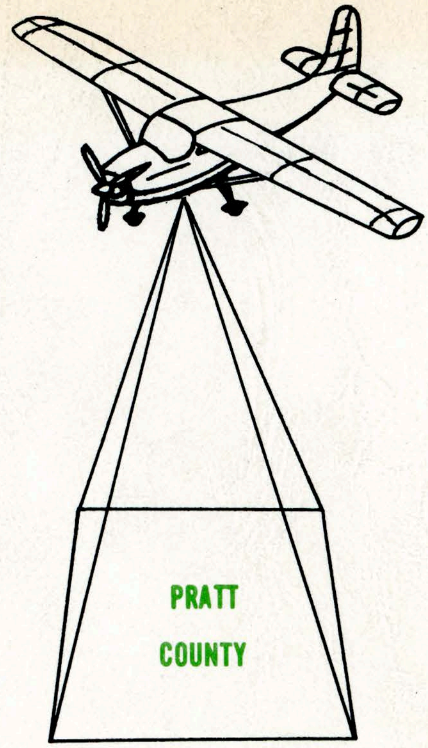
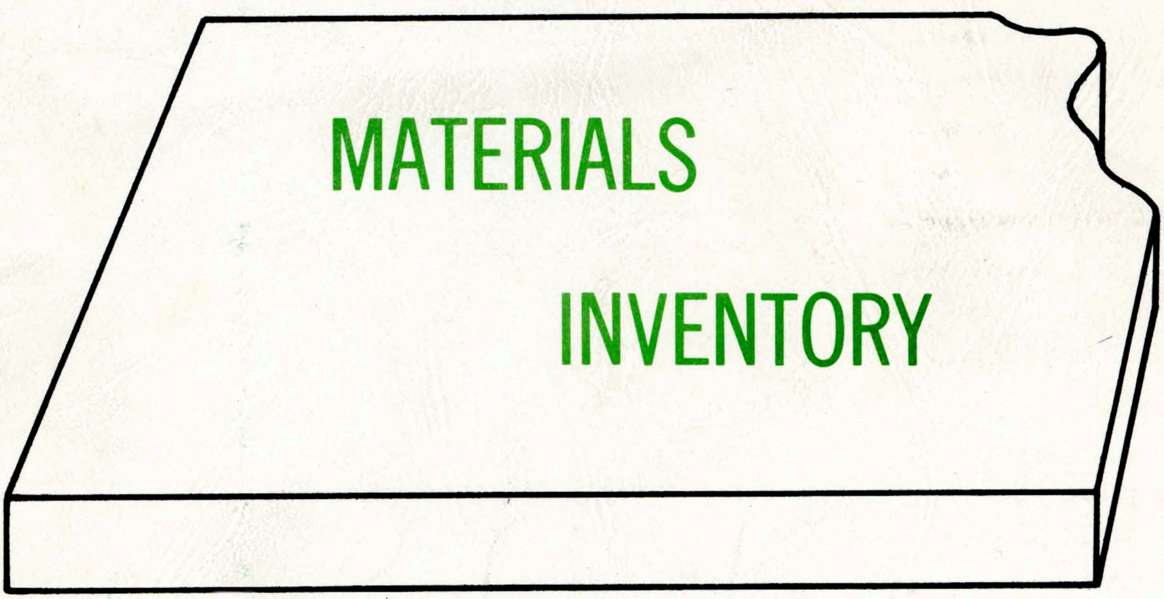


# PRATT COUNTY



# MATERIALS INVENTORY



PREPARED BY THE
STATE HIGHWAY COMMISSION OF KANSAS
LOCATION AND DESIGN CONCEPTS DEPARTMENT
IN COOPERATION WITH THE
U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
BUREAU OF PUBLIC ROADS

State Highway Commission of Kansas
Planning and Development Department -
Location and Design Concepts Department

# MATERIALS INVENTORY OF PRATT COUNTY, KANSAS

by

Gerald D. Hargadine, Geologist
assisted by
Dale P. Mahan
Photo Interpretation Section

Prepared in Cooperation with the
U. S. Department of Transportation
Federal Highway Administration
Bureau of Public Roads

1969

Materials Inventory Report No. 13

the **WHY ?**

**WHAT ?**

& **HOW ?**

# OF THIS REPORT

This report was compiled for use as a guide when prospecting for construction material in Pratt County.

*Construction material includes all granular material, binder material, and mineral filler suitable for use in highway construction.*

Known open sites, prospective sites, both sampled and unsampled, and all geologic units considered to be a source of construction material are described and mapped.

*Prospective sites are areas where geologic conditions are best for finding construction material.*

The diagram opposite shows how the MATERIALS INVENTORY SECTION may be used to evaluate and locate mapped sites.

The individually mapped sites certainly do not constitute the total construction material resources of the county. And, the data outlined in the diagram may be used for purposes other than the evaluation and location of these sites.

Beginning on page 7 is a section explaining the Geology of the county. This information (along with the maps, descriptions, and test data) provides the means of evaluating and locating additional construction material sources in the geologic units throughout Pratt County.

# TO LOCATE AND EVALUATE

# A MAPPED SITE OF CONSTRUCTION MATERIAL IN PRATT COUNTY

## Turn To The Materials Inventory Section

See
TABULATION OF CONSTRUCTION MATERIALS
Figure 7 Page 21

for material
**BY TYPE**
USE COLUMN 1

*For Quality Data See Figure 12 Page 27*

for material
**BY INTENDED USE**
USE COLUMN 3

for **DESCRIPTION** of MATERIAL

Column 4 gives page of DESCRIPTION which includes engineering characteristics, approximate locations, and references to materials maps.

for **AVAILABILITY** of MATERIAL

Column 5 gives the general location of available material and references the materials maps.

## MATERIALS MAPS

SEE PINK SHEET PAGE 29

Material source units, as well as all open and prospective pit sites are mapped. Each site is referenced to an individual data form.

## SITE DATA FORMS

| | |
|---|---|
| OPEN SITES - NOT SAMPLED | GREEN SHEET PAGE 31 |
| OPEN SITES - SAMPLED | GREEN SHEET PAGE 67 |
| PROSPECTIVE SITES - SAMPLED | GREEN SHEET PAGE 97 |
| PROSPECTIVE SITES - NOT SAMPLED | GREEN SHEET PAGE 107 |

Each site data form includes a map for site location and provides information concerning landownership, material quality (if available), geologic age, and site accessibility.

CONTENTS

# PREFACE

This report is one of a series compiled for the Highway Planning and Research Program, "Materials Inventory by Photo Interpretation." The program is a cooperative effort of the Bureau of Public Roads and the State Highway Commission of Kansas, financed by highway planning and research funds. The objective of the project is to provide a state-wide inventory of construction materials, on a county basis, to help meet the demands of present and future construction needs.

Basic geologic and materials data used in this report was derived from the report "Pleistocene Geology of Kansas" by J. C. Frye and A. B. Leonard, and from the forth-coming report "Geology and Ground-water Resources of Pratt County" by D. W. Berry, State Geological Survey of Kansas. Quality test results were obtained from the Materials Department, State Highway Commission of Kansas. Detailed soil and geologic information was obtained from preliminary soil surveys and centerline geological profiles prepared for design of major highways in the county.

Appreciation is extended to Eric Claassen, Pratt County Engineer, for verbal information concerning construction material in the area. The authors acknowledge the contributions made by R. E. Fry, Fifth Division Materials Engineer.

This report was prepared under the guidance of John D. McNeal, State Highway Engineer; Ray R. Biege, Jr., Engineer of the Location and Design Concepts Department; and Glen M. Koontz and Alvis H. Stallard of the Location and Design Concepts Department.

# ABSTRACT


The material resources of Pratt County are restricted to the Grand Island and Sappa Formations, Crete and Loveland Formations, Dune Sand, and Alluvium.

The Grand Island and Sappa Formations underlie most of Pratt County but are found exposed only along the major drainage channels. The Grand Island, which is the most important source of material, has been used in most phases of highway construction. The Sappa, which overlies the Grand Island, contains irregular beds of Pearlette volcanic ash which is a source of mineral filler.

The Crete and Loveland Formations cover the drainage divide south of the South Fork Ninnescah River and a small area north of the river. The Loveland eolian silt is not of economic value; however, the Crete, composed primarily of sand and gravel, is a possible source of granular material. The Crete is not currently produced because of its thin nature and limited areal distribution.

Dune Sand covers the northern one-third and a small area in the southeast portion of the county. Select sites in this unit are a source of base course binder.

Sand and gravel is produced from the Alluvium of the major streams by pumping operations. This material is similar to the Grand Island but has a higher percent of fines.

Usually, geo-engineering problems in Pratt County are not severe because of the granular nature of most surface material and the semi-arid climate.

Water supplies in Pratt County are relatively pure, with all tested sources being suitable for use in Portland Cement concrete. However, precaution should be exercised in localized areas where oil is produced and contamination from salt brine is a possiblity.

# GENERAL INFORMATION SECTION

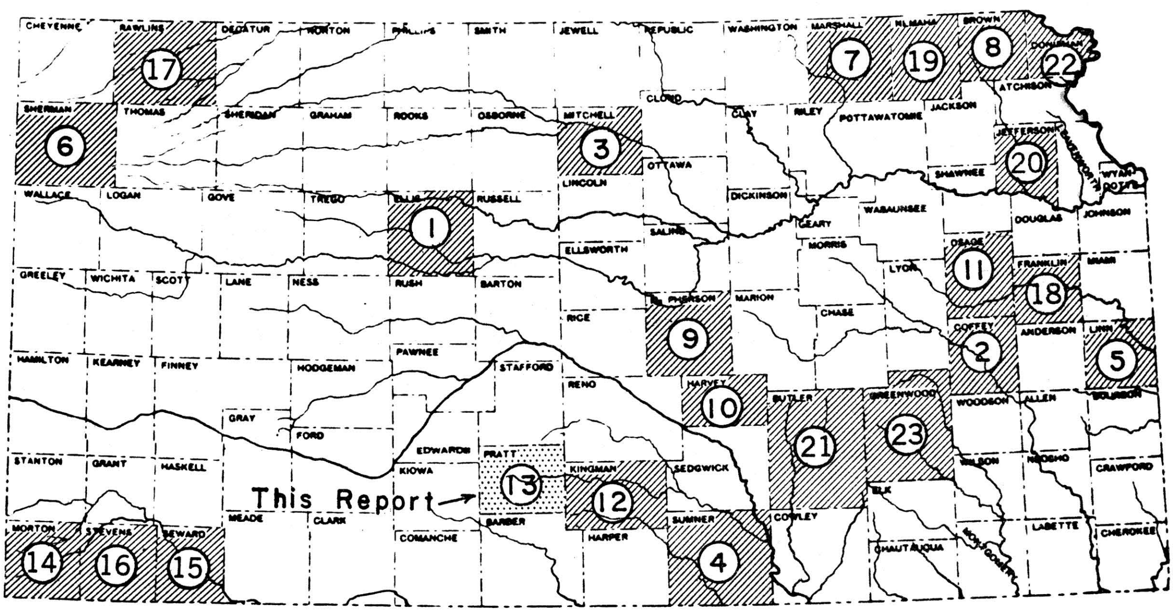



*Figure 1. Index map of Kansas showing the location of Pratt County along with the number and location of counties for which reports have been or are being completed.*

# PRATT COUNTY

Pratt County has an area of 720 square miles and a population of 11,416 according to figures compiled by the Kansas State Board of Agriculture in 1968. It lies in portions of the Great Bend Prairie, the High Plains, and the Red Hills-Wellington area physiographic divisions of Kansas.

Figure 1 shows the location of Pratt County as well as other counties currently included in the materials inventory program.

Drainage in Pratt County is mostly controlled by the South Fork of the Ninnescah but some streams flow to the Medicine River which traverses Barber County to the south. The Atchison, Topeka, and Santa Fe; Chicago, Rock Island and Pacific; and Missouri Pacific Railroad Companies serve Pratt County. U. S. Highways 54, 281, and Kansas Highway 61 are the major transportation routes. Figure 2 illustrates drainage, railroads, and highway locations.

# METHODS OF INVESTIGATION

Preparation for this report consisted of three phases: 1. Research and review of available information, 2. Photo interpretation, and 3. Field reconnaissance.

During phase one, information on geology, soils, and construction materials was reviewed. The results of quality tests on samples taken in Pratt County were then correlated with the various geologic units.

Phase two consisted of study and interpretation of aerial photographs taken by the State Highway Commission at a scale of one inch equals 2,000 feet. Figure 3 shows the photographic coverage map of Pratt County.

The geologic source beds were mapped and classified on photographs as were all open material sites previously sampled and reported. Then, all material sites were correlated with the geology of the county. Prospective areas were tentatively selected on the basis of the geology and aerial photographic pattern elements.

Phase three, a field reconnaissance of the county, was conducted after the initial study of the aerial photographs. This enabled the interpreter to examine the material with which he was working, to verify doubtful mapping situations, and to better acquaint himself with the geology of the county. Geologic classification of open sites was confirmed and prospective areas were inspected.

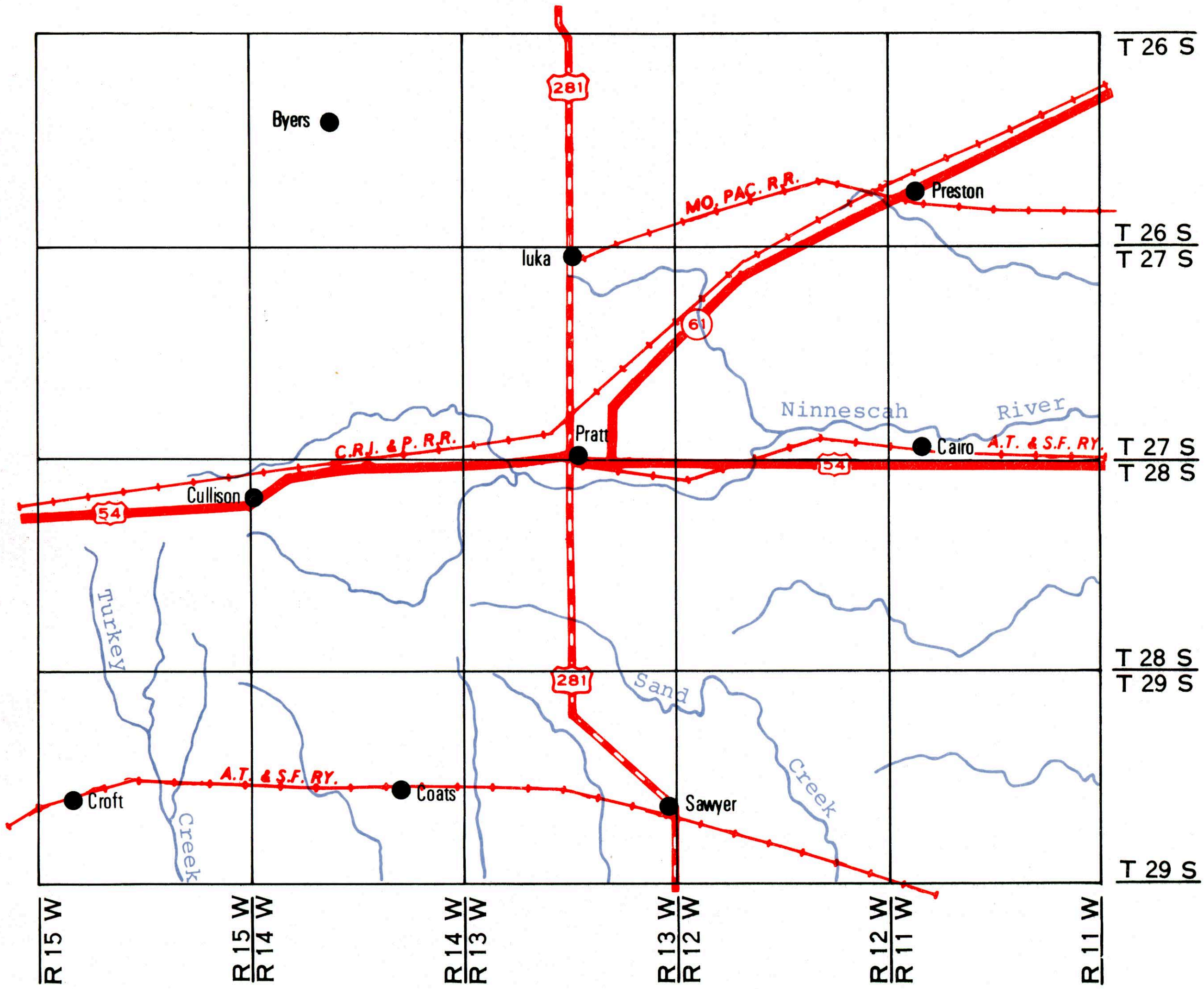



*Figure 2. Drainage and transportation facilities in Pratt County.*

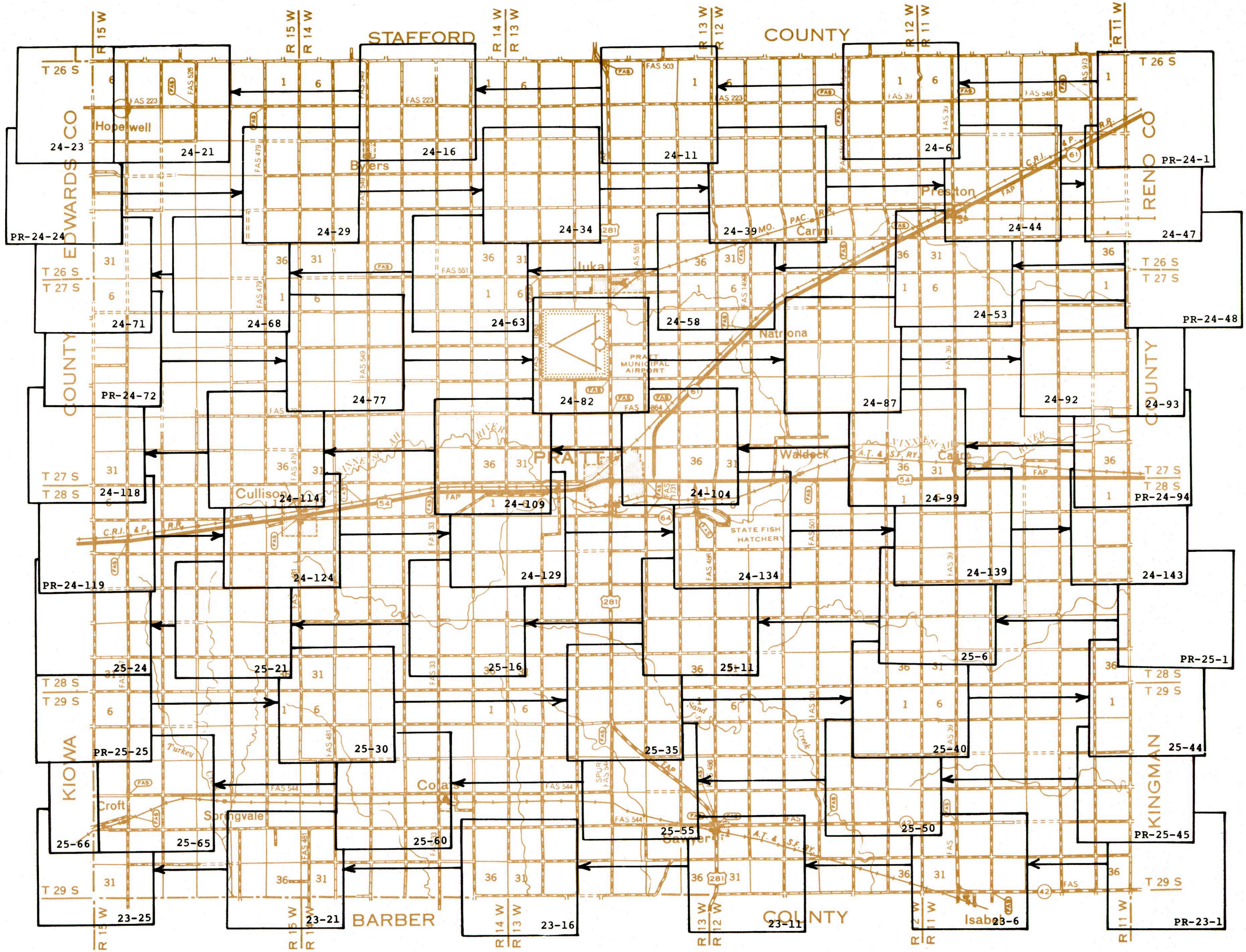
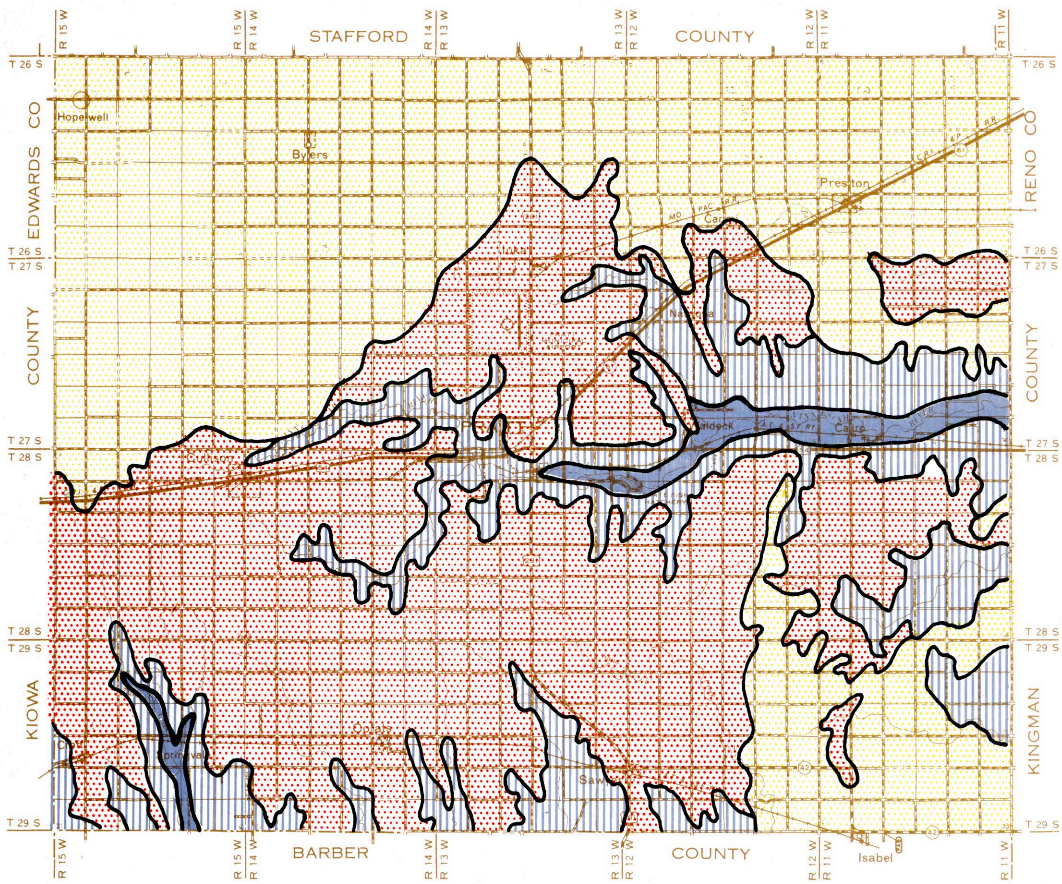



Figure 3. Aerial photographic coverage map for Pratt County. The numbers refer to photographs taken by the Photogrammetry Section, State Highway Commission of Kansas, October 12, 28, and 29, 1965 at a scale of 1:24,000. Aerial photographs are on file in the Photogrammetry Laboratory, State Office Building, Topeka, Kansas.

# GEOLOGY SECTION




*General Geology of Pratt County.*

**LEGEND**

| | |
|---|---|
| Alluvium | Loess |
| Dune Sand | Grand Island Formation |

## GENERAL GEOLOGY

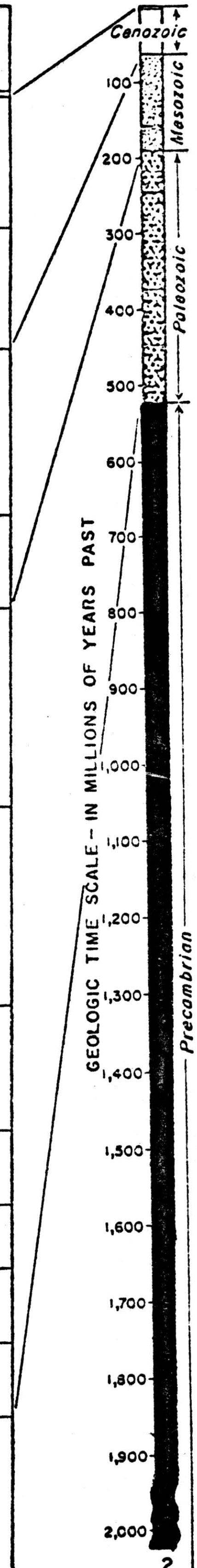
GEOLOGY is used for conducting materials inventories because material sources are the product of geologic agents. A knowledge of the geology makes it possible to ascertain the general properties of the material, to identify and classify each according to current geologic nomenclature, and thereby establish a uniform classification system. The quality of material from a given source may vary from one location to another, especially when dealing with unconsolidated deposits. The geologic classification of unconsolidated deposits denotes age rather than material type; therefore, two deposits can vary greatly in composition because of the difference in parent material, mode of deposition, or carrying capacity of the depositing agent.

By knowing the mode of deposition, type of material, geologic age, landform, and the results on quality tests, it is possible to derive general information on prospective sites. Sites selected for development can be evaluated by data obtained elsewhere from the same unit.

The geologic history of Pratt County is presented to provide a general understanding of the geologic events that were responsible for the deposition of construction materials resources. Since construction material sources are either exposed or near the surface, emphasis is placed on the segments of geologic time during which the surface units were deposited. The geologic timetable, figure 4, shows major time periods and the approximate duration of each.

| ERAS | PERIODS | ESTIMATED LENGTH IN YEARS | TYPE OF ROCK IN KANSAS | PRINCIPAL MINERAL RESOURCES |
|---|---|---|---|---|
| CENOZOIC | QUATERNARY (PLEISTOCENE)  | 1,000,000 | *Glacial drift; river silt, sand, and gravel; dune sand; wind-blown silt (loess); volcanic ash.* | Water, agricultural soils, sand and gravel, volcanic ash. |
| | TERTIARY | 59,000,000 | *River silt, sand, and gravel; fresh-water limestone; volcanic ash; bentonite; diatomaceous marl; opaline sandstone.* | Water, sand and gravel, volcanic ash, diatomaceous marl. |
| MESOZOIC | CRETACEOUS  | 70,000,000 | *Chalk, chalky shale, dark shale, vari-colored clay, sandstone, conglomerate. Outcropping igneous rock.* | Ceramic materials; building stone, concrete aggregate, and other construction rock; water. |
| | JURASSIC | 25,000,000 | *Sandstones and shales, chiefly subsurface.* | |
| | TRIASSIC | 30,000,000 | | |
| PALEOZOIC | PERMIAN  | 25,000,000 | *Limestone; shale; evaporites (salt, gypsum, anhydrite); red sandstone and siltstone; chert; some dolomite.* | Natural gas; salt; gypsum; building stone, concrete aggregate, and other construction materials; water. |
| | PENNSYLVANIAN  | 25,000,000 | *Alternating marine and non-marine shale, limestone, and sandstone; coal; chert.* | Oil, coal, limestone and shale for cement manufacture, ceramic materials, construction rock, agricultural lime, gas, water. |
| | MISSISSIPPIAN  | 30,000,000 | *Mostly limestone, predominantly cherty.* | Oil, zinc, lead, gas, chat and other construction materials. |
| | DEVONIAN | 55,000,000 | *Subsurface only. Limestone, black shale.* | Oil |
| | SILURIAN | 40,000,000 | *Subsurface only. Limestone.* | Oil |
| | ORDOVICIAN  | 80,000,000 | *Subsurface only. Limestone, dolomite, sandstone, shale.* | Oil, gas, water. |
| | CAMBRIAN | 80,000,000 | *Subsurface only. Dolomite, sandstone.* | Oil |
| PRE-CAMBRIAN | (Including PROTEROZOIC and ARCHEOZOIC ERAS) | 1,600,000,000 + | *Subsurface only. Granite, other igneous rocks, and metamorphic rocks.* | Oil and gas. |

*(Not scaled for geologic time or thickness of deposits)*




*State Geological Survey of Kansas*

*Figure 4. Geologic timetable. (Reproduced with the permission of the State Geological Survey of Kansas)*

Rocks which occur in the subsurface, but do not outcrop in Pratt County, range from Precambrian to Cretaceous in age. During Paleozoic time, deposits of limestone, shale, and sandstone were laid down when the surface was below sea level and generally, erosion occurred during periods of emergence. Most of the Paleozoic rocks are of marine origin; however, toward the end of the era, non-marine sediments of red beds and evaporites were deposited.

By the close of the Palezoic Era, seas withdrew from the area and in early Mesozoic time erosional processes were prominent. No deposits of Traissic and Jurassic age exist in Pratt County. Rocks of Cretaceous age (late Mesozoic) were deposited in the county but most have been removed by erosion associated with the Rocky Mountain uplift at the close of the Mesozoic. The erosional process continued well into the Cenozoic Era.

Late in Tertiary time, extensive deposits of silt, sand, and gravel were deposited over western Kansas. Subsequent erosion has removed most of this material from Pratt County.

All construction material in Pratt County was laid down during Pleistocene time. These deposits overlie the eroded surface of the Cretaceous and Permian beds. Figure 5 is a generalized geologic column of the surface geology of Pratt County which illustrates the relative stratigraphic position of the various geologic source units.

| Graphic Legend | Thickness | System | Series | Stage | Formations | Generalized Description | Construction Materials |
|---|---|---|---|---|---|---|---|
| | 0 to 50' | Quaternary | Pleistocene | Wisconsinan and Recent | Alluvium | Silt, sand and arkosic gravel with some clay binder; tan to red-brown. | Bituminous and concrete aggregate<br>Light type surfacing material<br>Base coarse aggregate<br>Shoulder material |
| | 0 to 20' | | | | Dune Sand | Fine to medium sand with minor amounts of silt and clay, cross-bedded, light tan. | Binder soil |
| | 0 to 30' | | | Illinoisan and Sangamonian | Loveland Formation | Clayey silt with some fine sand, tan. | None |
| | | | | | Crete Formation | Arkosic sand and gravel with minor amounts of silt and clay, tan. | Bituminous and concrete aggregate<br>Light type surfacing material<br>Base course aggregate<br>Shoulder material |
| | 50 to 160' | | | Kansan and Yarmouthian | Sappa Formation | Clayey silt and fine sand with zones and nodules of caliche. May contain the Pearlette volcanic ash zone. | Mineral Filler |
| | | | | | Grand Island Formation | Silt, sand and arkosic gravel; may contain some clay binder, tan. | Bituminous and concrete aggregate<br>Light type surfacing material<br>Base course aggregate<br>Shoulder material |

*Figure 5. Generalized geologic column of Pratt County.*

The *Pleistocene Epoch* of the Quaternary Period represents approximately the last one million years in the Cenezoic Era and a time of repeated glacial and interglacial cycles in North America. Glacial activity in Kansas was restricted to the extreme northeastern corner of the state. The sequence of glaciation occurring during this time plays a controlling role in the development of Pleistocene nomenclature. The glacial ages (Nebraskan, Kansan, Illinoisan, and Wisconsinan) represent the advance of the glaciers, while the three interglacial ages (Aftonian, Yarmouthian, and Sangamonian) represent major glacial recession. Figure 6 is a geologic timetable which shows the divisions of the Quaternary and the approximate duration of each.

The geologic history of the Pleistocene Epoch as discussed here is based mainly on reports by Williams and Lohman (1949) and Frye and Leonard (1952).

At the beginning of the Nebraskan time, Pratt County was a gentle plain sloping to the southeast, mantled by varying amounts of Tertiary deposits. With the advance of the Nebraskan glacier, streams degraded their channels and most of the Tertiary sediments were removed. As the glacier melted, warmer climates returned to south-central Kansas and a change in the regimen of the Nebraskan streams occurred. Alluviation of the streams started and continued until the valleys were filled and former stream divides buried. Today these deposits occur in the subsurface of Pratt County and are designated the Fullerton and Holdrege Formations.

| Divisions of the Quaternary Period | | | | |
|---|---|---|---|---|
| Period | Epoch | Age | Estimated length of age duration in years | Estimated time in years elapsed to present |
| Quaternary | Pleistocene | Recent | | 10,000 |
| | | Wisconsinan Glacial | 45,000 | 55,000 |
| | | Sangamonian Interglacial | 135,000 | 190,000 |
| | | Illinoisan Glacial | 100,000 | 290,000 |
| | | Yarmouthian Interglacial | 310,000 | 600,000 |
| | | Kansan Glacial | 100,000 | 700,000 |
| | | Aftonian Interglacial | 200,000 | 900,000 |
| | | Nebraskan Glacial | 100,000 | 1,000,000 |

*Figure 6. Geologic timetable of the Quaternary Period*

The Aftonian interglacial age was a stable cycle in which soil development took place. The *Afton Soil*, which developed at this time, is exposed at several points in Pratt County.

In early Kansan time, as the glaciers accumulated and advanced, erosion was severe in the stream channels over the state. Down-cutting occurred in most streams as a result of large amounts of meltwater from the continental glacier to the north, alpine glaciers in the Rocky Mountains to the west, and the moist climate associated with the age.

By late Kansan time, a drainage channel had formed from the Rocky Mountain area through south-central Kansas. This arterial stream, which was heavily laden with outwash, rapidly filled its valleys as the glaciers receeded. This alluvial material eventually topped low divides which resulted in a thick deposit of granular material (*Grand Island Formation*) over much of Pratt County. With the continual retreat of the glaciers, the stream velocity in Pratt County became slower resulting in deposition of a finer material termed the *Sappa Formation*. At the time the Sappa Formation was being deposited, volcanic activity in the southern Rocky Mountain area filled the atmosphere with ash dust. Some of the ash (*Pearlette Ash Zone*) was deposited in the Sappa.

Milder climates prevailed at the close of Kansan time and throughout the Yarmouthian interglacial age. During this time, the *Yarmouthian Soil* developed.

As the Illinoisan ice sheet advanced into the midcontinent region and glaciers accumulated in the Rocky Mountain area, cooler climates returned to south-central Kansas. Although the ice did not extend farther south than southeastern Iowa, the climate change caused a rejuvenation of streams. As the Illinoisan ice melted, milder climates returned and a veneer of outwash from the Rocky Mountains was deposited. These granular deposits comprise the Crete Formation.

During late Illinoisan and early Sangamonian time, wind-blown silts of the *Loveland Formation* were deposited.

In the latter part of Sangamonian, the *Sangamon Soil* developed.

The Wisconsinan glacier advanced no further south than central Iowa and northeast Nebraska. The moist, cool climate that accompanied the ice caused degradation of the terrain in Pratt County in early and late Wisconsinan time. As the Wisconsinan ice retreated, moderate climates returned and streams alluviated their valleys. Terraces of early and late Wisconsinan age form distinct levels adjacent to the present streams.

The Recent Age represents the time since the last glaciation. During this time, sediments have been reworked by wind and water. The *sand dunes* found in the northern one-third of the county were formed during this time.

# GEO-ENGINEERING SECTION

## INTRODUCTION

This section is a general appraisal of the material available in Pratt County for embankment, shoulder and subgrade construction. Potential ground-water problems and the quality of water available for concrete are briefly reviewed. Detailed field investigations may be necessary to ascertain the severity of specific problems and to make recommendations concerning design and construction procedures.

## GENERAL GEO-ENGINEERING CONDITIONS

Few geo-engineering problems are encountered in Pratt County because of: (1) an absence of bedrock exposures; (2) an abundance of granular material; (3) the presence of low P.I. soils; (4) the availability of relatively pure water; and (5) a semi-arid climate. However, some problems do exist.

Although no bedrock is exposed in the county, shale of Permian and (or) Cretaceous age may be close enough to the surface to be of consequence in bridge supports. The Cretaceous Shale may be weathered soft and clayey, but the Permian Red Shales should be firm.

In granular deposits, ground-water problems in low areas are common especially during wet seasons. The surface drainage in sand dune areas is poor with most movement being vertical. A clay "seal" may eventually form in the subsurface, and a perched water table may develop. This condition creates bog areas characterized by highly plastic material.

Much of the sandy material in Pratt County will not support vegetation well, with blow sand being a maintenance problem especially in cuts. Flat backslopes and seeding help defer erosion.

In Pratt County, ground-water is produced from unconsolidated granular material overlying bedrock. This water is relatively pure and safe for use in concrete; however, local contamination may occur in areas where oil wells are located.

# MATERIALS INVENTORY SECTION

## GENERAL INFORMATION

Construction material in Pratt County is from five sources: Grand Island, Sappa, and Crete Formations, Dune Sand, and Alluvium. The Grand Island, Crete, and Alluvium are sources of sand and gravel. The Pearlette Ash zone in the Sappa is an excellent source of mineral filler. Binder soil may be obtained from select locations in the Dune Sand.

Due to thick overburden on the stream divides, most material is produced along the major drainage channels.

The Grand Island Formation and Alluvium are major sources of granular material in Pratt County. According to Eric Claassen, Pratt County Engineer, the Grand Island supplies nearly all aggregate for light type surfacing. Bituminous mixes are often made from the Grand Island by a simple screening process and subsequent addition of volcanic ash as a mineral filler. Alluvial material, pumped from the South Fork Ninnescah River, is an important source of concrete aggregate. Because the Crete Formation is thin and limited in areal extent, it is not presently utilized as a material source.

# Contents

| Material Types | Geologic Source | Material Usage | Description | Availability |
|---|---|---|---|---|
| Sand and Gravel | Grand Island Formation | Light type surfacing, bituminous and concrete aggregate, base course and shoulder material. | Page 22 | Along the major drainage in the central and southern portions of the county. (Mapped on plates II, III, IV, V, and VI). |
| | Crete Formation | Not used presently, possibly used for light type surfacing, bituminous and concrete aggregate, base course and shoulder material. | Page 22 | Possibly along the major drainage in the southern two-thirds of the county near the break between the Grand Island and Sappa Formations and the Crete-Loveland Formations. (Mapped on plates I, II, III, IV, V, and VI). |
| | Alluvium | Light type surfacing, bituminous and concrete aggregate, base course and shoulder material. | Page 23 | The central portion of the county in the immediate stream bed of the South Fork Ninnescah River and its larger tributaries. Also in the southern portion along the major northern tributaries of the Medicine Lodge River. (Mapped on plates III, IV, V, and VI). |
| Volcanic Ash | Sappa Formation | Mineral Filler | Page 24 | Scattered volcanic ash deposits found along the South Fork Ninnescah River in a band through central Pratt County. (Mapped on plates II, III, IV, V, and VI). |
| Binder Soil | Dune Sand | Base Course Binder | Page 25 | Northern one-third of the county. (Mapped on plates I, II, III, IV, and V). |

*Figure 7 . Tabulation of the construction material types and their availability in Pratt County.*

# DESCRIPTION OF CONSTRUCTION MATERIALS

## Sand and Gravel

### *Grand Island Formation*

The Grand Island and Sappa Formations are floodplain deposits of Kansan Age. These units cover most of the county but are exposed mostly along the major drainage channels where erosion has removed the overburden. Because the Grand Island and Sappa cannot be distinguished as separate beds on aerial photographs, the two are included in the same map unit.

The Grand Island is composed of tan-colored silt, sand, and arkosic gravel along with scattered pieces of limestone, chert, and ironstone (figure 8). The texture ranges from fine to coarse with the fine fraction being more prominent.

The Grand Island is the best source of granular material in Pratt County. The raw material is extensively used for light type surfacing and, when processed, it can be used in bituminous mixes and concrete. It may also be used for base course and shoulder construction. Quality information on this material shows a Los Angeles wear range from 25.8 to 37.0 percent, soundness loss ratio from 0.94 to 0.99 and absorption from 0.5 to 0.8 percent. Additional test information is shown in figure 27.

### *Crete Formation*

The Crete and Loveland Formations are included in the same map unit. The Crete is primarily sand and gravel, and the Loveland, clayey silt. These two formations are found

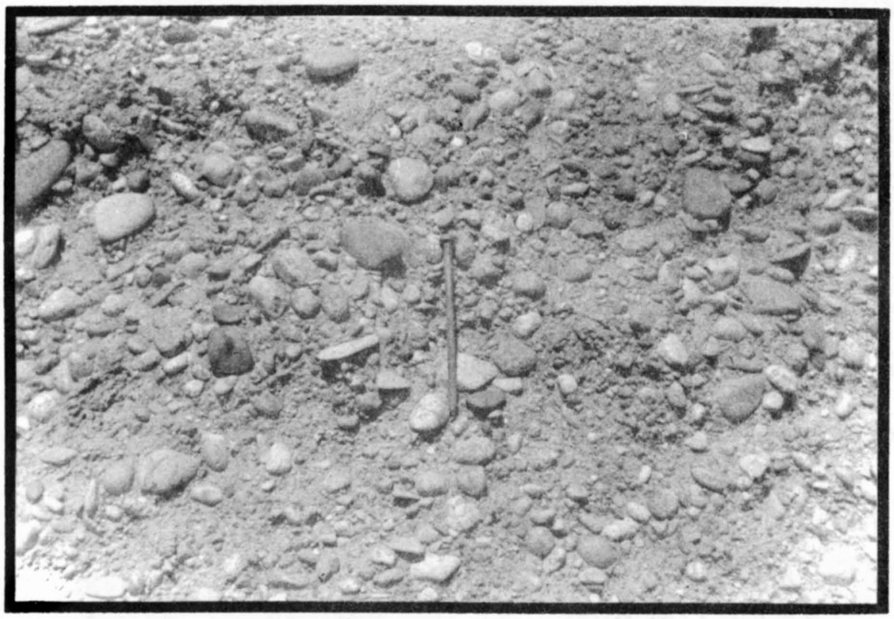


*Figure 8. Sand and gravel pit in the Grand Island Formation, SE¼ SE¼ sec.15, T29S, R15W.*

primarily south of the South Fork Ninnescah River. The Crete occurs at the base of the Loveland but comprises only a very small part of the map unit. No material has been produced from the Crete in Pratt County but some could be obtained near the contact of the Grand Island-Sappa and the Crete-Loveland map units (plates I through VI).

This unit is thin and not widely distributed in the county; however, aggregate from this source may be suitable for all phases of road construction.

*Alluvium*

The Alluvium is composed of arkosic sand and gravel derived largely from the Grand Island Formation. The maximum thickness is approximately 50 feet along the South Fork Ninnescah River. Most production, from the Alluvium in Pratt County, is pumped from pits located along this channels (figure 9).

Alluvial material is used for light type surfacing and for bituminous and concrete construction. It may also be satisfactory for base course and shoulder construction. Screening is necessary to obtain the desired gradation because of the abundance of fine sand. A large percentage of concrete aggregate used in Pratt County is obtained from the Alluvium.

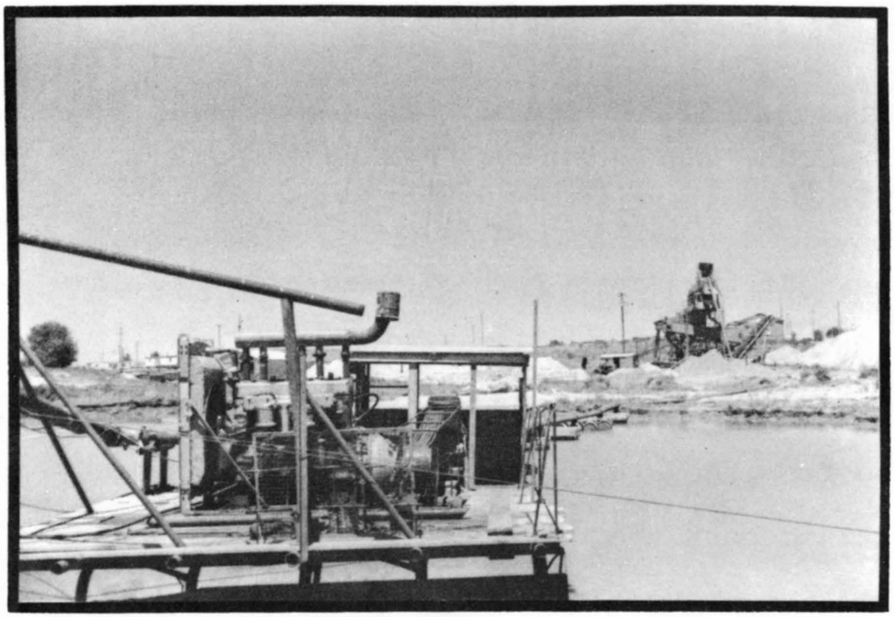


*Figure 9 . Sand and gravel pit in the Alluvium of the South Fork Ninnescah River, SW¼ sec. 4, T28S, R13W.*

Available quality information shows the Los Angeles wear to range from 27.0 to 35.6 percent, the soundness loss ratio from 0.95 to 0.99 and the absorption on two samples from 0.4 to 0.8 percent. Figure 12 shows quality and gradation information on samples of alluvial material.

## Mineral Filler

### *Sappa Formation*

The Sappa Formation, which overlies the Grand Island, is composed of tan, clayey silt with accumulations of caliche, and lenticular zones of Pearlette volcanic ash up to 15 feet thick for mineral filler (figure 10).

Several deposits of ash have been utilized in Pratt County; however, some deposits are contaminated with silt, clay, and caliche and are undesirable for construction purposes.

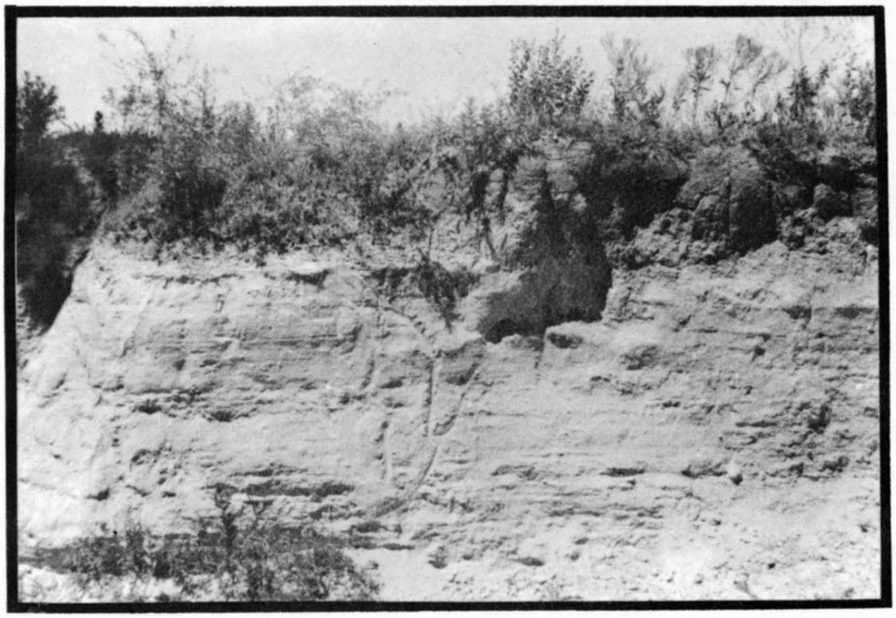


*Figure 10 . Pit in the Pearlette volcanic ash, NW¼ SE¼ sec.34, T27S, R12W.*

## Binder Soil

### *Dune Sand*

Sand dunes are found in the northern one-third and the southeast corner of Pratt County (figure 11 ). They are composed of tan-colored, cross-bedded, fine sand with varying amounts of silt and clay. Their thickness does not ordinarily exceed 20 feet.

Dune Sand is generally too coarse for mineral filler. However, some high plastic index silt can be found in a dune topography that is useful for base course binder.

*Figure 11. Dune sand topography in northeast Pratt County, NE¼ sec.35, T26S, R11W.*

| Location | Material Type | Percent Retained 1½ | 3/4 | 3/8 | 4 | 8 | 16 | 30 | 50 | 100 | 200 | Wash | G.F. | P.I. | L.L. | Sp.Gr. | Wt./Cu.Ft. | L.A. Wear | Soundness | Absorption | Source of Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grand Island Formation** | | | | | | | | | | | | | | | | | | | | | |
| NW¼NW¼ sec.15, T29S, R13W | Sand & Gravel | 0 | 4 | 8 | 19 | 34 | 49 | 71 | 92 | 99 | -- | -- | 3.77 | -- | -- | 2.61 | 111.4 | 33.2 | 0.97 | --- | Av. 9 samples, SHC form 619 No. 76-1 |
| NE¼ sec.27, T27S, R12W | Sand & Gravel | 0 | 2 | 8 | 18 | 34 | 52 | 75 | 92 | 99 | -- | 3 | 3.81 | -- | -- | 2.57 | 103.8 | 35.6 | 0.97 | --- | Av.15 samples, SHC form 619 No. 76-3 |
| SW¼SE¼ sec.16, T29S, R15W | Sand & Gravel | 0 | 3 | 10 | 19 | 32 | 48 | 68 | 89 | 96 | -- | 3 | 3.66 | -- | -- | 2.60 | 110.8 | 33.7 | 0.99 | --- | Av.16 samples, SHC form 619 No. 76-4 |
| NW¼NW¼ sec.27, T29S, R15W | Sand & Gravel | 2 | 9 | 16 | 25 | 36 | 54 | 73 | 85 | 98 | -- | 3 | 4.07 | -- | -- | 2.60 | 116.2 | 27.6 | 0.99 | --- | Av.14 samples, SHC form 619 No. 76-5 |
| SE¼ sec.13, T28S, R14W | Sand & Gravel | 0 | 1 | 9 | 21 | 40 | 61 | 81 | 96 | 100 | -- | -- | 4.22 | -- | -- | 2.60 | 116.7 | 32.2 | 0.98 | --- | Av.16 samples, SHC form 619 No. 76-6 |
| NW¼ sec.24, T28S, R14W | Sand & Gravel | 0 | 6 | 14 | 26 | 45 | 66 | 85 | 98 | 99 | -- | 1 | 4.50 | -- | -- | 2.60 | 116.6 | 32.2 | 0.98 | --- | Av.10 samples, SHC form 619 No. 76-7 |
| SE¼NE¼ sec. 5, T29S, R15W | Sand & Gravel | 0 | 4 | 9 | 16 | 29 | 48 | 77 | 96 | 99 | -- | 2 | 3.76 | -- | -- | 2.62 | 118.9 | 27.4 | 0.98 | --- | Av.24 samples, SHC form 619 No. 76-9 |
| NW¼ sec.23, T29S, R15W | Sand & Gravel | 0 | 7 | 12 | 19 | 27 | 42 | 63 | 87 | 98 | -- | 3 | 3.55 | -- | -- | 2.56 | 110.8 | 37.0 | 0.96 | --- | Av.18 samples, SHC form 619 No. 76-14 |
| NE¼ sec.18, T27S, R12W | Sand & Gravel | 0 | 1 | 4 | 11 | 22 | 38 | 61 | 86 | 93 | -- | 7 | 3.16 | -- | -- | 2.60 | 104.3 | 31.3 | 0.99 | --- | 1 sample, SHC form 619 No. 76-22 |
| SW¼SE¼ sec.29, T28S, R11W | Sand & Gravel | 0 | 0 | 3 | 9 | 20 | 36 | 61 | 90 | 98 | 100 | 1 | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | 1 sample, SHC form 619 No. 76-23 |
| SE¼ sec. 9, T28S, R13W | Sand & Gravel | 0 | 8 | 13 | 17 | 24 | 36 | 59 | 89 | 93 | -- | 2 | 3.43 | -- | -- | 2.61 | 110.7 | 31.0 | 0.99 | 0.8 | Av. 8 samples, SHC form 619 No. 76-29 |
| SE¼ sec.15, T29S, R15W | Sand & Gravel | 0 | 8 | 15 | 23 | 35 | 49 | 67 | 86 | 94 | -- | 2 | 3.69 | -- | -- | 2.62 | 112.7 | 25.8 | 0.98 | 0.5 | Av.18 samples, SHC form 619 No. 76-30 |
| NW¼ sec.31, T29S, R13W | Sand & Gravel | 0 | 4 | 10 | 17 | 26 | 40 | 62 | 89 | 98 | -- | 5 | 3.45 | -- | -- | 2.60 | 112.4 | 35.5 | 0.98 | --- | Av.10 samples, SHC form 619 No. 76-31 |
| SE¼ sec.27, T27S, R13W | Sand & Gravel | 0 | 1 | 5 | 10 | 20 | 35 | 59 | 88 | 98 | -- | 4 | 3.16 | -- | -- | 2.60 | 109.6 | 33.5 | 0.98 | --- | Av. 9 samples, SHC form 619 No. 76-32 |
| SW¼ sec. 6, T28S, R13W | Sand & Gravel | 0 | 0 | 7 | 23 | 41 | 64 | 84 | 95 | 98 | -- | 1 | 4.12 | -- | -- | 2.60 | 114.9 | 29.7 | 0.94 | 0.6 | 1 quality sample, Lab. No. 18728 |
| SW¼ sec.10, T29S, R13W | Sand & Gravel | 0 | 0 | 5 | 11 | 25 | 40 | 63 | 90 | 97 | -- | 2 | 3.29 | -- | -- | 2.60 | 108.4 | 28.2 | 0.98 | --- | 1 quality sample, Lab. No. 54740 |
| SE¼ sec. 9, T27S, R12W | Sand & Gravel | 0 | 0 | 2 | 7 | 19 | 38 | 67 | 93 | 99 | -- | .4 | 3.25 | -- | -- | 2.62 | 111.3 | 32.2 | 0.98 | 0.5 | 1 quality sample, Lab. No. 28891 |
| **Sappa Formation** | | | | | | | | | | | | | | | | | | | | | |
| SW¼SW¼ sec.21, T27S, R12W | Volcanic Ash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 15 | 85 | ---- | -- | -- | 2.41 | 49.1 | ---- | ---- | --- | Av. 8 samples, SHC form 619 No. 76-10 |
| NE¼ sec.25, T27S, R14W | Volcanic Ash | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 9 | 39 | -- | ---- | -- | -- | 2.38 | 60.4 | ---- | ---- | --- | 1 quality sample, Lab. No. 49523 |
| SW¼ sec.22, T27S, R12W | Volcanic Ash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 33 | 67 | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | 1 quality sample, Lab. No. 49524 |
| NW¼SE¼ sec.22, T28S, R14W | Volcanic Ash | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 17 | 42 | 58 | ---- | -- | -- | 2.36 | 54.0 | ---- | ---- | --- | Av.13 samples, SHC form 619 No. 76-20 |
| NW¼NE¼ sec.32, T27S, R14W | Volcanic Ash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 17 | 24 | 76 | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | Av. 9 samples, SHC form 619 No. 76-33 |
| **Dune Sand** | | | | | | | | | | | | | | | | | | | | | |
| NE¼NW¼ sec.28, T26S, R11W | Fine Sand | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 22 | 57 | 72 | 28 | ---- | -- | -- | 2.62 | 93.9 | ---- | ---- | --- | Av. 6 samples, SHC form 619 No. 76-13 |
| SE¼NE¼ sec.18, T29S, R11W | Fine Sand | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 21 | 56 | -- | 37 | ---- | 3 | -- | ---- | ---- | ---- | ---- | --- | Av. 8 samples, SHC form 619 No. 76-25 |
| NE¼NE¼ sec.36, T27S, R15W | Fine Sand | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 24 | 61 | 76 | -- | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | Av.16 samples, SHC form 619 No. 76-26 |
| SE¼NW¼ sec. 4, T28S, R15W | Fine Sand | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 21 | 55 | -- | -- | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | Av.15 samples, SHC form 619 No. 76-27 |
| NW¼ sec. 6, T28S, R15W | Fine Sand | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 17 | 62 | -- | -- | ---- | -- | -- | ---- | ---- | ---- | ---- | --- | Av.10 samples, SHC form 619 No. 76-28 |
| **Alluvium** | | | | | | | | | | | | | | | | | | | | | |
| NE¼NE¼ sec.27, T28S, R11W | Sand & Gravel | 0 | 1 | 4 | 9 | 24 | 53 | 74 | 92 | 98 | -- | 1 | 3.55 | -- | -- | 2.62 | 116.0 | 30.0 | 0.97 | --- | 1 quality sample, Lab. No. 44512 |
| SE¼NE¼ sec.33, T27S, R12W | Sand & Gravel | 3 | 7 | 13 | 20 | 31 | 44 | 64 | 92 | 98 | -- | 2 | 3.64 | -- | -- | 2.59 | 120.7 | 27.0 | 0.98 | --- | Av. 4 samples, SHC form 619 No. 76-15 |
| E½ sec.22, T29S, R13W | Sand & Gravel | 0 | 2 | 8 | 18 | 34 | 53 | 77 | 97 | 100 | -- | -- | 3.83 | -- | -- | 2.59 | 107.0 | 33.2 | 0.99 | --- | Av.17 samples, SHC form 619 No. 76-18 |
| SW¼ sec.23, T28S, R11W | Sand & Gravel | 0 | 0 | 2 | 7 | 18 | 36 | 59 | 87 | 98 | -- | -- | 3.04 | -- | -- | 2.61 | 113.3 | 30.8 | 0.96 | --- | Av. 6 samples, SHC form 619 No. 76-19 |
| SW¼ sec. 2, T28S, R13W | Sand & Gravel | 0 | 1 | 3 | 9 | 27 | 62 | 90 | 98 | 99 | -- | 1 | 3.89 | -- | -- | 2.62 | 110.2 | 30.2 | 0.98 | --- | 1 sample, SHC form 619 No. 76-21 |
| SE¼SE¼ sec. 5, T28S, R13W | Sand & Gravel | 0 | 0 | 4 | 16 | 41 | 69 | 86 | 94 | 96 | -- | 1 | 4.06 | -- | -- | 2.59 | 112.3 | 31.2 | 0.99 | 0.8 | 1 quality sample, Lab. No. 21311 |
| NE¼SE¼ sec.23, T28S, R11W | Sand & Gravel | 0 | 1 | 8 | 21 | 50 | 83 | 97 | 99 | 100 | -- | -- | 3.60 | -- | -- | 2.62 | 107.4 | 29.4 | 0.95 | 0.7 | 1 quality sample, Lab. No. 1870 |
| NE¼ sec.34, T27S, R12W | Sand & Gravel | 0 | 0 | 7 | 19 | 38 | 66 | 86 | 96 | 99 | -- | 1 | 4.11 | -- | -- | 2.61 | 116.7 | 30.2 | 0.99 | --- | 1 quality sample, Lab. No. 65069 |
| NW¼SW¼ sec. 4, T28S, R13W | Sand & Gravel | 0 | 2 | 6 | 12 | 22 | 35 | 59 | 88 | 97 | -- | 3 | 3.21 | -- | -- | 2.59 | 110.7 | 35.6 | 0.98 | 0.4 | 1 sample, SHC form 619 No. 73-34 |

*Figure 12. Results of tests completed on samples of material from several geologic source beds in Pratt County.*

# Materials Map Index

On the following pages are six materials maps covering Pratt County as shown below.

Plate I

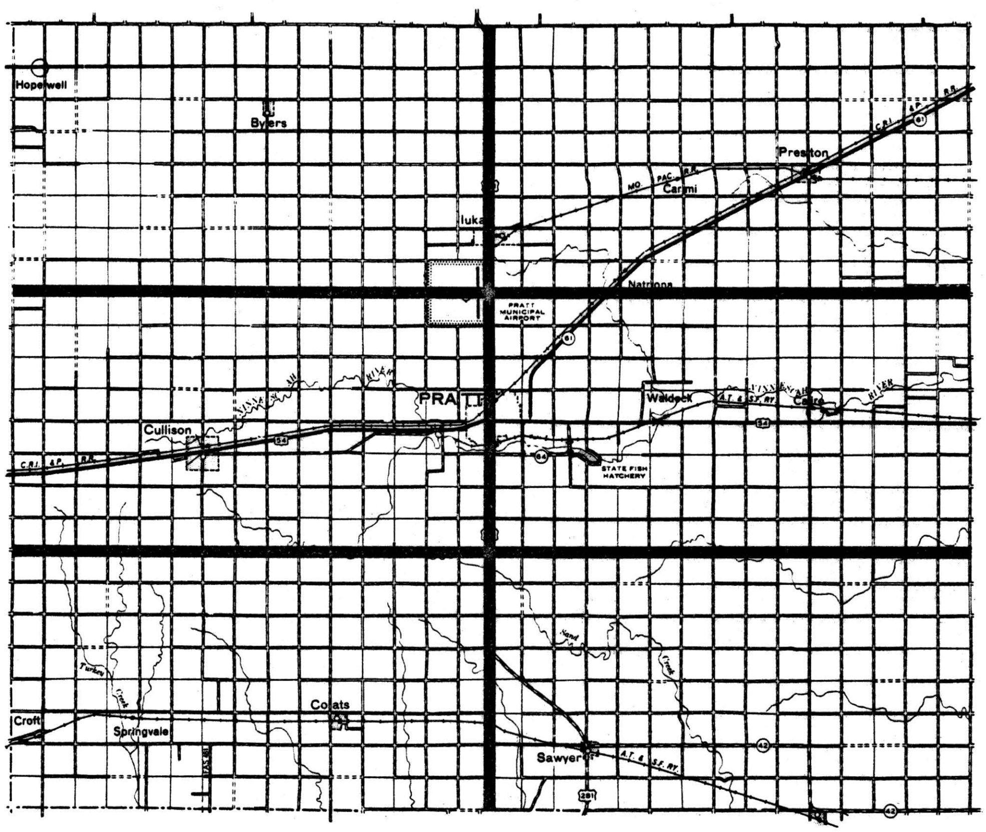
Plate II

Plate III

Plate IV

Plate V

Plate VI




Note: The individual site data forms follow Plate VI.

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

● Open site; not sampled (see appendix I)

■ Open site; sampled (see appendix II)

▼ Prospective site; sampled (see appendix III)

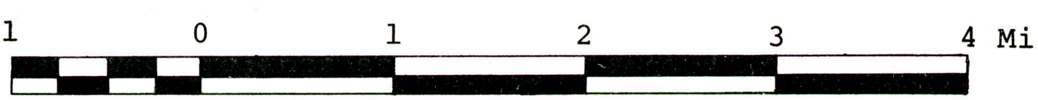
⬢ Prospective site; not sampled (see appendix IV)

SG+5 / Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - \+ indicates more than 20,000 cubic yards
  - \- indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale:


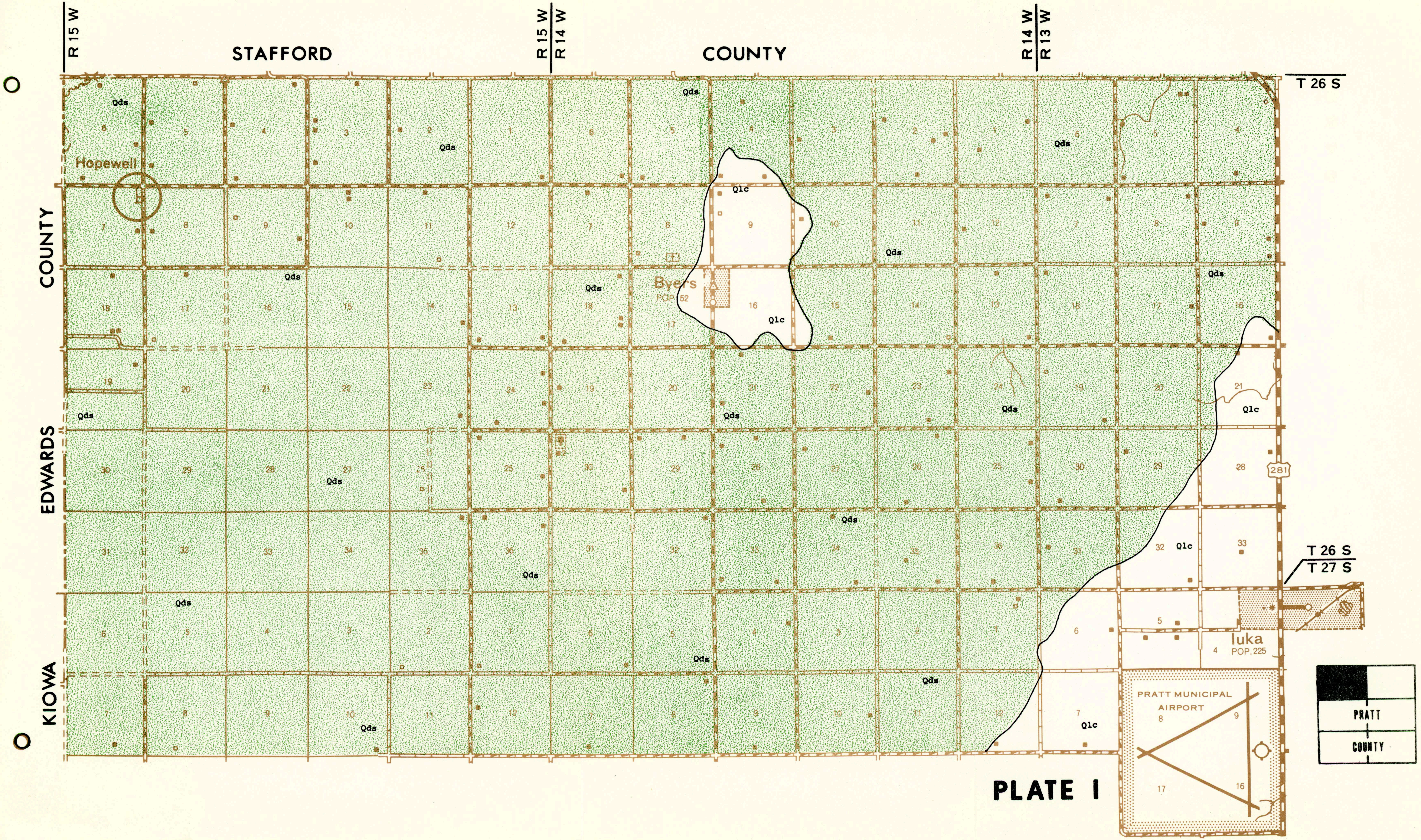

R 15 W
STAFFORD
R 15 W
R 14 W
COUNTY
R 14 W
R 13 W
T 26 S
EDWARDS COUNTY
KIOWA
Hopewell
Byers
POP. 52
Iuka
POP. 225
PRATT MUNICIPAL AIRPORT
281
T 26 S
T 27 S
PRATT
COUNTY
Qds
Qlc

PLATE I

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

- ● Open site; not sampled (see appendix I)
- ■ Open site; sampled (see appendix II)
- ▼ Prospective site; sampled (see appendix III)
- ⬢ Prospective site; not sampled (see appendix IV)

SG+5
Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - + indicates more than 20,000 cubic yards
  - - indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale:

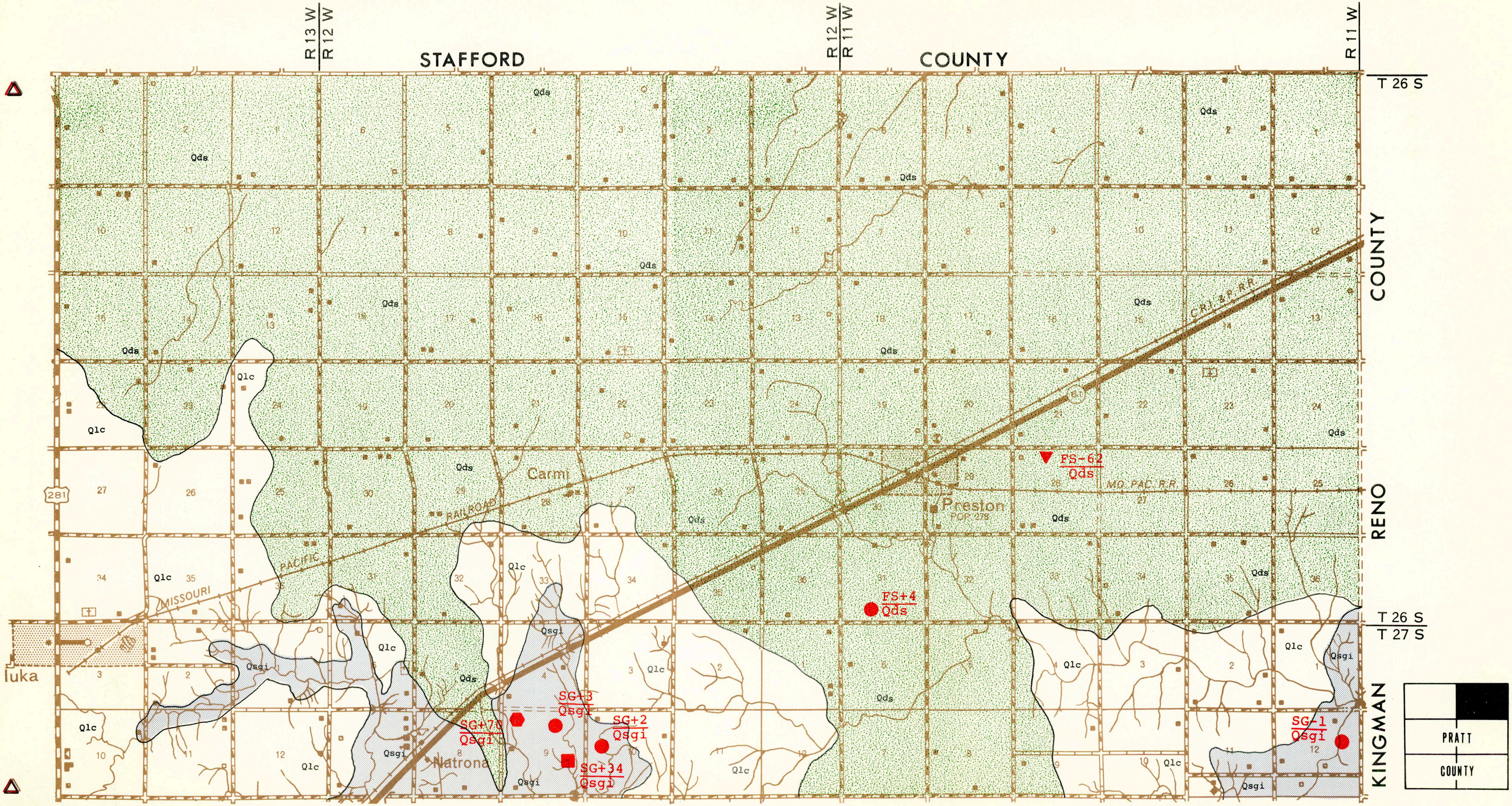

STAFFORD COUNTY
RENO COUNTY
KINGMAN COUNTY
R 13 W
R 12 W
R 11 W
T 26 S
T 27 S
Carmi
Preston
POP 278
Natrona
Iuka
281
MISSOURI PACIFIC RAILROAD
C.R.I.&P. R.R.
MO. PAC. R.R.
Qds
Qlc
Qsgi
FS-62 Qds
FS+4 Qds
SG+3 Qsgi
SG+70 Qsgi
SG+2 Qsgi
SG+34 Qsgi
SG-1 Qsgi
PRATT COUNTY

PLATE II

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

- ● Open site; not sampled (see appendix I)
- ■ Open site; sampled (see appendix II)
- ▼ Prospective site; sampled (see appendix III)
- ⬣ Prospective site; not sampled (see appendix IV)

SG+5
Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - \+ indicates more than 20,000 cubic yards
  - \- indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale:

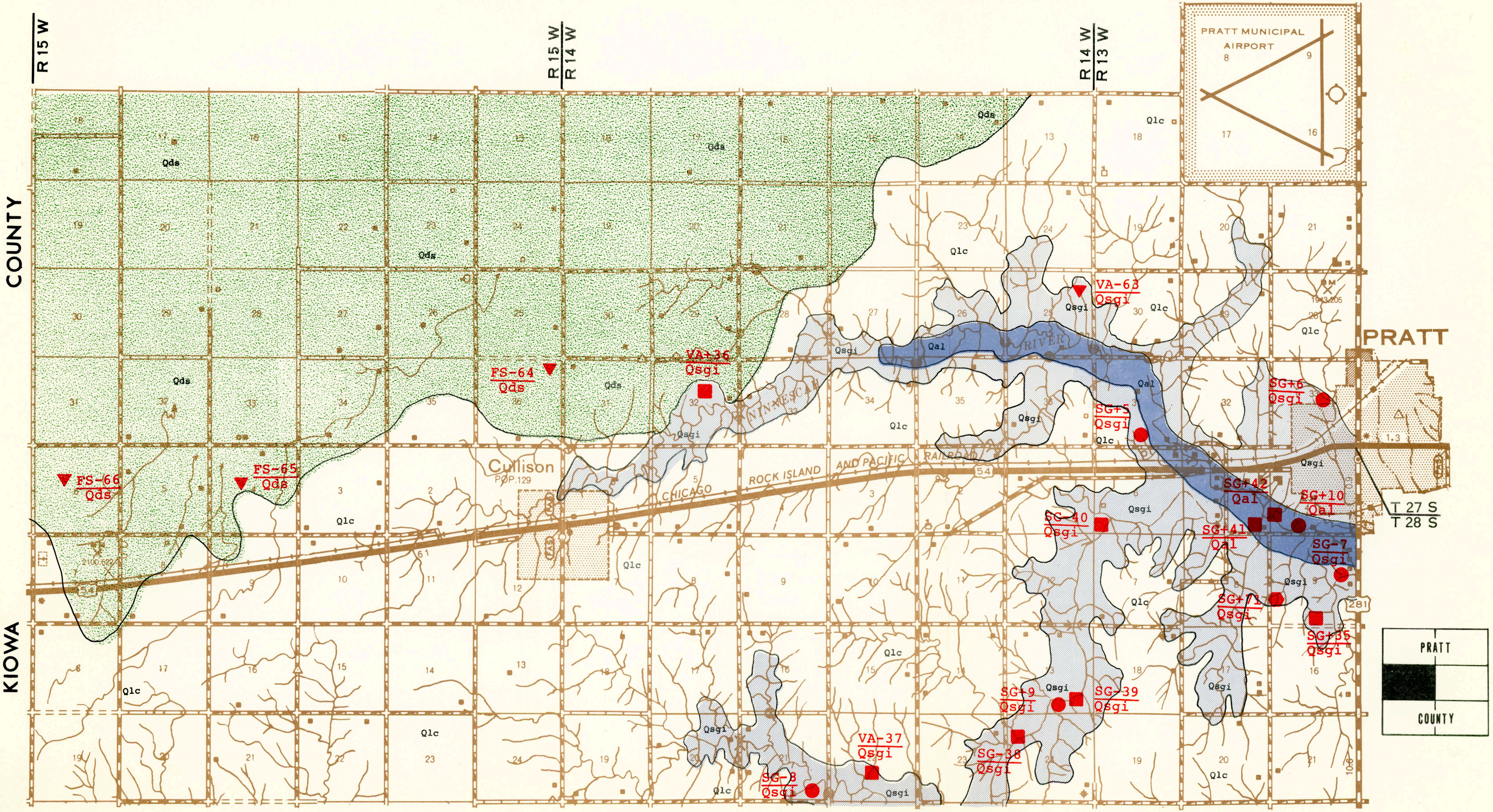


R 15 W
R 15 W
R 14 W
R 14 W
R 13 W
PRATT MUNICIPAL
AIRPORT
KIOWA
COUNTY
PRATT
T 27 S
T 28 S
Cullison
POP. 129
CHICAGO
ROCK ISLAND
AND PACIFIC
RAILROAD
NINNESCAH
RIVER
Qds
Qal
Qsgi
Qlc
FS-66
Qds
FS-65
Qds
FS-64
Qds
VA-36
Qsgi
VA-63
Qsgi
SG-5
Qsgi
SG-6
Qsgi
SG-42
Qal
SG-10
Qal
SG-40
Qsgi
SG-41
Qal
SG-7
Qsgi
SG-71
Qsgi
SG-35
Qsgi
SG-9
Qsgi
SG-39
Qsgi
SG-38
Qsgi
VA-37
Qsgi
SG-8
Qsgi
PRATT
COUNTY

PLATE III

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

- ● Open site; not sampled (see appendix I)
- ■ Open site; sampled (see appendix II)
- ▼ Prospective site; sampled (see appendix III)
- ⬢ Prospective site; not sampled (see appendix IV)

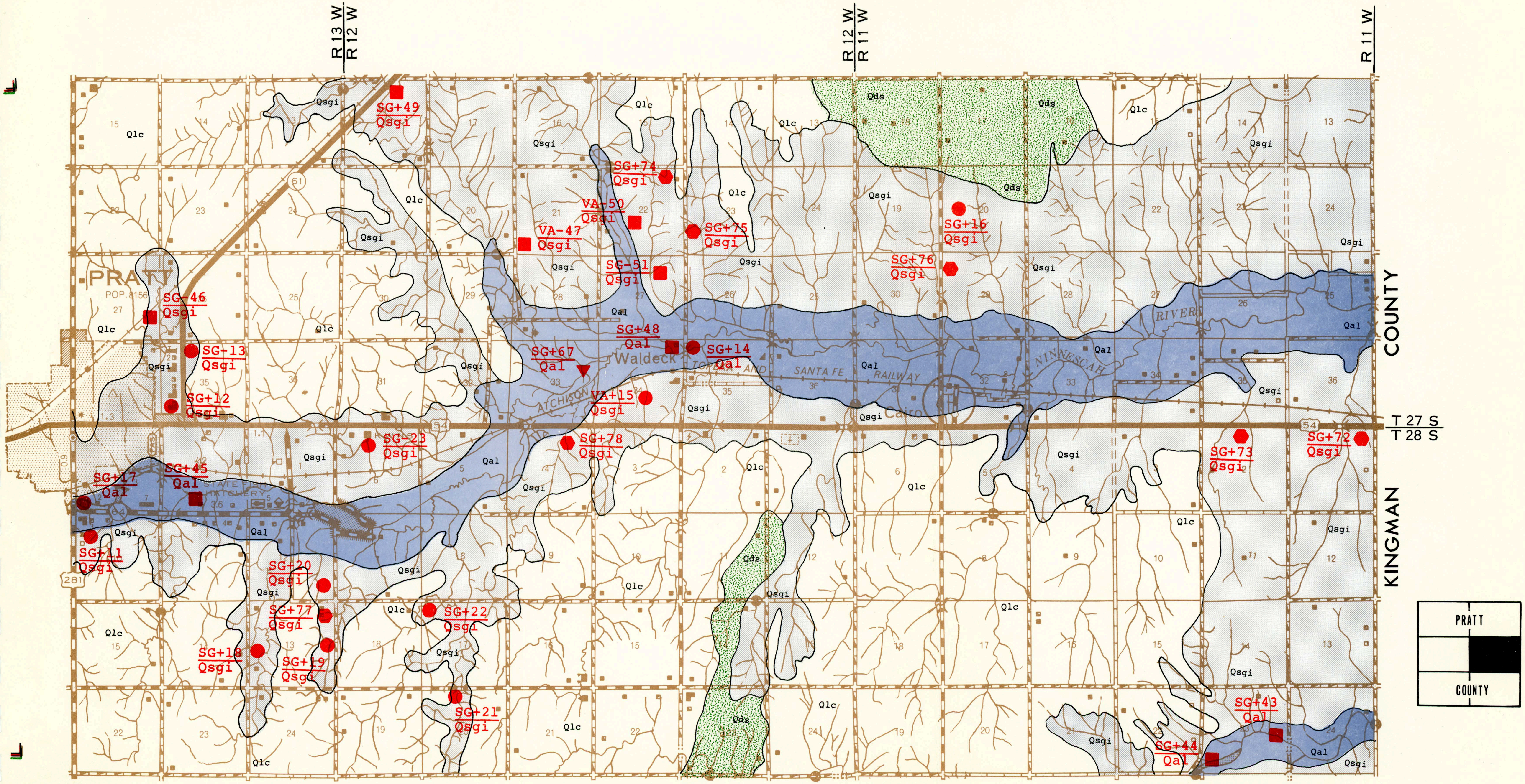
SG+5 / Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - \+ indicates more than 20,000 cubic yards
  - \- indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale: 1 0 1 2 3 4 Mi.



R 13 W
R 12 W
R 12 W
R 11 W
R 11 W
T 27 S
T 28 S
KINGMAN COUNTY
PRATT
POP. 8156
Waldeck
Cairo
ATCHISON TOPEKA AND SANTA FE RAILWAY
NINNESCAH RIVER
STATE FISH HATCHERY
SG+49 Qsgi
SG+74 Qsgi
VA-50 Qsgi
VA-47 Qsgi
SG+75 Qsgi
SG-51 Qsgi
SG+16 Qsgi
SG+76 Qsgi
SG-46 Qsgi
SG-13 Qsgi
SG+12 Qsgi
SG+48 Qal
SG+67 Qal
SG+14 Qal
VA+15 Qsgi
SG-23 Qsgi
SG+78 Qsgi
SG+73 Qsgi
SG+72 Qsgi
SG+17 Qal
SG+45 Qal
SG+11 Qsgi
SG+20 Qsgi
SG+77 Qsgi
SG+22 Qsgi
SG+18 Qsgi
SG+19 Qsgi
SG+21 Qsgi
SG+43 Qal
SG+44 Qal
Qlc
Qsgi
Qal
Qds
PRATT COUNTY


PLATE IV

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

- ● Open site; not sampled (see appendix I)
- ■ Open site; sampled (see appendix II)
- ▼ Prospective site; sampled (see appendix III)
- ⬢ Prospective site; not sampled (see appendix IV)

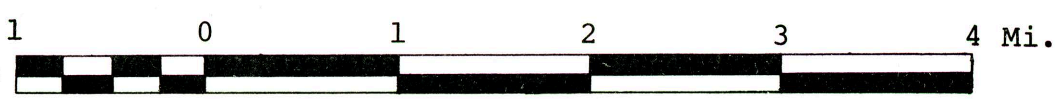
SG+5 / Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - \+ indicates more than 20,000 cubic yards
  - \- indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale:



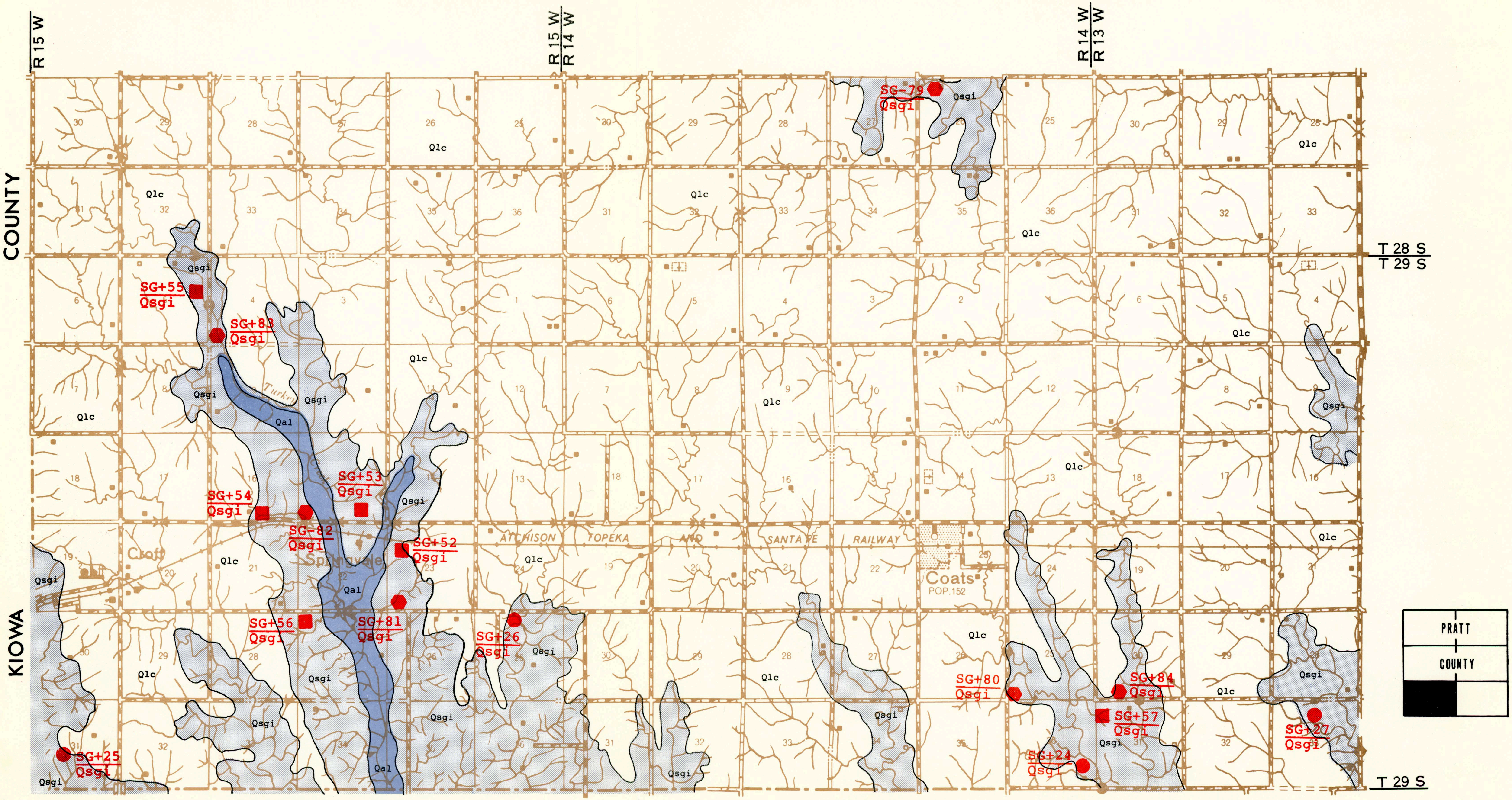

R 15 W
R 15 W
R 14 W
R 14 W
R 13 W
T 28 S
T 29 S
T 29 S
KIOWA COUNTY
BARBER COUNTY
PRATT COUNTY
ATCHISON TOPEKA AND SANTA FE RAILWAY
Coats
POP. 152
Croft
Springvale
Turkey
Qlc
Qsgi
Qal
SG-79
SG+55
SG+83
SG+54
SG+53
SG-82
SG+52
SG+56
SG+81
SG+26
SG+25
SG+80
SG+84
SG+57
SG+24
SG+27

PLATE V

# PRATT COUNTY MATERIALS MAP LEGEND

## EXPLANATION OF MATERIALS SITE DESIGNATIONS

- ● Open site; not sampled (see appendix I)
- ■ Open site; sampled (see appendix II)
- ▼ Prospective site; sampled (see appendix III)
- ⬢ Prospective site; not sampled (see appendix IV)

SG+5
Qsgi

- Material Type
  - SG - Sand and Gravel
  - FS - Fine Sand
  - VA - Volcanic Ash
- Estimated Quantity
  - \+ indicates more than 20,000 cubic yards
  - \- indicates less than 20,000 cubic yards
- *Reference to the site number on the following data forms.*
- Geologic Age and Unit

## EXPLANATION OF MAP SYMBOLS

| | | | |
|---|---|---|---|
| Qal | Alluvium | Qlc | Loveland and Crete Formations |
| Qds | Dune Sand | Qsgi | Sappa and Grand Island Formations |

Scale:

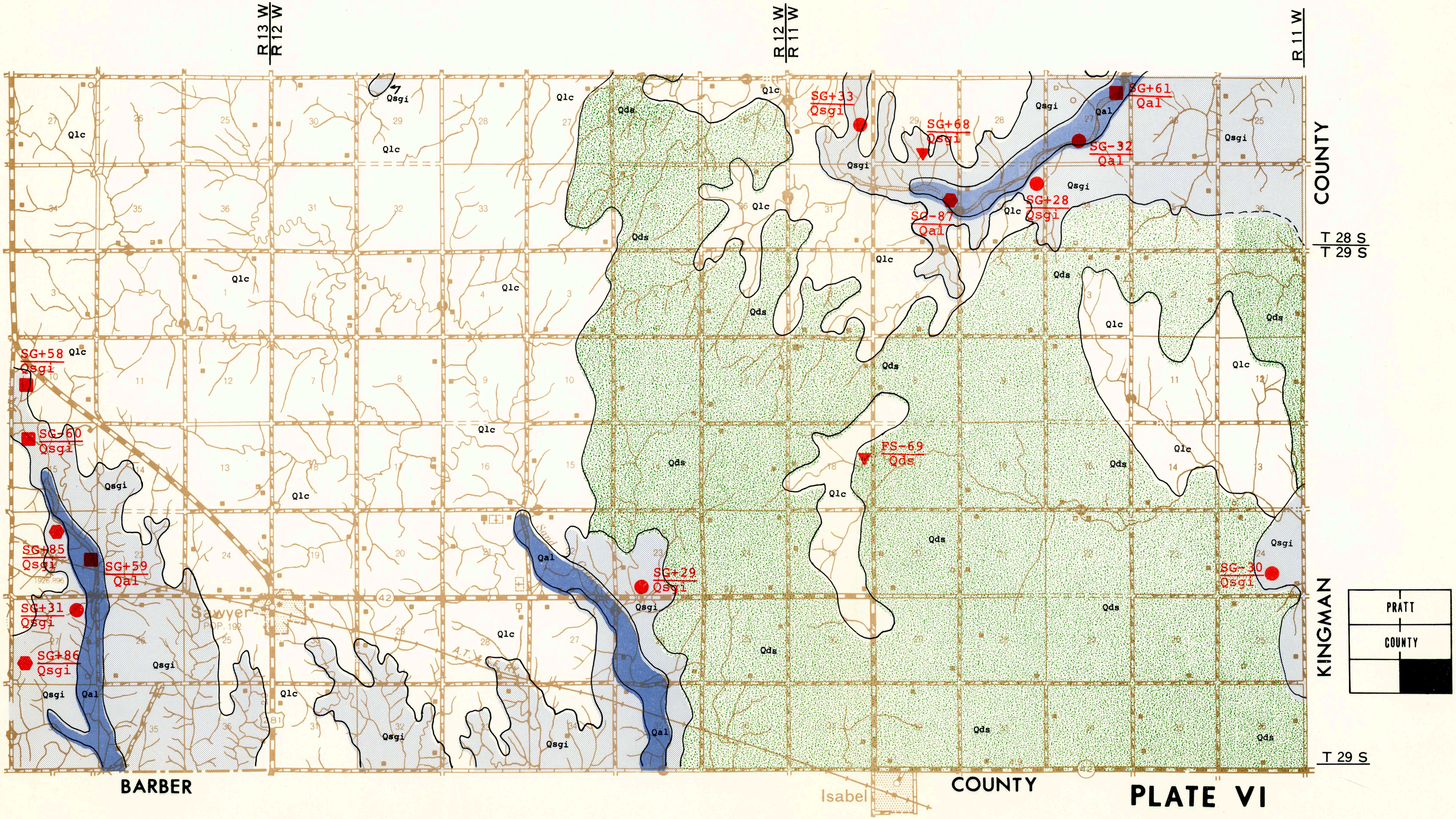

R 13 W
R 12 W
R 12 W
R 11 W
R 11 W
T 28 S
T 29 S
T 29 S
COUNTY
KINGMAN
BARBER
COUNTY
PRATT
COUNTY
Sawyer
POP. 192
Isabel
A.T.&S.F.
SG+33
Qsgi
SG+68
Qsgi
SG+61
Qal
SG-32
Qal
SG+28
Qsgi
SG-87
Qal
SG+58
Qsgi
SG-60
Qsgi
SG+85
Qsgi
SG+59
Qal
SG+31
Qsgi
SG+86
Qsgi
SG+29
Qsgi
FS-69
Qds
SG-30
Qsgi
Qlc
Qds
Qsgi
Qal

PLATE VI