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# GROUND-WATER GEOLOGY IN THE VICINITY OF DOVE AND CROTON CREEKS, STONEWALL, KENT, DICKENS AND KING COUNTIES, TEXAS
## With Special Reference to Salt-Water Seepage

By

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## ABSTRACT

An area of about 345 square miles in Stonewall, Kent, Dickens, and King Counties, Texas contributes substantial quantities of salt to the Brazos River by ground-water seepage. Large flats occupied by white crustal deposits of salt and gypsum are present in the Croton Creek area in Kent County and the Dove Creek area in King and Stonewall Counties. This report summarizes ground-water studies of these areas and is concerned with the geologic source of salt water and the hydrologic conditions under which the water occurs.

Rocks of Permian age crop out in this region and dip westward at a rate of about 25 feet per mile. The Childress dolomite (Lloyd, 1952) member of the Grayburg formation at the base of the Whitehorse group is the most prominent marker bed exposed in the area. Below its base lies clay of the Dog Creek formation of the El Reno group and above it is predominantly fine-grained sand of several formations comprising the remainder of the Whitehorse group. A thick section containing salt beds, correlated with the Seven Rivers formation (Whitehorse group), occurs at relatively shallow depths in the western part of the area.

In the Croton Creek area, unconfined ground water percolates through some of these salt beds and issues at the surface of salt flats and stream beds as widespread salt-water seepage. Land conservation practices which cause increased recharge to the water table increase the rate of salt solution by circulating ground water and, proportionately, the quantity of salt water discharged. Recently, irrigation by ground water has begun in the Croton Creek area, and local interest in such irrigation is strong. Intensive irrigation development here would probably lower the water table and thereby reduce the amount of salt water discharged into the Croton Creek drainage system.

Salt water occurs under artesian pressure in the Dove Creek area. The main conduit of the artesian system is inferred to be the permeable Childress dolomite which is hydraulically connected with the overlying, unconfined ground-water body. This connection results in artesian discharge in the flats, which lie at lower elevations than the elevation of the water table.

The salt water, moving up dip in the Childress member through solution channels, encounters a transition zone near the outcrop where anhydrite has altered to gypsum by hydration. Expansion resulting from hydration has sealed off permeability in this zone, thus forcing the water to seek an outlet through subjacent fractured and jointed clay and shale, through which it percolates to the land surface in Dove Creek flat.

This study indicates a large potential salt-water seepage under complex hydraulic conditions involving both confined and unconfined ground-water reservoirs. The scope of the investigation is insufficient to recommend corrective measures for ridding the Brazos River watershed of all or part of the salt water discharged from ground water sources in this area and more detailed studies are suggested.

# INTRODUCTION

## Purpose and Scope of the Investigation

The Brazos River watershed of Texas had one of the severest droughts of record during the period 1950-1956, and the mineral content of the runoff in part of the drainage system increased noticeably. A progressive increase in the mineral content of the runoff was measured in the water impounded in Possum Kingdom reservoir which was completed and put into operation in March of 1941. The increase in chloride content was from about 300 parts per million in 1942 to about 800 parts per million in 1956. Officials of the Brazos River Authority had long associated the objectionably high content of sodium chloride (NaCl) and calcium sulphate ($CaSO_4$) in normal and low flows of the headwater streams with the mineral character of the geologic terrane across which the streams flow. A reconnaissance study (Blank, 1955) showed that salt flats in northwest Stonewall and northeast Kent Counties contributed large quantities of brine to drainage ways. Ground-water discharged in these flats was reported to be the major source of natural minerals present in the water in Possum Kingdom reservoir, the nearest impounding development downstream from this area.

The Texas Board of Water Engineers made a study of the geology and its relation to the occurrence of ground water and salt-water discharge in the vicinity of the salt flats during the period from January through April 1957. The purpose of the study was to determine geologic conditions that control ground-water movement and to relate these conditions to the problem of solution of salt beds by circulating ground water and to the subsequent movement of the resulting brine to points of discharge in the Croton Creek and Dove Creek drainage systems. Investigations were made at Dove Creek flat in northwest Stonewall County, and at Short Croton flat and Hot Springs flat in northeast Kent County. Subsurface data were obtained in adjacent areas in King and Dickens Counties for use in regional correlation of Permian salt deposits.

This report summarizes the results of field investigations in an area of about 345 square miles in parts of Stonewall, Kent, Dickens and King Counties (figure 1). The area is about 100 miles northwest of Abilene, Texas, and is about 140 miles upstream from Possum Kingdom reservoir. The writer obtained records of 85 water wells, 14 deep oil tests, and 145 shallow exploration holes (tables 3 through 6 and figure 2). The investigation and report were authorized by the Board of Water Engineers, and technical supervision was by R. T. Littleton, Chief of Ground Water Investigations. Concurrently with this investigation but as part of a separate study, the United States Geological Survey constructed weirs and a gaging station in the Dove Creek area, and established a sampling program to determine the nature and quantities of minerals present in the waters of Dove Creek and its tributaries in the vicinity of Dove Creek flat.

## Previous Salt-Water Investigations

A study of the sources of salt water entering the upper parts of the Brazos River system was made by H. R. Blank of Texas A & M Research Foundation (1955). This study was a geohydrologic reconnaissance during which water samples were obtained to determine the localities of the principal sources of salt-water seepage in the drainage system above Possum Kingdom reservoir. Many of the stream channels in the region were dry when the study was made, but samples were obtained from standing bodies of water, low flow of streams, and whenever a stream was not flowing, underflow samples were obtained by digging pits in sand bars and channel fill of stream beds.


FIGURE I - INDEX MAP OF TEXAS SHOWING BRAZOS RIVER WATERSHED & OUTLINING AREA COVERED BY THIS REPORT

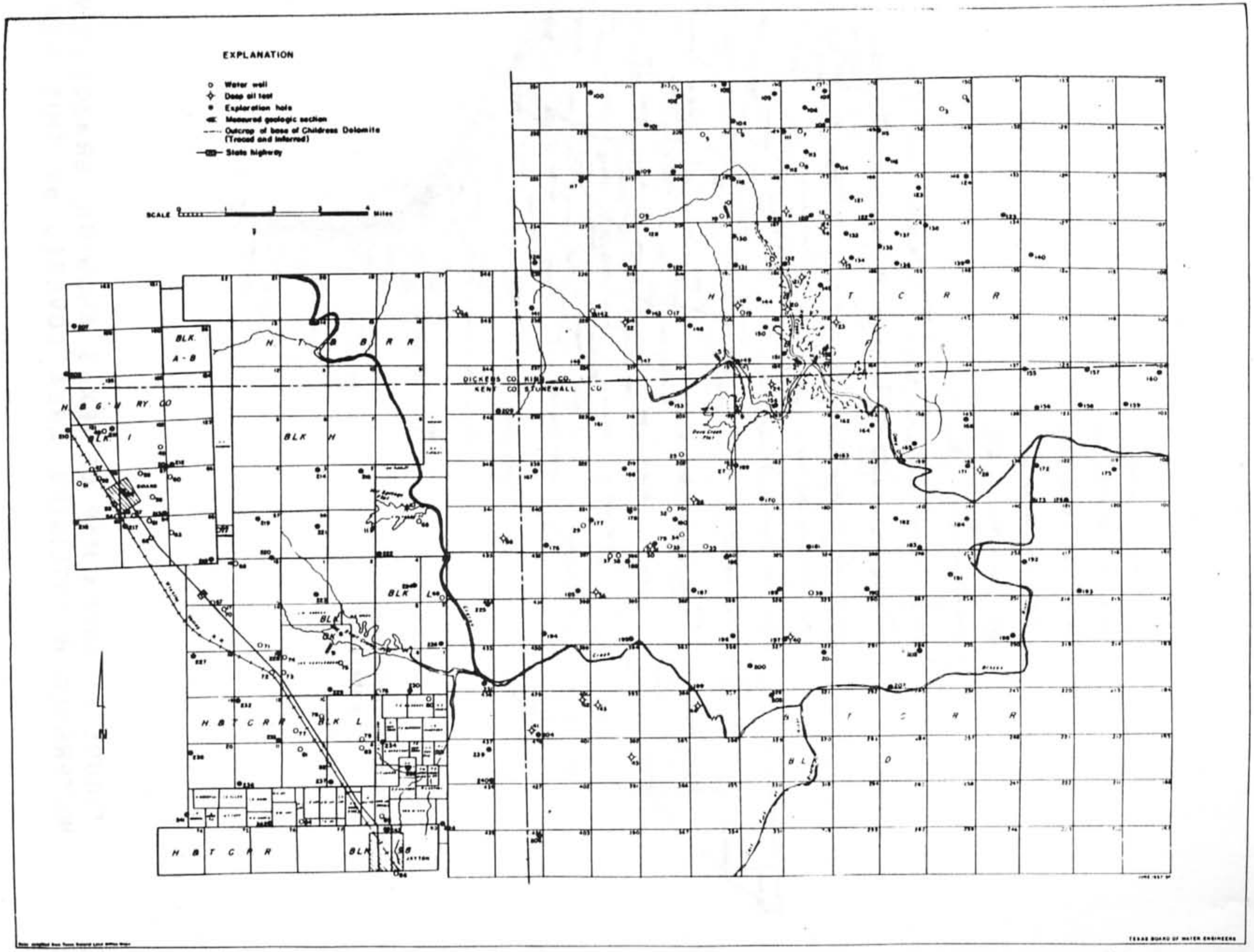


FIGURE 2 – LAND MAP OF PARTS OF STONEWALL, KENT, DICKENS, AND KING COUNTIES, TEXAS SHOWING LOCATIONS OF WATER WELLS, DEEP OIL TESTS, EXPLORATION HOLES, MEASURED GEOLOGIC SECTIONS, AND OUTCROP OF BASE OF THE CHILDRESS DOLOMITE.

As a result of Blank's report, the Ambursen Engineering Corporation of New York core-drilled Dove Creek flat in 1955 as a part of the foundation study for a proposed dam to impound and evaporate salt water (Mason and Johnston, 1955). The core drilling indicated that gypsiferous shale and clay underlay Dove Creek flat and was saturated with salt water under low artesian head. The report suggested that salt water seeps of Dove Creek flat may have their source in artesian flow through joint fissures in shale.

## Acknowledgements

Helpful counsel was obtained from geologists D. C. Van Siclen, Houston, Texas and G. C. Frazer, III, Abilene, Texas and Jack Brown, R. T. Payton and Otis Richards, Continental Oil Company, Abilene, Texas. R. W. Sundstrom, E. A. Moulder, A. G. Winslow and Burdge Irelan of the United States Geological Survey contributed helpful suggestions and discussions concerning the investigation. Ranchers of the areas, especially Messrs. G. W. Springer, W. A. Springer, Sr., W. A. Springer, Jr., and E. M. Jones, cooperated and assisted the writer in field activities on their ranches.

## DRAINAGE AND TOPOGRAPHY

The Brazos River watershed extends from the High Plains in eastern New Mexico across Texas to the Gulf of Mexico (figure 1). The drainage areas of the Brazos in Texas is about 44,130 square miles; the watershed has an overall length of 1,210 river miles and a maximum width of 120 miles.

The Brazos watershed spans three physiographic provinces of the United States: the Great Plains, Central Lowlands and Coastal Plain. The part of the watershed concerned in this study lies in the Osage Plains section of the Central Lowlands physiographic province. The report area is drained principally by the Salt Fork of the Brazos River and two main tributaries, Dove and Croton Creeks.

A generalized topographic map of the area (figure 3) was prepared using reported and barometric elevations of 219 water wells, deep oil tests and exploration holes, in conjunction with a field inspection of the area and study of aerial photographs. The significant topographic features include salt flats (plate 1, A and B) and a broad rolling plain dissected at its northeast edge by deep gullies and canyons. Altitudes range from 1,665 feet above sea level along the Salt Fork of the Brazos River at the eastern edge of the area to 2,180 feet on the level plains in the northwestern corner of the area studied. The land surface slopes generally eastward at an average of about 20 feet per mile. The maximum local relief is about 330 feet.

The salt flats are distinctive topographic features in this region contrasting sharply to the characteristic topography which consists of canyons, gullies, escarpments, bluffs and slopes. Their development is largely due to differential erosion in the section of redbed strata. They are bounded by steep bluffs and underlain by stratified or poorly stratified clay, silt, sand, and locally gypsum which are saturated with salt-water and are resistant to erosion. Clay, silt, and sand are carried into the flats by flood runoff and accumulate around the edges. However, this debris is largely removed by further runoff and partly by wind transportation. Much of the area of the flats is free of debris and thin crustal deposits of salt and gypsum form between periods of heavy runoff.

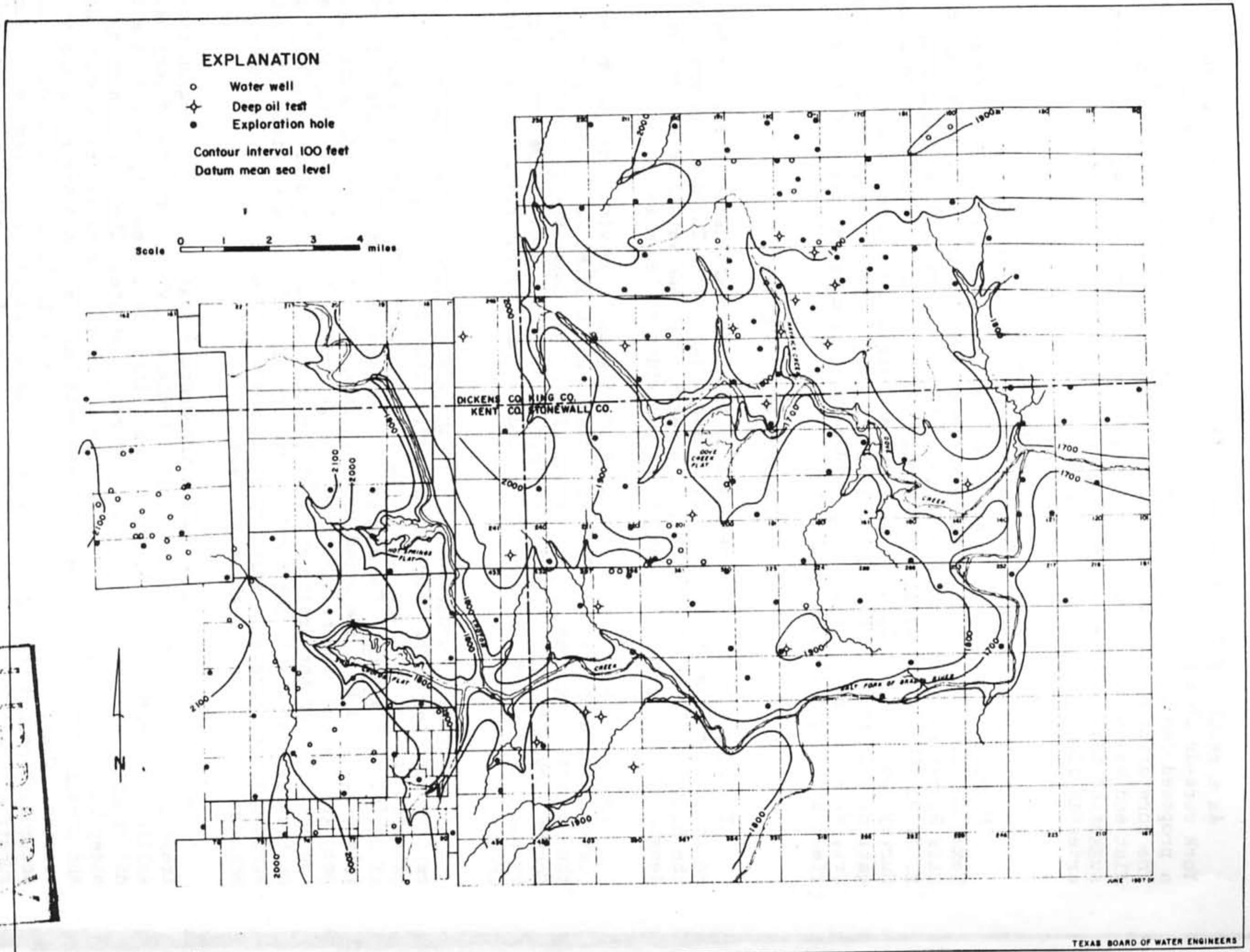


FIGURE 3 - RECONNAISSANCE TOPOGRAPHIC MAP OF PARTS OF STONEWALL, KENT, DICKENS, AND KING COUNTIES, TEXAS

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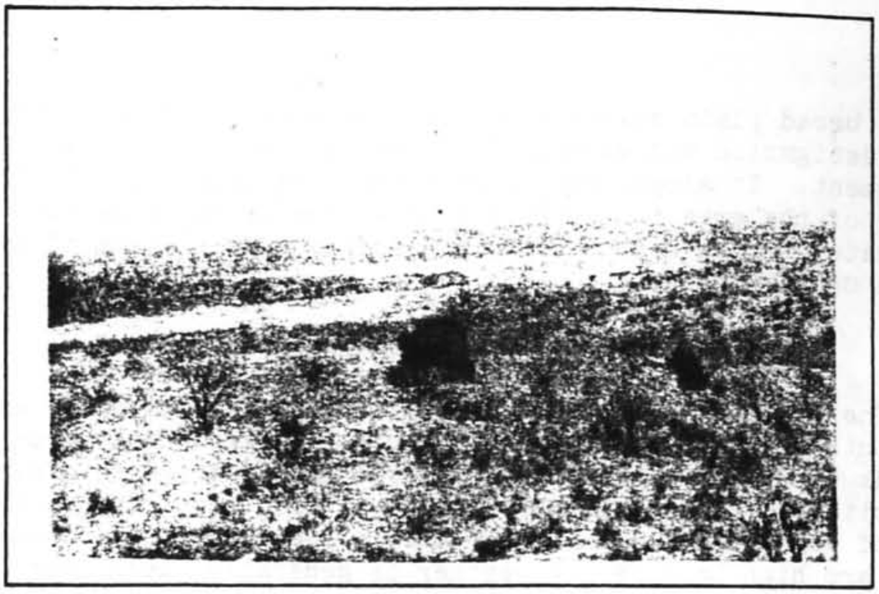
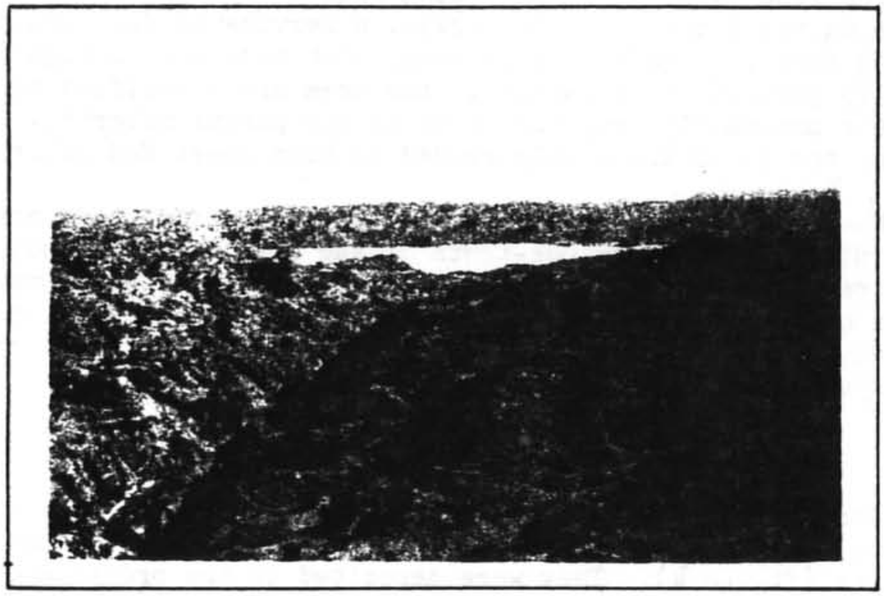


A. View of Dove Creek flat looking north



B. View of Short Croton flat looking northeast

PLATE 1 - SALT FLATS AND SURROUNDING TOPOGRAPHY

A broad plain covers about 30 square miles of the western part of the area of investigation and extends 20 miles farther west to the base of the High Plains escarpment. It slopes gently southeastward from 2,180 feet in the northwest corner of the area to 2,008 feet above sea level at Jayton. The plain is terminated on the northeast by steep slopes and "boxhead" canyons which slope toward Croton Creek.

## CLIMATE AND SOILS

The climate of the area is semi-arid with an average annual precipitation of about 22 inches. The annual rainfall ranges widely from year to year, and records show consecutive years of less than average rainfall. The lightest precipitation usually is during the winter. Local thunderstorms are the usual form of precipitation and occur mostly during spring and summer. Evaporation rates are high because the weather is generally clear, humidity is low, and wind velocities are generally high.

The soils are mainly residual with texture and color similar to the underlying parent rocks. The outcrop of the Childress dolomite is the dividing line between clayey soils to the east and fine sandy soils to the west. Irregularly shaped dunes of wind-blown sand, called "shinnery sand", are scattered over the area.

The fine sandy soils extending west of the Childress outcrop are described by the United States Soil Conservation Service as deep medium-textured; ranging from fine sand to silt loam, with moderate to high permeability. At least 75 percent of the soils in the area are classified as sandy loam and silt. They are dominantly red, the color of the parent material. Unless held by plant growth, the soils are easily eroded by both sheet and gully runoff.

Where the topography is suited to cultivation, land conservation practices are applied. Less than one-tenth of the area of this study is cultivated. The principal crops grown are cotton, winter wheat, oats and maize. The other nine-tenths of the land is rough and deeply dissected by erosion. It is only sparsely covered by such plants as mesquite, juniper, cacti and short grasses, and is used to pasture cattle.

## GEOLOGY

Stratified rocks of Permian age crop out in the area of study and consist of beds of red sand, silt and clay, with prominent horizons of gypsum and dolomite (figure 4). They were deposited in the province of the Permian sea referred to as the Eastern Shelf area, also called the Eastern Platform of the Midland basin. Triassic and Cretaceous rocks crop out west of the Permian rocks but are not related to the problem of salt seepage and therefore are not described in this report. Irregular deposits of windblown sand and thinly scattered gravel of Quaternary age occur in the area.

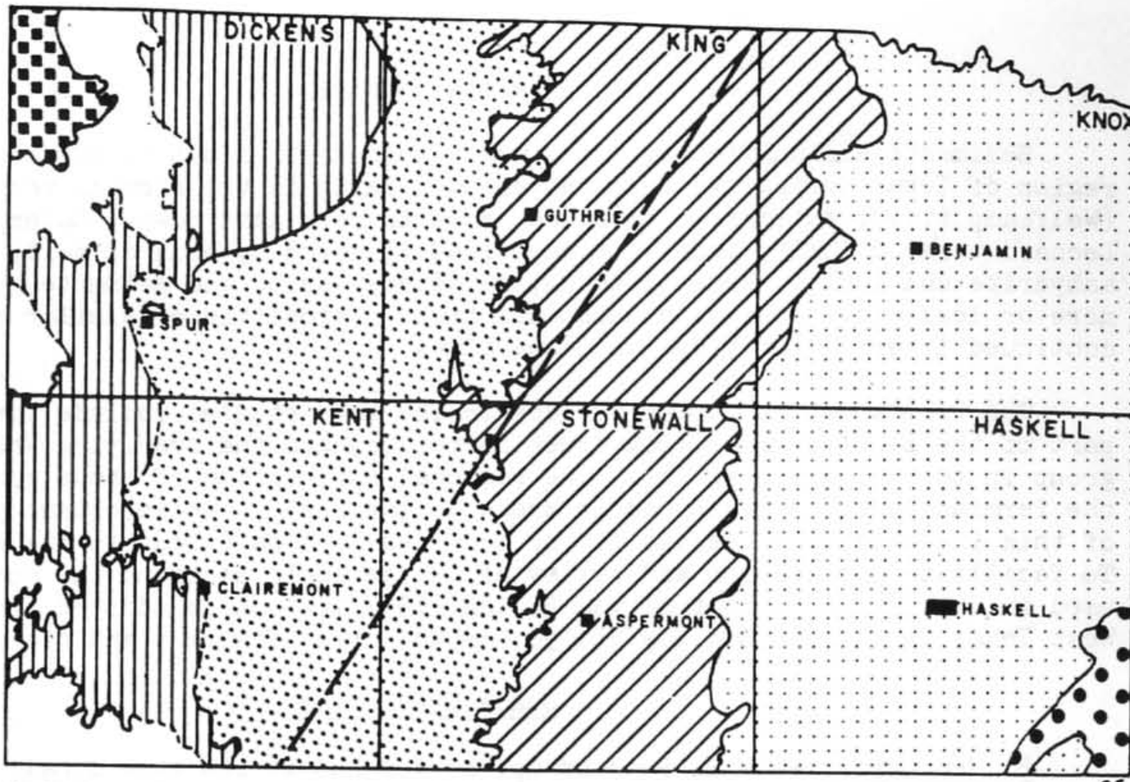



FIGURE 4 - OUTCROP MAP OF PART OF NORTH CENTRAL TEXAS
(COMPILED FROM AVAILABLE DATA)

SCALE: 1" = 15 MILES

EXPLANATION

CRETACEOUS

Cretaceous Undivided

TRIASSIC

Dockum Group

PERMIAN

Ochoa Series Undivided

GUADALUPE SERIES

Whitehorse Group

El Reno Group

LEONARD SERIES

Clear Fork Group

Wichita Group

Approximate east limit of salt water seepage

## Permian System

Sediments accumulated to a maximum thickness of about 6,500 feet in this region of Texas during the Permian period. Early in the Permian period (Wolfcamp time), extensive limestone deposits were laid down. Later, in Leonard time, dolomite beds were deposited followed by beds of salt, gypsum, anhydrite and shale. Beds of shale, sandstone, salt, and dolomite accumulated more or less continuously in Guadalupe time. Deposition of similar rocks continued intermittently during Ochoa time.

The Permian rocks at the surface in the area studied include the upper part of the El Reno group (Dog Creek formation) and the overlying Whitehorse group in the Guadalupe series. The regional correlation of these rocks to the Permian sections described in areas to the west is an important phase of this investigation because of the occurrence of salt beds in the section. To facilitate correlation and review of the geologic sections the nomenclature used in discussion is that of Van Siclen (1951), which he adopted from the West Texas Geological Society (Lloyd, 1952). (See figure 5 and table 1).

### Guadalupe Series

El Reno group.-The El Reno group, as defined at its type locality in Oklahoma, includes beds from the top of the Hennessy shale to the basal sandstone of the Whitehorse group (Becker, 1930, pp. 37-56). According to Lloyd (1952), the term "Pease River group" is interchangeable with "El Reno group". In Stonewall County, Texas, the El Reno group includes beds from the base of the San Angelo sandstone to the base of the Childress member of the Grayburg formation.

The San Angelo sandstone consists of massive sandstone and conglomerate, the latter consisting of chert and quartz pebbles. Its maximum thickness at the outcrop is about 100 feet, but it thins westward and is not recognized in the subsurface of the western part of the area. A detailed sample log of exploration hole number 189 shows sand from 920 to 950 feet. This interval is correlated as the San Angelo by reference to its position above the Merkel dolomite of the Leonard series. The Merkel dolomite occurs in this log from 990 to 1,000 feet and is a reliable subsurface marker horizon in this region of Texas.

Overlying the San Angelo sandstone are the Flower Pot, Blaine and Dog Creek formations, in ascending order. These formation names are from the type section in Oklahoma and have not been used extensively in the area covered by this report, nor is this nomenclature used widely in Texas. The term Blaine is used by many geologists in Texas (Sellards, 1932, pp. 178-179) to include all three of the formations above the San Angelo, but this usage is excluded in this report because it includes more lithologic units than does the type section Blaine. Only about 100 feet of the upper part of the El Reno group crops out in this area. In general, the Flower Pot, Blaine and Dog Creek formations consist of beds of red and green clay and shale with a few persistent dolomite beds and some sandstone. Lenticular massive gypsum beds, generally less than 4 feet in thickness, occur in the Dog Creek formation.

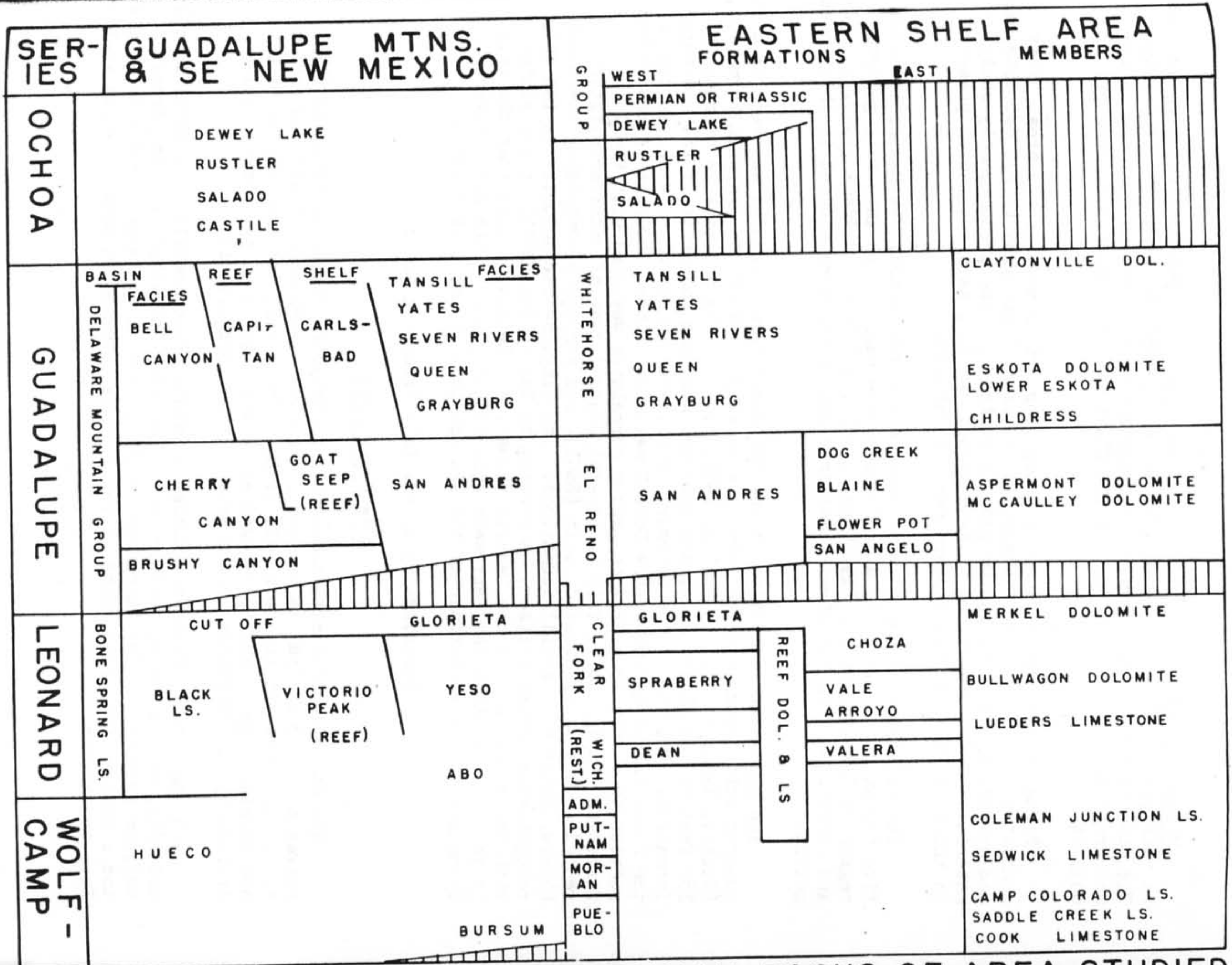



FIGURE 5 - CORRELATION OF PERMIAN ROCKS OF AREA STUDIED WITH STANDARD REFERENCE SECTIONS (After Van Siclen, 1951)

Whitehorse group.-Lloyd and Thompson (1929, pp. 945-956) first recognized in this part of Texas strata equivalent to the Whitehorse group of Oklahoma. The name is used in this report to include the beds between the base of the Childress dolomite and the top of the Claytonville (formerly Sweetwater) dolomite.

Formations of the Whitehorse group crop out in most of the area. They consist predominantly of fine-grained red sand, light gray to red dolomite beds, and several thick white gypsum beds in contrast to the predominantly shaly materials of the underlying El Reno group. A thick salt section is present in the subsurface of the western part of the area.

The Whitehorse group in West Texas and south-central New Mexico includes five formations (figure 5), all of which have been traced into this general region of Texas by Dickey (1940, pp. 37-51), and Page and Adams (1940, pp. 52-64), and correlated with the strata that crop out in the area studied in this investigation.

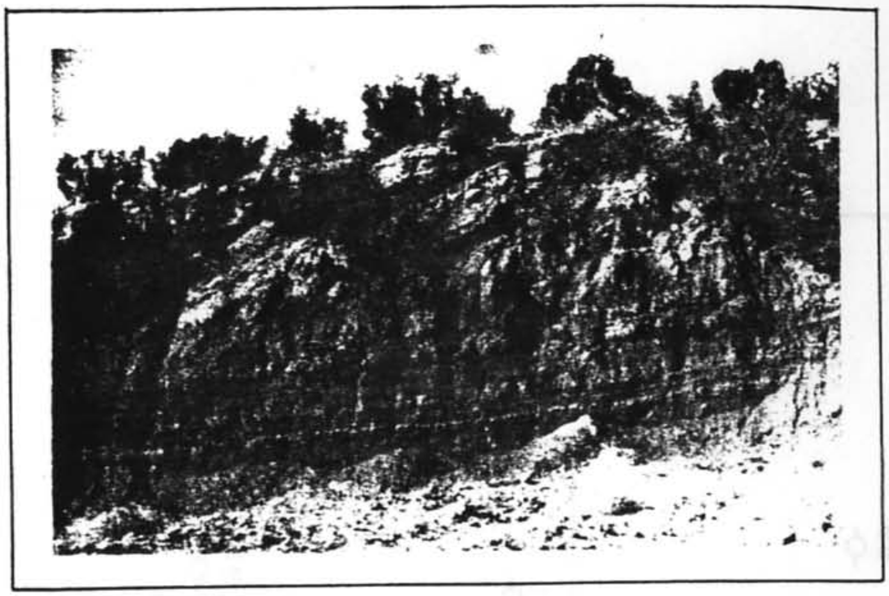
The gypsum and anhydrite of the Childress member changes westward from its outcrop into dolomite which forms the basal 30 feet of the Grayburg formation (Dickey, 1940, p. 46, Van Siclen, 1951, p. 30). The dolomite is overlain by 160 feet of red shale, salt, and some red sand and anhydrite of the Grayburg formation. The top of the Grayburg is believed to correlate with the top of the Lower Eskota gypsum of the Dove Creek area. About 140 feet of the redbed section above the Lower Eskota gypsum correlates westward with the Queen formation. Lying above this is several hundred feet of undifferentiated redbeds, consisting of sand, salt (NaCl), and anhydrite comprising the Seven Rivers, Yates and Tansill formations. The Claytonville dolomite is the only recognizable marker horizon. According to Van Siclen (1951) it correlates with the upper part of the Tansill formation. He also states that the salt in the above section may represent substantially all of the Seven Rivers formation in the subsurface of the western part of the area studied.

## Stratigraphy of the Salt Producing Areas

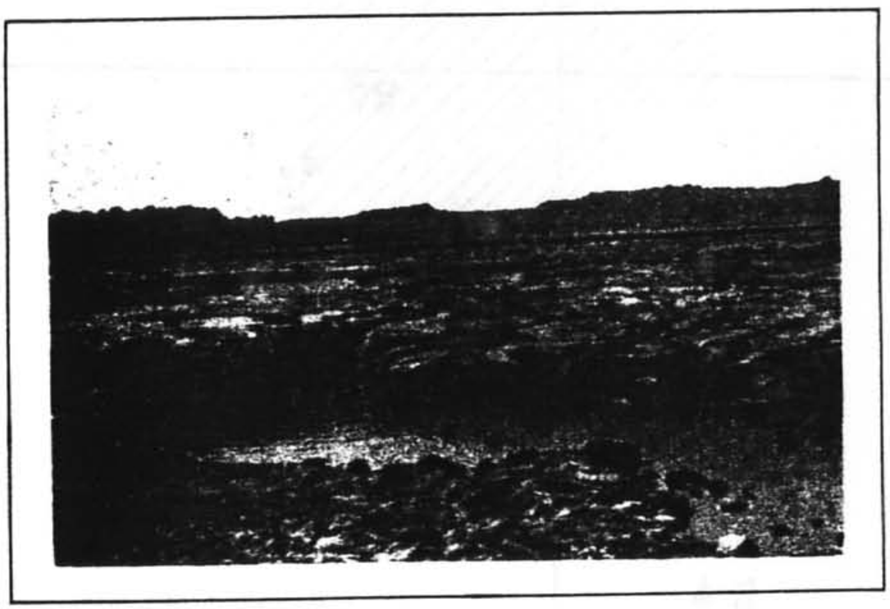
### Dove Creek Area

The Childress dolomite member of the Grayburg formation of Lloyd (1952) serves as the principal marker bed in the Dove Creek area in this investigation. It crops out in the bluffs of Dove Creek flat and the canyons of Dove and Hayrick Creeks, and is recognized in the logs of 96 exploration holes drilled by oil companies in the area of this investigation.

On the outcrop this rock member consists predominantly of gypsum, locally dolomite, and in the subsurface is predominantly of anhydrite (anhydrous calcium sulphate). The thickness in the outcrop area ranges from 9 to 13 feet and a similar thickness range is recorded or reported in logs of wells west of Dove Creek flat.



A. Exposed on steep bluff of Hayrick Creek - dashed line is base of Childress member



B. Clay of the same stratigraphic horizon exposed at lower end of Dove Creek flat

PLATE 2 - CLAY OF THE DOG CREEK FORMATION

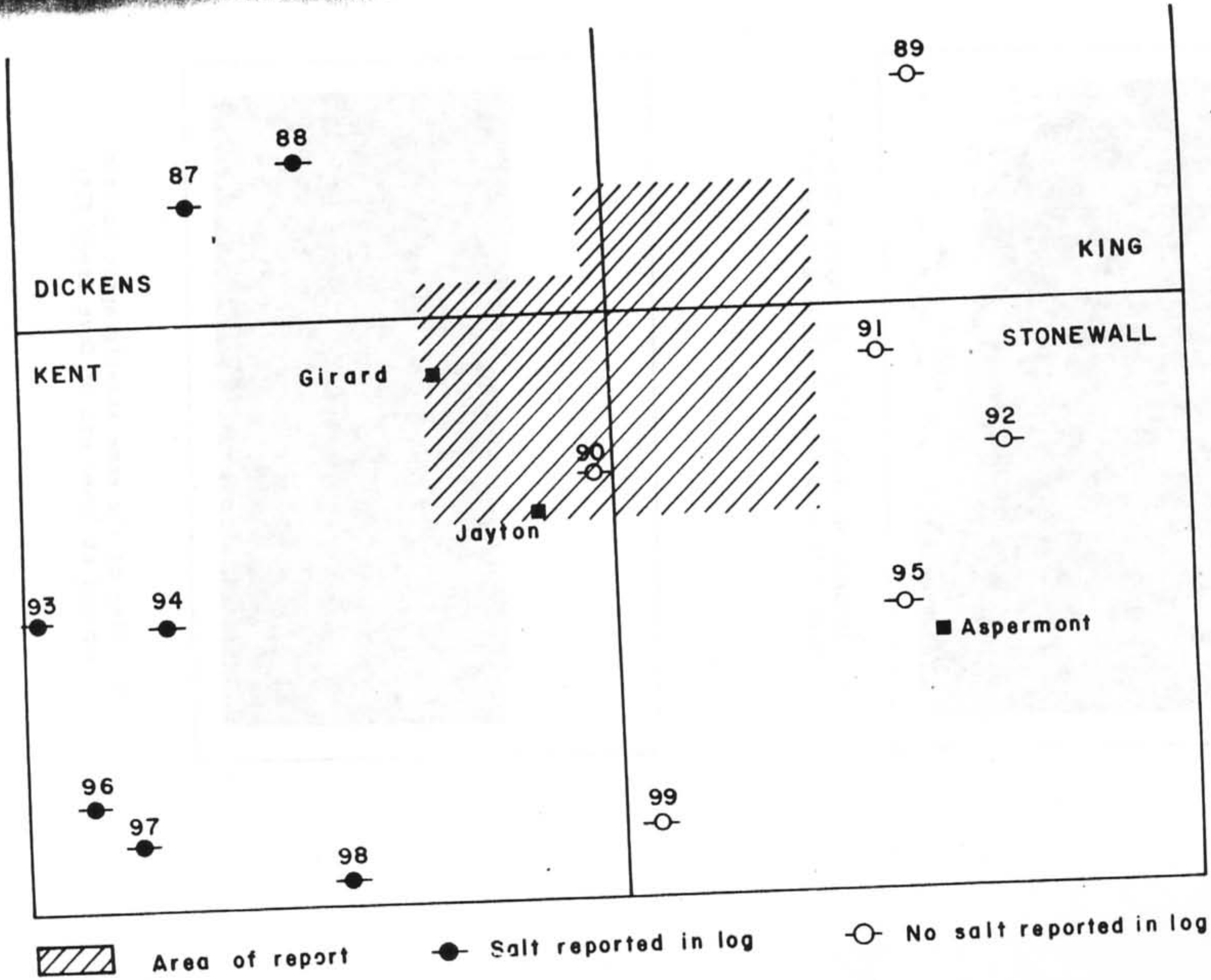



FIGURE 6 - MAP SHOWING LOCATIONS OF OIL TESTS DRILLED WITH CABLE-TOOL EQUIPMENT IN AND NEAR AREA STUDIED.

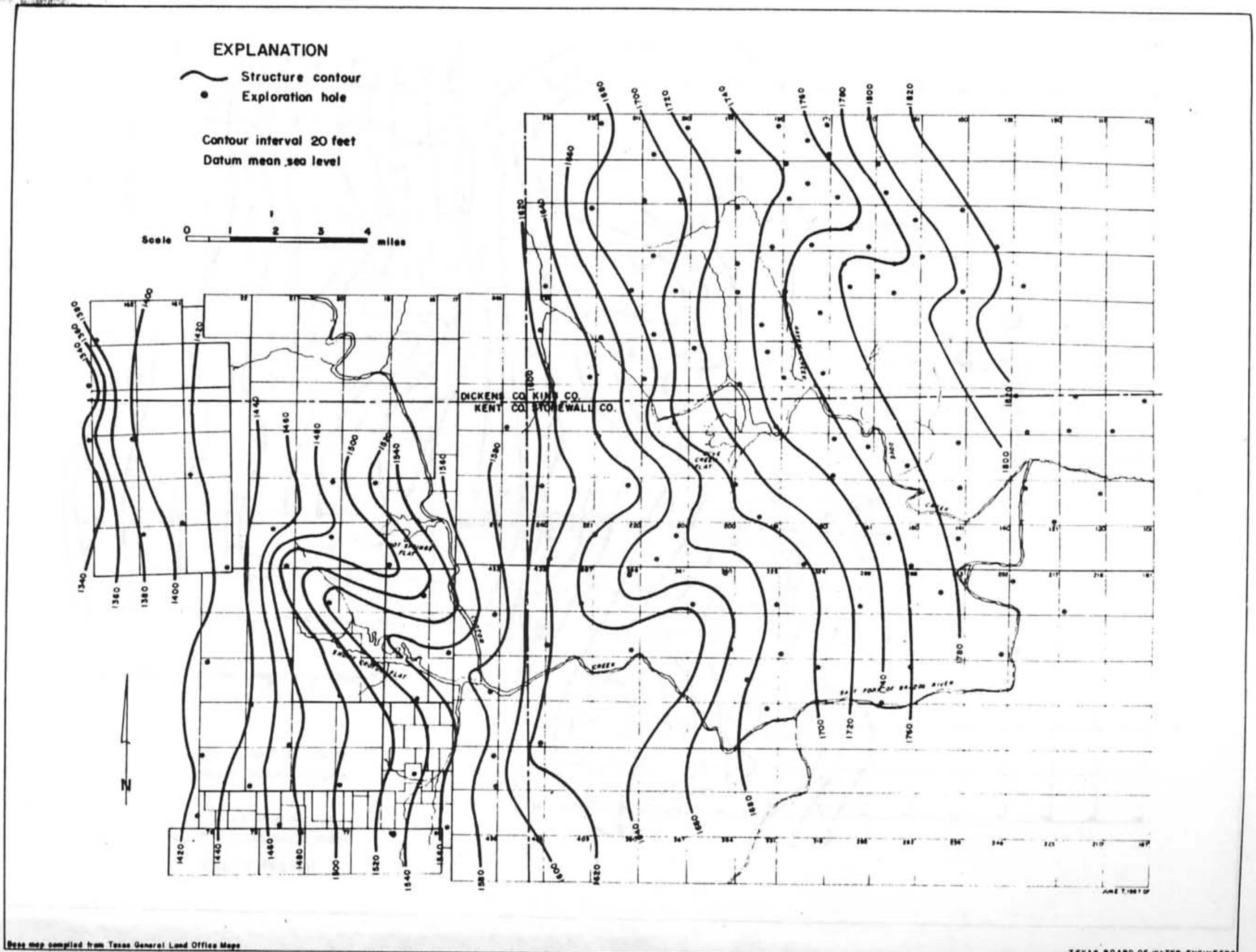
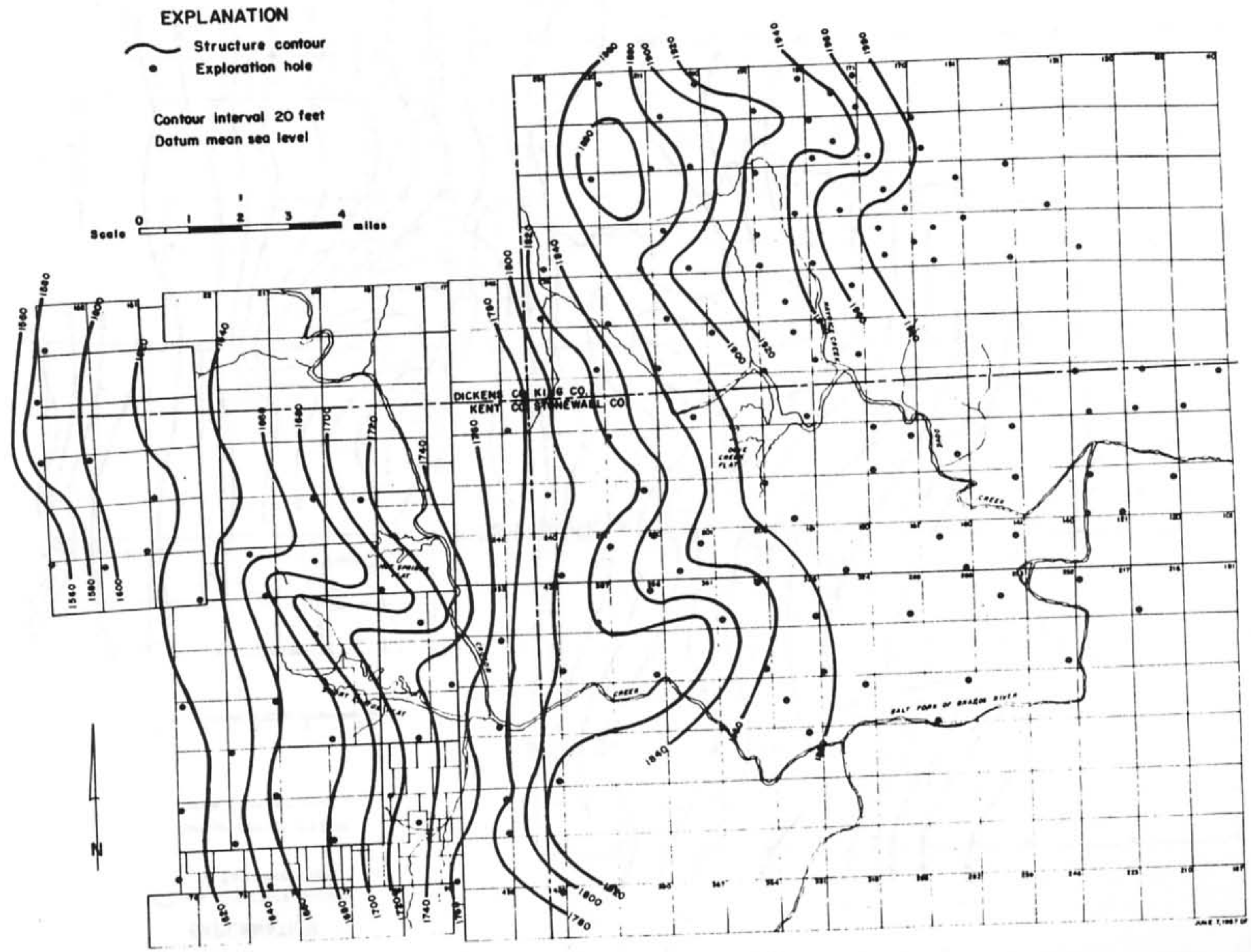



FIGURE 7 – STRUCTURE MAP ON THE TOP OF THE CHILDRESS MEMBER IN PARTS OF STONEWALL, KENT, DICKENS, AND KING COUNTIES, TEXAS




TEXAS BOARD OF WATER ENGINEERS

Base map compiled from Texas General Land Office Maps

FIGURE 8 — STRUCTURE MAP ON THE TOP OF THE UPPER ESKOTA GYPSUM IN PARTS OF STONEWALL, KENT, DICKENS, AND KING COUNTIES, TEXAS

# GROUND WATER

## Topography and the Water Table

The water table is the upper surface of an unconfined ground-water body and in this area its shape and slope conform in a general way to the topography. Because of the predominantly fine-grained character and generally low permeability of the sediments the water table follows closely the steep gradients of deeply eroded surfaces. It intersects the land surface in canyons and in salt flats. Near the head of Hayrick Canyon in southwest King County fresh water seeps occur. In the Croton Creek area salt water seepage is widespread.

A reconnaissance map showing the shape and slope of the water table (figure 9) was prepared from water level measurements in 56 wells at which elevation were established. All the wells in the vicinity of Dove Creek flat and south and west of Croton Creek flats were scheduled (table 6) and where possible water-levels in the wells were measured. Elevations were established on 55 wells and one exploration hole by barometric altimetry or from data provided by oil companies. United States Coast and Geodetic Survey bench marks in eastern Kent County and ground elevations of exploration holes and deep oil tests, established by oil companies in King and Stonewall Counties, were used as control points for altimetry.

## Ground Water in Northeast Kent County

The ground water hydrology illustrated in figure 10, which is a generalized cross-section extending about three and one-half miles southwest from Short Croton salt flat, is typical of a large area in northeast Kent County. The surface configuration was plotted from elevations of wells and hand leveled geologic sections and the position of the water table was determined by water level measurements made in wells in the area. The distance between locations of wells plotted are not to scale nor are the distances between the wells and prominent canyons and escarpments. The topographic slope from the plain to the salt flats is about 150 feet per mile, whereas the hydraulic gradient is about 130 feet per mile.

The hydraulic system (figure 10) is unconfined, and contains mineralized but usable water to an approximate depth of 250 feet. Salt water underlies the usable ground water but the depth and extent of the contact is not known exactly. Salt water was encountered in Well 74 at a depth of 253 feet. No other well records with this type of information were obtained, because local water-well drillers rarely keep logs. Moreover they seldom drill far below the water table for fear of penetrating the salt-fresh water contact. Some general idea of the extent of salt-water occurrence is indicated by widespread salt-water seepage in the Croton Creek drainage area, particularly at salt flats.

The source of recharge to the ground water reservoir is precipitation. Surface conditions favor recharge on the broad, rolling plain in the western part of this area, where the sandy soil cover accepts precipitation readily, especially when runoff is reduced by land conservation practices. Local residents report that in their experience the water table beneath the plain has risen, but this rise is not documented by periodic measurements.

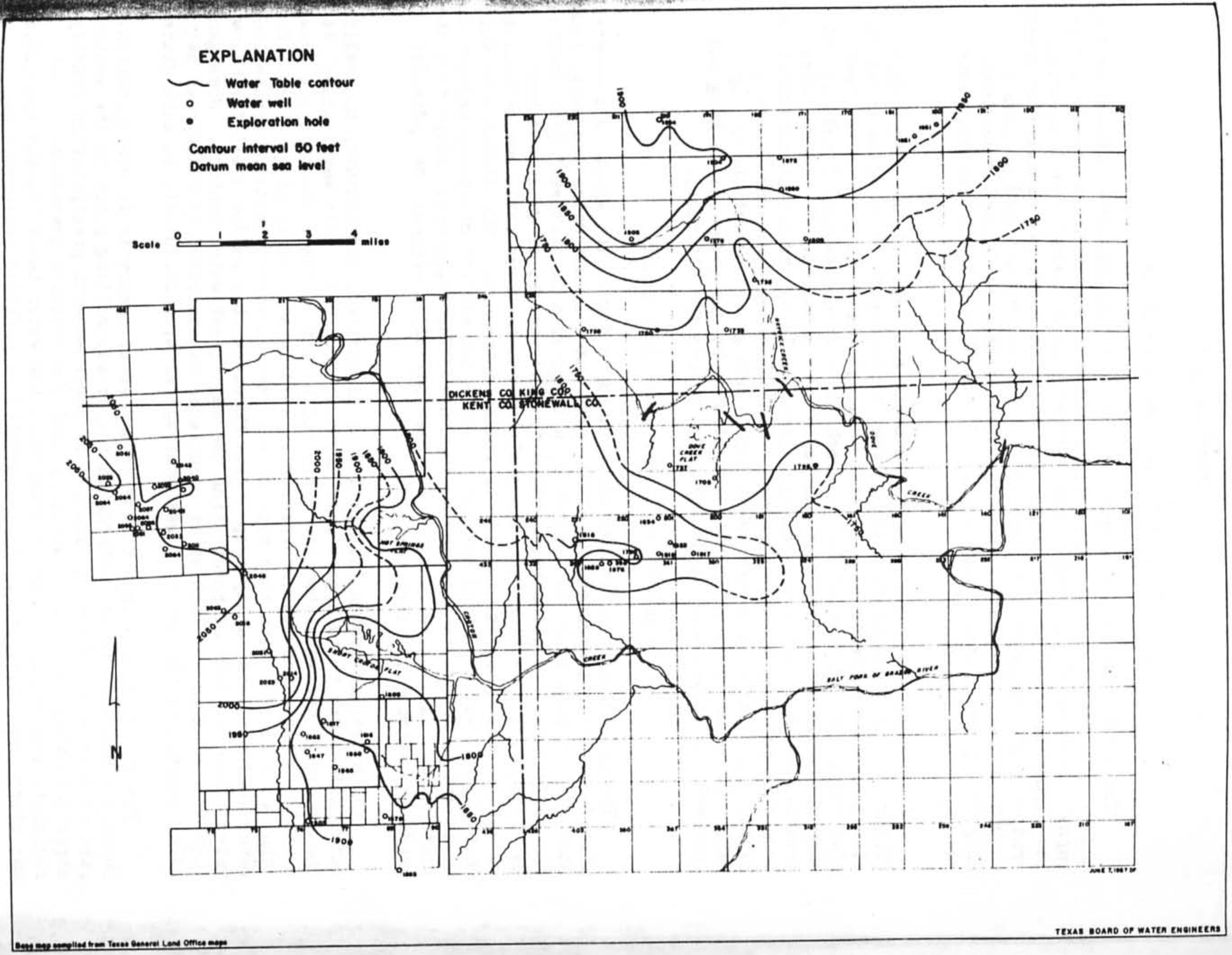



FIGURE 9 — RECONNAISSANCE MAP OF THE WATER TABLE IN PARTS OF STONEWALL, KENT, DICKENS, AND KING COUNTIES, TEXAS

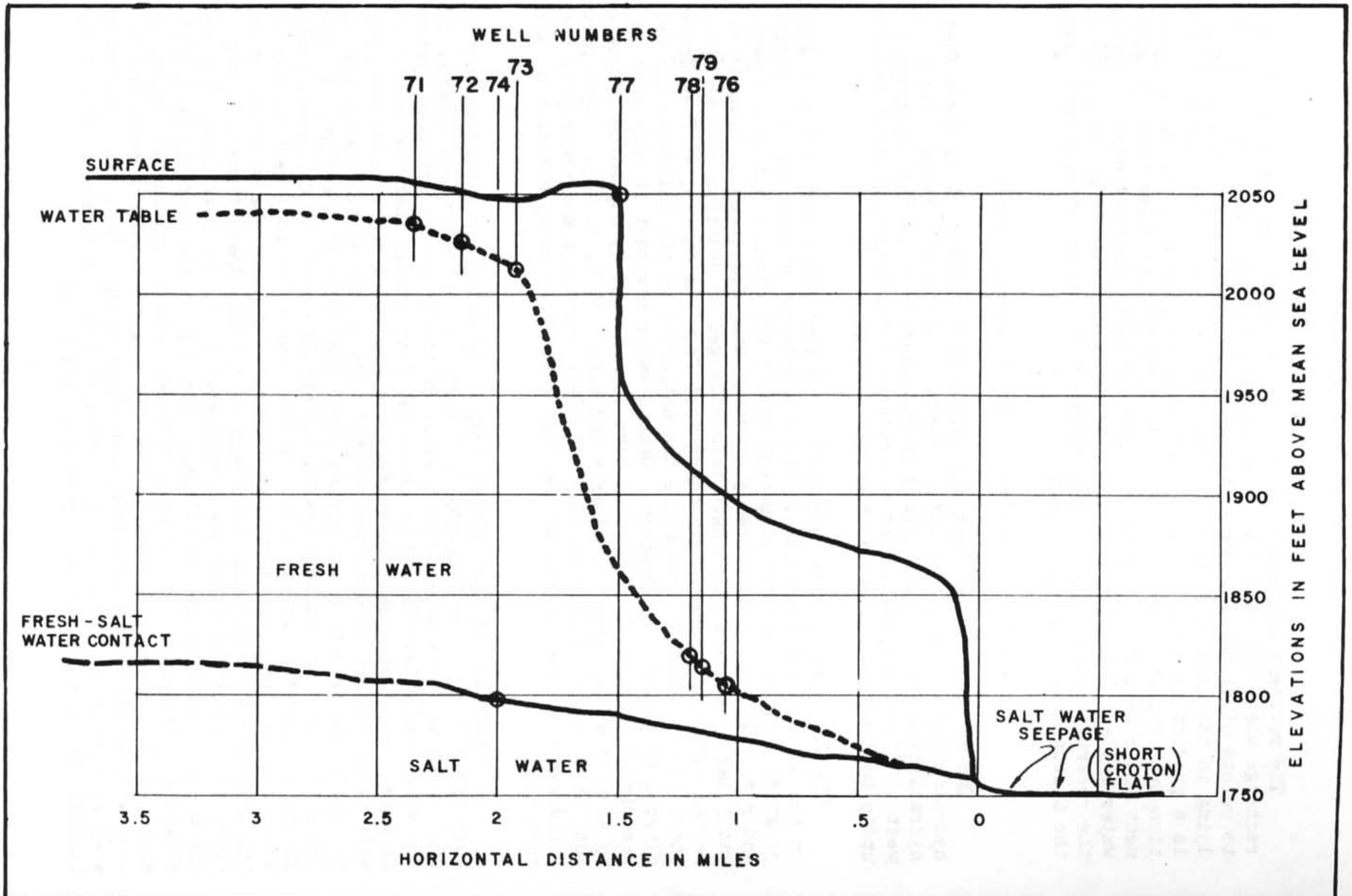



FIGURE 10-GENERALIZED CROSS-SECTION SHOWING THE GROUND WATER HYDROLOGY IN THE SHORT CROTON FLAT AREA, KENT COUNTY, TEXAS

The movement of ground water in the area is from the area of greatest recharge where the water table is highest, through the ground water reservoir to points of discharge. Enroute the ground water dissolves salt (halite) lying in the zone of saturated rocks. The writer infers that salt-water seepage is a product of the solution of salt beds belonging to the Seven Rivers formation by circulating ground water. As recharge increases there is greater movement and consequently a greater amount of salt water seepage. Lowering the water table in this area by ground-water withdrawals from the usable part of the reservoir should, therefore, decrease the amount of salt water seepage in the Croton Creek drainage system.

Artesian System of the Childress Dolomite

The artesian system that discharges salt water at Dove Creek flat is hydrologically complex. Solution channels in the Childress horizon, connected hydraulically with an unconfined ground water body up the topographic slope west of Dove Creek flat, form an artesian conduit through which water moves updip to discharge points in the flat (figure 11).

The Childress gypsum, a bed 10 to 13 feet thick consisting of gypsum on the outcrop and anhydrite in the subsurface, extends over the entire area of study. It is the most competent bed in the shallow subsurface section, and regional tilting undoubtedly produced many fractures through which ground water has moved, and which have been enlarged by solution into an interconnected cavernous system. Extending west from the outcrop at Dove Creek flat, there is a transition zone where the anhydrite of the Childress has been altered to gypsum by hydration. Ground water movement in this zone is restricted because the fractures have been closed by expansion of the gypsum by as much as 33 percent (Sellards and Baker, 1934, p. 623). Less permeable confining layers of jointed clay and shale overlying and underlying the Childress near the outcrop at the flat grade into sandy shales and sands down dip.

In figure 11, the unconfined body of ground water extending west of Dove Creek flat to the vicinity of Girard, in northeast Kent County, is postulated as the source of salt water of the Childress artesian system. The water table near Girard is about 390 feet higher than the land surface in Dove Creek flat. Salt water from the saturated rocks below the fresh-salt water contact in undifferentiated beds of the Whitehorse series enters the Childress from this unconfined water body west of the flat. It moves updip through solution cavities in the anhydrite of the Childress toward points of discharge in the flat. At the transition zone west of the flat where the Childress anhydrite has altered to gypsum, the water moves into the underlying jointed clay and shale of the Dog Creek formation, and comes to the surface under low hydrostatic head. At Dove Creek flat there are about 60 feet of saturated clay. Stand pipe measurements in the flat showed a hydrostatic head of only five feet above land surface which is about 60 feet lower in elevation than the reported head at exploration hole 153, which was not measured, but where water flowed over the top of a 43 foot derrick. This head loss results from the movement of salt water through the less permeable jointed clay and shale.

The scope of the present investigation did not indicate the westward extent of the hydraulic system discharging at Dove Creek flat.

## SUMMARY AND CONCLUSIONS

This study shows a large potential for salt-water seepage in this area of the Brazos River watershed. Salt-water seepage is evident at salt flats in the Dove Creek and Croton Creek drainage system. The geologic terrane contains beds of pure salt which are being dissolved by percolating ground water. The dip of the strata is opposite to the direction of the topographic slope and there has been little opportunity for ground-water flushing of permeable strata except locally up dip where these strata form confined hydraulic conduits. Such conduits are hydraulically connected to sources of salty ground water.

Owing to the occurrence of salt water under unconfined conditions, and resulting widespread seepage not only on salt flats but in the floors of the main canyons, the pollution potential is large in the Croton Creek watershed. Points of discharge are too numerous and too small to observe and measure. Moreover, much of the water evaporates or probably moves down stream as underflow. In the aggregate a substantial quantity of salt water is discharged from the ground-water reservoir. The salt-water that issues at the surface in the Dove Creek drainage system is largely channeled through a single geologic horizon and much of it discharges in the floor of Dove Creek flat. Runoff of the salt water is readily observed and can be measured.

Incomplete measurements of the salt water discharge at Dove Creek flat have been made, but no calculations of the quantity of salt have been released for inclusion in this report. There are at present no provisions for measuring the salt-water discharge from Croton Creek. No direct comparison can be made of the relative amounts of salt discharged in the two areas, but on the basis of the ground-water conditions determined in this investigation, it seems likely that the quantity discharged in the Croton Creek drainage system is in the same order of magnitude as the quantity discharged at Dove Creek flat.

Favorable recharge conditions in the western part of the area apparently have caused the water table to rise over a period of years. Such increased recharge favors greater ground-water movement and rock solution and widespread discharge. Large withdrawals from the usable part of the ground-water reservoir by wells would probably cause a decline in the water table and by so lowering the head of the reservoir cause a decrease in the surface seepage in the low areas of the Croton Creek drainage system. It is not known whether this process would affect the movement of salt water in the Childress dolomite nor can it be inferred from available data.

It can be concluded that the salt-water seepage in the area is the result of ground water recharge, movement and discharge involving both unconfined and confined reservoirs. The potential salt water seepage is substantial and may be expected to increase as recharge to the ground-water reservoir increases due either to land conservation practices or excessive precipitation during wet years or both.

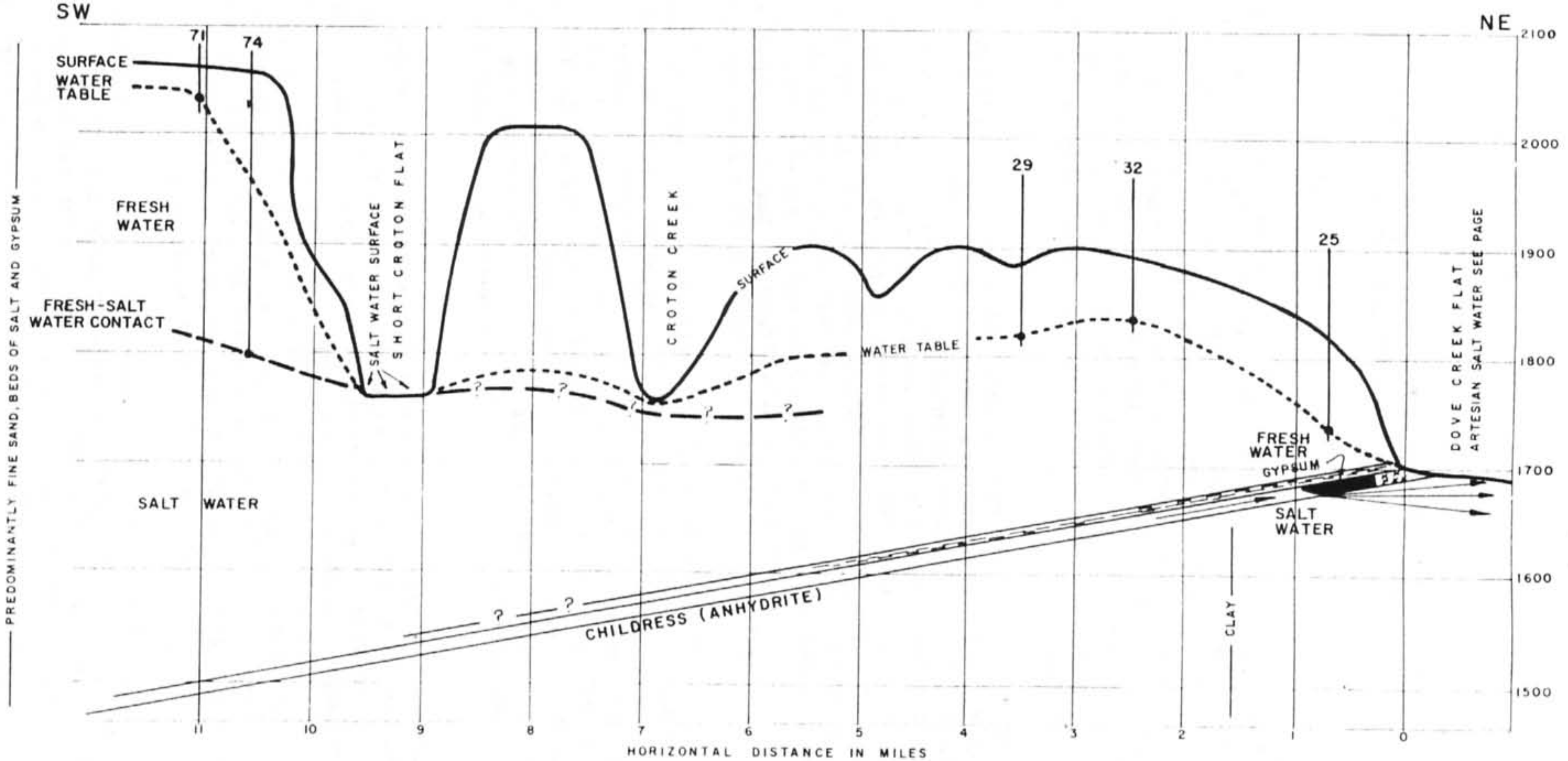



FIGURE 11 - GENERALIZED CROSS-SECTION SHOWING HYDROLOGIC CONDITIONS ASSOCIATED WITH THE ARTESIAN SYSTEM IN THE CHILDRESS MEMBER, KENT AND STONEWALL COUNTIES, TEXAS

## SUGGESTIONS FOR FURTHER STUDIES

The present investigation has given an indication of geologic conditions pertaining to the occurrence of ground water and salt water seepage. However, the scope of the investigation is insufficient to determine corrective measures for ridding the Brazos River watershed of all or part of the salt water discharged from ground-water sources in this area.

More detailed study is needed and should include, but not necessarily be limited to, the following: (1) topographic mapping of the area including preparation of detailed topographic maps of the salt flats and immediate areas, (2) detailed geologic mapping, (3) a detailed well inventory, (4) leveling of all wells and test holes for the purpose of mapping the water table or the artesian pressure surface as applicable, (5) test drilling of the Childress dolomite immediately west of Dove Creek flat, (6) pumping tests on wells in the western part of the area to determine if the ground-water reservoir will supply irrigation demand, (7) the determination of the chemical quality of the ground water, including the chemical and physical characteristics of the fresh-salt water contact.

Concurrent with more detailed ground-water studies, an expanded program of stream gaging and sampling in the Croton Creek watershed should be established and maintained.

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## SUBSURFACE DATA

Table 3 contains the elevations of the principal geologic marker horizons of this investigation. These elevations and also land surface elevations were obtained from 145 electric logs supplied by oil companies. These logs were made available to the writer but could not be released in full for publication.

Table 5 contains drillers' logs of three oil tests drilled with cable tools which record salt sections. These oil tests were drilled prior to 1935 but since that time rotary type equipment has been used to drill in this area. Beds of salt are rarely recorded in logs of rotary drilled holes because cuttings of the salt are dissolved so no holes drilled with this equipment are tabulated.

Table 1.-Generalized table of stratified rocks in the Dove Creek and Croton Creek areas, Stonewall, Kent, King and Dickens Counties, Texas

| System | Group | Formation | Member | Thickness (feet) | Physical Characteristics | Water-bearing Characteristics |
|---|---|---|---|---|---|---|
| Permian | Whitehorse | Tansill | Claytonville dol. | 640± | A series of redbed strata which is predominantly sandy with fine-grained sand and loosely cemented sandstone. Contains persistent gypsum and dolomite horizons, and occasional lenticular beds of clay and shale. Beds of pure salt are present in the subsurface in western part of the area. | Saturated sandy zones that lie above saturated salt water zones contain water suitable for irrigation and stock uses. Persistent gypsum horizons serve as hydraulic conduits through which salt water moves under artesian pressure. |
| | | Yates | | | | |
| | | Seven Rivers | | | | |
| | | Queen | Upper Eskota | | | |
| | | Grayburg | Lower Eskota<br>Childress dol. | | | |
| | El Reno (Pease River) | Dog Creek | | 650± | The upper 100 feet crops out at Dove Creek flat. Consists of red and green laminated clay and shale with thin veins of gypsum. | Contains salt water in jointed clay at Dove Creek flat. |
| | | Blaine | | | Not determined | Contains little or no usable water. |
| | | Flower Pot | | | Not determined | Contains little or no usable water. |
| | | San Angelo | | | Outcrop consists of massive sandstone and conglomerate but is less sandy in downdip part of the formation. | Contains water in outcrop area and several miles downdip or west of the outcrop. |

Table 2.-Geologic Sections in the Salt Producing Areas

Section 1. Measured on bluff north side of Dove Creek at gaging stations in northeast corner, Section 177, Block F, H & T C RR Survey, Stonewall County.

| | Feet | Inches |
|---|---|---|
| Childress gypsum, massive, white, fractured and weathered | 9 | 0 |
| Clay, green, nodular | 0 | 9 |
| Clay, red, nodular and conchoidal fracture | 26 | 6 |
| Gypsum, gray, platy | 0 | 2 |
| Clay, red, nodular, silty | 2 | 0 |
| Gypsum, greenish-gray | 0 | 1 |
| Clay, red, nodular and conchoidally fractured | 8 | 0 |
| Gypsum, white, crumbles easily | 0 | 3 |
| Clay, red, nodular | 8 | 0 |
| Gypsum, green to gray, strongly laminated | 5 | 0 |
| Clay, red and green, exhibits nodular and conchoidal fractures | 4 | 6 |
| Clay, red, nodular, crumbly when dry | 3 | 6 |
| Clay, green to gray, nodules about $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches in diameter | 1 | 6 |
| Clay, red, nodular, shaly | 3 | 6 |
| Floor of Dove Creek | | |
| Total of section | 72 | 9 |

Section 2. Measured on high bluff west of Hayrick Creek where road crosses creek in SE $\frac{1}{4}$ SW $\frac{1}{4}$, Section 176, Block F, H & T C RR Survey, King County.

| | Feet | Inches |
|---|---|---|
| Childress, gypsum, massive, white, many solution cavities filled with red silt and powdered gypsum | 10 | 0 |
| Clay, green, nodular, dense and hard | 1 | 0 |
| Clay, red, scattered green blotches | 10 | 0 |
| Clay, red gypsiferous | 0 | 5 |
| Clay, red, with green circular blotches about one inch in diameter | 6 | 6 |
| Clay, green, streaked red, nodular | 0 | 8 |
| Clay, banded, red and green, nodular | 10 | 0 |
| Gypsum, gray, interbedded with red clay | 0 | 6 |
| Clay, red, nodular, friable | 5 | 0 |
| Gypsum, white, crumbly, platy | 0 | 2 |
| Total of section | 44 | 3 |

Table 2.-Geologic Sections in the Salt Producing Areas--Continued

Section 3. Measured on north side where Dove Creek flat joins Dove Creek, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 197, Block F, H & TC RR Survey, Stonewall County.

| | Feet | Inches |
|---|---|---|
| Childress gypsum, white massive fractured by hydration and weathering | 9 | 6 |
| Clay, green, gysiferous, dense and hard | 1 | 6 |
| Clay, red, contains green specks and green layers, dense and hard | 5 | 0 |
| Total of Section | 16 | 0 |

Section 4. Measured on bluff, west side of Dove Creek flat, Section 197, Block F, H & TC RR Survey, Stonewall County.

| | Feet | Inches |
|---|---|---|
| Gypsum, white, massive, a few dolomitic lenses | 4 | 0 |
| Sand, red, fine, loose | 20 | 0 |
| Clay, red and green, laminated, horizontal bedding planes | 5 | 0 |
| Top of Childress gypsum | | |
| Total of Section | 29 | 0 |

Section 5. Measured on bluff, south side of Dove Creek, near center of Section 197, Block F, H & TC RR Survey, Stonewall County.

| | Feet | Inches |
|---|---|---|
| Lower Eskota gypsum, massive, white, some residual dolomitic layers | 10 | 0 |
| Sand, red, very fine, unconsolidated | 42 | 0 |
| Dolomite, gray, dense | 0 | 6 |
| Sand, red, very fine, unconsolidated | 60 | 6 |
| Gypsum, white, anhydritic and dolomitic | 4 | 0 |
| Sand, red, fine, unconsolidated | 20 | 0 |
| Clay, red and green, gypsiferous, hard | 3 | 6 |
| Top of Childress gypsum in creek bed | | |
| Total of Section | 140 | 6 |

Table 2.-Geologic Sections in the Salt Producing Areas--Continued

Section 6. Measured at head of Hayrick Creek canyon in SE corner, Section 193, Block F, H & TC RR Survey, King County

| | Feet | Inches |
|---|---|---|
| Gypsum, white, massive (Top of Hayrick Mountain) | 3 | 6 |
| Sand, red, very fine, unconsolidated | 22 | 0 |
| Gypsum, massive, gray | 0 | 4 |
| Sand, red, very fine, loose | 5 | 6 |
| Gypsum, white, massive | 3 | 0 |
| Sand, red, fine loose | 8 | 2 |
| Gypsum, white to gray, platy | 2 | 0 |
| Sand, red, fine unconsolidated | 55 | 0 |
| Upper Eskota gypsum, massive, white, near base is 1'0" of red, silty dolomite | 10 | 0 |
| Sand, red, fine, silty | 19 | 0 |
| Dolomite, brownish, red, silty, breaks into thin sheets and flagstones when exposed at surface | 1 | 2 |
| Sand, red, fine silty | 13 | 2 |
| Lower Eskota gypsum, massive, white, many solution cavities | 10 | 0 |
| Total of Section | 152 | 10 |

Section 7. Measured on bluff, north side of Short Croton Creek, about one mile east of extreme western end of Short Croton flat, Section 1, Block O K, H & TC RR Survey, Kent County

| | Feet | Inches |
|---|---|---|
| Sand, red, very fine-grained and silt, unconsolidated | 15 | 6 |
| Gypsum, white, massive | 0 | 8 |
| Sand, red, very fine and silt, loose | 3 | 10 |
| Gypsum, massive, white (probably same bed as 3'6" gypsum of section 6) | 3 | 0 |
| Sand, fine, loose, lower 4'0" saturated with salt water and thus more compact and harder | 27 | 6 |
| Bed of Short Croton Creek | | |
| Total of Section | 50 | 6 |

Table 2.-Geologic Sections in the Salt Producing Areas--Continued

Section 8. Measured on steep bluff at west end of Short Croton flat and directly south of fence (north line of James Castelberry Survey, Kent County).

| | Feet | Inches |
|---|---|---|
| Sand, red, very fine, loose, surface covered with powdery gypsum crust | 22 | 0 |
| Sandstone, red with gray blotches, fine-grained highly gypsiferous | 0 | 3 |
| Sand, red, fine unconsolidated, white | 3 | 6 |
| Gypsum, white, massive and granular | 3 | 4 |
| Sand, red, very fine-grained, unconsolidated | 108 | 6 |
| Base of Short Croton flat | | |
| Total of section | 137 | 7 |

Section 9. Measured on east side of steep canyon which is tributary to Short Croton flat from the south in James Castleberry Survey, Kent County.

| | Feet | Inches |
|---|---|---|
| Silt, red, scattered rounded chert-cobbles | 33 | 0 |
| Gypsum, white, pure massive | 12 | 0 |
| Sand, red, very fine-grained to silty, unconsolidated | 36 | 6 |
| Gypsum, white, massive, forms small ledge | 1 | 2 |
| Sand, red, very fine-grained, silty, loose, has high angle of repose | 121 | 0 |
| Gypsum, white, massive (is same bed as 3'4" gypsum of Section 8) | 3 | 4 |
| Total of Section | 207 | 0 |

Section 10. Bluff at north side of Hot Springs flat, one-fourth mile upstream from its mouth at Croton Creek in center of Chas. Hardwick Survey, Kent County.

| | Feet | Inches |
|---|---|---|
| Silt to fine sand, red, loose | 20 | 6 |
| Gypsum, white massive, (same bed as 3'0" gypsum of section 7 and perhaps is same as 3'6" of section 6) | 3 | 0 |
| Silt, red and green, gypsiferous | 0 | 6 |
| Gypsum, white, nodular | 0 | 4 |
| Sand, red, very fine-grained, silty, forms high angle of repose | 22 | 6 |
| Gypsum, gray, platy, wavy | 0 | 5 |
| Silt, red, salt crust on lower three feet | 11 | 6 |
| Silt, deposited by creek of Hot Springs flat saturated with salt water | 3 | 6 |
| Creek bed | | |
| Total of Section | 62 | 3 |

Table 2.-Geologic Sections in the Salt Producing Areas--Continued

Section 11. Measured on steep bluff at the southwest end of Hot Springs flat in SE$\frac{1}{4}$ NE$\frac{1}{4}$, Section 1, Block H, H & TC RR Survey, Kent County.

| | Feet | Inches |
|---|---|---|
| Gypsum, white, massive (same as 3'4" gypsum of sections 8 and 9) | 3 | 4 |
| Sand, red with grayish-green spots, very fine, silty | 107 | 0 |
| Floor of Hot Springs flat | | |
| Total of Section | 110 | 4 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent and King Counties, Texas

Abbreviations: P, projected; NP, not present
Locations are given in feet and direction from nearest section corner.
Remarks: Elevations given for tops of marker beds.

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) | | |
|---|---|---|---|---|
| | | Land surface | Childress | Upper Eskota |
| | Block F, H & TC RR Co. Survey, King County | | | |
| 100 | 35N 40W, SE Cor., Sec. 211 | 2075 | 1677p | 1871 |
| 101 | 1525E 110N, SW Cor., Sec. 210 | 1990 | 1695 | 1885 |
| 102 | 670S, NE Cor., Sec. 210 Flowed salt water above 43 foot drilling rig from zone of Lower Eskota or Upper Eskota. | 1956 | 1731 | 1931p |
| 103 | 150W, NE Cor., Sec. 191 Base of fresh water elevation 1748. | 1940 | 1740 | 1930p |
| 104 | 120E 735N, SW Cor., Sec. 190 | 1997 | 1732 | 1917 |
| 105 | 300W 880S, NE Cor., Sec. 190 | 1941 | 1746 | 1936p |
| 106 | 2250S 2775W, NE Cor., Sec. 171 | 1898 | 1773 | np |
| 107 | 225S 575W, NE Cor., Sec. 171 | 1882 | 1777 | np |
| 108 | On E line and 95 N, SE Cor., Sec. 171 | 1961 | 1766 | 1956p |
| 109 | 200E 100N, SW Cor., Sec. 209 | 2089 | 1684 | 1874 |
| 110 | 900W 190N, SE Cor., Sec. 209 | 2046 | 1696 | 1886 |
| 111 | 300E 50S, NW Cor., Sec. 172. Base of fresh water at elevation 1748. | 1937 | 1752 | 1937p |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration holes number | Location and Remarks | Elevation (datum is mean sea level) | | |
|---|---|---|---|---|
| | | Land surface | Childress | Upper Eskota |
| | Block F, H & TC RR Co. Survey, King County | | | |
| 127 | 270W 70N, SE Cor., Sec. 214 | 1916 | 1691 | 1881 |
| 128 | 1700E 710S, NW Cor., Sec. 207 | 1998 | 1683 | 1873 |
| 129 | 1150W 150N, SE Cor., Sec. 207 | 1942 | 1717 | 1912 |
| 130 | 170E 1980S, NW Cor., Sec. 187 | 1943 | 1735 | 1928p |
| 131 | 175E 600N, SW Cor., Sec. 187 | 1911 | 1736 | np |
| 132 | 180E 250N, SW Cor., Sec. 174 | 1792 | 1762 | np |
| 133 | 1800E 1400S, NW Cor., Sec. 167 | 1854 | 1789 | np |
| 134 | 1050N 2300E, SW Cor., Sec. 167 | 1859 | 1779 | np |
| 135 | 2350N 100E, SW Cor., Sec. 154 | 1894 | 1774 | np |
| 136 | 2300E 240N, SW Cor., Sec. 154 | 1848 | 1778 | np |
| 137 | 1950S 2700E, NW Cor., Sec. 154 | 1872 | 1782 | np |
| 138 | 200E 300S, NW Cor., Sec. 147 | 1890 | 1795 | np |
| 139 | 300W 100N, SE Cor., Sec. 147 | 1823 | 1813p | np |
| 140 | 1620E 1140N, SW Cor., Sec. 127 | 1868 | 1943 | np |
| 141 | 660S 350E, NW Cor., Sec. 235 | 1868 | 1634 | 1825 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) | | |
|---|---|---|---|---|
| | | Land Surface | Childress | Upper Eskota |
| | Block F, H & TC RR Co. survey, King County | | | |
| 112 | 885E 570N, SW Cor., Sec. 172 | 1979 | 1759 | 1944 |
| 113 | 2300S 2825W, NE Cor., Sec. 172 | 1951 | 1746 | 1936p |
| 114 | 1000E 900N, SW Cor., Sec. 169 | 1963 | 1758 | 1948p |
| 115 | 25E 25S, NW Cor., Sec. 152 | 1982 | 1797 | 1987p |
| 116 | 1250E 1425W, SW Cor., Sec. 152 | 1955 | 1785 | np |
| 117 | 20N 300E, SW Cor., Sec. 188 | 2087 | 1687 | 1887 |
| 118 | 200S 50E, NW Cor., Sec. 188 | 1941 | 1731 | 1921p |
| 119 | 550W 40N, SE Cor., Sec. 188 | 1921 | 1747 | np |
| 120 | 1300W 140N, SE Cor., Sec. 173 | 1956 | 1786 | np |
| 121 | 2650W 2650S, NE Cor., Sec. 168 | 1931 | 1766 | np |
| 122 | 500N 200W, SE Cor., Sec. 168 | 1856 | 1771 | np |
| 123 | 1600S 500W, NE Cor., Sec. 153 | 1926 | 1791 | np |
| 124 | 100S 100W, NE Cor., Sec. 148 | 1963 | 1818 | np |
| 125 | 200N 1650W, SE Cor., Sec. 133 | 1861 | 1821p | np |
| 126 | 200S 120E, NW Cor., Sec. 234 | 1871 | 1636 | 1833 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent and King Counties -- Continued

| Exploration holes number | Location and Remarks | Elevation (datum is mean sea level) Land surface | Childress | Upper Eskota |
|---|---|---|---|---|
| | Block F, H & TC RR Co. Survey, King County | | | |
| 142 | 50N 625E, SW Cor., Sec. 215 | 1860 | 1655 | 1850p |
| 143 | 1060E 310N, SE Cor., Sec. 206 | 1886 | 1681 | 1876p |
| 144 | 2050W 2030N, SE Cor., Sec. 186 | 1919 | 1744 | np |
| 145 | 450W 1800S, NE Cor., Sec. 175 | 1849 | 1774 | np |
| 146 | 110S 480E, NW Cor., Sec. 225 | 1950 | 1625 | 1825 |
| 147 | 100E 900N, SW Cor., Sec. 205 | 1847 | 1672 | np |
| 148 | 950E 1710S, NW Cor., Sec. 196 | 1873 | 1718p | np |
| 149 | 325N 700E, SW Cor., Sec. 185 | 1741 | 1736p | np |
| 150 | 2350W 1600S, NE Cor., Sec. 185 | 1847 | 1752 | np |
| 151 | 380E 920N, SE Cor., Sec. 176 | 1756 | 1741p | np |
| 152 | 1750N 300W, SE Cor., Sec. 176 | 1797 | 1762 | np |
| | Block-F, H & TC RR Co. Survey, Stonewall County | | | |
| 153 | 1200W 980N, SE Cor., Sec. 204. Salt water from aquifer near base of Childress flowed above 43 foot drilling rig. 7-inch casing set to 173 feet. | 1726 | 1701p | np |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) | | |
|---|---|---|---|---|
| | | Land surface | Childress | Upper Eskota |
| | Block F, H & TC RR Co. Survey, Stonewall County | | | |
| 154 | 825N 350W, SE Cor., Sec. 184 | 1775 | 1740 | np |
| 155 | 175S 300E, NW Cor., Sec. 124 | 1744 | np | np |
| 156 | 1975E 50N, SW Cor., Sec. 124 | 1698 | np | np |
| 157 | 2400E 150S, NW Cor., Sec. 117 | 1757 | np | np |
| 158 | 1290E 160N, SW Cor., Sec. 117 | 1722 | np | np |
| 159 | 760E 740N, SW Cor., Sec. 104 | 1721 | np | np |
| 160 | 60W 200S, NE Cor., Sec. 104 | 1773 | np | np |
| 161 | 550E 100S, NW Cor., Sec. 218 | 1885 | 1640 | 1830 |
| 162 | 100S 300E, NW Cor., Sec. 163 | 1810 | 1755 | np |
| 163 | 100E 380N, SW Cor., Sec. 163. Base of fresh water at depth of 90 feet. | 1826 | 1741 | np |
| 164 | 700S 180W, NE Cor., Sec. 163 | 1706 | np | np |
| 165 | 700W 1450N, SE Cor., Sec. 158 | 1710 | np | np |
| 166 | 220W 200S, NE Cor., Sec. 143 | 1808 | 1793 | np |
| 167 | 100W 200S, NE Cor., Sec. 239 | 1991 | 1606 | 1796 |
| 168 | 800W 400S, NE Cor., Sec. 219 | 1822 | 1632 | 1822p |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) | | |
| --- | --- | --- | --- | --- |
| | | Land surface | Childress | Upper Eskota |
| | Block F, H & TC RR Co. Survey, Stonewall County | | | |
| 169 | On W line and 500S, NW Cor., Sec. 182 | 1775 | 1690 | np |
| 170 | 1720W 550N, SE Cor., Sec. 182 | 1866 | 1711 | np |
| 171 | 250S 100W, NE Cor., Sec. 142 | 1716 | np | np |
| 172 | 2000E 300S, NW Cor., Sec. 122 | 1677 | np | np |
| 173 | 2100E 150N, SW Cor., Sec. 122 | 1675 | np | np |
| 174 | 25W 0N, SE Cor., Sec. 122 | 1731 | np | np |
| 175 | 100W 400S, NE Cor., Sec. 119 | 1667 | np | np |
| 176 | 100E 350N, SW Cor., Sec. 221 | 1928 | 1623 | 1808 |
| 177 | 1450S 25E, NW Cor., Sec. 220 | 1952 | 1642 | 1832 |
| 178 | 75W 325S, NE Cor., Sec. 220 | 1863 | 1663 | 1848p |
| 179 | 1300N 220E, SW Cor., Sec. 201 | 1903 | 1678 | 1868 |
| 180 | 1125S; 1675W, NE Cor., Sec. 201 | 1889 | 1674 | 1864p |
| 181 | 1840W 300N, SE Cor., Sec. 180 | 1868 | 1698 | np |
| 182 | 2250E 1770S, NW Cor., Sec. 160 | 1780 | 1750 | np |
| 183 | 130W 200N, SE Cor., Sec. 160 | 1807 | 1772 | np |
| 184 | 190W 1280S, NE Cor., Sec. 141 | 1683 | np | np |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) Land surface | Childress | Upper Eskota |
|---|---|---|---|---|
| | Block D, H & TC RR Co. Survey, Stonewall County | | | |
| 185 | 220W 600N, SE Cor., Sec. 397. 7-inch casing set to 296 feet. | 1855 | 1640p | 1830p |
| 186 | 130S 185W, NE Cor., Sec. 396 | 1885 | 1670 | 1855 |
| 187 | 60N 170E, SW Cor., Sec. 360 | 1840 | 1635 | 1825p |
| 188 | 170S 260W, NE Cor., Sec. 360 | 1879 | 1669 | 1859p |
| 189 | 54N 65W, SE Cor., Sec. 325 | 1878 | 1688 | 1878p |
| 190 | 735W 680N, SE Cor., Sec. 289 | 1896 | 1731 | np |
| 191 | 2470W 2400N, SE Cor., Sec. 253 | 1798 | 1773 | np |
| 192 | 1080S 410E, NW Cor., Sec. 217 | 1692 | np | np |
| 193 | 0N 600E, SW Cor., Sec. 216 | 1747 | np | np |
| 194 | 35E 1100N, SE Cor., Sec. 398 | 1823 | 1618 | 1808p |
| 195 | 250N 700W, SE Cor., Sec. 395 | 1737 | 1637 | np |
| 196 | 46N 30W, SE Cor., Sec. 359 | 1878 | 1673 | 1868p |
| 197 | 100E 100N, SW Cor., Sec. 323 | 1900 | 1685 | 1875p |
| 198 | 900N 700W, SE Cor., Sec. 251 | 1670 | np | np |
| 199 | 700E 600N, SE Cor., Sec. 358 | 1722 | 1647 | np |
| 200 | 1000E 2650S, NW Cor., Sec. 327 | 1868 | 1683 | 1873p |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) | | |
|---|---|---|---|---|
| | | Land surface | Childress | Upper Eskota |
| | Block D, H & TC RR Co. Survey, Stonewall County | | | |
| 201 | 880W 1200S, NE Cor., Sec. 322 | 1887 | 1707 | np |
| 202 | On S line 1100E, SW Cor., Sec. 286 | 1713 | np | np |
| 203 | 650S 520W, NE Cor., Sec. 286 | 1805 | 1760 | np |
| 204 | 75W 200N, SE Cor., Sec. 429 | 1949 | 1636 | 1832 |
| 205 | 1000W 200S, NE Cor., Sec. 328 | 1836 | 1666 | np |
| 206 | 400S 250W, NE Cor., Sec. 426 | 1918 | 1593 | 1783 |
| | Block 1, H & GN RR Co. Survey, Dickens County | | | |
| 207 | 100S 45W, NE Cor., Sec. 162 | 2176 | 1386 | 1586 |
| 208 | 50N 100W, SE Cor., Sec. 158 | 2147 | 1327 | 1587 |
| | Block F, H & TC RR Co. Survey, Kent County | | | |
| 209 | 50S, 330W, NE Cor., Sec. 237 | 2052 | 1582p | 1777 |
| | Block 1, H & GN RR Co. Survey, Kent County | | | |
| 210 | 600W 50S, NE Cor., Sec. 120 | 2095 | 1355 | 1555 |
| 211 | 300N 30E, SW Cor., Sec. 121 | 2134 | 1404 | 1602 |
| 212 | 260S 35W, NE Cor., Sec. 123 | 2176 | 1421 | 1616 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, Dickens, and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) Land surface | Childress | Upper Eskota |
|---|---|---|---|---|
| | Block 1, H & GN RR Co. Survey, Kent County | | | |
| 213 | 50W 50N, SE Cor., Sec. 87 | 2169 | 1409 | 1614 |
| | Block H, HT & B RR Co. Survey, Kent County | | | |
| 214 | 220N, 1000E, SW Cor., Sec. 3 | 2112 | 1490p | 1680 |
| 215 | 500N, 1230E, SW Cor., Sec. 2 | 1951 | 1521 | 1716 |
| | Block 1, H & GN RR Co. Survey, Kent County | | | |
| 216 | 25E 100S, NW Cor., Sec. 83 | 2102 | 1347 | 1547 |
| 217 | 400S 50E, NW Cor., Sec. 84 | 2109 | 1389 | 1599 |
| 218 | 80N 120E, SE Cor., Sec. 85 | 2153 | 1428p | 1633 |
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 219 | 480N 2635W, SE Cor., Sec. 57 | 2101 | 1451p | 1646 |
| 220 | 50N 550W, SE Cor., Sec. 57 | 2153 | 1506 | 1680 |
| 221 | 1500S, 900W, NE Cor., Sec. 58 | 2059 | 1486 | 1676 |
| | Block L, Chas. S. Hardwick Hrs. Survey, Kent County | | | |
| 222 | 50E 100N, SW Cor. | 1951 | 1491 | 1683 |
| | Block OK, H & TC RR Co. Survey, Kent County | | | |
| 223 | 750N 950W, SE Cor., Sec. 1 | 2091 | 1541 | 1711 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, Dickens and King Counties -- Continued

| Exploration holes number | Location and Remarks | Elevation (datum is mean sea level) Land surface | Childress | Upper Eskota |
|---|---|---|---|---|
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 224 | 1775N 300W, SE Cor., Sec. 4 | 1883 | 1523 | 1718 |
| | Block D, H & TC RR Co. Survey, Kent County | | | |
| 225 | 180S 100W, NE Cor., Sec. 434 | 1882 | 1577 | 1772 |
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 226 | 100N 150W, SE Cor., Sec. 2 | 1871 | 1561 | 1746 |
| 227 | 20S 800E, NW Cor., Sec. 18 | 2119 | 1439 | 1619 |
| 228 | 50S 100W, NE Cor., Sec. 13 | 2062 | 1481 | 1657 |
| | Block OK, H & TC RR Co. Survey, Kent County | | | |
| 229 | 200N 2800W, SE Cor., Jas. Castleberry Survey | 2089 | 1499 | 1669 |
| 230 | 1425W 50N, SE Cor., Sec. 6 | 1920 | 1540 | 1727 |
| | Block D, H & TC RR Co. Survey, Kent County | | | |
| 231 | 1000N 800W, SE Cor., Sec. 251 | 1791 | 1581 | 1771 |
| 232 | 40S 45E, NW Cor., Sec. 12 | 2054 | 1429 | 1631 |
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 233 | 100W 100N, SE Cor., Sec. 12 | 2006 | 1481 | 1664 |
| 234 | E. Barefoot Survey, Kent County on NW Cor. of Survey | 2015 | 1515 | 1715 |
| 235 | 350S 100E, NW Cor., Sec. 20 | 2065 | 1430 | 1610 |

Table 3.-Records of exploration holes in parts of Stonewall, Kent, Dickens and King Counties -- Continued

| Exploration hole number | Location and Remarks | Elevation (datum is mean sea level) Land surface | Childress | Upper Eskota |
|---|---|---|---|---|
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 236 | 85E 45N, SW Cor., Sec. 11 | 2015 | 1450 | 1630 |
| 237 | 50E 400N, SW Cor., Sec. 8 | 2010 | 1503 | 1683 |
| | H. H. Sandell Survey Kent County | | | |
| 238 | 1000N 1050E, SW Cor., of Survey | 1929 | 1539 | 1734 |
| | Block D, H & TC RR Co. Survey, Kent County | | | |
| 239 | 800S 200W, NE Cor., Sec. 437 | 1834 | 1585 | 1782 |
| 240 | 280W 100N, SE Cor., Sec. 437 | 1975 | 1595 | 1788 |
| | Block L, H & TC RR Co. Survey, Kent County | | | |
| 241 | 2900S 100E, NE Cor., Sec. 26 | 2007 | 1422 | 1612 |
| | P. A. Harris Survey, Kent County | | | |
| 242 | 100W 65N SE Cor., of Survey | 1974 | 1464 | 1644 |
| | Block 98, H & TC RR Co. Survey Kent County | | | |
| 243 | 75S 600W, NE Cor., Sec. 89 | 2013 | 1536p | 1723 |
| | Block F, H & TC RR Co. Survey, Kent County | | | |
| 244 | 800W 600N, SW Cor., Sec. 438 | 1992 | 1575 | 1767 |

Table 4.-Location, date drilled and ground elevation of oil tests drilled with cable-tool equipment in and near area studied

| Test hole number | Location | Company | Year drilled | Ground elevation (in feet above mean sea level) |
|---|---|---|---|---|
| *87 | At Spur in Sec. 244, Block 1, H & GN RR Co. Survey, Dickens County | Swenson Land Co. | 1913 | 2335 |
| *88 | SE Cor. NW¼, 300E 300S, Sec. 311, H & GN RR Co. Survey, Dickens County | Moutray Oil Co. | 1927 | 2271 |
| 89 | 1320 N 1320 E, Sec. 120, Block A, John B. Rector Survey, King County | Midway Exploration Co. | 1927 | 1706 |
| 90 | 330N 330E, Sec. 429, Block D, H & TC RR Co. Survey, Kent County | Phillips Petroleum Co. | 1926 | -- |
| 91 | 300S 960W, Sec. 120, Block F, H & TC RR Co. Survey, Stonewall County | Arkansas Fuel Oil Co. | 1926 | 1732 |
| 92 | Center of NE¼ of NE¼, Sec. 105, Block D. H & TC RR Co. Survey, Stonewall County | Peer Oil Corp. of Texas | 1927 | 1740 |
| *93 | 1320W 1320N, Sec. 57, Block 7, H & GN RR Co. Survey, Kent County | Douglas Oil Co. | 1927 | 2398 |
| *94 | 200N 200W, Sec. 131, Block G, W & NW Survey, Kent County | The Texas Company | 1926 | -- |
| 95 | Center of SW¼, Sec. 153, Block D, H & TCRR Co. Survey, Stonewall County | F. P. Zoch | 1927 | -- |
| *96 | 330S, 330W, Sec. 60, Block G, W & N RR Survey, Kent County | Atlantic Oil Prod. Co. | 1930 | 2256 |
| *97 | 1980N 600W, Sec. 11, Block 4, H & GN RR Co. Survey, Kent County | Marland Oil Co. of Texas | | |

Table 4.-Location, date drilled and ground elevation of oil tests drilled with cable-tool equipment in and near area studied--Continued

| Test hole number | Location | Company | Year drilled | Ground elevation (in feet above mean sea level) |
|---|---|---|---|---|
| *98 | SW Cor. of Block K, Sec. 49, T. A. Thomson Survey, Kent County | Marland Oil Co. & Texon Oil Co. | 1928 | -- |
| 99 | 330S 330E, Sec. 371, Block 2, H & TC RR Co. Survey, Stonewall County | General Crude Oil Co. | 1938 | -- |

* Salt reported in log.

Table 5.-Driller's logs of the upper part of oil tests in Kent and Dickens Counties, Texas

| | Thickness (feet) | Depth (feet) |
|---|---|---|
| **Oil Test 88** | | |
| Collar | 0 | 8 |
| Red sandrock | 11 | 19 |
| Red rock | 51 | 70 |
| Red sandrock | 15 | 85 |
| Red bed | 10 | 95 |
| Red sand | 8 | 103 |
| Red bed | 17 | 120 |
| Red bed and gypsum streaks | 15 | 135 |
| Red rock | 10 | 145 |
| Sand rock, hard | 5 | 150 |
| Red rock | 15 | 165 |
| Red rocks and gypsum streaks | 10 | 175 |
| Red rock | 10 | 185 |
| Gypsum rock and gravel | 18 | 203 |
| Salt water at 200 feet | | |
| Red rock | 17 | 220 |
| Lime | 20 | 240 |
| Red rock | 13 | 253 |
| Red quick sand | 11 | 264 |
| Gypsum rock, hard | 16 | 280 |
| Red bed | 37 | 317 |
| Lime shell | 3 | 320 |
| Red bed | 15 | 335 |
| Red rock | 5 | 340 |
| Gypsum water | 5 | 345 |
| Gypsum and gravel | 15 | 360 |
| Salt | 75 | 435 |
| Red bed | 30 | 465 |
| Salt | 10 | 475 |
| Lime | 15 | 490 |
| Salt | 22 | 512 |
| Lime | 13 | 525 |
| Salt | 5 | 530 |
| Lime | 10 | 540 |
| Red bed | 35 | 575 |
| Red rock | 45 | 620 |
| Salt | 25 | 645 |
| Red bed | 5 | 650 |
| Lime, hard | 15 | 665 |
| Red sand | 10 | 675 |
| Red rock | 5 | 680 |
| Red sand | 5 | 685 |
| Lime | 30 | 715 |
| Red rock | 15 | 730 |
| Lime | 10 | 740 |
| Salt | 10 | 750 |
| Red rock and shells | 35 | 785 |
| Sandy shale | 75 | 860 |
| Red rock | 35 | 895 |
| Lime | 30 | 925 |
| Sandy shale | 30 | 955 |
| Red rock | 15 | 970 |
| Lime | 10 | 980 |
| Sand | 5 | 985 |
| Not logged | 7 | 992 |
| Sand | 10 | 1,002 |
| Red Shale | 63 | 1,065 |
| Red rock | 32 | 1,097 |
| Gray lime | 17 | 1,114 |
| Salt and gypsum rock | 16 | 1,113 |
| Lime shells | 20 | 1,150 |
| Blue shale | 15 | 1,165 |
| Red rock | 15 | 1,180 |
| Not logged | 5 | 1,195 |
| Lime | 5 | 1,200 |
| Gray sand | 5 | 1,205 |
| Red rock | 6 | 1,211 |
| Salt | 4 | 1,215 |
| Total depth | | 3,943 |
| (no salt recorded below 1,215 feet) | | |

Table 5.-Driller's logs of the upper part of oil tests in Kent and Dickens Counties, Texas - Continued

Oil test 93

| | Thickness (feet) | Depth (feet) |
|---|---|---|
| Red rock | 0 | 300 |
| Broken lime | 20 | 320 |
| Gravel | 10 | 330 |
| Red rock | 32 | 362 |
| Salt | 85 | 447 |
| Red sand | 10 | 457 |
| Red rock and salt | 83 | 540 |
| White lime, anhydrite and red rock | 10 | 550 |
| Red sand | 10 | 560 |
| Red rock and salt | 40 | 600 |
| Red rock | 50 | 650 |
| Hard lime | 50 | 700 |
| Salt | 25 | 725 |
| Lime | 30 | 755 |
| Soft salt | 20 | 775 |
| Red rock | 25 | 800 |
| Red rock and salt | 60 | 860 |
| Broken lime | 15 | 875 |
| Red rock | 25 | 900 |
| Salt | 20 | 920 |
| Anhydrite | 30 | 950 |
| Salt | 15 | 965 |
| Anhydrite | 5 | 970 |
| Red rock Cave | 15 | 985 |
| Salt | 10 | 995 |
| Red rock | 40 | 1,035 |
| Red sand | 15 | 1,050 |
| Salt | 20 | 1,070 |
| Red sand | 10 | 1,080 |
| Red rock salt | 395 | 1,475 |
| Lime shells sandy hard | 15 | 1,490 |
| Red rock | 15 | 1,505 |
| Anhydrite | 10 | 1,515 |
| White sand | 17 | 1,532 |
| Lime coarse | 6 | 1,538 |
| Lime fine | 7 | 1,545 |
| Slate | 30 | 1,575 |
| Lime white hard | 35 | 1,610 |
| Lime and slate | 60 | 1,670 |
| Salt | 5 | 1,675 |
| Total Depth | | 4,508 |

(No salt recorded below 1,675 feet)

Oil test 98

| | Thickness (feet) | Depth (feet) |
|---|---|---|
| Surface, red sandy | 0 | 110 |
| Anhydrite, white | 15 | 125 |
| Red bed | 45 | 170 |
| Lime white | 12 | 182 |
| Red sandy | 68 | 250 |
| Sand, quick | 25 | 275 |
| Lime white | 10 | 285 |
| Red sandy | 15 | 300 |
| Water at 300 and 320 feet | | |
| Sand quick | 10 | 310 |
| Gravel | 10 | 320 |
| Red sandy | 55 | 375 |
| Red quick sand | 10 | 385 |
| Red sandy | 15 | 400 |
| Gravel red | 10 | 410 |
| Red sandy | 5 | 415 |
| Red rock water at 420-455 feet | 5 | 420 |
| Gravel sand | 35 | 455 |
| Clay red | 5 | 460 |
| Red rock | 5 | 465 |
| Anhydrite | 20 | 585 |
| Red sandy | 25 | 610 |
| Salt white hard | 65 | 675 |
| Sand red sharp, water | 75 | 750 |
| Total Depth | | 3,576 |

(No salt recorded below 675 feet)

Table 6.-Records of wells in parts of Stonewall, Kent, Dickens, and King Counties, Texas

All wells are drilled unless otherwise noted in remarks column
Method of Lift: E, electric; G, gasoline; W, windmill
Use of water : D, domestic; N, not used; S, stock

| Well No. | Owner | Driller | Date completed | Depth of well (ft.) | Diameter of well (in.) | Altitude of land surface (ft.) | Water level: Below land surface datum (ft.) | Water level: Date of measurement | Method of lift | Use of water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | W. A. Springer, Sr. | -- | -- | 55 | 6 | 1946 | 51.7 | Jan. 14, 1957 | W | S | |
| 2 | W. A. Springer, Jr. | Dick Shirley | 1944 | 80 | 6 | 1880 | -- | -- | W | S | |
| 3 | do. | -- | -- | -- | 6 | 1891 | 39.8 | Feb. 12, 1957 | W | S | |
| 4 | do. | Clyde Spray | 1951 | -- | 6 | 1884 | 33.4 | do. | W | S | Driller went through Childress (12') into salt-bearing clay. Fresh water sand overlies 3 feet of clay which lies on the Childress. |
| 5 | W. A. Springer, Sr. | -- | -- | 105 | 7 | 1986 | -- | -- | W | S | |
| 6 | W. A. Springer, Jr. | Obie Wright | 1953 | 75 | 7 | 1963 | 59.1 | Jan. 14, 1957 | W | S | |
| 7 | do. | Mr. Russel | 1939 | 75 | 7 | 1922 | 50.0 | do. | W | S | Reported suitable for drinking. |
| 8 | do. | do. | -- | 135 | 7 | 1976 | 126.3 | do. | W | S | do. |
| 9 | W. A. Springer, Sr. | -- | Old | 95 | 7 | 1987 | 81.9 | do. | W | S | |
| 10 | W. A. Springer, Jr. | Obie Wright | 1953 | 180 | 7 | 1950 | 172.0 | do. | W | S | |
| 11 | Mary Martin | Continental Oil Co. | 1950 | 7,100 | -- | 1973 | -- | -- | -- | N | Oil Test. |
| 12 | W. A. Springer, Jr. | - Russel | 1939 | 175 | 7 | 1958 | 149.0 | Feb. 12, 1957 | W | S | |
| 13 | do. | -- | -- | 80 | 5 | 1801 | 66.4 | do. | W | S | Top of casing is 33 feet (hand-leveled) above top of Childress. |

Table 6.-Records of wells in parts of Stonewall, Kent, Dickens, and King Counties--Continued

| Well No. | Owner | Driller | Date completed | Depth of well (ft.) | Diameter of well (in.) | Altitude of land surface (ft.) | Water level: Below land surface datum (ft.) | Water level: Date of measurement | Method of lift | Use of water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | Mary Martin | Continental Oil Co. | 1951 | 6,345 | -- | 1949 | -- | -- | -- | N | Oil Test |
| 15 | do. | do. | 1950 | 7,173 | -- | 1831 | -- | -- | -- | N | do. |
| 16 | G. W. Springer | Obie Wright | 1950 | 150 | 7 | 1875 | 136.8 | Feb. 13, 1957 | W | S | |
| 17 | do. | -- | Old | 113 | 12 | 1854 | 104.3 | do. | W | S | |
| 18 | Mary Martin | DeSoto Oil Co. | 1946 | 4,905 | -- | 1880 | -- | -- | -- | N | do. |
| 19 | W. A. Springer, Jr. | - Russel | 1939 | 135 | 7 | 1957 | 118.6 | Jan. 14, 1957 | W | S | |
| 20 | Mary Martin | Continental Oil Co. | 1952 | 4,650 | -- | 1710 | -- | -- | -- | N | do. |
| 21 | do. | do. | 1952 | 4,877 | -- | 1822 | -- | -- | -- | N | do. |
| 22 | G. W. Springer | Byars Oil Co. | 1954 | 5,511 | -- | 1883 | -- | -- | -- | N | do. |
| 23 | G. C. Carothers | Sid Katz | 1953 | 6,435 | -- | 1835 | -- | -- | -- | N | do. |
| 24 | W. A. Springer, Jr. | Continental Oil Co. | 1952 | 4,872 | -- | 1785 | -- | -- | -- | N | do. |
| 25 | G. W. Springer | Obie Wright | 1949 | 150 | $6\frac{1}{4}$ | 1876 | 138.6 | Feb. 13, 1957 | W | S | |
| 26 | Carl Springer Estate | Continental Oil Co. | 1952 | 4,840 | -- | 1874 | -- | -- | -- | N | do. |
| 27 | G. W. Springer | -- | -- | 30 | 5 | 1734 | 26.4 | Feb. 15, 1957 | W | S | |
| 28 | G. C. Carothers | Continental Oil Co. | 1950 | 6,686 | -- | 1675 | -- | -- | -- | N | do. |
| 29 | G. W. Springer | Obie Wright | 1950 | -- | $6\frac{1}{4}$ | 1924 | 105.5 | Feb. 19, 1957 | W | S | "Gyppy" water perched at 90 feet in same well. |
| 30 | do. | Dick Shirley | -- | 112 | 6 | 1875 | 95.2 | Feb. 13, 1957 | W | S | Pumping rods pulled. 120 feet well and 30 feet lower elevation is old caved-in well reported depth 75 feet. |
| 31 | Carl Springer Estate | Continental Oil Co. | 1951 | 6,948 | -- | 1905 | -- | -- | -- | N | Oil Test. |

Table 6.-Records of wells in parts of Stonewall, Kent, Dickens, and King Counties--Continued

| Well No. | Owner | Driller | Date completed | Depth of well (ft.) | Diameter of well (in.) | Altitude of land surface (ft.) | Water level: Below land surface datum (ft.) | Water level: Date of measurement | Method of lift | Use of water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | G. W. Springer | Continental Oil Co. | 1949 | -- | 7 | 1889 | 55.2 | Feb. 13, 1957 | -- | N | Not developed for use as water well. |
| 33 | do. | Houston Ward | -- | -- | 6 | 1858 | 40.5 | do. | W | S | |
| 34 | do. | do. | 1930 | -- | 3½ | 1872 | 38.6 | do. | W | S | |
| 35 | do. | Dick Shirley | 1945 | 68 | 6 | 1874 | 57.2 | do. | W | S | |
| 36 | T. H. Ward | Continental Oil Co. | 1952 | 5,307 | -- | 1872 | -- | -- | -- | N | Oil Test. |
| 37 | Ben Roach | Ben Roach | 1952 | 30 | 48 | 1858 | 20.5 | Feb. 14, 1957 | W | S | Dug well. |
| 38 | do. | do. | 1936 | 100 | -- | 1876 | 70.2 | Jan. 10, 1957 | W | S | Gypsiferous dolomite at depth 90-100 feet; salty clay below 100 feet; not enough fresh water to make well. |
| 39 | Ned Ward | -- | 1923 | 175 | 5 | -- | -- | do. | W | S | |
| 40 | T. H. Ward | Ashland Oil and Refining Co. | 1955 | 6,948 | -- | 1914 | -- | -- | -- | N | Oil test. |
| 41 | M. S. Sandell | Texas Pacific Coal and Oil Co. | 1946 | 6,837 | -- | 1913 | -- | -- | -- | N | Oil test. |
| 42 | J. D. Patterson, Jr. | U. S. Smelting and Refining Co. | 1951 | 5,345 | -- | 2115(?) | -- | -- | -- | N | do. |
| 43 | do. | Shell Oil Co. | 1940 | 6,760 | -- | 1862 | -- | -- | -- | N | do. |
| 44 | M. L. Patterson | do. | 1941 | 6,827 | -- | 1839 | -- | -- | -- | N | do. |
| 45 | A. R. Daniels | DeSoto Oil Co. | 1952 | 6,812 | -- | 1871 | -- | -- | -- | N | do. |
| 46 | Doc Curleson | Norsworthy Oil Co. | 1950 | 7,510 | 9-5/8 | 2017 | -- | -- | -- | N | do. |
| 47 | Charles Dunlap | -- | 1917 | 120 | -- | 2138 | 105.2 | Mar. 26, 1957 | W | D,S | |
| 48 | W. P. Peak | -- | Old | -- | 5 | 2112 | 50.9 | do. | W | N | |
| 49 | Gewel Cooper | -- | Old | 150 | -- | 2177 | 133.6 | Apr. 3, 1957 | W | S | |

Table 6.-Records of wells in parts of Stonewall, Kent, Dickens, and King Counties--Continued

| Well No. | Owner | Driller | Date completed | Depth of well (ft.) | Diameter of well (in.) | Altitude of land surface (ft.) | Water level: Below land surface datum (ft.) | Water level: Date of measurement | Method of lift | Use of water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | Luther Bowen | Skelly Oil Co. | 1951 | 343 | 6 | 2167 | 127.2 | Apr. 3, 1957 | -- | N | Exploration hole. |
| 51 | Henry Stiles | -- | 1930 | 45 | -- | 2092 | 38.3 | do. | W | S | |
| 52 | do. | - Rogers | 1941 | 65 | -- | 2107 | 42.6 | do. | -- | D,S | |
| 53 | Ted Dardin | -- | -- | -- | 6 | 2107 | 43.1 | Mar. 26, 1957 | -- | N | |
| 54 | W. B. Francis | -- | -- | 80 | 8 | 2107 | 41.0 | do. | -- | N | |
| 55 | J. R. Carr | -- | 1947 | 82 | 8 | 2109 | 58.2 | Apr. 3, 1957 | W | S | Irrigates garden. |
| 56 | Girard Garage | -- | -- | 90 | -- | 2119 | 62.1 | Mar. 26, 1957 | W | S | |
| 57 | T. B. Page | T. B. Page | 1947 | -- | -- | 2107 | 58.8 | Apr. 3, 1957 | W | S | |
| 58 | Lum Davidson | -- | 1925 | 120 | -- | 2140 | 107.9 | Mar. 26, 1957 | W | S | |
| 59 | Red Cooper | -- | 1925 | 90 | -- | 2119 | 71.0 | do. | W | N | |
| 60 | Hamlin Standlind | -- | -- | 75 | 6 | 2143 | 53.8 | Apr. 3, 1957 | W | S | |
| 61 | J. G. Page | -- | Old | 175 | -- | 2132 | 98.6 | do. | W | S | |
| 62 | Occie Borrows | -- | 1951 | 120 | 6-5/8 | 2135 | 51.3 | Mar. 26, 1957 | W | S | |
| 63 | Hastings Estate | -- | -- | 220 | 6 | 2159 | 148.5 | Apr. 4, 1957 | W | S | |
| 64 | Lamore Page | -- | -- | 120 | 6 | -- | -- | -- | W | S | Obstruction at 111 feet. |
| 65 | C. C. York | -- | -- | 40 | 6 | -- | 27.4 | Apr. 11, 1957 | -- | N | Ten feet from this hole is another well with a windmill. |
| 66 | Charles Branch | Ryan, Hays and Burke | 1951 | 6,695 | -- | 1947 | -- | -- | -- | N | Oil test. |
| 67 | Mrs. B. F. Spradling | B. F. Spradling | 1909 | 53 | 48 | 2102 | 33.3 | Apr. 4, 1957 | W | S | Dug well. |
| 68 | C. C. York | -- | Old | 90 | -- | 2098 | 60.4 | do. | W | S | New well 25 feet west. |
| 69 | do. | -- | -- | -- | 36 | -- | 5.4 | do. | W | S | Dug well. |

Table 6.-Records of wells in parts of Stonewall, Kent, Dickens, and King Counties--Continued

| Well No. | Owner | Driller | Date completed | Depth of well (ft.) | Diameter of well (in.) | Altitude of land surface (ft.) | Water level: Below land surface datum (ft.) | Water level: Date of measurement | Method of lift | Use of water | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | E. W. Clark | -- | -- | 140 | 6 | 2105 | 86.7 | Apr. 2, 1957 | W | S | |
| 71 | C. C. York | -- | -- | 42 | 48 | 2059 | 28.0 | Apr. 11, 1957 | -- | N | Dug well. |
| 72 | W. L. Buckelew | -- | -- | 45 | 36 | 2053 | 30.2 | Apr. 2, 1957 | W | S | do. |
| 73 | E. M. Jones | Black and Jay | 1941 | 36 | 48 | 2044 | 30 | Apr. 4, 1957 | E | S | Dug 48-inch hole; curbed with 2"x4" wood, then put in 6" pipe and filled hole with gravel. |
| 74 | do. | do. | 1940 | 202 | -- | 2050 | -- | -- | E | S | Drilled to 256 feet encountered salt water at about 253 feet which rose 30-40 feet in hole; plugged back to 202 feet. |
| 75 | do. | Merle Jay | 1943 | 14 | 48 | -- | 8.2 | Mar. 25, 1957 | W | S | Dug well. |
| 76 | do. | - Webb | -- | 110 | -- | 1902 | 94.0 | do. | W | D | |
| 77 | Marvin Fuller | Floyd Fuller | 1947 | 170 | 5 | 2008 | 146.5 | Apr. 5, 1957 | W | S | |
| 78 | E. M. Jones | Shorty Leach | -- | 250 | 7 | 2053 | 236.5 | Mar. 25, 1957 | G | S | |
| 79 | do. | do. | 1950 | 290 | 7 | 2088 | 272.0 | do. | W | S | |
| 80 | E. E. York | -- | -- | -- | 6-5/8 | -- | -- | -- | W | D,S | |
| 81 | W. D. Hall | Floyd Wilhoit | 1942 | -- | 5 | 2009 | 162.0 | Apr. 5, 1957 | W | D,S | Can be used for drinking; well pumped 3 days prior to water level measurement. |
| 82 | E. E. York | -- | -- | -- | 6-5/8 | 2037 | 171.9 | do. | W | S | |
| 83 | do. | -- | -- | 265 | 6-5/8 | 2088 | 228.3 | do. | W | S | |
| 84 | C. D. McCurry | -- | -- | 120 | 6-5/8 | 1988 | 48.7 | Apr. 4, 1957 | W | S | |
| 85 | O. C. Lowrance | - Webb | -- | 180 | 5-5/8 | 2013 | 135.1 | do. | W | S | |
| 86 | Walton Davis | -- | 1930 | -- | -- | 2013 | 120.4 | Mar. 24, 1957 | W | D | |