GROUND WATER IN THE GREENVILLE AREA, HUNT COUNTY, TEXAS

By

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Prepared in cooperation between the Geological Survey, U. S. Department of the Interior, and the Texas State Board of Water Engineers

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Introduction

A brief investigation of the ground-water resources in the Greenville area was made by the writer in April 1945 in response to a request to the Texas State Board of Water Engineers from Mr. Garrett S. Lee, Mayor of the city of Greenville, and Mr. R. B. Bush, City Engineer. The purpose of the investigation was to determine the possibility of developing a supply of ground water near the city for industrial purposes. The municipal water supply for Greenville is obtained from the Cowleech Fork of the Sabine River and is impounded in four reservoirs having a combined capacity of about 830,000,000 gallons. The present supply is of satisfactory quality for public use, and the reservoir capacity is sufficient to take care of a fairly large increase in water requirements. However, the city wishes to evaluate the ground-water resources in the vicinity with a view that it may become desirable to make use of that source of supply for post-war industrial expansion.

This report is based on data obtained in the field, on information furnished by oil companies, and on a report by W. L. Broadhurst [a] concerning the ground-water supply at Commerce about 12 miles northeast of Greenville. The geology shown on the accompanying map is based in part on data obtained from oil companies and in part on the geologic map of Texas compiled by the Federal Geological Survey.

[a] *Broadhurst, W. L., Development of ground water for public supply at Commerce, Hunt County, Texas. State Board of Water Engineers, March 1944.*

During the field work records were obtained of 35 privately-owned water wells and 10 oil tests, all of which are shown on the map. Samples of water were collected from 10 wells and analyzed in the laboratory of the Geological Survey at Austin.

Geologic formations and their water-bearing properties

Most of Hunt County is typical black prairie country, having a deep regolith of black calcareous soil derived from the underlying marls and chalks. The gently rolling prairie is crossed from northwest to southeast by several streams that have cut broad shallow valleys in the original plain. The major streams in the county are the Cowleech and South Forks of Sabine River, South Sulphur River, and Caddo Creek (see map).

The geologic formations exposed in the county are the Taylor marl and the Navarro group of Lower Cretaceous age, and the Midway group of Paleocene age. The water-bearing sands encountered in oil tests in the Greenville area, in the order of their occurrence downward, are the Nacatoch sand of the Navarro group, the Wolfe City sand of the Taylor group, the Blossom sand of Austin age, and the Woodbine sand. The Woodbine sand crops out in areas to the north and northwest of the county. Only the Nacatoch sand yields water sufficiently low in dissolved solids for domestic or industrial supply. As far as is known there are no wells in Hunt County that draw from the Wolfe City sand or the Blossom sand. The Woodbine sand yields water of good quality at Celeste, which is about 12 miles updip from Greenville, however, the water becomes highly mineralized a short distance south of Celeste and undoubtedly is salty in the vicinity of Greenville.

The Nacatoch sand is a member of the Navarro group, which in ascending order, consists of the Neylandville marl, the Nacatoch sand, Corsicana marl, and the Kemp clay. The outcrop of the Nacatoch sand has not been fully mapped in Hunt County, however, it is known to occur as a belt that extends from a point a few miles north of Commerce southwestward through Cash to a point near the southwest corner of the county. The outcrop is reported as a narrow belt on the east side of the major fault from South Sulphur River to the Sabine River. The Nacatoch consists of a series of sands, sandstone, shale, sandy shale, and boulders. Generally there is only one water-bearing horizon in the formation, and it occurs near the top below a very thin glauconitic fossil bed, which is locally called the 'cap rock'. This water-bearing bed consists of 30 to 40 feet of sand interbedded with some shale and sandy shale. In some areas the shale phase predominates. In some oil tests and in a few water wells a basal sand bed has been noted in the Nacatoch, however the available data indicates that it is not persistent over a large area, and little is known of its water-bearing properties.

All the wells shown on the map draw from the Nacatoch sand. Data obtained from water wells and oil test show that the dip of the formation is very erratic, and that locally it is somewhat distorted by faulting. In general the sand dips to the southeast from the normal outcrop at a rate of 50 to 150 feet to the mile; the outcrop is brought to the surface in the Campbell area by the major fault, and the direction and rate of the dip in this area is more or less comparable to that west of the fault.

The principal structural feature in the county is the zone of faulting east and southeast of Greenville. These faults are a part of the Mexia fault zone, which is traceable from Titus County westward and southwestward to Medina County

in the south-central part of the state. Most of the faulting is by normal faults, and the downthrow is generally to the west or northwest, however, some faults are present with downthrow to the east or southeast, thus producing small grabens. The faults shown on the map are not necessarily single faults but are a series of more or less parallel faults. The major fault in the area enters the county just south of Commerce and trends in a southwesterly direction to a point about 2 miles south of Dixon. The vertical displacement along this fault, based on the Woodbine sand and determined from electrical logs of oil tests, is about 600 feet; the maximum displacement at the surface is estimated to be about 400 feet. The displacement along most of the minor faults is generally less than 25 feet.

Well data

The wells shown on the map - with the exception of the municipal wells at Commerce and Lone Oak, and the well at the Boles Orphan Home south of Cash - are domestic or farm wells of small diameter and with small yields.

The only wells that yield more than 100 gallons a minute are the three municipal wells at Commerce which produce from about 220 to about 360 gallons a minute. In 1943, according to Broadhurst, the water levels in these wells during shut-down were 225 to 245 feet below the land surface; and the pumping levels were as much as 380 feet below the surface, the pumping level in well 2 and possibly in well 3 being below the top of the sand when both wells were operated simultaneously. The static water level in well 1 when it was drilled in 1914 was 125 feet below the surface; in 1918 it was 180 feet; and in November 1943 it was 226 feet. This record shows that the water level declined about 100 feet from 1914 to 1943 and that more than half of the decline occurred during the first four years. The specific capacity (gallons per minute per foot of drawdown) of the three wells is about 3.

The average daily pumpage in 1943 from the municipal wells at Commerce was about 350,000 gallons. This represented a considerable increase over the pumpage in former years.

Chemical character of the ground water

The chemical character of the ground water in the Greenville area varies over a very wide range. Partial analyses of water from 20 wells (see map) show that in 12 of the wells either the chloride or the sulfate in the water or both is more than 250 parts per million. Of the 8 wells showing less than 250 parts per million of chloride and sulfate, 5 are in or near Commerce and 3 are 4 to 9 miles east of Greenville. Even in the Commerce area the quality of the water varies considerably; the water from two wells about a mile west of that city and near the outcrop of the Nacatoch sand shows sulfate of 354 and 645 parts per million and chloride of only 62 and 65 parts per million.

In an effort to obtain a satisfactory water supply for the Greenville airport, about 7 miles southeast of the city, three test holes were drilled in 1942. A sample of water was obtained from the lower Nacatoch sand, and the analysis shows 397 parts per million of chloride and 591 parts per million of sulfate. The upper sand, which is at or near the surface in this section, was not sampled. Because of the high mineralization of the water the plan to obtain a supply for the airport from wells was abandoned.

The wide range in the chemical character of the water from the Nacatoch sand in the Greenville area appears to be associated with the faulting and the lenticularity of the sands. Of the five wells sampled east of the major fault only one well yields water of good quality, however, there is a possibility that east of

the fault and 8 to 12 miles east of Greenville good water occurs in areas of limited extent.

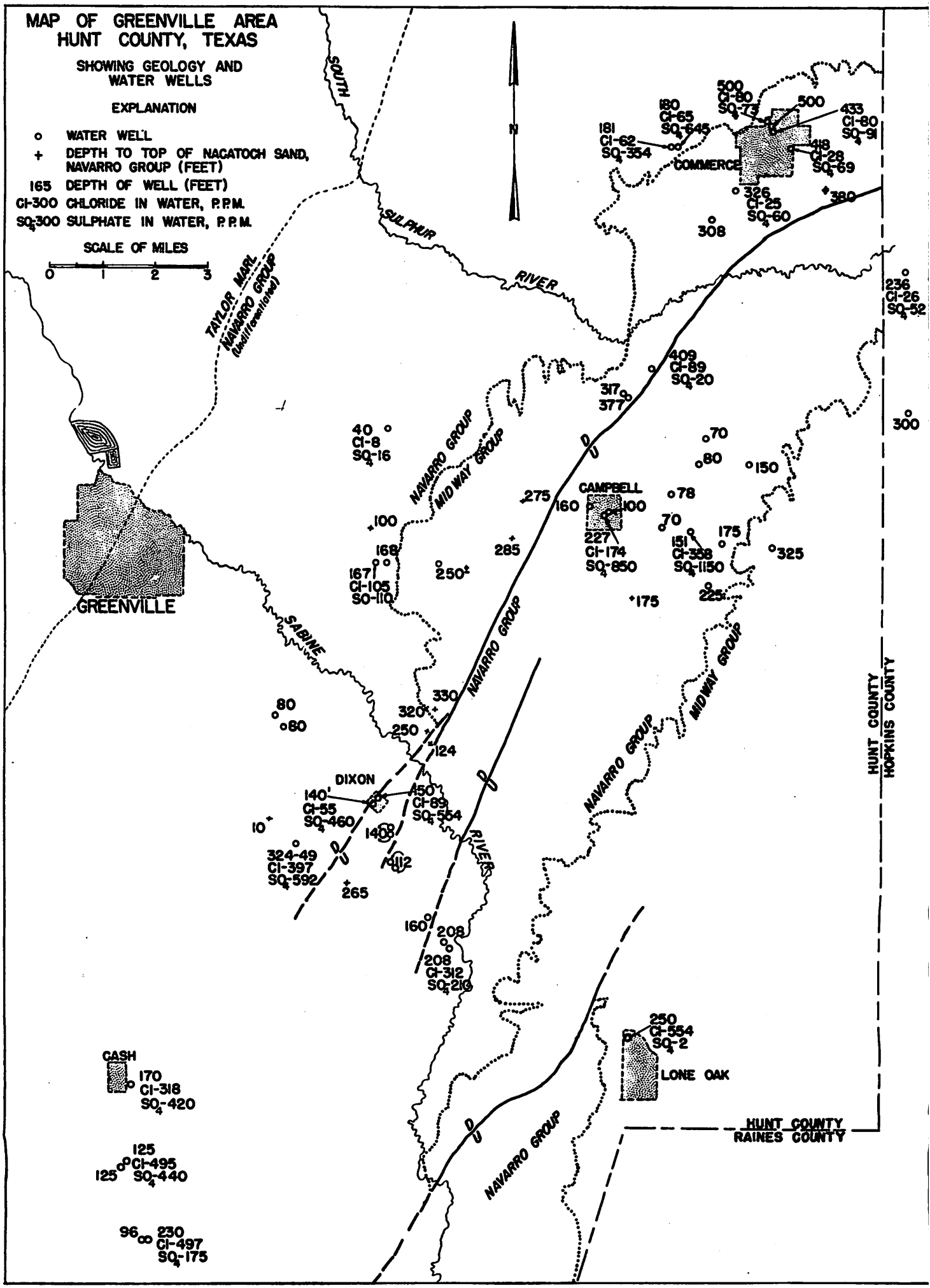
The most promising area near Greenville in which water of good quality can be obtained roughly coincides with the outcrop of the Midway group west of the major fault and extends from the Sabine River about 6 miles southeast of Greenville northeastward to the South Sulphur River.

Conclusions

The supply of ground water of good quality in the Greenville area is small. The Nacatoch sand is the only water-bearing formation that yields water of acceptable quality, and in a large part of the area water from this sand is too high in sulfate and chloride for most purposes.

Ground water conditions are most favorable at and near Commerce, which obtains its public supply from the Nacatoch sand and is the largest user of ground water in the area, the average daily pumpage from the three municipal wells being about 350,000 gallons a day in 1943. However, the water level in city well 1 at Commerce has declined about 100 feet since 1914, and the pumping levels in the wells are as much as 380 feet below the surface. These data indicate that a large additional development of ground water for industrial use should not be contemplated in the vicinity of Commerce.

The most favorable unexplored section in the area in which water of good quality can be obtained roughly coincides with the outcrop of the Midway group west of the major fault and extends from the South Sulphur River to the Sabine River 5 to 10 miles from Greenville. However, even in that belt, in view of the experience at Commerce, no very large supply is to be expected. It is doubtful, therefore, whether the expenditure of funds by the City of Greenville for an extensive test drilling program would be warranted.


MAP OF GREENVILLE AREA
HUNT COUNTY, TEXAS
SHOWING GEOLOGY AND
WATER WELLS
EXPLANATION
WATER WELL
DEPTH TO TOP OF NACATOCH SAND, NAVARRO GROUP (FEET)
165 DEPTH OF WELL (FEET)
Cl-300 CHLORIDE IN WATER, P.P.M.
SO4-300 SULPHATE IN WATER, P.P.M.
SCALE OF MILES
0 1 2 3
N
SOUTH SULPHUR RIVER
TAYLOR MARL (NAVARRO GROUP undifferentiated)
NAVARRO GROUP
MIDWAY GROUP
GREENVILLE
SABINE RIVER
COMMERCE
CAMPBELL
DIXON
CASH
LONE OAK
HUNT COUNTY
HOPKINS COUNTY
HUNT COUNTY
RAINES COUNTY
500 Cl-80 SO4-75
180 Cl-65 SO4-645
181 Cl-62 SO4-354
433 Cl-80 SO4-91
418 Cl-28 SO4-69
326 Cl-25 SO4-60
380
308
236 Cl-26 SO4-52
300
409 Cl-89 SO4-20
317
377
40 Cl-8 SO4-16
70
80
150
275
160
78
100
227 Cl-174 SO4-850
151 Cl-358 SO4-1150
175
325
225
168
167 Cl-105 SO-110
250±
285
175
330
320±
250±
124
80
80
140' Cl-55 SO4-460
450' Cl-89 SO4-554
10±
140±
112
324-49 Cl-397 SO4-592
265
160
208
208 Cl-312 SO4-219
250 Cl-554 SO4-2
170 Cl-318 SO4-420
125
125 Cl-495 SO4-440
96
230 Cl-497 SO4-175