STATE OF SOUTH DAKOTA
Frank Farrar, Governor

SOUTH DAKOTA GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

Special Report 48

GROUND-WATER INVESTIGATION FOR THE CITY OF COLOMEL, SOUTH DAKOTA
by
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Science Center
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Vermillion, South Dakota
1969
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INTRODUCTION

Present Investigation

This report contains the results of a special investigation by the South Dakota Geological Survey from June 12 to July 18, 1968, in and around the city of Colome, Tripp County, South Dakota (fig. 1).

Colome now obtains its water from 6 wells, about 40 feet deep, located two miles west of the city (fig. 2). The combined production of the wells is 17 gallons per minute. The low production rate is due to the high clay content and resulting low permeability of the sediments yielding water to the wells.

A survey of the ground-water possibilities was conducted in the Colome area. Included in this survey were: (1) review of the geology as mapped by the South Dakota Geological Survey (Collins, 1957a, b; and Stevenson, 1959), (2) mapping the geology of approximately 8 square miles in the northeast part of the study area, (3) drilling 143 auger test holes, (4) collecting 17 water samples for analysis, (5) surveying the elevation of the test holes in the recommended area.

As a result of this survey, a new area for ground-water development was found one and one-half miles southwest of the present well field (fig. 2). A site in the SW1/4SW1/4 of section 1, T. 97 N., R. 76 W. (fig. 2) was recommended for a pump test. Although the survey indicated that maximum yield would be obtained from an area to the south of the recommended site, the distance from the city and the total water requirements for the city were the main factors for the recommendation of the pump test site.

In September, 1968, a pump test was run on a new well in the recommended area. This test was conducted by J. T. Banner and Associates, Inc., with the assistance of the South Dakota Geological Survey. The data from the pump test is on file at the South Dakota Geological Survey. The results of the pump test indicated that the aquifer would sustain one or more wells with a minimum spacing of 350 feet and a maximum of 50 gallons per minute production. With any additional well yields exceeding 50 gallons per minute, spacing between wells would have to be more than 350 feet.

The cooperation of the residents of Colome, especially the city officials, Mayor K. E. Johnson, the City Councilmen, and Ben Reed, City Marshal, was greatly appreciated. The assistance of J. T. Banner and Associates, Inc. and the South Dakota Chemical Laboratory is acknowledged.

Location and Extent of Area

The Colome area as used in this report includes a region that measures six miles north-south and eight miles east-west. The area is located in south-central South Dakota in Tripp County in the Pierre Hills and Tertiary Table Lands sections of the Great Plains physiographic province (fig. 1).

GENERAL GEOLOGY

Surficial Deposits

The surficial deposits of the Colome area include alluvium, dune sand and loess. Alluvium in this area consists of silt and sand occurring as a thin layer along the Ponca Creek and its tributaries (fig. 3). The dune sand and loess do not cover large areas so these deposits are not shown on figure 3.

Exposed Bedrock

The Cretaceous Pierre Shale underlies the entire area and is exposed at lower altitudes in the northeast part of the study area (fig. 3). Overlying the Pierre Shale and exposed throughout the rest of the area are Tertiary deposits of the Ogallala Group (fig. 3). The
Figure 1. Map showing the major physiographic divisions of western South Dakota and location of the Colome area.
Figure 2. Map showing location of the recommended area for additional water supplies at Colome.
Ogallala Group is represented in the Colome area by the Ash Hollow Formation (upper unit) and the Valentine Formation (lower unit).

The Ash Hollow Formation consists of medium-gray to light olive-green calcareous sand and sandstone. It is a fine-grained arkosic sand and sandstone with siltstone layers (Collins, 1957a and b). The buttes and uplands southwest of Colome are capped with the Ash Hollow Formation.

The Valentine Formation is mostly greenish-tan to tan, fine to medium-grained sand. The size and color of the sand may vary locally. Included in the Valentine Formation is the Bijou facies which is a locally cemented sand. The sand is well cemented by siliceous or opaline material and forms a硬 dense green arkosic sandstone (Collins, 1957a and b).

The maximum thickness of Ogallala Group in the study area is 94 feet (test hole 142, App. A).

A varicolored clay layer is locally present underlying the sediments of the Ogallala Group and overlying the Pierre Shale. At some locations the clay contains sand and pebbles. The presence of this clay deposit has been determined from test hole data. This clay probably crops out along the contact of the Pierre Shale and the Valentine Formation (fig. 3); however, the probable thinness of the clay unit, the low slopes and resulting lack of exposures at the contact has obscured any possible surface exposures of this unit in this area. On the Winner geologic quadrangle (Collins, 1957a) the Brule Formation occupies a similar stratigraphic position as the varicolored clay near Colome. More information is required to determine whether the varicolored clay near Colome is part of the Brule Formation.

The Pierre Shale is a dark, platy marine clay-shale, upper layers are gray to olive-brown, and the lower layers are black to dark gray. The total thickness of the Pierre Shale may be as much as 900 feet in the Colome area.

**Subsurface Bedrock**

The subsurface information is based on data extrapolated to the Colome area from oil well tests in Tripp and Gregory Counties. The following formations are described in descending order from younger to older.

**Cretaceous Sediments**

The Niobrara Formation consists mostly of white speckled calcareous shale or marl and is approximately 160 feet thick.

The Carlile Shale is light- to medium-gray, plastic shale and is about 230 feet thick.

The Greenhorn Limestone is a light-colored fragmental limestone and a medium-gray, highly calcareous shale and is about 50 feet thick.

The Belle Fourche Shale is about 130 feet thick and consists of medium-gray shale.

The Dakota Formation is comprised of alternating shale and sandstone and is nearly 420 feet in the Colome area. The lower part of the formation contains very little shale.

The Skull Creek Shale is a medium-gray shale approximately 40 feet thick.

The Inyan Kara Group consists of alternating beds of shale and sandstone and is at least 300 feet thick in the Colome area.

**Paleozoic Sediments**

The Pennsylvanian system is represented by the Roundtop Formation, which in this area is about 75 feet of varicolored shale, and the Fairbank Formation which is approximately 140 feet of sandstone.

The Mississippian system is represented by about 25 feet of carbonates of the Logepole Formation.

The Devonian-Silurian systems consist of a 40-foot sand section.

The Ordovician system is represented by 60 feet of sandy and porous Red River carbonates.
The Cambrian and Ordovician sands are approximately 60 feet thick and overlie the Precambrian granite.

GROUND WATER

Concepts

Ground water is defined as that water contained in the voids or openings within rocks or sediments below the water table. The water table is the upper surface of the zone of saturation. Practically all open spaces in the rocks that lie beneath the water table are filled with water. Rocks (including the soil) that lie above the water table are in the zone of aeration. Some of the interstices in this zone are also filled with water, but the water is either held in them by molecular attraction or is moving downward toward the zone of saturation. Water within the ground moves downward through the unsaturated zone under the action of gravity, whereas in the saturated zone, it moves in a direction determined by the surrounding hydraulic head.

Contrary to popular belief, ground water does not occur in “veins” that crisscross the land at random. Instead it can be shown that water is found nearly everywhere beneath the surface, but at varying depths. Nearly all ground water is derived from precipitation in the form of rain, melting snow, or ice. This water either evaporates, percolates directly downward to the water table and becomes ground water, or drains off as surface water. Surface water either evaporates, escapes to the ocean by streams, or percolates downward into the rocks.

Recharge is the addition of water to an aquifer (a formation having structures that permit appreciable water to move through it under ordinary field conditions), and is accomplished in four main ways: (1) downward percolation of precipitation from the ground surface, (2) by downward percolation from surface bodies of water, (3) by lateral underflow of water in transient storage, and (4) by artificial recharge, which takes place from excess irrigation, seepage from canals, and water purposely applied to augment ground-water supplies.

Discharge of ground water from an aquifer is accomplished in four main ways: (1) by evaporation and transpiration of plants, (2) by seepage upward or laterally into surface bodies of water, (3) by lateral movement of water in transient storage, and (4) by pumping from wells, which constitutes the major artificial discharge of ground water.

The porosity of a rock or soil is a measure of the contained open pore spaces, and it is expressed as the percentage of void space to the total volume of the rock. The porosity of a sedimentary deposit depends chiefly on (1) the shape and arrangement of its particles, (2) the degree of assortment of its particles, (3) the cementation and compaction to which it has been subjected since its deposition, (4) removal of mineral matter through solution by percolating water, and (5) the fracturing of the rock, resulting in joints and other openings. Thus the size of the material has no or little effect on porosity if all other factors are equal.

The permeability of a rock is its capacity for transmitting a fluid. Water will pass through a material with interconnected pores, but will not pass through material with unconnected pores, even if the latter material has a higher porosity. Therefore, permeability and porosity are not synonymous.

Ground Water in Surficial Deposits

Alluvium in the Colone area is thin and has a restricted areal extent. A few farm wells penetrate the alluvium and are completed in the Pierre Shale. Although the bottom of the wells are in Pierre Shale, most of the water probably comes from the alluvium. These wells usually provide enough water for domestic purposes but this deposit should not be considered a potential city water supply because of its limited yield.
Ground Water in Exposed Bedrock

In the study area the Ash Hollow Formation is fine-grained and is usually above the water table. Thus, in this report, the Ash Hollow is not considered to be a water-bearing unit.

The Valentine Formation comprises the main aquifer in the Colome area. The extent of the formation can be seen on figure 3. Although the formation is extensive, the saturated sand unit which comprises the aquifer varies locally in thickness (fig. 4). The area recommended for development is shown on figure 2. Within this area the saturated sand is fine to medium grained and generally well sorted although locally it may contain considerable silt and clay.

The saturated thickness of sand in the recommended area varies from about 30 to 60 feet. The maximum saturated thickness of sand encountered in the study area is about one and one-half miles south of the recommended area where 76 feet of saturated sand was penetrated (test hole 142, fig. 5 and App. A, see also fig. 4). Additional information would be required to properly evaluate this area. The somewhat linear pattern and rapid thinning and thickening of the sand unit in the study area is suggestive of a channel deposit.

The varicolored clay underlying the Ogallala Group is relatively thin and has low permeability. Locally this clay might supply enough water for domestic purposes but it would not provide enough water for a municipal water supply.

The Pierre Shale underlies the entire area either at surface or in the subsurface. Several wells in the area were completed in the Pierre Shale, including some of the city wells, but because of the low permeability of the shale it does not yield large quantities of water. Water quality data presented in the next section of this report indicate that even these wells bottomed in Pierre Shale derive most or all of their water from the overlying sediments of the varicolored clay and the Ogallala Group.

Ground Water in Subsurface Bedrock

The sandstones of the Dakota Formation and the Inyan Kara Group are the only Cretaceous sediments in the study area that could supply an adequate quantity of water for a municipal water supply. The top of the Dakota Formation is at a depth of about 1400 feet at Colome. The basal 130 feet of the Dakota Formation would probably supply the greatest amount of water. The top of the Inyan Kara Group is at a depth of approximately 1900 feet at Colome.

The top of the Paleozoic rocks is at a depth of about 2100 feet. All the Paleozoic Formations except the upper Roundtop Formation are potential aquifers in the Colome area.

Quality of Ground Water

Ground water always contains dissolved chemical substances in various amounts. Contained chemicals are derived (1) from the atmosphere as water vapor condenses and falls, (2) from soil and underlying deposits as the water moves downward to the water table, and (3) from deposits below the water table where the water is circulating. In general, the more chemical substances that a water contains, the poorer its quality.

Table 1 is a comparison of the quality of water from the Ogallala Group with the Public Health Standards for drinking water. Except for low fluoride all the samples are within the Public Health standards. Table 2 shows the results of water analyses from various sources. Generally these samples are higher in chemical content than water from the Valentine Formation.

Several wells in the Colome area are completed in the Pierre Shale although most of the water probably is derived from the overlying sediments. Supportive evidence for this conclusion is furnished by looking at the water analyses in Table 2. Water samples W2, W12, and W16 are from wells completed only in the Pierre Shale. The water from these wells contains considerably more total solids than the other wells listed. The other wells in Table 2
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<th>Iron</th>
<th>Manganese</th>
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<th>Hardness (as CaCO₃)</th>
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<td>2.0</td>
<td>0.16</td>
<td>7.8</td>
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<td>0.23</td>
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<td>7.8</td>
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<td>281</td>
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<td>18</td>
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<td>15.4</td>
<td>0.02</td>
<td>7.6</td>
<td>225</td>
<td>382</td>
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</table>

1/ Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, March 20, 1968).
2/ 1.2 is optimum for South Dakota.

Location of water samples from the Ogallala Group
(for map location, see figure 5)


W3. NWIS/SD/81SW6/5SW6 sec. 2, T. 97 N., R. 76 W., F. Sand, 30 feet deep, water table 10 feet.
W4. NEIS/NEIS/81SW6/5SW6 sec. 1, T. 97 N., R. 76 W., J. Jorgensen, 30 feet deep, water table 12 feet.
W5. SEIS/NEIS/81SW6/5SW6 sec. 1, T. 97 N., R. 76 W., 15 feet deep, New City Well.
W6. NEIS/NEIS/5SW6/5SW6 sec. 1, T. 97 N., R. 76 W., D. Hageman, 35 feet deep?
W8. SEIS/SEIS/NEIS/NEIS sec. 10, T. 97 N., R. 76 V., P. Sand, 30 feet deep, water table 15 feet.
W9. NWIS/SD/81SW6/5SW6 sec. 11, T. 97 N., R. 75 W., P. Siefson, 30 feet deep.
W11. NEIS/SEIS/5SW6/5SW6 sec. 11, T. 97 N., R. 76 W., M. Petetz, 30 feet deep.
W15. SEIS/SEIS/5SW6 sec. 10, T. 97 N., R. 75 W., Mrs. C. Schulte, 40 feet deep.
<table>
<thead>
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<th>Sample</th>
<th>Source</th>
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<th>Sodium</th>
<th>Magnesium</th>
<th>Chloride</th>
<th>Sulphate</th>
<th>Iron</th>
<th>Magnesium (as mg)</th>
<th>Nitrate (as mg)</th>
<th>Fluoride</th>
<th>pH</th>
<th>Hardness (CaCO₃)</th>
<th>Total Solids</th>
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<td>A</td>
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<td></td>
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<td></td>
<td></td>
<td>0.005</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
<td>1300</td>
</tr>
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<td>W1</td>
<td>O &amp; C</td>
<td>25</td>
<td>7</td>
<td>50</td>
<td>500</td>
<td>0.3</td>
<td>10.0</td>
<td></td>
<td></td>
<td>0.6</td>
<td>7.6</td>
<td>327</td>
<td>462</td>
</tr>
<tr>
<td>W2</td>
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<td>7</td>
<td>50</td>
<td>575</td>
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<td>0</td>
<td>14.2</td>
<td>0.38</td>
<td>7.4</td>
<td>1150</td>
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<td>W7</td>
<td>C &amp; P</td>
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<td>44.5</td>
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<tr>
<td>W17</td>
<td>A &amp; P</td>
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<td>7.2</td>
<td>285</td>
<td>470</td>
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</table>

1/ A, Alluvium; G, Ogallala Group; C, Varicolored clay between Ogallala Group and Pierre Shale.
2/ Modified for South Dakota by the Department of Health (written communication, Water Supply Section, March 20, 1966).
3/ 1.2 is optimum for South Dakota.

Location of water samples from different formations
(for map location, see figure 3)

W1. SW35NW1/4SE1/4 sec. 31, T. 98 N., R. 75 W., present city well field.
W2. NE5/8SW1/8SE1/8 sec. 34, T. 98 N., R. 75 W., D. Evans, 50 feet deep.
W7. NW35NW1/4SW1/8 sec. 3, T. 97 N., R. 75 W., K. Johnson, 28 feet deep.
W12. SW15/16SW15/16 sec. 10, T. 97 N., R. 75 W., H. Stocker, 65 feet deep.
W16. NE15/16NE1/4Sec. 23, T. 97 N., R. 75 W., M. Feist, 20 feet deep, water table 8 feet
(next to house).
W17. SWSW15/16NE1/4 sec. 23, T. 97 N., R. 75 W., M. Feister, 27 feet deep (in the farm).

Sample W1, except for pH, was analyzed by the South Dakota Chiltem Laboratory. The rest of the samples were analyzed by the Water Quality Laboratory of the South Dakota Geological Survey.
are completed in the Pierre Shale which is overlain with sediments of the Ogallala Group, the varicolored clay or alluvium. In all instances the water from these wells is of better quality than the water which is derived wholly from the Pierre Shale.

No quality of water is listed for subsurface bedrock formations at Colome; however, data from surrounding areas indicate the water is highly mineralized and would probably require treatment for use as a municipal supply.

CONCLUSIONS AND RECOMMENDATIONS

After the field study it was concluded that the city of Colome could test for future water supplies in the Valentine Formation in the recommended area outlined in figure 2. After considering the aquifer characteristics (saturated thickness, clay content, and grain size), distance from the city, the total water requirement, land availability, and easement rights, a pump test was conducted in SW¼SW¼ section 1, T. 97 N., R. 76 W. The pump test was run at a rate of 50 gallons per minute with one well. This pumping rate is almost three times the rate of the whole present well field production. The results of the pump test indicate that the new well field will provide enough water for the city at the present time. The results of the pump test also indicated that the spacing of the wells should be a minimum of 350 feet with wells yielding 50 gallons per minute. If additional wells are installed in the area and exceed 50 gpm production, new spacing criteria should be computed.

The city officials should consult with the South Dakota Water Resources Commission with regard to obtaining a water right and a permit to drill new city well(s), and the South Dakota Department of Health with regard to the biological and chemical suitability of the water.
REFERENCES CITED


———, 1957b, Geology of Wewela quadrangle, South Dakota: S. Dak. Geol. Survey, map and text.


# APPENDIX A
Logs of test holes and wells in the Colome area
(for location see figure 5)

Test Hole No. 1 (drilled in 1965)
Location: NW\%NW\%NW\% sec. 27, T. 98 N., R. 76 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>Topsoil, brown, sandy</td>
</tr>
<tr>
<td>3-4</td>
<td>Sand, medium, clayey</td>
</tr>
<tr>
<td>4-14</td>
<td>Clay, tan</td>
</tr>
</tbody>
</table>

Test Hole No. 2 (drilled in 1965)
Location: NW\%NW\%NW\% sec. 26, T. 98 N., R. 76 W.
Depth to water: 6 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil, sandy</td>
</tr>
<tr>
<td>2-9</td>
<td>Sand, brown, clayey</td>
</tr>
<tr>
<td>9-19</td>
<td>Clay, some sand</td>
</tr>
</tbody>
</table>

Test Hole No. 3
Location: NE\%SE\%NE\%SE\% sec. 29, T. 98 N., R. 75 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12</td>
<td>Clay, light-brown, sandy</td>
</tr>
<tr>
<td>13-27</td>
<td>Clay, dark-brown</td>
</tr>
<tr>
<td>27-34</td>
<td>Clay, yellowish-brown, some pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 4
Location: NW\%NW\%NW\%NW\% sec. 28, T. 98 N., R. 75 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-5</td>
<td>Clay, dark-brown, sandy</td>
</tr>
<tr>
<td>5-24</td>
<td>Shale, yellowish-gray</td>
</tr>
</tbody>
</table>

Test Hole No. 5
Location: NE\%NE\%NE\%NE\% sec. 28, T. 98 N., R. 75 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Topsoil, sandy clay</td>
</tr>
<tr>
<td>4-19</td>
<td>Shale, yellowish-brown</td>
</tr>
</tbody>
</table>
Test Hole No. 6
Location: S\(\frac{1}{4}\)SE\(\frac{1}{4}\)SE\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 27, T. 98 N., R. 75 W.
Depth to water: not measured

0- 6  Roadbed
7- 28  Clay, brown, medium
28- 68  Clay, brown, very tight
68- 74  Clay, dark gray (shale)

Test Hole No. 7
Location: S\(\frac{1}{4}\)SE\(\frac{1}{4}\)SE\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 27, T. 98 N., R. 75 W.
Depth to water: dry

0- 6  Roadbed
6- 9  Clay, gray
9- 26  Clay, sandy
26- 36  Clay, brownish-gray, sandy
36- 49  Clay, yellowish-brown (weathered shale?)

Test Hole No. 8
Location: NW\(\frac{1}{4}\)NW\(\frac{1}{4}\)NW\(\frac{1}{4}\)NW\(\frac{1}{4}\) sec. 26, T. 98 N., R. 75 W.
Depth to water: dry

0- 4  Topsoil
4- 10  Clay, dark-brown
10- 24  Shale, yellowish-brown, grading to dark gray

Test Hole No. 9 (drilled in 1965)
Location: S\(\frac{1}{4}\)NE\(\frac{1}{4}\)NE\(\frac{1}{4}\) sec. 33, T. 98 N., R. 76 W.
Depth to water: 16 feet

0- 2  Topsoil, black
2- 5  Sand, brown, medium
5- 10  Sand, dark-brown, clayey
10- 20  Sand, tan, clayey
20- 34  Sand, medium
34- 39  Clay

Test Hole No. 10
Location: SW\(\frac{1}{4}\)SW\(\frac{1}{4}\)SW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 34, T. 98 N., R. 76 W.
Depth to water: 18 feet

0- 18  Sand, light-brown, fine to medium
18- 28  Sand, dark-brown, fine to medium
28- 38  Sand and clay, brown
38- 59  Clay, greenish-tan, grading to reddish-brown
Test Hole No. 11
Location: SE\%SE\%SW\%SW\% sec. 35, T. 98 N., R. 76 W.
Surface elevation: 2253 feet
Depth to water: 7 feet

0- 8  Roadbed
8- 16  Sand, gray, medium
16- 24  Clay, greenish-tan, sandy
24- 59  Clay, brown

Test Hole No. 12
Location: SE\%SE\%SW\%SW\% sec. 35, T. 98 N., R. 76 W.
Depth to water: 6 feet

0- 5  Roadbed
5- 16  Sand, light-brown, fine to medium
16- 27  Clay, tan
27- 34  Shale, gray

Test Hole No. 13
Location: NW\%NW\%SE\%SE\% sec. 35, T. 98 N., R. 76 W.
Depth to water: 4 feet

0- 4  Topsoil
4- 11  Sand, light-gray, medium
11- 34  Clay, yellowish-brown

Test Hole No. 14
Location: SW\%SW\%SW\%NW\% sec. 36, T. 98 N., R. 76 W.
Depth to water: dry

0- 36  Clay, yellowish-brown
36- 44  Shale, black

Test Hole No. 15
Location: NW\%NW\%SE\%NW\% sec. 36, T. 98 N., R. 76 W.
Depth to water: dry

0- 7  Clay, brown, contains some pebbles
7- 19  Clay, brown, no pebbles
19- 22  Clay, brownish-yellow
22- 29  Shale, black

Test Hole No. 16
Location: NE\%NE\%SW\%SE\% sec. 36, T. 98 N., R. 76 W.
Depth to water: dry
Test Hole No. 16 – continued.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-6</td>
<td>Clay, brown, sandy</td>
</tr>
<tr>
<td>6-9</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>9-35</td>
<td>Clay, yellowish-brown</td>
</tr>
<tr>
<td>36-44</td>
<td>Shale, black</td>
</tr>
</tbody>
</table>

Test Hole No. 17

Location: SW\%SW%NW%\%SW% sec. 31, T. 98 N., R. 75 W.
Depth to water: 20 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Sand, brown, fine to medium</td>
</tr>
<tr>
<td>4-9</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>9-19</td>
<td>Clay, sandy</td>
</tr>
<tr>
<td>19-24</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>24-39</td>
<td>Clay, brown to grayish-brown</td>
</tr>
</tbody>
</table>

Test Hole No. 18

Location: SW\%SW%SW%SW% sec. 31, T. 98 N., R. 75 W.
Surface elevation: 2316 feet
Depth to water: 8 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8</td>
<td>Sand, brown, medium</td>
</tr>
<tr>
<td>6-11</td>
<td>Sand, light-grey, medium</td>
</tr>
<tr>
<td>11-17</td>
<td>Sand, some clay</td>
</tr>
<tr>
<td>17-29</td>
<td>Clay, light-brown</td>
</tr>
</tbody>
</table>

Test Hole No. 19

Location: NE\%NE%SW%SW% sec. 31, T. 98 N., R. 75 W.
Depth to water: 19 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td>Sand, dark-brown, medium</td>
</tr>
<tr>
<td>7-13</td>
<td>Clay, brown, sandy</td>
</tr>
<tr>
<td>13-19</td>
<td>Clay, yellowish-brown, contains pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 20

Location: NE\%NE%SE%SW% sec. 31, T. 98 N., R. 75 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td>Silt and sand, light-brown</td>
</tr>
<tr>
<td>7-30</td>
<td>Clay, dark-brown, weathered</td>
</tr>
<tr>
<td>30-34</td>
<td>Clay and weathered shale</td>
</tr>
</tbody>
</table>

Test Hole No. 21

Location: NE\%NE%SE%SW% sec. 31, T. 98 N., R. 75 W.
Depth to water: dry
Test Hole No. 21 – continued.

0- 2  Topsoil
2- 5  Clay, brown, to light-gray, sandy
5- 12  Sand, light-brown, medium
12- 19  Clay, dark-gray
19- 29  Clay, brownish-yellow

Test Hole No. 22
Location: SE%SE%SW%SW sec. 31, T. 98 N., R. 75 W.
Depth to water: dry

0- 7  Sand, brownish-tan, medium
7- 23  Clay, yellowish-brown
23- 29  Clay, grayish-brown, darker at bottom

Test Hole No. 23
Location: NW%SE%SW%SE sec. 31, T. 98 N., R. 75 W.
Depth to water: dry

0- 5  Sand, dark-brown, medium, some clay
5- 31  Clay, brown
31- 36  Clay, yellowish-brown
36- 49  Shale, black

Test Hole No. 24
Location: SE%SE%SE%SE sec. 31, T. 98 N., R. 75 W.
Depth to water: 18 feet

0- 15  Sand, tan, medium
15- 18  Sand, tan, medium, some clay
18- 21  Sand, medium, some clay
21- 29  Clay, dark gray

Test Hole No. 25
Location: SE%SE%NE%NE sec. 31, T. 98 N., R. 75 W.
Depth to water: 17 feet

0- 2  Topsoil
2- 6  Sand, brown, medium to coarse
6- 17  Clay, brown, sandy
17- 31  Sand, fine to medium
31- 39  Clay, silver-gray, sandy
39- 41  Clay, greenish-tan, sandy
41- 45  Shale, brown
45- 49  Shale, dark-gray
<table>
<thead>
<tr>
<th>Test Hole No. 26</th>
<th>Location: NE%NE%SE%SE% sec. 31, T. 98 N., R. 75 W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water:</td>
<td>21 feet</td>
</tr>
<tr>
<td>0- 2</td>
<td>Topsoil, sandy</td>
</tr>
<tr>
<td>2- 22</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>22- 50</td>
<td>Silt, brown, some sand</td>
</tr>
<tr>
<td>50- 59</td>
<td>Shale, brownish gray, weathered</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Hole No. 27</th>
<th>Location: SW%NE%SW%SW% sec. 32, T. 98 N., R. 75 W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water:</td>
<td>7 feet</td>
</tr>
<tr>
<td>0- 7</td>
<td>Clay, light-brown, sandy</td>
</tr>
<tr>
<td>7- 14</td>
<td>Sand, tan, fine to medium</td>
</tr>
<tr>
<td>14- 34</td>
<td>Clay, brown, sandy</td>
</tr>
<tr>
<td>34- 39</td>
<td>Shale</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Hole No. 28</th>
<th>Location: NE%NE%NE%SW% sec. 32, T. 98 N., R. 75 W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water:</td>
<td>dry</td>
</tr>
<tr>
<td>0- 3</td>
<td>Topsoil</td>
</tr>
<tr>
<td>3- 30</td>
<td>Silt, dark-brown, some pebbles</td>
</tr>
<tr>
<td>30- 44</td>
<td>Clay, brown (weathered shale)</td>
</tr>
<tr>
<td>44- 55</td>
<td>Shale, brown to black</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Hole No. 29</th>
<th>Location: NW%SW%NW%SE% sec. 32, T. 98 N., R. 75 W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water:</td>
<td>dry</td>
</tr>
<tr>
<td>0- 4</td>
<td>Clay, dark-brown</td>
</tr>
<tr>
<td>4- 29</td>
<td>Clay, light-brown, sandy</td>
</tr>
<tr>
<td>39- 44</td>
<td>Shale, brown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Hole No. 30</th>
<th>Location: SW%NW%SW%SE% sec. 32, T. 98 N., R. 75 W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water:</td>
<td>dry</td>
</tr>
<tr>
<td>0- 2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2- 9</td>
<td>Clay, grayish-brown, sandy</td>
</tr>
<tr>
<td>9- 29</td>
<td>Clay, brown, some pebbles</td>
</tr>
<tr>
<td>29- 39</td>
<td>Sand, brown, medium</td>
</tr>
<tr>
<td>39- 44</td>
<td>Sand, light-brown</td>
</tr>
<tr>
<td>44- 49</td>
<td>Clay, dark-brown</td>
</tr>
</tbody>
</table>

** * * * **
Test Hole No. 31
Location: SE\%SE\%NE\%SE\% sec. 32, T. 98 N., R. 75 W.
Depth to water: dry
0- 3  Topsoil, sandy
3- 9  Sand, brown, clayey
9- 39 Clay, brown.
39- 49 Shale, brown

* * *

Test Hole No. 32
Location: SW\%SW\%SW\%NW\% sec. 33, T. 98 N., R. 75 W.
Depth to water: dry
0- 9  Clay, brown, few sand grains
9- 19  Clay, brown, more sand
19- 34  Clay, no sand
34- 39  Shale, brown, weathered
39- 44  Shale, gray

* * *

Test Hole No. 33
Location: SW\%NE\%NE\%NW\% sec. 33, T. 98 N., R. 75 W.
Depth to water: dry
0- 3  Topsoil
3- 12  Clay, brown, medium
12- 14  Sand, brown, fine to medium
14- 17  Sand, clayey, brown
17- 26  Shale, brownish-gray
26- 29  Shale, black

* * *

Test Hole No. 34
Location: SW\%SE\%SE\%NE\% sec. 33, T. 98 N., R. 75 W.
Depth to water: 7 feet
0- 4  Topsoil
4- 7  Clay, brown
7- 11  Sand, light-brown, fine to medium
11- 16  Clay, tan
16- 22  Shale, black
22- 29  Rock

* * *

Test Hole No. 35
Location: NW\%NW\%NW\%NW\% sec. 34, T. 98 N., R. 75 W.
Depth to water: not measured
0- 6  Roadbed
6- 12  Clay, light-green
12- 34  Clay, light-brown
Test Hole No. 35 – continued.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>34-39</td>
<td>Clay, reddish-brown, sandy</td>
</tr>
<tr>
<td>39-49</td>
<td>Clay, dark-brownish-gray</td>
</tr>
</tbody>
</table>

Test Hole No. 36
Location: SW¼SW¼NW¼NW¼ sec. 34, T. 98 N., R. 75 W.
Depth to water: not measured

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-16</td>
<td>Clay, greenish-tan</td>
</tr>
<tr>
<td>16-22</td>
<td>Clay, reddish-tan</td>
</tr>
<tr>
<td>22-29</td>
<td>Clay, contains pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 37
Location: SW¼SE¼SW¼SW¼ sec. 34, T. 98 N., R. 75 W.
Depth to water: 13 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>Roadbed</td>
</tr>
<tr>
<td>6-16</td>
<td>Clay, dark-gray</td>
</tr>
<tr>
<td>16-24</td>
<td>Clay, yellowish-brown, contains pebbles</td>
</tr>
<tr>
<td>24-34</td>
<td>Clay, light-gray, contains pebbles</td>
</tr>
<tr>
<td>34-44</td>
<td>Shale, black</td>
</tr>
</tbody>
</table>

Test Hole No. 38
Location: SW¼SW¼SW¼SW¼ sec. 36, T. 98 N., R. 75 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>Sand, dark-brown, fine</td>
</tr>
<tr>
<td>3-7</td>
<td>Clay, brown, sandy</td>
</tr>
<tr>
<td>7-30</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>30-39</td>
<td>Clay, black</td>
</tr>
</tbody>
</table>

Test Hole No. 39
Location: NW¼NW¼NW¼SW¼ sec. 3, T. 97 N., R. 76 W.
Depth to water: 90 feet?

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-16</td>
<td>Sand, dark-brown, fine to medium</td>
</tr>
<tr>
<td>16-40</td>
<td>Sand, light-brown, fine to medium, little clay</td>
</tr>
<tr>
<td>40-133</td>
<td>Sand, tan, fine to medium</td>
</tr>
<tr>
<td>133-134</td>
<td>Clay, greenish-tan</td>
</tr>
</tbody>
</table>

Test Hole No. 40 (drilled in 1965)
Location: NW¼NE¼NW¼ sec. 3, T. 97 N., R. 76 W.
Depth to water: 10 feet
Test Hole No. 40 – continued.

0- 2  Topsoil
2-  4  Sand, brown, medium
4-  8  Sand, tan, fine
15- 29  Clay, tan

Test Hole No. 41 (drilled in 1965)
Location: NE%NE%NE%NE%NW% sec. 3, T. 97 N., R. 76 W.
Depth to water: 6 feet

0-  4  Roadbed
4-  9  Sand, fine to medium, some clay
9- 14  Sand, fine, some clay
14- 19  Clay, gray, not compacted
19- 24  Clay, compacted
24- 29  Shale, light-brown

Test Hole No. 42
Location: NW%NW%NW%SE%SE% sec. 3, T. 97 N., R. 76 W.
Depth to water: 69 feet

0-  5  Sand, dark-brown, fine to medium
5- 27  Sand, brown, medium, some clay
27- 34  Sand, light-brown, clay
34- 48  Sand, light-brown, fine to medium, some clay
48- 69  Sand, tan, clean
69-103  Sand, light-brown, medium, little or no clay
103-108  Clay, greenish-brown

Test Hole No. 43
Location: NW%NW%NW%NW% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2249 feet
Depth to water: 5 feet

0-  5  Sand, dark-gray, medium
5- 27  Sand, light-gray, fine to medium
9- 19  Sand, light-gray, fine, some clay
19- 25  Clay, brown, very sandy
25- 45  Clay, light-grayish-brown
45- 69  Shale, light-brown to gray

Test Hole No. 44
Location: SW%SW%SW%NW% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2291 feet
Depth to water: 3 feet

0-  1  Topsoil
1- 9  Sand, brown, fine to medium
Test Hole No. 44 – continued.

9- 29 Sand, light-gray, little clay
29- 34 Sand, dark-gray
34- 40 Sand, black, with much clay
40- 59 Clay, white, grading into reddish-brown
59- 64 Clay, brown, many pebbles

Test Hole No. 45
Location: NE%NE%SW%SW% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2258 feet
Depth to water: 1 foot

0- 1 Topsoil
1- 17 Sand, brown, fine to medium
17- 27 Clay, greenish-tan
27- 34 Clay, reddish-brown, with pebbles

Test Hole No. 46
Location: SE%NE%SW%SW% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2330 feet
Depth to water: 34 feet?

0- 2 Topsoil
2- 34 Sand, light-brown, medium
34- 66 Sand, brown, medium, clean
66- 74 Clay, tan, very hard drilling

Test Hole No. 47
Location: NW%NW%NW%SE% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2281 feet
Depth to water: 3 feet

0- 3 Topsoil
3- 12 Sand, light-gray, medium
12- 24 Clay, greenish-tan, sandy
24- 34 Clay, brownish-red, sandy
34- 44 Clay, brown

Test Hole No. 48
Location: NE%NW%SE%SE% sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2298 feet
Depth to water: 3 feet

0- 1 Topsoil
1- 14 Sand, brown, medium
14- 27 Sand, dark-gray, fine, some clay
27- 34 Shale, yellowish-brown, some black patches
Test Hole No. 49
Location: SE¹⁄₄SE¹⁄₄SE¹⁄₄NE¹⁄₄ sec. 2, T. 97 N., R. 76 W.
Surface elevation: 2303 feet
Depth to water: 7 feet
0- 9  Sand, medium
9- 33  Sand, light-brown, medium
33- 49  Clay, brown, some sand grains

Test Hole No. 50
Location: NE¹⁄₄NE¹⁄₄SE¹⁄₄NE¹⁄₄ sec. 5, T. 97 N., R. 76 W.
Surface elevation: 2298 feet
Depth to water: 6 feet
0- 4  Sand, brown
4- 23  Sand, light-brown
23- 34  Clay, sandy

Test Hole No. 51
Location: NW¹⁄₄NW¹⁄₄NW¹⁄₄NW¹⁄₄ sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2285 feet
Depth to water: 6 feet
0- 6  Sand, brown, fine to medium
6- 12  Sand, light-brown, medium
12- 34  Clay, yellowish-brown

Test Hole No. 52
Location: SW¹⁄₄SW¹⁄₄SW¹⁄₄SW¹⁄₄ sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2310 feet
Depth to water: 5 feet
0- 14  Sand, dark-gray, medium
14- 33  Sand, gray
33- 44  Clay, light-brown

Test Hole No. 53 (drilled by the City Council)
Location: NE¹⁄₄SE¹⁄₄SW¹⁄₄SW¹⁄₄ sec. 1, T. 97 N., R. 75 W.
Depth to water: 7 feet
0- 2  Topsoil
2- 39  Sand, fine to medium
39- 40  Clay, light-brown, some white thin layers
Test Hole No. 54 (New city well, drilled by Thorpe Well Co.)
Location: SE\%NE\%SW\%NW\% sec. 1, T. 97 N., R. 76 W.
Depth to water: 7 feet

0- 2  Topsoil
2- 42  Sand, fine to medium
42- 44  Clay, light-brown

Test Hole No. 55 (Drilled by Thorpe Well Co.)
Location: SE\%NE\%SW\%NW\% sec. 1, T. 97 N., R. 76 W.
Depth to water: 9 feet

0- 2  Topsoil
2- 42  Sand, fine to medium
42- 47  Clay, light-brown

Test Hole No. 56 (Drilled by Thorpe Well Co.)
Location: SE\%NE\%SW\%NW\% sec. 1, T. 97 N., R. 76 W.
Depth to water: 11 feet

0- 1  Topsoil
1- 42  Sand, fine, some medium
42- 47  Clay, light-brown

Test Hole No. 57 (Drilled by the City Council)
Location: NE\%NE\%SW\%NW\% sec. 1, T. 97 N., R. 76 W.
Depth to water: 8 feet

0- 2  Topsoil
2- 42  Sand, fine to medium
42- 43  Clay, light-brown

Test Hole No. 58
Location: NE\%NE\%SW\%NW\% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2310 feet
Depth to water: 7 feet

0- 7  Sand, dark-brown, fine to medium
7- 37  Sand, tan, fine to medium, some clay
37- 49  Shale, yellowish-brown, with black chunks of shale

Test Hole No. 59 (Drilled by Dreyer Well Driller)
Location: SE\%SE\%NW\%SW\% sec. 1, T. 97 N., R. 76 W.
Depth to water: 7 feet

0- 2  Topsoil
Test Hole No. 59 -- continued.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-7</td>
<td>Sand, dark-brown, fine to medium</td>
</tr>
<tr>
<td>7-27</td>
<td>Sand, tan, fine to medium, some clay</td>
</tr>
<tr>
<td>37-42</td>
<td>Clay, yellowish-brown</td>
</tr>
</tbody>
</table>

* * *

Test Hole No. 60 (Drilled by Dreyer Well Driller)
Location: NE½ SW½ NW½ SW¼ sec. 1, T. 97 N., R. 76 W.
Depth to water: 9 feet

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-9</td>
<td>Sand, medium</td>
</tr>
<tr>
<td>9-33</td>
<td>Sand, light-brown, fine to medium, some clay</td>
</tr>
<tr>
<td>33-40</td>
<td>Clay, brown</td>
</tr>
</tbody>
</table>

* * *

Test Hole No. 61
Location: SW¼ SW¼ SE¼ NW¼ sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2301 feet
Depth to water: 4 feet

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Sand, light-brown, fine to medium</td>
</tr>
<tr>
<td>4-29</td>
<td>Sand, tan, fine to medium, little or no clay</td>
</tr>
<tr>
<td>29-39</td>
<td>Clay, yellowish-brown</td>
</tr>
</tbody>
</table>

* * *

Test Hole No. 62
Location: SW¼ SW¼ NE¼ NW¼ sec. 1, T. 97 N., R. 76 W.
Depth to water: 6 feet

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>6-11</td>
<td>Sand, light-gray, medium</td>
</tr>
<tr>
<td>11-21</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>21-29</td>
<td>Clay, yellowish-brown</td>
</tr>
</tbody>
</table>

* * *

Test Hole No. 63
Location: NW¼ NW¼ NE¼ NW¼ sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2293 feet
Depth to water: 5 feet

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>Sand, brown, medium</td>
</tr>
<tr>
<td>9-23</td>
<td>Sand, fine to medium</td>
</tr>
<tr>
<td>23-34</td>
<td>Clay, brown</td>
</tr>
</tbody>
</table>

* * *

Test Hole No. 64
Location: NW¼ NW¼ NE¼ NE¼ sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2311 feet
Test Hole No. 64 – continued.

Depth to water: dry

0- 3 Sand, light-brown, medium
3- 19 Clay, brown
19- 24 Clay, brownish-gray

Test Hole No. 65
Location: NW\%NW\%SW\%SE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2307 feet
Depth to water: 5 feet

0- 5 Sand, light-brown, medium
5- 14 Sand, tan, fine
14- 21 Sand, tan, medium
21- 44 Clay, brownish-yellow, some pebbles

Test Hole No. 66
Location: NE\%NW\%SW\%SE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2342 feet
Depth to water: 22 feet

0- 2 Topsoil
2- 14 Sand, fine to medium, some clay
14- 34 Sand, tan, medium, some clay
34- 57 Sand, tan, medium to coarse
57- 64 Clay, yellowish-brown

Test Hole No. 67
Location: NW\%NW\%SE\%SE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2376 feet
Depth to water: 61 feet

0- 2 Sand, brown, fine to medium
2- 18 Sand, tan, clayey, some pebbles
18- 74 Sand, tan, medium
74- 90 Sand, brown, medium to coarse, little or no clay
90- 93 Clay, dark reddish-brown

Test Hole No. 68
Location: SE\%SE\%SE\%SE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2345 feet
Depth to water: 19 feet

0- 2 Topsoil
2- 39 Sand, medium
Test Hole No. 68 – continued.

39- 49  Shale, brown
49- 54  Shale, brown, some pebbles

Test Hole No. 69
Location: SE%SE%NE%SE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2331 feet
Depth to water: 9 feet
0-  5  Sand, light-brown, medium
5-  7  Sand, gray
7- 21  Sand, light-gray, becoming fine
21- 29  Sand, light-brown, fine, with clay
29- 35  Sand and clay, light-brown, becoming very fine
35- 44  Shale, light-brown

Test Hole No. 70
Location: SE%SE%NE%NE% sec. 1, T. 97 N., R. 76 W.
Surface elevation: 2315 feet
Depth to water: dry
0-  4  Clay, light-brown
4-  6  Clay, olive green
46- 44  Clay, browny-gray (weathered shale?)

Test Hole No. 71
Location: SW%SW%NE%NW% sec. 6, T. 97 N., R. 75 W.
Depth to water: dry
0-  7  Sand, light-brown
7- 11  Sand, light-gray
11- 14  Clay, dark-brown, sandy
14- 24  Clay, yellowish-brown

Test Hole No. 72
Location: NE%NE%SW%SW% sec. 6, T. 97 N., R. 75 W.
Depth to water: dry
0-  4  Sand, brown, fine to medium
4- 15  Sand, light-brown, clayey
15- 19  Shale, black

Test Hole No. 73
Location: SW%SW%SE%SW% sec. 6, T. 97 N., R. 75 W.
Depth to water: 24 feet
Test Hole No. 73 – continued.

0-  4  Sand, medium
4-  9  Clay, some fine sand grains
9- 14  Clay, no sand
14- 19  Clay, olive
19- 24  Clay, brown (weathered shale?)

Test Hole No. 74
Location: NW%NW%NW%SE% sec. 6, T. 97 N., R. 75 W.
Depth to water: 10 feet

0-  9  Sand, light-brown, medium
9- 14  Sand, fine
14- 19  Sand, fine, some clay
19- 24  Clay
24- 29  Shale

Test Hole No. 75
Location: NW%SW%SE%SE% sec. 6, T. 97 N., R. 75 W.
Depth to water: 15 feet

0- 14  Sand, light-brown, medium
14- 29  Clay, dark-gray
29- 39  Shale, brown, very hard drilling
39- 44  Shale, dark-gray
44- 49  Shale, black

Test Hole No. 76
Location: NW%NW%SE%SE% sec. 6, T. 97 N., R. 75 W.
Surface elevation: 2321 feet
Depth to water: dry

0-  2  Topsoil
2- 17  Clay, dark-brown, some pebbles
11- 14  Shale, yellowish-brown

Test Hole No. 77
Location: NE%NE%SW%NE% sec. 6, T. 97 N., R. 75 W.
Depth to water: dry

0-  2  Topsoil
2- 23  Clay, tan
23- 28  Clay, gray
26- 34  Shale, black

***
Test Hole No. 78
Location: NW\%NW\%SW\%NW sec. 5, T. 97 N., R. 75 W.
Depth to water: dry
0-4 Clay, very sandy
4-9 Clay, with pebbles
9-19 Clay, brown, few pebbles
19-34 Clay, no pebbles
34-39 Shale, gray

Test Hole No. 79
Location: NW\%NW\%NW\%SW\%sec. 5, T. 97 N., R. 75 W.
Depth to water: dry
0-5 Clay, light-brownish-gray, few pebbles
5-24 Clay, brown
24-59 Shale, black

Test Hole No. 80
Location: SE\%SE\%NE\%SE\% sec. 5, T. 97 N., R. 75 W.
Depth to water: dry
0-3 Sand, medium
3-12 Clay, light-brown, sandy
12-29 Clay, brown
25-39 Clay, black

Test Hole No. 81
Location: SE\%SE\%NE\%SE\% sec. 5, T. 97 N., R. 75 W.
Depth to water: dry
0-2 Topsoil
2-18 Clay, brown
18-24 Clay, gray, some pebbles

Test Hole No. 82
Location: NE\%NE\%SE\%NE\% sec. 5, T. 97 N., R. 75 W.
Depth to water: dry
0-4 Clay, brownish-black, sandy
4-13 Clay, dark-brown
13-23 Clay, brownish-yellow
23-34 Shale, black

Test Hole No. 83
Location: SE\%SE\%SE\%SW\% sec. 4, T. 97 N., R. 75 W.
Test Hole No. 83 – continued.

Depth to water: dry

0- 7 Clay, brown, sandy  
7- 14 Clay, brown  
14- 19 Shale, black  

Test Hole No. 84
Location: SW%SW%SW%SW% sec. 3, T. 97 N., R. 75 W.  
Depth to water: dry

0- 5 Clay, dark-brown, sandy  
5- 16 Clay, light-brown, sandy  
16- 24 Shale, black  

Test Hole No. 85
Location: NW%NW%NW%NW% sec. 3, T. 97 N., R. 75 W.  
Depth to water: dry

0- 9 Clay, dark-brown  
9- 17 Clay, light-brown  
17- 23 Clay, yellowish-brown  
23- 24 Shale, black  

Test Hole No. 86
Location: SE%NE%NE%SE% sec. 3, T. 97 N., R. 75 W.  
Depth to water: dry

0- 3 Clay, dark-brown  
3- 18 Clay, light-brown  
18- 26 Shale, weathered  
26- 29 Shale, black  

Test Hole No. 87
Location: NE%NE%NE%SE% sec. 3, T. 97 N., R. 75 W.  
Depth to water: dry

0- 2 Topsoil  
2- 16 Clay, dark-brown, some pebbles  
16- 18 Clay, yellowish-brown  
18- 24 Shale, black  

Test Hole No. 88
Location: SW%SW%SW%SW% sec. 1, T. 97 N., R. 75 W.  
Depth to water: dry
Test Hole No. 88 - continued.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Topsoil, sandy</td>
</tr>
<tr>
<td>4- 29</td>
<td>Clay, tan, sandy</td>
</tr>
<tr>
<td>29- 39</td>
<td>Clay, dark-brown, grading to black shale</td>
</tr>
</tbody>
</table>

Test Hole No. 89
Location: SW\%NW\%NW\%SE\% sec. 10, T. 97 N., R. 76 W.
Depth to water: 38 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 19</td>
<td>Sand, tan, medium</td>
</tr>
<tr>
<td>19- 38</td>
<td>Sand, tan, medium, little clay</td>
</tr>
<tr>
<td>38- 49</td>
<td>Sand, brown, medium, some clay</td>
</tr>
<tr>
<td>49- 63</td>
<td>Sand, brown, fine to medium, silt</td>
</tr>
<tr>
<td>63- 69</td>
<td>Clay, greenish-brown, some pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 90
Location: SW\%SW\%SE\%SW\% sec. 10, T. 97 N., R. 76 W.
Depth to water: 12 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 12</td>
<td>Sand, dark-brown, medium, some clay</td>
</tr>
<tr>
<td>12- 17</td>
<td>Sand, tan, medium, some clay</td>
</tr>
<tr>
<td>17- 47</td>
<td>Sand, tan, little clay</td>
</tr>
<tr>
<td>47- 59</td>
<td>Clay, reddish-brown, very compact</td>
</tr>
</tbody>
</table>

Test Hole No. 91
Location: SE\%SE\%SE\%NE\% sec. 10, T. 97 N., R. 76 W.
Surface elevation: 2337 feet
Depth to water: 22 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Roadbed</td>
</tr>
<tr>
<td>4- 16</td>
<td>Sand, light-brown, fine to medium</td>
</tr>
<tr>
<td>16- 34</td>
<td>Sand, tan, medium, some clay</td>
</tr>
<tr>
<td>34- 58</td>
<td>Sand, tan, medium</td>
</tr>
<tr>
<td>58- 79</td>
<td>Clay, reddish-brown, very compact</td>
</tr>
</tbody>
</table>

Test Hole No. 92
Location: SE\%NW\%NW\%NW\% sec. 11, T. 97 N., R. 76 W.
Surface elevation: 2325 feet
Depth to water: 17 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2- 14</td>
<td>Sand, light-brown, fine to medium</td>
</tr>
<tr>
<td>14- 53</td>
<td>Sand, tan, fine to medium, little clay</td>
</tr>
<tr>
<td>53- 64</td>
<td>Clay, dark-brown, some pebbles</td>
</tr>
</tbody>
</table>

* * *
Test Hole No. 93
Location: SE\%NE\%NE\%NW\% sec 11, T. 97 N., R. 76 W.
Surface elevation: 2319 feet
Depth to water: 3 feet

0- 2  Topsoil, sandy
3- 9  Sand, dark-brown, medium, clean
9- 51  Sand, tan, medium, some coarser grains, little or no clay
51- 60  Clay, tannish-brown
60- 64  Clay, black, some brown chunks of shale

****

Test Hole No. 94
Location: SW\%NW\%SE\%SW\% sec 11, T. 97 N., R. 76 W.
Surface elevation: 2428 feet
Depth to water: 7 feet

0- 2  Topsoil
2- 7  Sand, dark-brown, fine to medium
7- 39  Sand, light-gray, fine to medium
39- 52  Sand, dark-brown, medium, clean
52- 64  Clay, brown, some pebbles

****

Test Hole No. 95
Location: SW\%SE\%SW\%SE\% sec 11, T. 97 N., R. 76 W.
Surface elevation: 2333 feet
Depth to water: 5 feet

0- 5  Sand, black, some clay
5- 11  Sand, tan, fine to medium, some clay
11- 28  Sand, tan, less clay
28- 39  Clay, brown, some pebbles, some dark chunks of shale

****

Test Hole No. 96
Location: NW\%SE\%SE\%NW\% sec 11, T. 97 N., R. 76 W.
Surface elevation: 2340 feet
Depth to water: 7 feet

0- 2  Topsoil
2- 58  Sand, tan, fine to medium, some clay
58- 66  Clay, white, few pebbles
66- 74  Clay, yellowish-brown, some dark patches

****

Test Hole No. 97
Location: SE\%NW\%SW\%SE\% sec 11, T. 97 N., R. 76 W.
Surface elevation: 2327 feet
Depth to water: 1 foot
Test Hole No. 97 – continued.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Layer Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-3</td>
<td>Sand and clay</td>
</tr>
<tr>
<td>3-41</td>
<td>Sand, fine to medium</td>
</tr>
<tr>
<td>41-54</td>
<td>Clay, yellowish-brown, some dark chunks of shale</td>
</tr>
</tbody>
</table>

** Test Hole No. 98  
Location: SE\%NW\%NW\%SE\% sec. 11, T. 97 N., R. 76 W.  
Surface elevation: 2330 feet  
Depth to water: 11 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Layer Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>Sand, dark-brown, fine to medium</td>
</tr>
<tr>
<td>6-35</td>
<td>Sand, light-brown, fine to medium</td>
</tr>
<tr>
<td>35-52</td>
<td>Sand, gray, medium, little or no clay</td>
</tr>
<tr>
<td>52-64</td>
<td>Clay, brown, some pebbles</td>
</tr>
</tbody>
</table>

** Test Hole No. 99  
Location: SE\%NW\%NE\%SE\% sec. 11, T. 97 N., R. 76 W.  
Surface elevation: 2328 feet  
Depth to water: 3 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Layer Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-14</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>14-34</td>
<td>Sand, tan, fine to medium, some clay</td>
</tr>
<tr>
<td>34-55</td>
<td>Sand, tan, fine to medium, little clay</td>
</tr>
<tr>
<td>55-69</td>
<td>Clay, greenish-tan, some pebbles</td>
</tr>
</tbody>
</table>

** Test Hole No. 100  
Location: NW\%SE\%SW\%NE\% sec. 11, T. 97 N., R. 76 W.  
Surface elevation: 2314 feet  
Depth to water: 1 foot

<table>
<thead>
<tr>
<th>Depth</th>
<th>Layer Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-35</td>
<td>Sand, gray, with clay</td>
</tr>
<tr>
<td>35-45</td>
<td>Sand, brown, fine to medium</td>
</tr>
<tr>
<td>45-59</td>
<td>Clay, brownish-red</td>
</tr>
</tbody>
</table>

** Test Hole No. 101  
Location: SE\%NW\%SE\%NE\% sec. 11, T. 97 N., R. 76 W.  
Surface elevation: 2332 feet  
Depth to water: 16 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Layer Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-16</td>
<td>Sand, tan, fine to medium</td>
</tr>
<tr>
<td>16-26</td>
<td>Sand, medium, clean</td>
</tr>
<tr>
<td>26-62</td>
<td>Sand, medium to fine</td>
</tr>
<tr>
<td>62-86</td>
<td>Clay, white, sandy</td>
</tr>
<tr>
<td>86-94</td>
<td>Clay, reddish-brown, very compact</td>
</tr>
</tbody>
</table>

**
Test Hole No. 102
Location: SE%NE%NW%NE% sec. 11, T. 97 N., R. 76 W.
Surface elevation: 2308 feet
Depth to water: 3 feet

0-2  Topsoil, sandy
2-24  Sand, light-gray, fine
24-37  Sand, brown
37-54  Clay, reddish-brown, compact

Test Hole No. 103
Location: SE%NW%NE%NE% sec. 11, T. 97 N., R. 76 W.
Surface elevation: 2308 feet
Depth to water: 2 feet

0-2  Topsoil
2-23  Sand, light-gray, fine to medium, some clay
33-49  Clay, tan, reddish-tan

Test Hole No. 104
Location: NE%NE%NW%NW% sec. 12, T. 97 N., R. 76 W.
Surface elevation: not measured
Depth to water: 10 feet

0-2  Topsoil
2-10  Sand, tan, fine to medium
10-47  Sand, tan, some clay
47-54  Clay, yellowish-brown

Test Hole No. 105
Location: NE%SE%SW%NW% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2327 feet
Depth to water: 6 feet

0-2  Topsoil
2-4  Sand, brown, some clay
4-6  Sand, brown, clayey
6-29  Sand, greenish-gray, fine to medium, some clay
29-52  Sand, light-brown, medium
52-54  Shale, reddish-brown, with black chunks of shale

Test Hole No. 106
Location: NW%NW%NW%SW% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2382 feet
Depth to water: 79 feet

0-3  Sand, brown, medium
5-12  Sand, clayey, compact
Test Hole No. 106 – continued.

12-79 Sand, light-brown, medium
79-113 Sand, medium
113-124 Clay, light-brown, some pebbles

* * * *

Test Hole No. 107
Location: SE\%SE\%NW\%SW\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2358 feet
Depth to water: 36 feet

0- 3 Topsoil
3- 36 Sand, light-brown, fine to medium
36- 82 Sand, tan, fine to medium, little or no clay
82- 94 Clay, white, grading to reddish-brown, very compact

* * * *

Test Hole No. 108
Location: NW\%NE\%SE\%SW\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2333 feet
Depth to water: 4 feet

0- 1 Topsoil
1- 43 Sand, light-brown, medium
43- 57 Clay, tan, sandy
57- 59 Clay, reddish-green, very tough drilling

* * * *

Test Hole No. 109
Location: NE\%SE\%NE\%SW\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2330 feet
Depth to water: 3 feet

0- 3 Topsoil
3- 21 Sand, tan, fine to medium
21- 30 Sand, black, large amount of clay
30- 42 Sand, brown, fine to medium
42- 50 Clay, reddish-brown, some pebbles
50- 61 Clay, yellowish-brown (shale)

* * * *

Test Hole No. 110
Location: NW\%NW\%SW\%NE\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2373 feet
Depth to water: 58 feet

0- 4 Clay, sandy
4- 58 Sand, tan, fine to medium
58- 78 Sand, tan, fine to medium, some clay
78- 89 Clay, yellowish-brown, some pebbles

* * * *
Test Hole No. 111
Location: NW\%NW\%NW\%NE\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2383 feet
Depth to water: 64 feet

0- 6 Sand, light-brown, medium
6- 22 Clay, sandy
22- 64 Sand, tan, medium
64- 84 Sand, light-brown, medium
84- 92 Sand, tan, fine to medium
92-114 Clay, brown, some pebbles

Test Hole No. 112
Location: NE\%NE\%SE\%NE\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2353 feet
Depth to water: 32 feet

0-  2 Topsoil
  2- 32 Sand, light-brown, fine to medium
  32- 43 Sand, tan, fine to medium, some clay
  43- 54 Clay, yellowish-brown, some pebbles

Test Hole No. 113
Location: NE\%SW\%NE\%SE\% sec. 12, T. 97 N., R. 76 W.
Surface elevation: 2330 feet
Depth to water: 4 feet

0-  1 Topsoil
  1-  4 Sand, brown, medium
  4- 14 Sand, tannish-gray, some clay
  14- 47 Sand, dark-gray, some clay
  42- 49 Clay, yellowish-brown

Test Hole No. 114
Location: SW\%SW\%SW\%SW\% sec. 7, T. 97 N., R. 75 W.
Surface elevation: 2313 feet
Depth to water: 4 feet

0-  0 Roadbed
  0- 19 Sand, dark-gray, medium, contains some clay
  19- 26 Sand, light-gray, more clay
  24- 34 Clay, reddish-brown, sandy
  34- 39 Clay, brown, some pebbles

Test Hole No. 115
Location: NE\%NE\%SW\%NW\% sec. 7, T. 97 N., R. 75 W.
Depth to water: 2 feet
Test Hole No. 115 – continued.
0-  2  Topsoil, sandy
2- 11  Sand, brownish-gray, fine to medium
11- 19  Shale, black

** **

Test Hole No. 116
Location: NE%NE%NE%NW% sec. 7, T. 97 N., R. 75 W.
Depth to water: 29 feet
0-  2  Topsoil
2-  7  Sand, medium, well sorted
7- 14  Clay, sandy
14- 22  Clay, light-gray
22- 29  Shale, black

** **

Test Hole No. 117
Location: SE%SE%SE%NW% sec. 7, T. 97 N., R. 75 W.
Depth to water: dry
0-  5  Sand, dark-brown, fine to medium
5- 25  Clay, yellowish-brown
25- 29  Clay, yellowish-brown, some dark chunks of shale

** **

Test Hole No. 118
Location: SE%SE%SE%NE% sec. 7, T. 97 N., R. 75 W.
Depth to water: 15 feet
0-  2  Topsoil
2- 20  Sand, light-brown, fine to medium
20- 29  Clay, dark-gray, some pebbles, grades to black shale

** **

Test Hole No. 119
Location: NE%NW%NE%NW% sec. 8, T. 97 N., R. 75 W.
Depth to water: dry
0-  5  Sand, dark-brown, medium
5-  9  Sand, dark-gray, medium
9- 17  Clay, light-brown, sandy
17- 24  Clay, silver-gray, sandy
24- 29  Shale, black

** **

Test Hole No. 120
Location: SW%SW%SW%NW% sec. 10, T. 97 N., R. 75 W.
Depth to water: dry
Test Hole No. 120 — continued.

0- 2 Topsoil
2- 19 Clay, brown
19- 24 Shale, black

Test Hole No. 121
Location: NW\%NW\%NW\%NW\% sec. 11, T. 97 N., R. 75 W.
Depth to water: dry

0- 4 Roadbed
4- 12 Clay, brown, sandy, hard to drill
12- 22 Clay, dark-brown
22- 29 Shale, sand-gray

Test Hole No. 122
Location: SE\%SE\%NE\%NE\% sec. 16, T. 97 N., R. 76 W.
Depth to water: 57 feet

0- 4 Roadbed
4- 6 Clay, dark-gray, sandy
6- 57 Sand, fine to medium
57- 63 Sand, light-brown, fine to medium
63- 68 Clay, brown, many pebbles

Test Hole No. 123
Location: NW\%NE\%NE\%NE\% sec. 15, T. 97 N., R. 76 W.
Depth to water: 8 feet

0- 4 Roadbed
4- 29 Sand, light-brown, medium
29- 41 Sand, dark-gray, fine
41- 71 Sand, tan, fine to medium
71- 76 Clay, greenish-gray
76- 86 Clay, reddish-brown
86- 89 Clay, light-brown, compact

Test Hole No. 124
Location: NW\%NW\%NE\%NW\% sec. 14, T. 97 N., R. 76 W.
Surface elevation: 2330 feet
Depth to water: 4 feet

0- 4 Roadbed
4- 52 Sand, dark-brown, fine to medium, some clay
52- 59 Clay, red changing to green, very tough drilling
Test Hole No. 125
Location: SE\%SE\%SW\%SW\% sec. 14, T. 97 N., R. 76 W.
Depth to water: dry

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Roadbed</td>
</tr>
<tr>
<td>4-12</td>
<td>Sand, tan, fine to medium</td>
</tr>
<tr>
<td>12-26</td>
<td>Sand, tan, medium, little or no clay</td>
</tr>
<tr>
<td>26-39</td>
<td>Clay, tan, very tough drilling</td>
</tr>
</tbody>
</table>

Test Hole No. 126
Location: NE\%NE\%SE\%SE\% sec. 14, T. 97 N., R. 76 W.
Depth to water: 36 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Roadbed</td>
</tr>
<tr>
<td>4-6</td>
<td>Clay, tan, sandy</td>
</tr>
<tr>
<td>6-26</td>
<td>Sand, tan, cemented layers</td>
</tr>
<tr>
<td>26-36</td>
<td>Clay, sandy</td>
</tr>
<tr>
<td>36-62</td>
<td>Sand, fine to medium, some clay</td>
</tr>
<tr>
<td>62-74</td>
<td>Clay, yellowish-brown</td>
</tr>
</tbody>
</table>

Test Hole No. 127
Location: NW\%NE\%NE\%NW\% sec. 13, T. 97 N., R. 76 W.
Surface elevation: 2343 feet
Depth of water: 17 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Roadbed</td>
</tr>
<tr>
<td>2-17</td>
<td>Sand, brown, medium</td>
</tr>
<tr>
<td>17-64</td>
<td>Sand, tan, fine to medium</td>
</tr>
<tr>
<td>64-74</td>
<td>Clay, brownish-yellow</td>
</tr>
</tbody>
</table>

Test Hole No. 128
Location: SW\%SE\%SW\%SW\% sec 13, T. 97 N., R. 76 W.
Depth to water: 21 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Sand, dark-brown, fine to medium</td>
</tr>
<tr>
<td>2-6</td>
<td>Sand, tan</td>
</tr>
<tr>
<td>6-9</td>
<td>Clay, some sand</td>
</tr>
<tr>
<td>9-36</td>
<td>Sand, light tan, some clay</td>
</tr>
<tr>
<td>36-48</td>
<td>Clay, yellowish-brown</td>
</tr>
<tr>
<td>48-64</td>
<td>Clay, brown, some pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 129
Location: SW\%SW\%SE\%NE\% sec. 13, T. 97 N., R. 76 W.
Depth to water: 12 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>12-19</td>
<td>Sand, tan, some clay</td>
</tr>
<tr>
<td>19-24</td>
<td>Sand?</td>
</tr>
</tbody>
</table>
Test Hole 129
continued.

24-31 Sand, fine, contains some clay
31-54 Clay, yellowish-brown

Test Hole No. 130
Location: SE\%SE\%SE\% SE\% sec. 13, T. 97 N., R. 76 W.
Depth to water: 6 feet

0-3 Topsoil
3-19 Sand, dark-brown, medium
19-44 Sand, tan, fine, some clay
44-59 Clay, brown, compact

Test Hole No. 131
Location: NE\%NE\%SE\%SE\% sec. 13, T. 97 N., R. 76 W.
Depth to water: 4 feet

0-4 Topsoil
4-34 Sand, gray, fine to medium
34-44 Clay, greenish-gray, some pebbles

Test Hole No. 132
Location: NE\%NE\%SE\%NE\% sec. 13, T. 97 N., R. 76 W.
Depth to water: 6 feet

0-6 Sand, brown, medium
6-37 Sand, tan, fine to medium
37-43 Clay, reddish-tan
43-49 Clay, brown

Test Hole No. 133
Location: NW\%NW\%NE\%NE\% sec. 13, T. 97 N., R. 76 W.
Surface elevation: 2326 feet
Depth to water: 4 feet

0-4 Roadbed
4-14 Sand, dark-brown, medium, some clay
14-42 Sand, dark-brown, fine, some clay
42-49 Clay, tan

Test Hole No. 134
Location: SW\%SW\%SE\%SW\% sec. 18, T. 97 N., R. 75 W.
Depth to water: 4 feet

0-4 Roadbed
4-17 Sand, dark-gray, fine to medium, very clayey
Test Hole No. 134 – continued.

17-29 Sand, tan, medium
29-40 Clay, reddish-brown, compacted
40-44 Clay, yellowish-brown, some pebbles

* * * *

Test Hole No. 135
Location: SE%SE\%NE\%SE\% sec. 18, T. 97 N., R. 75 W.
Depth to water: 7 feet

0-2 Roadbed
2-7 Sand, dark-brown, medium
7-17 Sand, light-gray, medium
17-30 Sand, dark-gray
30-36 Sand, tan, some clay
36-49 Clay, reddish-brown, some pebbles

* * * *

Test Hole No. 136
Location: SW\%SW\%SW\%SW\% sec. 17, T. 97 N., R. 75 W.
Depth to water: 29 feet

0-4 Topsoil
4-28 Sand, light-brown, fine to medium
38-49 Clay, yellowish-brown, some pebbles

* * * *

Test Hole No. 137
Location: NW\%NW\%NW\%NW\% sec. 17, T. 97 N., R. 75 W.
Depth to water: not measured

0-4 Roadbed
4-9 Sand, brown, fine
9-18 Clay, yellowish-brown
18-24 Clay, yellowish-brown, some gray chunks of shale

* * * *

Test Hole No. 138
Location: NW\%NW\%NW\%NW\% sec. 16, T. 97 N., R. 75 W.
Depth to water: 13 feet

0-1 Topsoil
1-6 Clay, brown
6-17 Clay, light-green
17-29 Shale, yellowish-brown

* * * *

Test Hole No. 139
Location: NE\%NE\%NE\%NE\% sec. 16, T. 97 N., R. 75 W.
Depth to water: dry
Test Hole No. 139 – continued.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>4-10</td>
<td>Clay, dark-gray</td>
</tr>
<tr>
<td>10-12</td>
<td>Shale, yellowish-brown (weathered)</td>
</tr>
<tr>
<td>12-14</td>
<td>Shale, black</td>
</tr>
</tbody>
</table>

Test Hole No. 140
Location: NE%NE%NE%NE% sec. 16, T. 97 N., R. 75 W.
Depth to water: 5 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Clay, dark-brown, sandy</td>
</tr>
<tr>
<td>4-10</td>
<td>Clay, brown</td>
</tr>
<tr>
<td>10-15</td>
<td>Shale, yellowish-brown (weathered)</td>
</tr>
<tr>
<td>15-19</td>
<td>Shale, black, some yellow chunks of clay</td>
</tr>
</tbody>
</table>

Test Hole No. 141
Location: NE%NE%NE%NE% sec. 27, T. 57 N., R. 76 W.
Depth to water: 34 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Roadbed</td>
</tr>
<tr>
<td>4-17</td>
<td>Sand, light-brown, fine to medium</td>
</tr>
<tr>
<td>17-34</td>
<td>Clay, tan, sandy, tough drilling</td>
</tr>
<tr>
<td>34-42</td>
<td>Sand, tan, fine</td>
</tr>
<tr>
<td>42-101</td>
<td>Sand, tan, medium, little clay</td>
</tr>
<tr>
<td>101-104</td>
<td>Clay, grayish-tan, few pebbles</td>
</tr>
</tbody>
</table>

Test Hole No. 142
Location: NE%NE%NE%NE% sec. 23, T. 97 N., R. 76 W.
Depth to water: 18 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 7</td>
<td>Sand, dark-brown, medium</td>
</tr>
<tr>
<td>7-18</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>18-94</td>
<td>Sand, tan, medium</td>
</tr>
<tr>
<td>94-114</td>
<td>Clay, brown</td>
</tr>
</tbody>
</table>

Test Hole No. 143
Location: SE%SE%SE%NE% sec. 23, T. 97 N., R. 76 W.
Depth to water: 17 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 4</td>
<td>Sand, dark-brown, medium</td>
</tr>
<tr>
<td>4-60</td>
<td>Sand, tan, medium</td>
</tr>
<tr>
<td>60-77</td>
<td>Sand, tan, fine</td>
</tr>
<tr>
<td>77-94</td>
<td>Clay, tan</td>
</tr>
</tbody>
</table>

***
Test Hole No. 144
Location: NW%NE%NE%NE% sec. 25, T. 97 N., R. 76 W.
Depth to water: 5 feet
0-  5  Sand, light-brown, medium
  5- 30  Sand, tan
  30- 41  Sand, cemented
  41- 66  Sand, tan, fine to medium
  66- 79  Clay, sandy
  79- 89  Clay, yellowish-brown, contains pebbles

Test Hole No. 145
Location: NE%NE%NE%NE% sec. 25, T. 97 N., R. 76 W.
Depth to water: 22 feet
0-  2  Topsoil
  2- 22  Sand, tan, fine to medium
  22- 45  Sand, tannish-gray, fine
  45- 49  Clay, very compact

Test Hole No. 146
Location: NW%NW%NW%NW% sec. 29, T. 97 N., R. 75 W.
Depth to water: 7 feet
0-  6  Roadbed
  6- 21  Sand, light-brown, medium
  21- 25  Clay, greenish-tan, sandy
  25- 34  Shale, yellowish-brown

Test Hole No. 147
Location: NW%NW%NW%NW% sec. 29, T. 97 N., R. 75 W.
Depth to water: 5 feet
0-  5  Sand, brown, fine to medium
  5-  9  Sand, dark-brown, fine grains
  9- 10  Shale, light-brown

Test Hole No. 148
Location: SW%SW%SW%SW% sec. 21, T. 97 N., R. 75 W.
Depth to water: 16 feet
0-  2  Topsoil
  2- 12  Clay, tan
 12- 19  Shale, black
Test Hole No. 149
Location: SW\%SW\%SW\%SW\% sec. 21, T. 97 N., R. 75 W.
Depth to water: 3 feet
0- 3 Sand, dark-gray
3- 21 Sand, tan, fine to medium
21- 34 Shale, brownish-yellow

Test Hole No. 150
Location: SW\%SW\%SW\%SE\% sec. 21, T. 97 N., R. 75 W.
Depth to water: 2 feet
0- 2 Clay, black, sandy
2- 8 Sand, tannish-gray, medium
8- 24 Clay, tan

Test Hole No. 151
Location: SE\%SE\%SE\%SE\% sec. 21, T. 97 N., R. 75 W.
Depth to water: 2 feet
0- 2 Topsoil
2- 4 Sand, light-gray, medium
4- 12 Clay, brownish-gray
12- 24 Clay, light-brown, some pebbles

Test Hole No. 152
Location: NW\%NW\%NW\%SW\% sec. 22, T. 97 N., R. 75 W.
Depth to water: 2 feet
0- 2 Sand, light-brown, fine to medium
2- 7 Sand, gray
7- 14 Clay, yellowish-brown

Test Hole No. 153
Location: SW\%SW\%NW\%NW\% sec. 22, T. 97 N., R. 75 W.
Depth to water: 12 feet
0- 3 Sand, light-brown, medium
3- 22 Clay, brown, sandy
22- 34 Clay, gray, with yellow chunks of clay

Test Hole No. 154
Location: NE\%NE\%NE\%NE\% sec. 21, T. 97 N., R. 75 W.
Depth to water: 9 feet
0- 9 Clay and sand, light-brown
9- 14 Sand, light-brown, with clay
14- 19 Shale, yellowish-green
APPENDIX B

Well records in the Colome area

Source: A, Alluvium; O, Ogallala Group; C, Varicolored Clay; P, Pierre Shale
Use: D, domestic; S, stock.

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Depth of Well (feet)</th>
<th>Depth to Water (feet)</th>
<th>Source</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vobr, L.</td>
<td>NW%NW%SW%NE% sec. 2, T. 97 N., R. 75 W.</td>
<td>20</td>
<td>10</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>Vobr, L.</td>
<td>SW%SW%SW%SE% sec. 2, T. 97 N., R. 75 W.</td>
<td>60</td>
<td>30</td>
<td>P</td>
<td>D,S</td>
</tr>
<tr>
<td>Johnson, K.</td>
<td>NW%NW%NW%NW% sec. 3, T. 97 N., R. 75 W.</td>
<td>28</td>
<td>10?</td>
<td>C,P</td>
<td>S</td>
</tr>
<tr>
<td>Johnson, K.</td>
<td>SE%NW%NW%NW% sec. 3, T. 97 N., R. 74 W.</td>
<td>35</td>
<td></td>
<td>C,P</td>
<td>S</td>
</tr>
<tr>
<td>Johnson, K.</td>
<td>SE%NE%NW%NW% sec. 3, T. 97 N., R. 74 W.</td>
<td>50</td>
<td></td>
<td>C,P</td>
<td>S</td>
</tr>
<tr>
<td>Vavra, F.</td>
<td>NW%NW%NE%NW% sec. 5, T. 97 N., R. 74 W.</td>
<td>32</td>
<td>15</td>
<td>O,C</td>
<td>D,S</td>
</tr>
<tr>
<td>Atteberry, R.</td>
<td>NW%SW%SE%SE% sec. 5, T. 97 N., R. 74 W.</td>
<td>30</td>
<td>6</td>
<td>O,C,P</td>
<td>D,S</td>
</tr>
<tr>
<td>Barland, E.</td>
<td>SW%SW%SE%SW% sec. 7, T. 97 N., R. 75 W.</td>
<td>38</td>
<td>5</td>
<td>O</td>
<td>D</td>
</tr>
<tr>
<td>Martz, G.</td>
<td>SW%NE%NE%NE% sec. 7, T. 97 N., R. 75 W.</td>
<td>35</td>
<td>8</td>
<td>O</td>
<td>S</td>
</tr>
<tr>
<td>Schultz, L.</td>
<td>SE%SE%NE%SE% sec. 7, T. 97 N., R. 75 W.</td>
<td>72</td>
<td>30</td>
<td>O,C,P</td>
<td>S</td>
</tr>
<tr>
<td>Martz, G.</td>
<td>NE%NE%NW%NW% sec. 8, T. 97 N., R. 75 W.</td>
<td>60</td>
<td>14</td>
<td>O,C,P</td>
<td>D,S</td>
</tr>
<tr>
<td>Atteberry, R.</td>
<td>NE%SW%NE%NE% sec. 8, T. 97 N., R. 74 W.</td>
<td>60</td>
<td>30</td>
<td>C,P</td>
<td>S</td>
</tr>
<tr>
<td>Kalenda, R.</td>
<td>NW%NW%SW%SW% sec. 9, T. 97 N., R. 74 W.</td>
<td>42</td>
<td>6</td>
<td>C,P</td>
<td>D,S</td>
</tr>
<tr>
<td>Atteberry, R.</td>
<td>SW%SW%NE%SW% sec. 9, T. 97 N., R. 75 W.</td>
<td>35</td>
<td>8</td>
<td>C,P</td>
<td>S</td>
</tr>
<tr>
<td>Name</td>
<td>Location</td>
<td>Depth of Well (feet)</td>
<td>Depth to Water (feet)</td>
<td>Source</td>
<td>Use</td>
</tr>
<tr>
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<td>---------------------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>Sorber, H.</td>
<td>SW¼SW¼SW¼SE¼ sec. 10, T. 97 N., R. 75 W.</td>
<td>65</td>
<td>15</td>
<td>P</td>
<td>D,S</td>
</tr>
<tr>
<td>Bertran, H.</td>
<td>SW¼SW¼SW¼SW¼ sec. 10, T. 97 N., R. 74 W.</td>
<td>50</td>
<td>12</td>
<td>O</td>
<td>D,S</td>
</tr>
<tr>
<td>Dedlow, E.</td>
<td>NW¼NE¼NE¼NE¼ sec. 14, T. 97 N., R. 74 W.</td>
<td>22</td>
<td>6</td>
<td>O,C</td>
<td>D,S</td>
</tr>
<tr>
<td>Baldwin, O</td>
<td>NE¼NW¼NE¼NW¼ sec. 17, T. 97 N., R. 74 W.</td>
<td>25</td>
<td>10</td>
<td>O,C</td>
<td>P</td>
</tr>
<tr>
<td>Fries, L.</td>
<td>SE¼SE¼NE¼NE¼ sec. 17, T. 97 N., R. 74 W.</td>
<td>40</td>
<td>15</td>
<td>P</td>
<td>D,S</td>
</tr>
<tr>
<td>Bigelow, R.</td>
<td>SE¼SE¼NE¼NE¼ sec. 17, T. 97 N., R. 75 W.</td>
<td>60</td>
<td>10</td>
<td>O,C,P</td>
<td>D,S</td>
</tr>
<tr>
<td>Zimmerman, R.</td>
<td>SE¼SE¼NE¼NE¼ sec. 18, T. 97 N., R. 74 W.</td>
<td>22</td>
<td>10</td>
<td>O</td>
<td>D,S</td>
</tr>
<tr>
<td>Zimmerman, R.</td>
<td>SE¼SE¼NE¼NE¼ sec. 18, T. 97 N., R. 74 W.</td>
<td>28</td>
<td>5</td>
<td>O</td>
<td>S</td>
</tr>
<tr>
<td>Schultz, C.</td>
<td>SE¼SE¼SE¼NE¼ sec. 18, T. 97 N., R. 75 W.</td>
<td>40</td>
<td></td>
<td>O,C</td>
<td>D,S</td>
</tr>
<tr>
<td>McFarland, T.</td>
<td>NW¼NW¼NE¼NW¼ sec. 19, T. 97 N., R. 75 W.</td>
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<td>14</td>
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<td>A,P</td>
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<td>Fetzer, H.</td>
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<td>Depth to Water (feet)</td>
<td>Source</td>
<td>Use</td>
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