TEXAS BOARD OF WATER ENGINEERS



Contamination Report No. 4

# RECONNAISSANCE REPORT ON THE BISHKIN-MEYERS WELL NEAR PIERCE, WHARTON COUNTY, TEXAS

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# RECONNAISSANCE REPORT ON THE BISHKIN-MEYERS WELL NEAR PIERCE, WHARTON COUNTY, TEXAS

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## SUMMARY OF CONCLUSIONS

Water from the Bishkin-Meyers irrigation well is indicated, by comparison of chemical analyses, to be highly contaminated with respect to chloride and sodium ions. Chloride is concentrated by approximately 170 times in comparison with concentrations found in uncontaminated waters of nearby wells of similar depth.

The source of contamination is not indicated to be of natural origin because shallow strata generally contain water of excellent quality throughout this area except in a few areas where shallow wells have been reported to be contaminated by brine disposed to earthen pits.

Brine has been disposed in the area (figure 1) for several years and may be the source of contamination in the Bishkin-Meyers well, or salt water may enter the fresh ground water body through wells which penetrate oil-producing horizons. Improperly abandoned oil wells are reported by local persons. Earthen pits ranging in depth from 5 to 15 feet are employed to dispose of approximately 500 barrels of brine within a half-mile radius of the contaminated well (figure 1). Approximately 8,000 barrels per day are disposed to pits ranging in depth from an estimated 15 to 30 feet at points one to two miles west-northwest of the well. Brine has been disposed in large quantities in this area for a number of years.

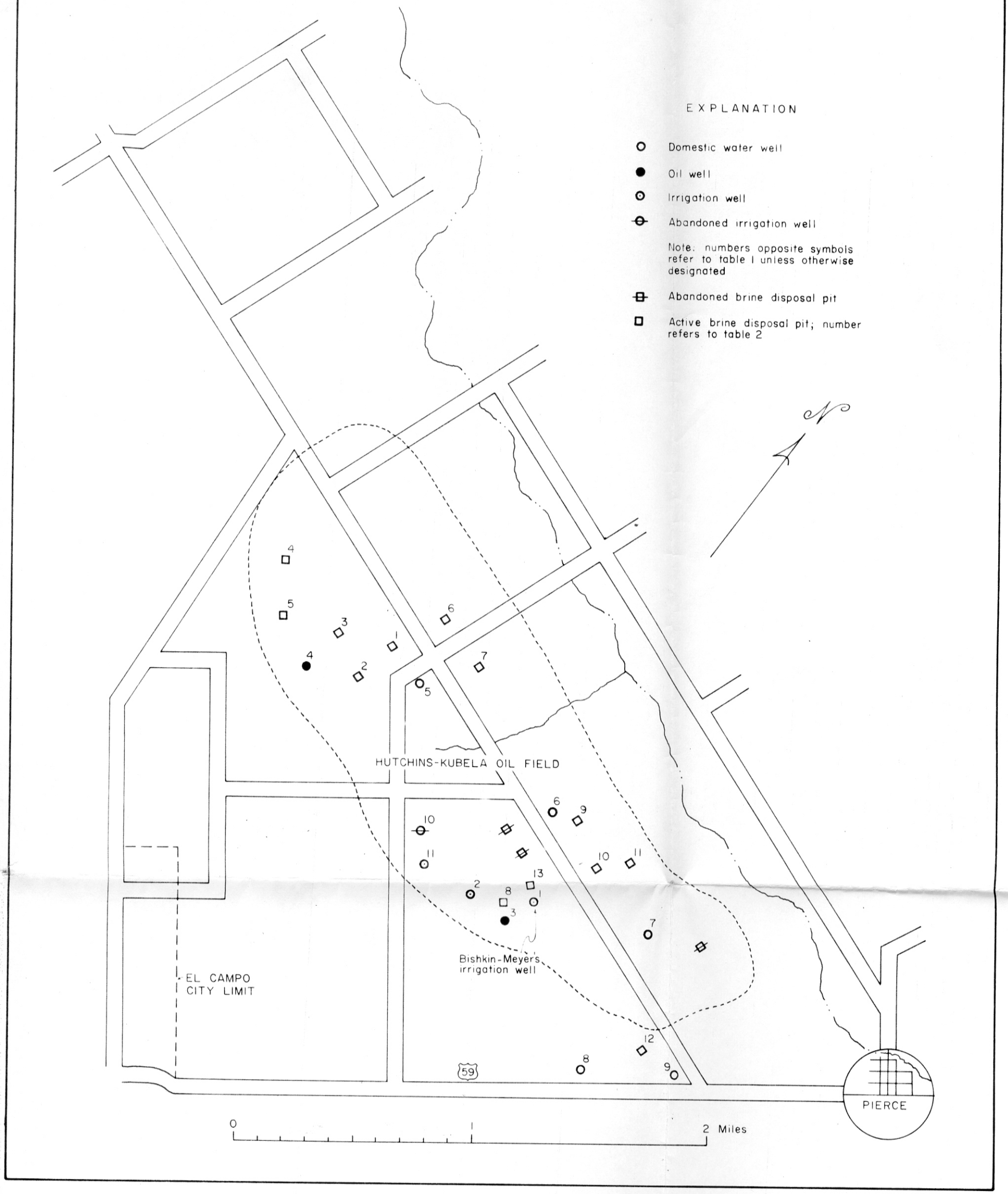


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FIGURE 1. - Map showing approximate location of wells and brine disposal sites near Pierce, Wharton County, Texas

Data obtained from pumping and sampling water from the contaminated well do not permit identification of the stratigraphic interval in which the contaminant occurs. When the well is abandoned, it should be plugged with cement opposite a 20-foot interval of the shale which occurs between depths of 128 and 167 feet in the well, in order to confine the salt water to the stratum in which it occurs.

## INTRODUCTION

This report presents the results of a reconnaissance investigation of the alleged contamination of a newly-completed irrigation well by salt water, approximately 2.0 miles northeast of El Campo, Wharton County, Texas, on property owned by A. Bishkin and M. Meyers, in the Hutchins-Kubela oil field. The investigation was conducted during the period September 17-19, 1958, in response to a complaint by Mr. Alvin Kuretsch of Pierce, Texas, a lessee of Bishkin-Meyers rice land and the subject well, and Mr. A. A. Wuensch, water well drilling contractor of El Campo, Texas.

The field investigation consisted principally of (1) pumping the irrigation well to document the alleged contamination and to determine, if possible, the stratigraphic source of the contaminating salt and the chemical character of the contaminated water, (2) selected sampling of brine from oil producing horizons and of water from uncontaminated wells near the irrigation well, (3) inspecting earthen pits employed for brine disposal on leases near, or updip from the irrigation well, and estimating amounts of brine disposed at each, and (4) measuring water levels in selected wells near the irrigation well.

## GEOLOGY AND OCCURRENCE OF GROUND WATER

Strata penetrated by the Bishkin-Meyers irrigation well to a depth of 250 feet are principally alternating sands, gravels, and clays or shales underlying approximately 25 feet of surficial clay and caliche. The strata belong to the Beaumont clay formation and possibly the Lissie formation of Quaternary age. No evidence of abnormal geologic structure in shallow strata is reflected by available electric logs or by field observations. The normal attitude of strata in the area is gently homoclinal, toward the southeast.

Ground water occurs in all permeable zones below the base of the caliche and clay in this area. It is supplied by precipitation on the outcrop areas of the permeable strata and by direct infiltration of runoff through the beds of streams. Precipitation percolates down to the regional water table and then moves with the water in a direction determined by the established hydraulic gradient on the water table.

A generalized log of the strata penetrated by the well, as obtained from the drilling contractor, Mr. A. A. Wuensch, is presented below:

| | |
|---|---|
| 0- 28 | Clay, black to brown, and caliche with red clay at the base. |
| 28-128 | Streaks of sand, gravel and clay, including 76 feet of water-bearing strata; coarse sand and gravel, 100-128 feet. |
| 128-167 | Red shale and clay. |
| 167-238 | Streaks of fine sand, gravel and shale or clay. |
| 238-248 | Solid clay or shale. |

Information obtained from Mr. Wuensch indicates that the lenticular, permeable sand and gravel zones occurring above the thick shale section

at 128 feet may be hydraulically interconnected. Figure 3 shows the well construction and pump setting in relation to the generalized geologic section penetrated.

Electrical logs of deep wells indicate that potentially usable water occurs in permeable zones to depths exceeding 1800 feet beneath the area surrounding the Bishkin-Meyers well.

## QUALITY OF WATER IN WELLS

Water from domestic water wells (table 1) sampled near the Bishkin-Meyers irrigation well ranging in depth from 40 to 135 feet contained less than 100 ppm chloride ion with one exception, well 5, figure 1, which contained 480 ppm of chloride, indicating that it is contaminated when compared with other wells of similar depth in the area.

Water samples were taken from two irrigation wells (table 1) and partial chemical analyses were made by the United States Geological Survey. The water from well 2 contained 442 ppm of dissolved solids and 66 ppm of chloride ion after pumping for 10 minutes at approximately 1,200 gpm.

The Bishkin-Meyers irrigation well was pumped for approximately four hours on August 17, 1958, at estimated rates ranging from 200 to 1,400 gpm. The well was not pumped for approximately 24 hours prior to starting the test. During the first three minutes of pumping at 200-250 gpm, the chloride content of the water ranged from 2,800 to 10,000 ppm (figure 2). After 10 minutes pumping at this rate, the concentration had increased to 11,600 ppm, remaining approximately at this level throughout the remainder of the test.

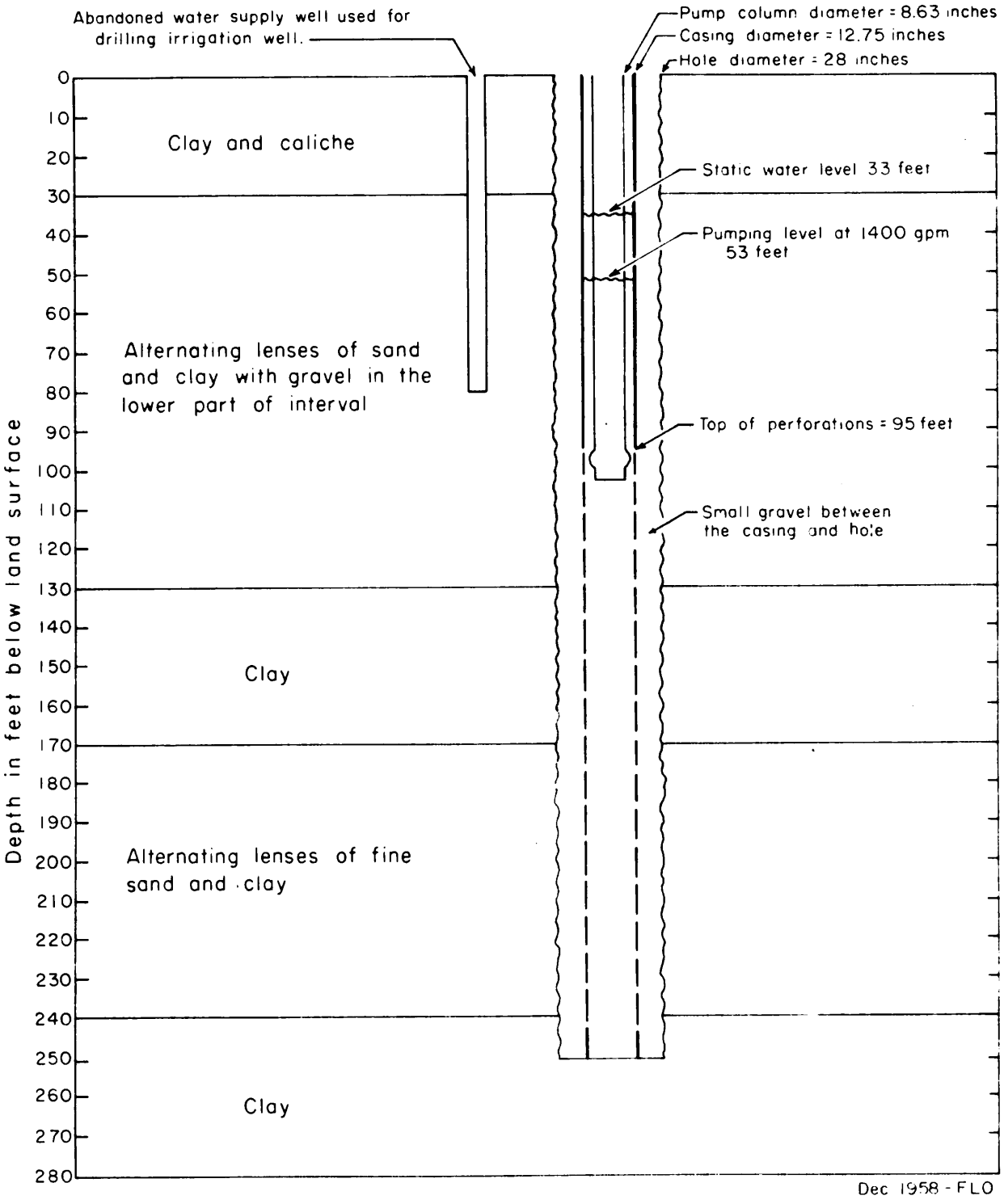


Figure 3. - Diagramatic sketch showing well construction data and generalized geology, Bishkin-Meyers irrigation well

This pumping test showed that the water in the well is highly contaminated by chloride ion and sodium ion in comparison with the quality of water in the uncontaminated irrigation well sampled (well 2) and indicates that the degree of contamination is little affected by varying pumping rates between 200 and 1,400 gpm. After an overnight shut-down, samples were taken again from the well during the first two minutes of pumping. Analyses of these samples showed that the quality of water in the bore of the well freshens under static well conditions (figure 2). The well contained approximately 18,500 ppm dissolved solids and 11,300 ppm of chloride after being pumped for an hour at 1,400 gpm on August 18 (well 1, table 1).

High chloride concentration was not apparent in water from well 2 during the 1958 irrigating season despite its proximity to the Bishkin-Meyer well. The depths of the two wells are approximately equal.

Samples of brine from two producing oil sands of the Hutchins-Mabela field were taken and partial chemical analyses obtained (table 1). The analysis of brine from well 3 is representative of the quality of brine disposed on leases closest to the Bishkin-Meyers well. The brine is similar in chemical character to brine from well 4 which is representative of large amounts of brine disposed daily at points one to two miles west-northwest of the subject well. Brines from both horizons contained approximately 65,000 ppm of dissolved solids and 40,000 ppm of chloride ion.

## POSSIBLE SOURCES OF CONTAMINATION

The contamination in the Bishkin-Meyers well is not considered to be of natural origin. Available electrical logs in the area surrounding

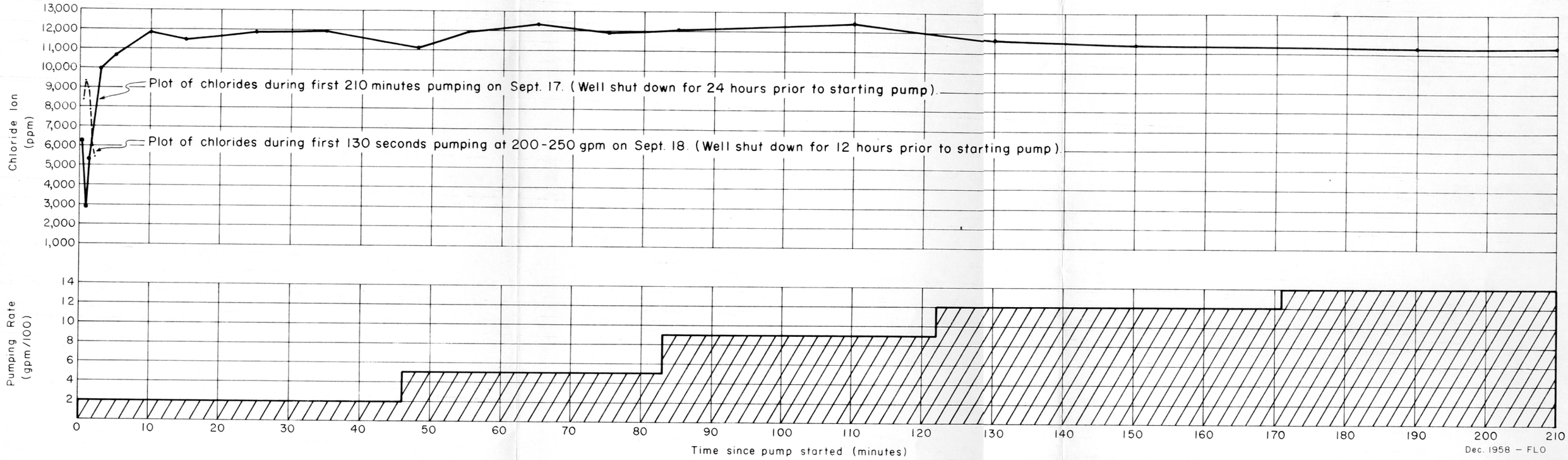


FIGURE 2.- Chloride concentration in relation to time and rate of pumping, Bishkin-Meyers irrigation well

the well do not show the quality of water in strata above 600 feet. However, water of good-to-excellent quality occurred in all sands at the 600-foot level and to depths exceeding 1,000 feet, according to electrical logs run prior to 1940. Local residents report that high salinity was unknown in shallow ground water prior to the advent of oil development in the area.

They also report that surface casing was pulled during World War II from two abandoned wells close to the contaminated irrigation well but this has not been verified. An investigation of that report by the Texas Railroad Commission was inconclusive, but original reports in files of that agency indicate the wells were properly plugged when they were abandoned.

Brine disposed through earthen pits as constructed and used in this area, given sufficient time under hydraulic gradients created by pumping, could move toward present or future irrigation wells in the area.

## BRINE DISPOSAL IN THE HUTCHINS-KUBELA OIL FIELD

Oil was reportedly discovered in this field in the late thirties but large amounts of brine were not produced with the oil until the mid-forties, when original reservoir pressures had declined considerably. At present, a large percentage of wells in the field are produced by natural gas-injection systems. Earthen pits have been employed to dispose of all brine produced with oil in the area near the Rishkin-Meyers well.

Earthen pits examined range from approximately 5 feet to 30 feet in depth and from 400 to approximately 15,000 square feet in area. An

exposed earth section in a newly-excavated pit estimated to be 30 feet deep consisted of a few feet of red-brown clay overlying approximately 25 feet of gray caliche with some reddish clay in the lower part. Below this, reportedly, was a permeable sand which was obscured by water in the pit. The described section is typical of materials removed from deep disposal pits in the area. According to statements of oil-field workers, the pits are commonly bottomed in the first "dry" sand beneath the caliche and clay when large quantities of brine must be disposed. Brine introduced into the pits may percolate into the sands and move downward to the water table, 30-35 feet below ground level.

Brine discharged through these pits may join the fresh ground-water body which is constantly but slowly moving beneath the pits under an established hydraulic gradient. The brine may then move along with the ground water while settling downward due to greater density. Diffusion of the brine with the fresh water is usually limited.

Brine moving from a particular pit or pits may directly encounter some wells, may be drawn into others by pumping, and may miss others entirely in moving beneath a particular area. Shallow, domestic wells completed at levels considerably above the salt water may not be contaminated by brine moving directly beneath them.

Measured water levels indicate that the ground water body moves in an east-southeasterly direction, generally toward the Colorado River. The Bishkin-Meyers well is approximately 1.5 miles east-southeast of many pits which dispose large volumes of brine daily (figure 1). Other pits which dispose smaller quantities of brine are near the well.

Estimated quantities of brine disposed daily to each pit or group of pits inspected during this investigation are presented in table 2. Approximately 275 barrels per day are disposed within 350 yards of the well (pits 8 and 13, figure 1) and approximately 8,000 barrels are disposed daily in the area west-northwest of the well (pits 1-7, figure 1). The chemical character of brine disposed in both areas is essentially the same (table 1). In addition to existing disposal pits shown on figure 1, abandoned sites exist near the irrigation well where brine was disposed to pits for many years.

Table 1.-Partial analyses of water from wells near Pierce, Wharton County, Texas

| Well number 1/ | Approximate depth of well (ft) | Use of well | Owners or operator of well | Water level | | Chemical analyses (constituents in ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Depth below ground (ft) | Date measured | Total solids2/ | Chloride | Sodium | Calcium | Magnesium | Bicarbonate | Carbonate | Sulphate | Silica |
| 1 | 249 | irrigation | A. Bishkin and M. Meyers | 33.4 | 9/17/58 | 18,500 | 11,300 | 5,300 | 1,450 | 205 | 303 | 0 | 101 | 23 |
| 2 | 237 | irrigation | Louis Kainer | -- | -- | 442 | 66 | 66 | 82 | 13 | 369 | 0 | 9 | 25 |
| 3 | 5,000 | oil well | C. Andrade III | -- | -- | 66,200 | 40,200 | 23,800 | 1,400 | 224 | 153 | 0 | 456 | 32 |
| 4 | 5,000 | oil well | Gilcrease Oil Company | -- | -- | 65,100 | 39,300 | 23,800 | 1,250 | 141 | 287 | 0 | 398 | 29 |
| 5 | 50 | domestic | A. Hubenak | -- | -- | -- | 480 | -- | -- | -- | -- | -- | -- | -- |
| 6 | 106 | domestic stock | J. F. Kubela | 30.9 | 9/19/58 | -- | 50 | -- | -- | -- | -- | -- | -- | -- |
| 7 | 40' | domestic | J. W. Kubela | -- | -- | -- | 80 | -- | -- | -- | -- | -- | -- | -- |
| 8 | 68 | domestic stock | A. Bishkin and M. Meyers | 31.5 | 9/18/58 | -- | 80 | -- | -- | -- | -- | -- | -- | -- |
| 9 | 135' | domestic | J. A. Filip | 31.2 | 9/19/58 | -- | 90 | -- | -- | -- | -- | -- | -- | -- |
| 10 | 65' | abandoned | S. Kainer | 34.0 | 9/19/58 | No water sample taken | | | | | | | | |
| 11 | 240' | irrigation | S. Kainer | 33.5 | 9/19/58 | No water sample taken | | | | | | | | |

1/ Number correspond to numbers used on figure 1.

2/ Sum of determined constituents

**Table 2.-Quantities of brine disposed to earthen pits in the Hutchins-Kubela oil field, Wharton County, Texas**

| Reference number of pit (figure 1) | Oil producing lease | Name of operator | Estimated disposal rate (bpd) | Operator-reported rate (1957)(bpd) |
|---|---|---|---|---|
| 1 | W. W. Duson "B" | Gilcrease Oil Company | 1,350 | 1,120 |
| 2 | W. W. Duson "C" | Gilcrease Oil Company | 900 | 630 |
| 3 | W. W. Duson "D" | Gilcrease Oil Company | 800 | 1,480 |
| 4 | Bergwell - Montgomery | L. M. Josey, et al | 2,170 | 2,536 |
| 5 | J. A. Wright | Adams & Haggerty | --- | 48 |
| 6 | J. F. Kubela estate | Adams & Haggerty | 1,550 | 1,740 |
| 7 | J. W. Kubela | Adams & Haggerty | 700 | 620 |
| 8 | A. Bishkin and M. Meyers | C. Andrade, III | --- | 262 |
| 9 | J. W. Kubela | Gilcrease Oil Company | --- | 15 |
| 10 | J. W. Kubela "A" | Gilcrease Oil Company | 4 | 5 |
| 11 | J. W. Kubela "C" | Gilcrease Oil Company | 40 | 43 |
| 12 | A. Nielson (?) | C. Andrade, III (?) | 205 | --- |
| 13 | A. Bishkin and M. Meyers | Gilcrease Oil Company | 15 | 11 |
| | TOTALS | | 7,734 | 8,510 |