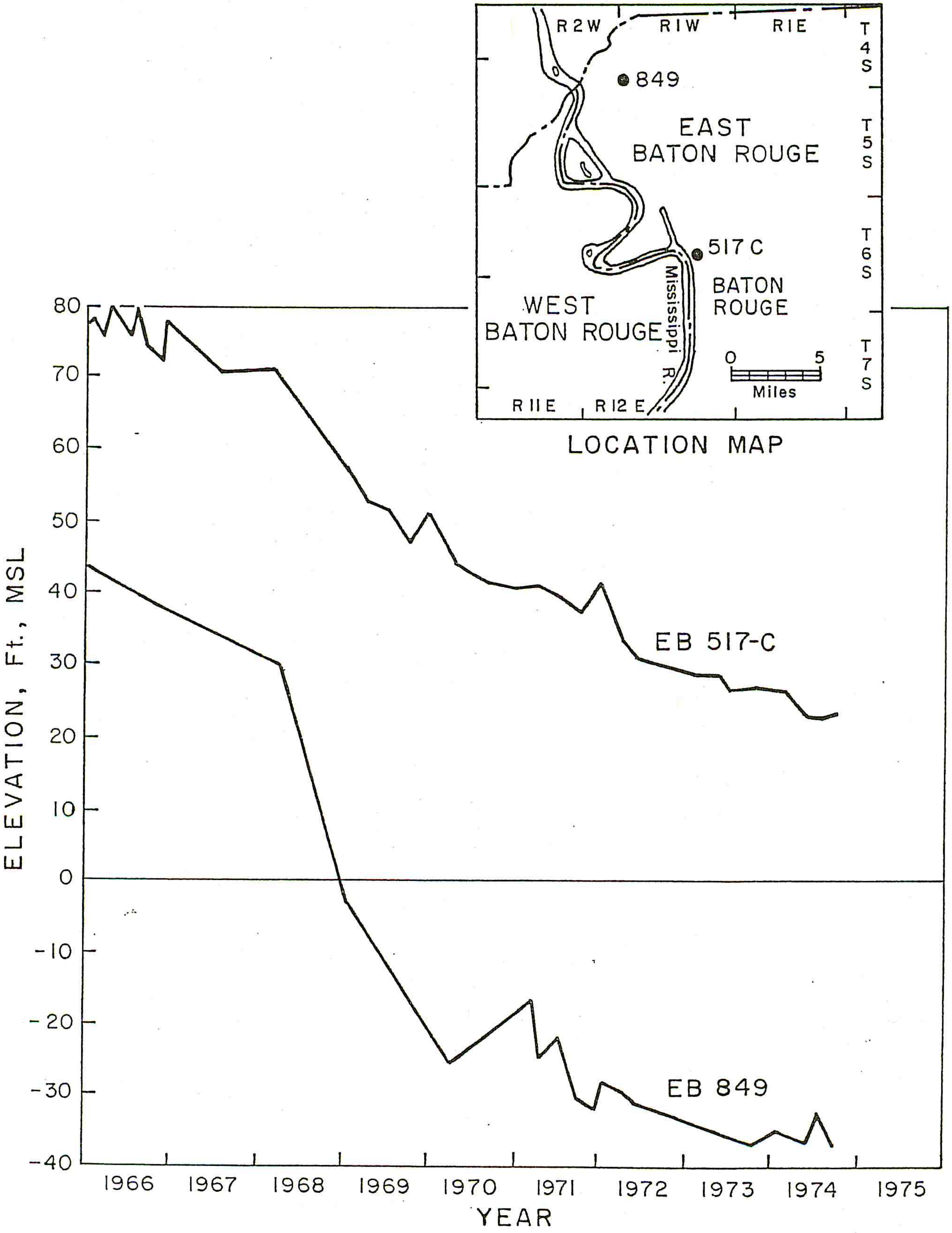
• - Electric log control point

91 - Chloride concentration mg/L and
1969 - Year of sample

"2800-FOOT" SAND
SALT WATER-FRESH WATER DISTRIBUTION

FIG. 6

groundwater pumping north of the saltwater-freshwater interface in the "2800-foot" sand will cause increased drawdowns which could eventually result in the northern movement of saltwater toward centers of offtake. Monitoring of water-quality and water-level changes is necessary to assure efficient utilization of freshwater from this aquifer in the future. The monitoring network should be reviewed continuously and adjusted to respond to changes in water quality, water levels, pumping and/or geologic and hydrologic interpretations.



SELECTED HYDROGRAPHS, "2800-FOOT" SAND

FIG. 7

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APPENDIX

List of Wells Used in Geologic Cross Sections (Fig. 3)

Well No.	Company	Well Name		La.Cons.Dept. Serial No.	Location Sec.	T.	R.
		Cross Section A-A'					
1	Shell Oil Co.	Schwing	#1	123666	85	7S	8E
2	Gen. Crude Oil	Consolidated	#1	111948	49	7S	8E
3	Texas Crude Oil	Bomer-Banks Lmbr.	#1	84392	44	6S	8E
4	E. Saunders Alpaugh	Andrews	#1	74610	32	6S	8E
5	Texas Co.	J. O. Long	#3	38461	29	6S	8E
6	Texas Co.	G. W. Dearing	#1	35120	20	6S	8E
7	E. C. Wentworth	Wilcox	#1	82531	48	5S	8E
		Cross Section B-B'					
1	Headington Co.	La. Clay Prod.	#3	141052	35	7S	11E
2	Amerada	Wilbert	#2	25806	35	7S	11E
3	Monterey Expl.	A. Wilbert Sons	#1	51583	14	7S	11E
4	Jett Drlg. Co.	Morley Cypress	#1	62590	3	7S	11E
5	Humble Oil	So. Land Prod.	#1	65320	31	6S	11E
6	Wilcans & Secan Oil	Robt. Palmer	#1	142199	25	6S	10E
7	Milton J. Bernos	C. A. Lorio		-	15	6S	10E
8	Chevron Oil Co.	L. Crochet et al.	#1	149146	37	6S	10E
9	Circle Drlg. Co.	J. E. Jumonville	#1	85701	101	5S	10E
		Cross Section C-C'					
1	Amerada Petr. Corp.	Aillet Est. et al.		36962	102	7S	12E
2	U.S. Geological Survey	WBR 97		-	70	7S	12E
3	Circle Drlg. Co.	Oaks	#1	47932	93	7S	12E
4	U.S. Geological Survey	WBR 104		-	93	7S	12E
5	U.S. Geological Survey	WBR 101		-	91	7S	12E
6	U.S. Geological Survey	WBR 33		-	64	7S	12E
7	U.S. Geological Survey	WBR 95		-	43	6S	12E
8	U.S. Geological Survey	WBR 750		-	75	6S	1W
		Cross Section D-D'					
1	Texas Co.	La. Cent. Land	#1	49636	38	6S	8E
2	E. Saunders Alpaugh	Andrews	#1	74610	32	6S	8E
3	C. H. Sands	Albin Majors	#1	63999	121	6S	9E
4	An-Son Corp. et al.	W. H. Patterson	#1	96421	19	6S	10E
5	Deep South Oil	So. Land & Prod.	#1	45166	35	6S	10E
6	Humble Oil	So. Land Prod.	#1	65320	31	6S	11E
7	Jett Drlg. Co.	Morley Cypress	#1	62590	3	7S	11E
8	U.S. Geological Survey	WBR 102		-	7	7S	12E
9	U.S. Geological Survey	WBR 33		-	64	7S	12E