

SOUTH DAKOTA
STATE GEOLOGICAL SURVEY
E.P. Rothrock, State Geologist

Report of Investigations

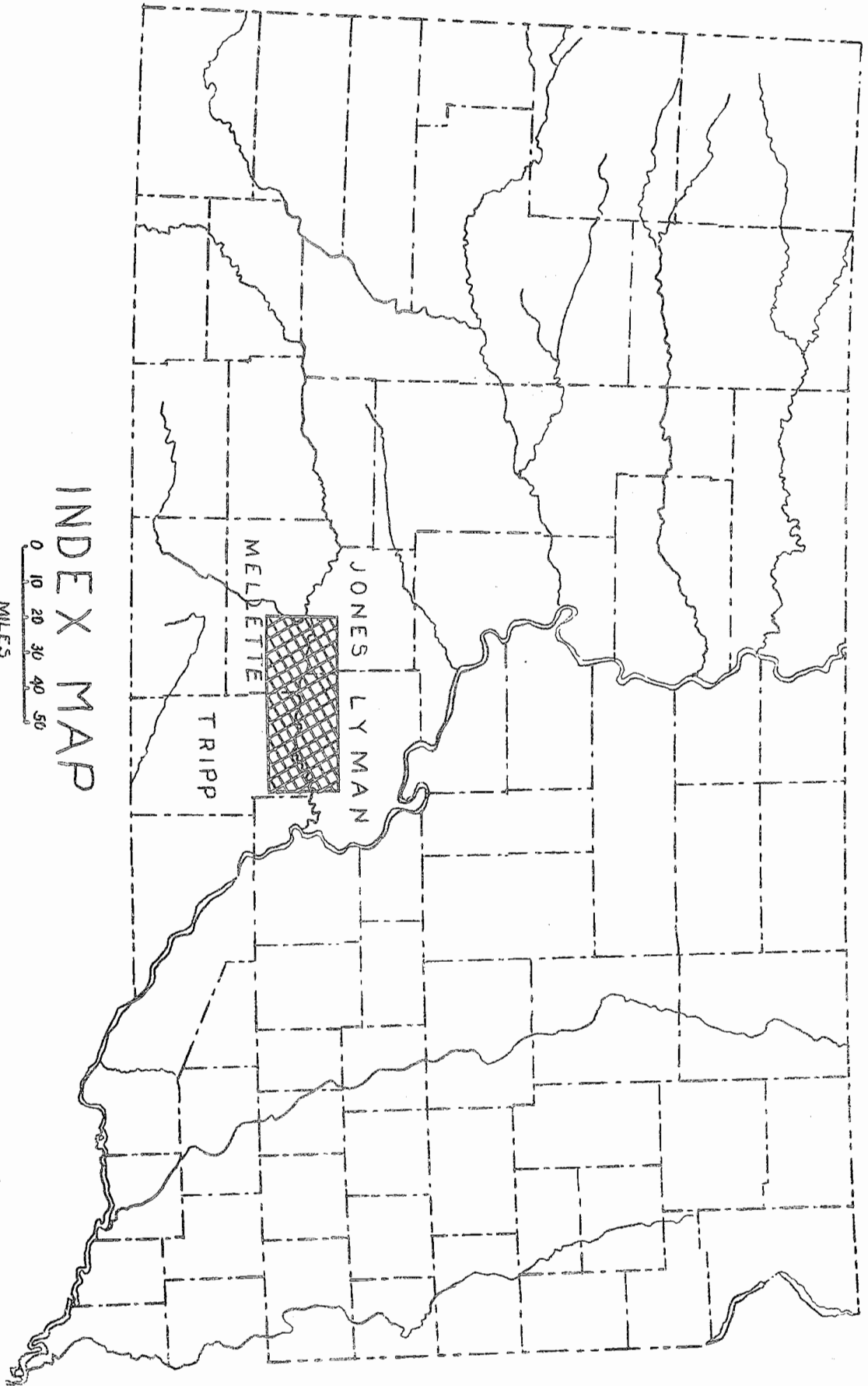
No. 55

GRAVEL DEPOSITS ALONG THE WHITE RIVER
BETWEEN THE SOUTH FORK OF THE WHITE RIVER
AND SOUTH DAKOTA HIGHWAY 47

by

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University of South Dakota
Vermillion, South Dakota
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INDEX MAP

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MILES

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GRAVEL DEPOSITS ALONG THE WHITE RIVER
BETWEEN THE SOUTH FORK OF THE WHITE RIVER
AND SOUTH DAKOTA HIGHWAY 47

INTRODUCTION

Purpose

The increasing demand for highway and other types of construction along the White River has raised the question as to where suitable materials are located. It was known that there were gravel deposits in this area, but there was no inventory of the amount or quality of materials or the exact locations where they occurred.

The present investigation was undertaken to present an inventory of the gravel deposits in this area that could furnish suitable materials at a feasible cost of removal. No attempt was made to include all of the small deposits of gravel which occur along the White River, but only those of sufficient size and thickness and with shallow enough cover to make removal feasible. Neither was any attempt made to include those deposits which exist in the present flood plain of the river, although such deposits undoubtedly exist, especially below the mouths of tributaries flowing into the river from the south.

METHODS OF WORK

Since this was to be a reconnaissance, considerable reliance had to be placed on topography. Gravel and sand deposits usually express themselves in certain topographic forms. These forms indicate the type of material which lies beneath them.

Outcrops of gravel around the edges of these topographic forms indicate the thickness of the gravel deposit and the amount of cover that would have to be stripped before removing the gravel. Where it was possible to do so, trenches were dug into the outcrops to determine these facts. Where outcrops were not available, test pits were dug with either an auger or pick and shovel to determine thickness, quality of gravel and amount of

cover. Volumes of material have been computed from known thicknesses of deposits of gravel and known areas of beds based on information obtained from test pits and outcroppings.

The time available did not permit sufficiently careful testing to insure given volumes of gravel in any area. The intent of the survey was solely to point out areas from which suitable quantities of gravel could be removed at a feasible cost. Before excavation is undertaken, therefore, these areas should be systematically tested with a system of regularly spaced test pits.

Areas for the computation of volumes and the location of deposits were obtained by mapping with a plane table.

ACKNOWLEDGEMENT

The engineer was assisted in the survey by Robert Wyant, who performed most of the instrument work and did most of the mapping; Bud Barton, who functioned in the capacity of rodman; and William Bolenbaugh, who, with the engineer, located and tested the deposits to be mapped. During the last week of the work Donald Rothrock and R.R. Ruelle assisted by mapping gravel deposits north of the White River. The intelligent and faithful work of these men contributed much to the success of the survey.

ORIGIN OF DEPOSITS

In the development of a normal river valley terraces of sand and gravel are frequently formed along the bluffs. Such terraces are, in reality, remnants of old river bottoms through which the stream has carved a deeper channel. They usually lie at about the same height above the valley bottoms for long stretches. The deposits along the White River in the area under consideration follow this pattern quite closely. During the various stages of erosion the White River has, through this area, shifted its channel to the north, leaving terraces south of the river. The gravel and sand deposits, therefore, exist mainly in these terraces.

Some small narrow terraces exist north of the White River in the eastern part of the area covered by this report. These terraces were undoubtedly formed during the same stages of river

development as the lower terraces farther upstream. There are deposits of sand and gravel in most of these terraces.

The predominant mineral in all of these gravel deposits is chalcedony from veins, geodes and concretions in the Bad Lands. Other minerals are light gray limestone from concretions of the Pierre shale, flint and cherts from the Black Hills, a few miscellaneous igneous and metamorphic rocks and feldspar from the arkosic sands of the Chadron formation and the Black Hills pegmatites. This mixture of minerals causes the gravel of these deposits to be very light colored and hard. It also results in a low percentage of chalk rock and other soft materials.

Reworking of the materials from the older or higher into the younger or lower terraces seems to have been the case; consequently, each deposit contains gravels from all of the higher terraces.

The origin and detailed characteristics of these deposits were not the main object of this survey; therefore, a great deal of work in these fields remains to be done. The important fact is that this material comes from a number of sources and is a mixture of all, with chalcedony from the Bad Lands the predominant mineral. This mixture results in hard, light colored gravels.

In a reconnaissance survey of this sort it is impossible to obtain much of the information that is necessary before excavation is begun. The following descriptions are designed to give a general picture of the individual deposits from which it will be possible to determine whether more detailed investigations are warranted. If these descriptions serve as a guide to the engineer or contractor looking for such material, they will have served their purpose.

DESCRIPTION OF DEPOSITS

The investigation was started at the mouth of the south fork of the White River and then worked east, covering the area south of the White River first and then the area north of the river. For this reason only the descriptions will start at the western end of the area investigated. The first area to be described will be the area between the south fork of the White River and White Thunder Creek. The other areas south of the river will be described in the order in which they lie downstream from White

Thunder Creek. The areas north of the White River will be described in the order in which they lie downstream from the mouth of the south fork of the White River.

Area South of White River
Between South Fork of the White River
And White Thunder Creek

FIRST TERRACE: The first terrace which lies about 175 feet above the flood plain of the White River is from one to three miles wide. A layer of good quality gravel, from three to four feet in thickness with from 20 to 25 feet of cover, outcrops along the river bluff through the area. This gravel is underlaid by Pierre shale. The cover is excessive except on a few small spurs along the tributaries of the White River. The material from the spurs along the south fork of the White River was removed for use on United States Highway 183.

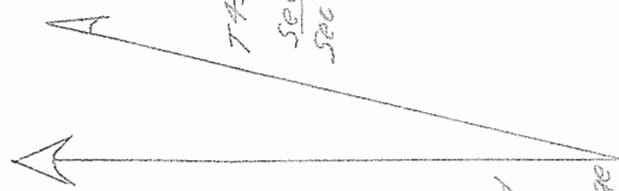
Pit No. 1, which lies just above the level of this terrace is a gravel bar which protruded into the river from the south bank after the terrace was formed. The following are the results of a screen test of material taken from a test pit in this deposit:

Passing a $\frac{1}{2}$ " mesh screen	89.5%
Passing a $\frac{1}{4}$ " mesh screen	78.4%
Passing a No. 10 screen	59.8%
Passing a No. 30 screen	32.2%
Passing a No. 60 screen	20.1%
Passing a No. 100 screen	5.2%
Passing a No. 150 screen	4.3%
Passing a No. 250 screen	.9%

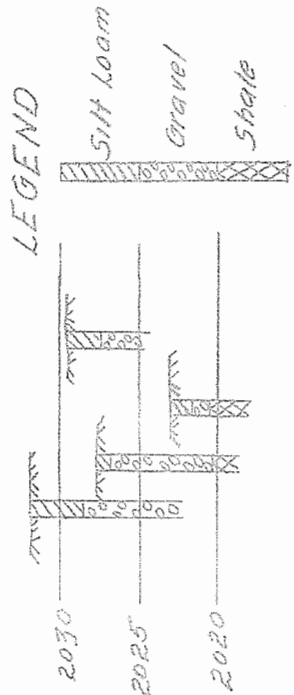
The deposit which lies in the northwest quarter of Section 9 and the southwest quarter of Section 4, Township 43 north, Range 27 west, contains about 55,000 cubic yards of material that could be removed at a feasible cost.

SECOND TERRACE: The second terrace above the White River lies at about 115 feet higher elevation than the first terrace and is from three quarters of a mile to a mile and a half wide through the area. There are a number of sand and gravel deposits in this terrace but, with the exception of the deposits along the tributaries of the White River where the surface has eroded considerably below the general level of the terrace, the cover of over ten feet appears to be excessive. Pit No. 2, "The Harrison Pit," is a gravel deposit in this terrace. There is also a sand

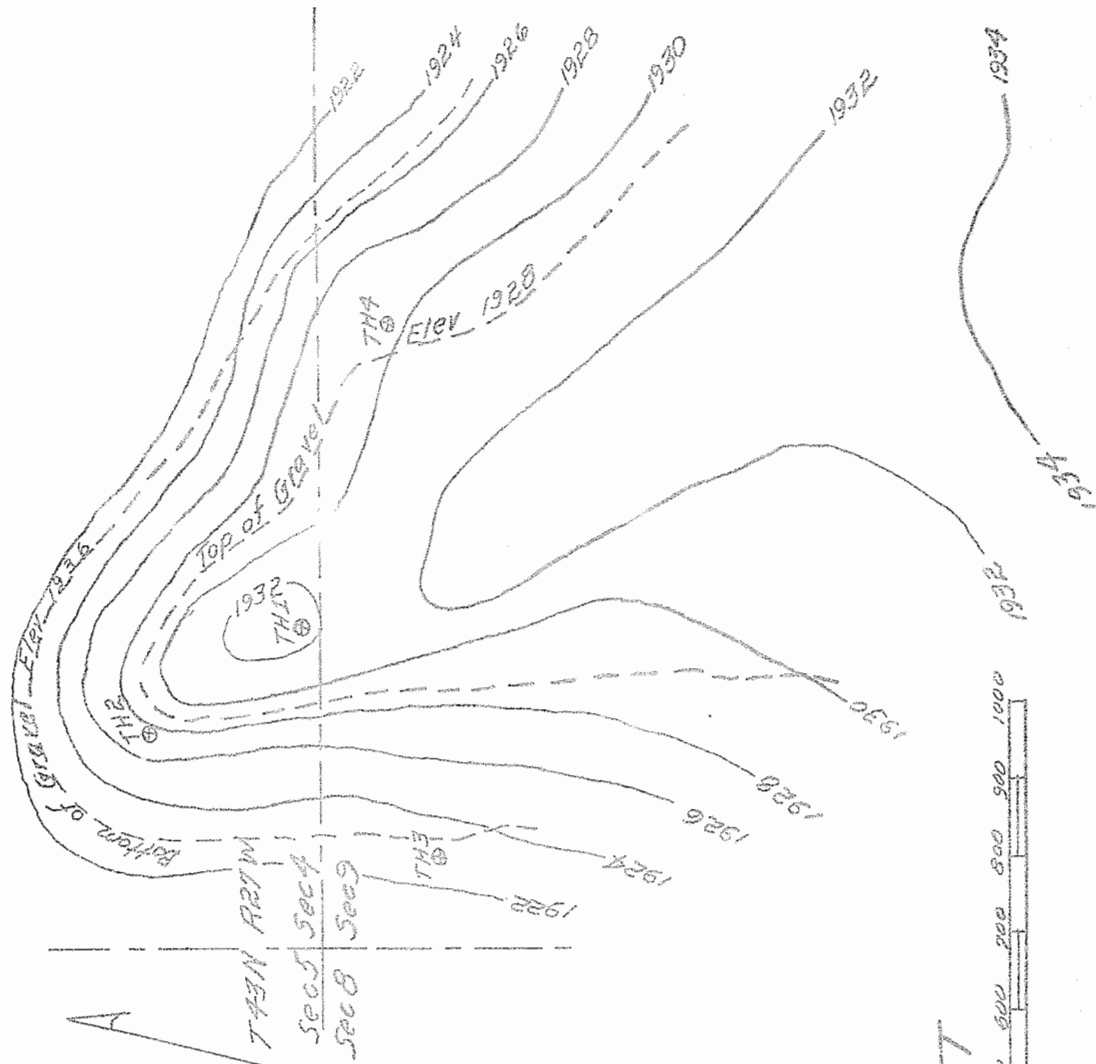
PIT NO 1



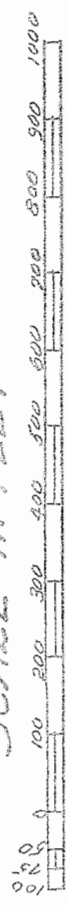
LOG OF TEST HOLES



This deposit of gravel is located at the foot of the second terrace above the White River on a low flat spur and is the site of a large prairie dog town. The material has a very large percentage of fines, and is not well graded as there is very little pea gravel. The coarser material is of good quality with little or no chalk rock or ferrous material. Estimated quantity of gravel 55,000 Cubic yards.



SCALE IN FEET

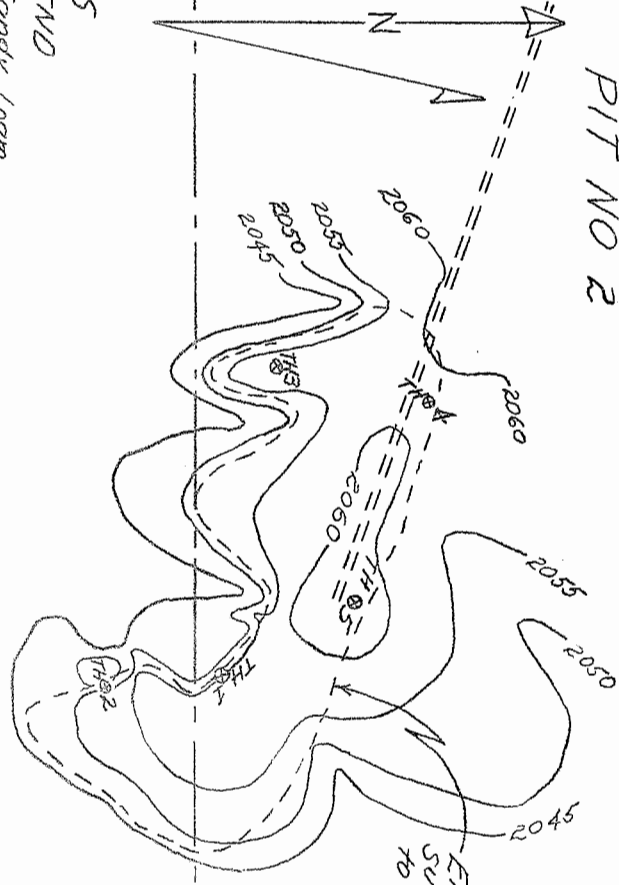
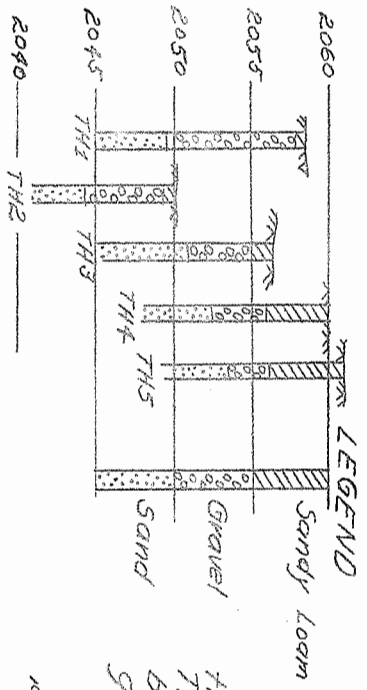


HARRISON PIT PIT NO 2

TWP 43N
R 28W R 27W

Sec 12 Sec 7
Sec 13 Sec 19

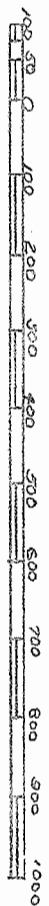
LOG OF TEST HOLES



Extent of gravel of sufficient thickness to make removal feasible

Some gravel has been removed from this pit by the S. Dak State Highway Department. The material has a large percentage of fines, but is of good quality. Estimated quantity of gravel in pit is 15,000 cubic yards.

SCALE IN FEET



pit in the northwest quarter of Section 7, from which most of the material has been removed.

THIRD TERRACE: The third terrace lies about 25 feet above the second terrace and contains a number of small deposits of gravel with some large deposits of fine sand. The gravel deposits in this terrace, with the exception of the small deposits along White Thunder Creek, have too much cover for removal of material at a reasonable cost.

Pits No. 3 and No. 4, which are both located just west of and above the valley of White Thunder Creek are deposits in this terrace. The following are the results of a screen test of materials from a test pit in Pit No. 3:

Passing a $\frac{1}{2}$ " mesh screen	61.4%
Passing a $\frac{3}{4}$ " mesh screen	54.3%
Passing a No. 10 screen	40.7%
Passing a No. 30 screen	11.6%
Passing a No. 60 screen	0.7%
Passing a No. 100 screen	0.2%
Passing a No. 150 screen	0.1%
Passing a No. 250 screen	0.1%

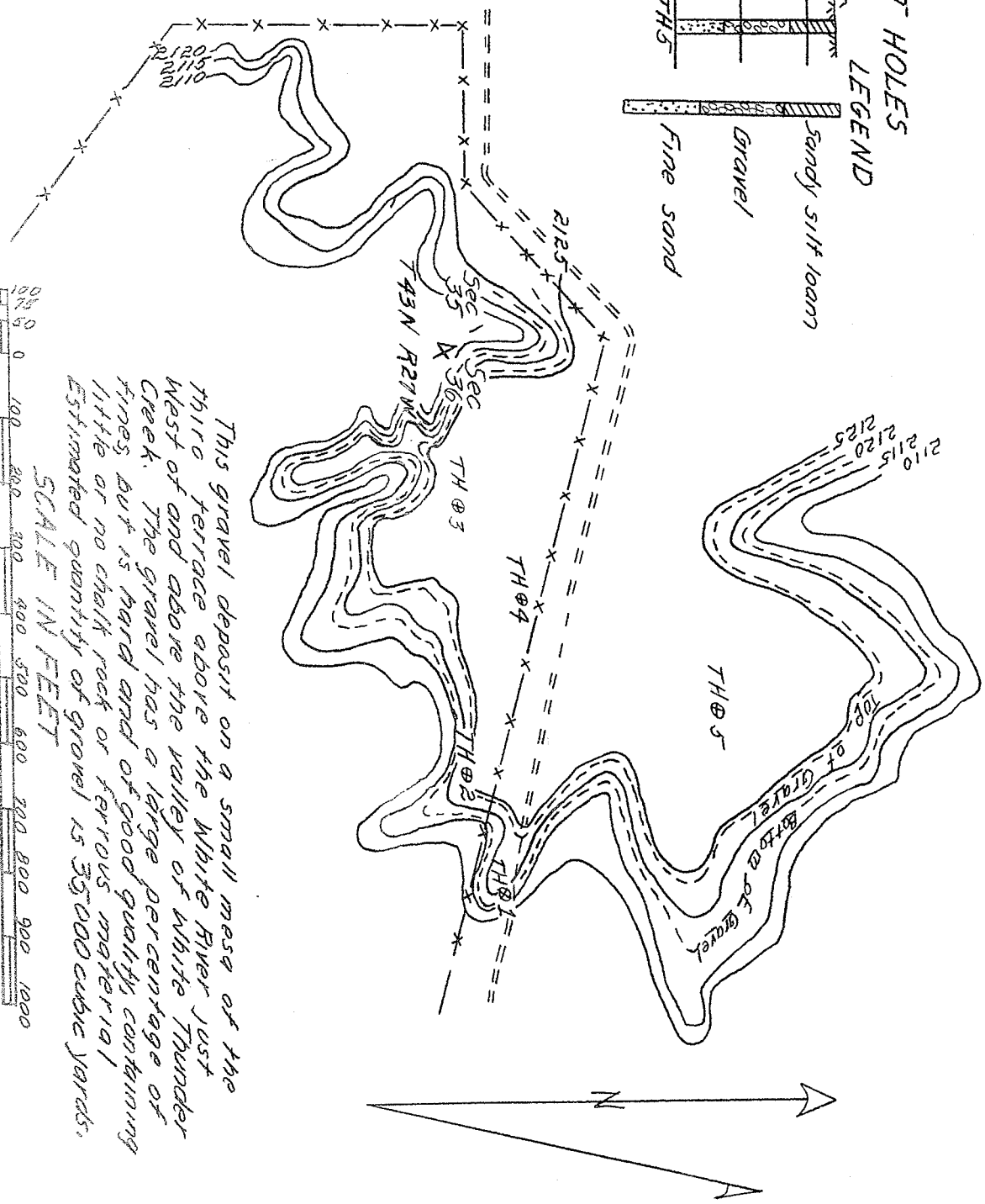
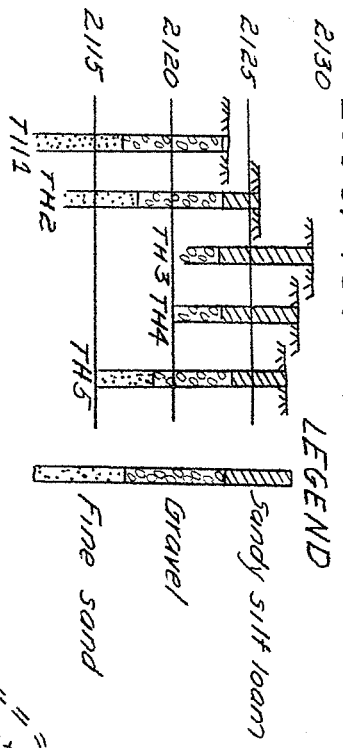
HILLS ABOVE THIRD TERRACE: In the hills above terrace No. 3 there are deposits of sand and gravel but either the deposits are too thin or cover is too great for feasible removal of material. Cross section No. 1, which was taken on the section line just west of Pit No. 2, is a typical section of the area just described.

Area South of White River
Between White Thunder and Oak Creeks

FIRST TERRACE: The first terrace lies about 175 feet above the flood plain of the White River and is from one to two miles wide through the area. The same layer of gravel described in the area to the west outcrops along the river bluffs. The gravel is of good quality, is from three to four feet in thickness and has from 20 to 25 feet of cover. With the exception of deposits on small spurs along the river and its tributaries where the surface has eroded to a level considerably below that of the terrace, the cover is excessive. A considerable quantity of gravel has been removed from these spurs in the past for use on South Dakota Highway 53, but there are still a large number of these small deposits from which material could be removed.

PIT NO 3

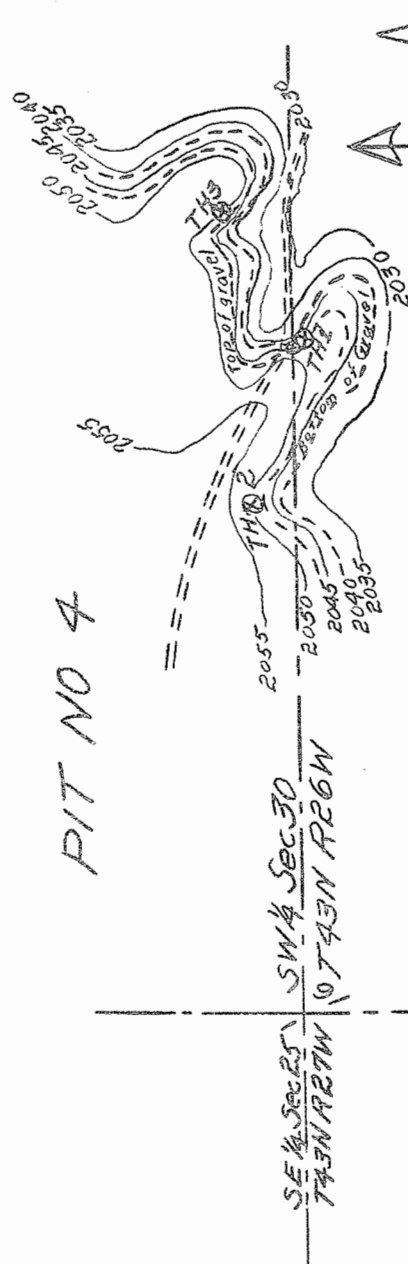
LOG OF TEST HOLES



This gravel deposit on a small mesa of the third terrace above the White River just west of and above the valley of White Thunder Creek. The gravel has a large percentage of fines but is hard and of good quality, containing little or no chert rock or ferrous material. Estimated quantity of gravel is 35,000 cubic yards.

SCALE IN FEET

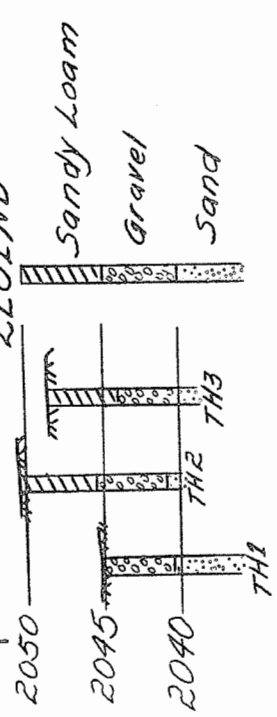




PIT NO 4

SE 1/4 Sec 25 T43N R27W SW 1/4 Sec 30 T43N R26W

LOG OF TEST HOLES LEGEND



This deposit of gravel is located on the third terrace above the White River just above and west of the valley of White Thunder Creek. The gravel is of good quality and quite well graded as to percentage of fines and coarse material. The layer of gravel is only about 4' in thickness and cover is quite heavy a short distance back from the top of the slope to the valley of White Thunder Creek. Estimated quantity of gravel removal of which would be feasible is 2000 cubic yards.

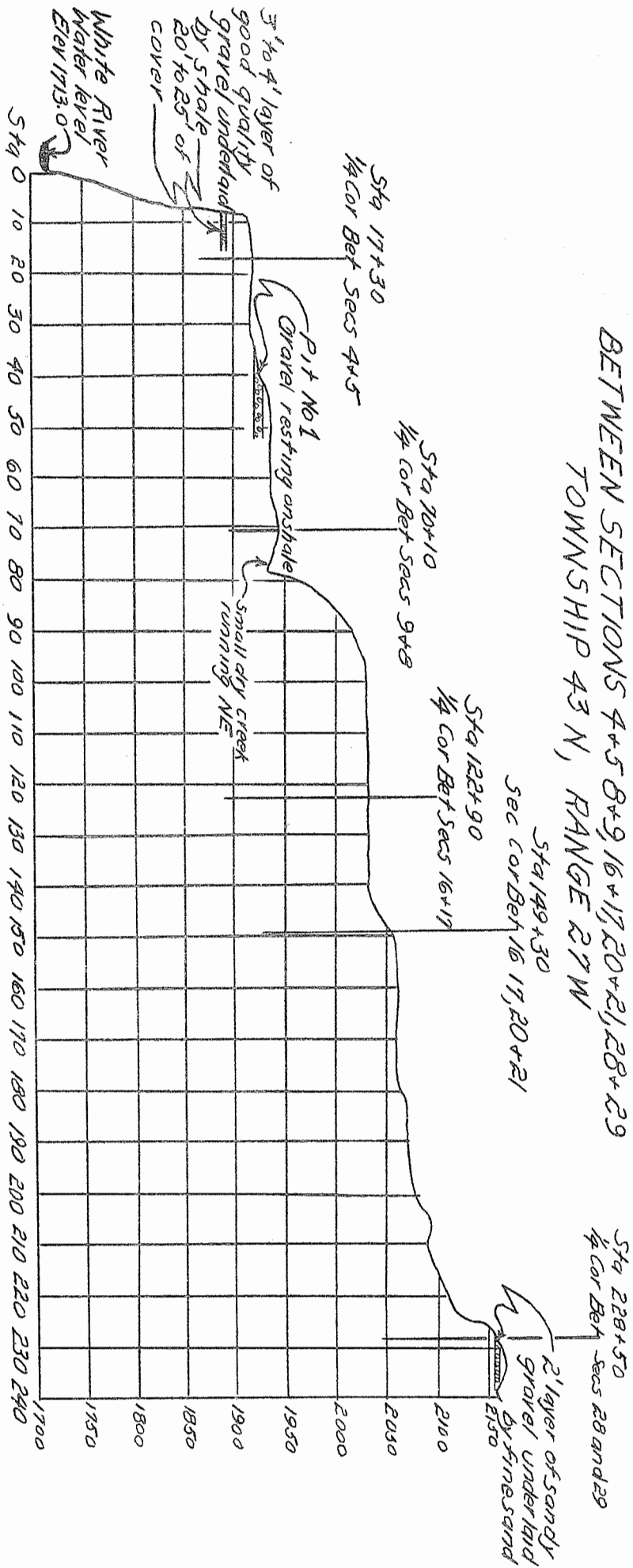


CROSS SECTION NO 1

AREA SOUTH OF THE WHITE RIVER

BETWEEN SECTIONS 4+5 8+9, 16+17, 20+21, 28+29

TOWNSHIP 43 N, RANGE 27 W



SECOND TERRACE: The second terrace lies about 115 feet above the first terrace and is about two and one half miles wide in the western part and one mile wide in the eastern part of the area. There are many deposits of sand and gravel in this terrace, most of which have a high percentage of fines.

Pits No. 5, 6 and 7 are located in this terrace.

The following are the results of screen tests of material taken from test pits in Pits No. 5 and 7:

Pit No. 5

Passing a $\frac{1}{2}$ " mesh screen	89.6%
Passing a $\frac{1}{4}$ " mesh screen	72.5%
Passing a No. 10 screen	44.9%
Passing a No. 30 screen	25.0%
Passing a No. 60 screen	7.9%
Passing a No. 100 screen	3.7%
Passing a No. 150 screen	3.2%
Passing a No. 250 screen	1.1%

Pit No. 7

Passing a $\frac{1}{2}$ " mesh screen	85.7%
Passing a $\frac{1}{4}$ " mesh screen	74.0%
Passing a No. 10 screen	41.8%
Passing a No. 30 screen	6.3%
Passing a No. 60 screen	2.9%
Passing a No. 100 screen	1.5%
Passing a No. 150 screen	0.6%
Passing a No. 250 screen	0.2%

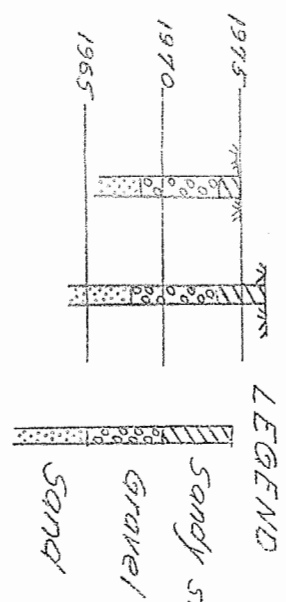
THIRD TERRACE: The third terrace lies about 25 feet above the second terrace and contains many deposits of sand with a few small deposits of gravel. Gravel deposits in this terrace are quite thin, of small area and run quite heavy in fines. Pits No. 8 and No. 9 are located in this terrace.

The following are the results of a screen test of the material from a test pit in Pit No. 9:

Passing a $\frac{1}{2}$ " mesh screen	90 %
Passing a $\frac{1}{4}$ " mesh screen	72.9%
Passing a No. 10 screen	45.0%
Passing a No. 30 screen	20.3%

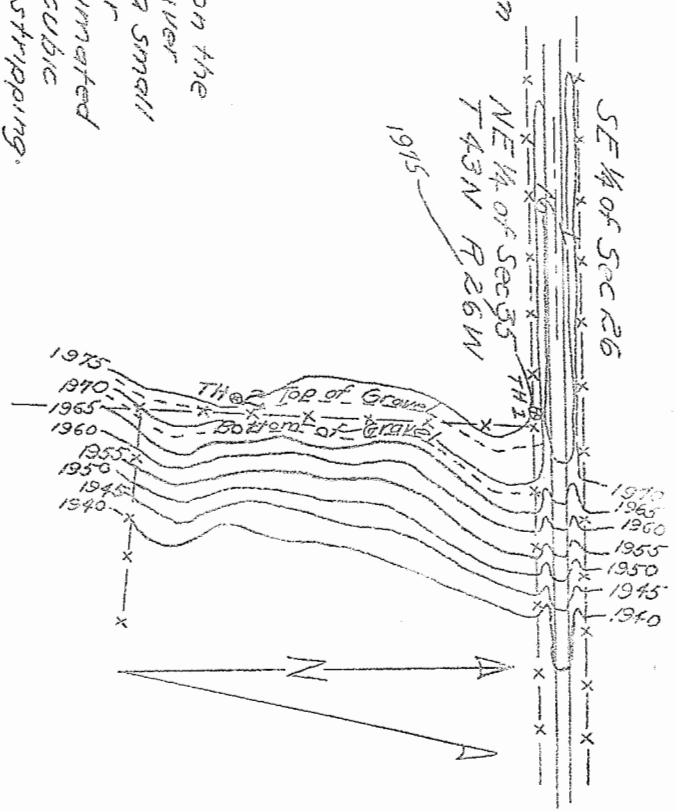
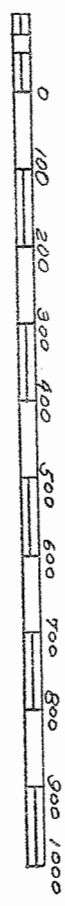
PIT NO 5

LOG OF TEST HOLES



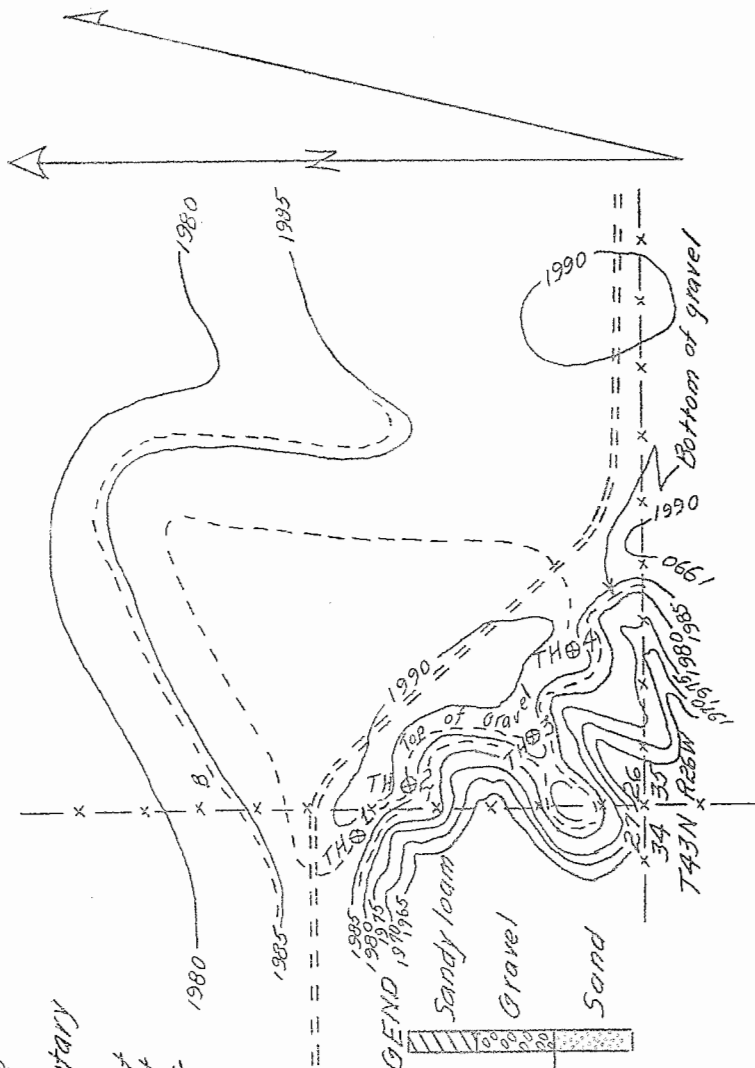
This gravel deposit is located on the second terrace above the White River just above and to the west of a small dry creek. The gravel is of fair quality, but heavy in fines. Estimated quantity of gravel is 20,000 cubic yards, with from 2' to 5' of stripping.

SCALE IN FEET

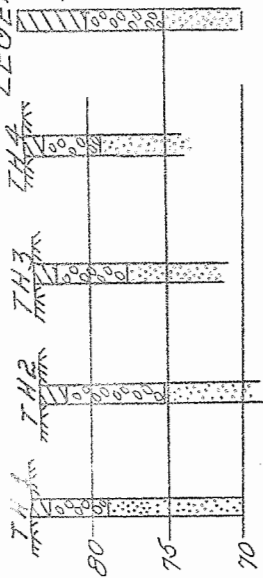


PIT NO 6

This deposit of gravel is located on the third terrace above the White River, above and NW of a small dry tributary of White Thunder Creek. The material is of good quality, but quite heavy in fines, with about 3' of cover. Estimated quantity of gravel is 15,000 cubic yards.



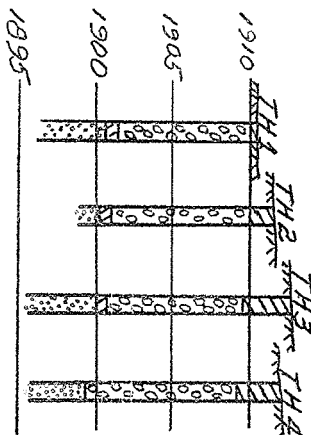
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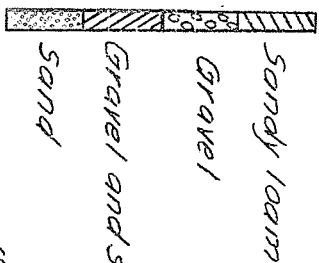
SCALE IN FEET

PIT NO 7

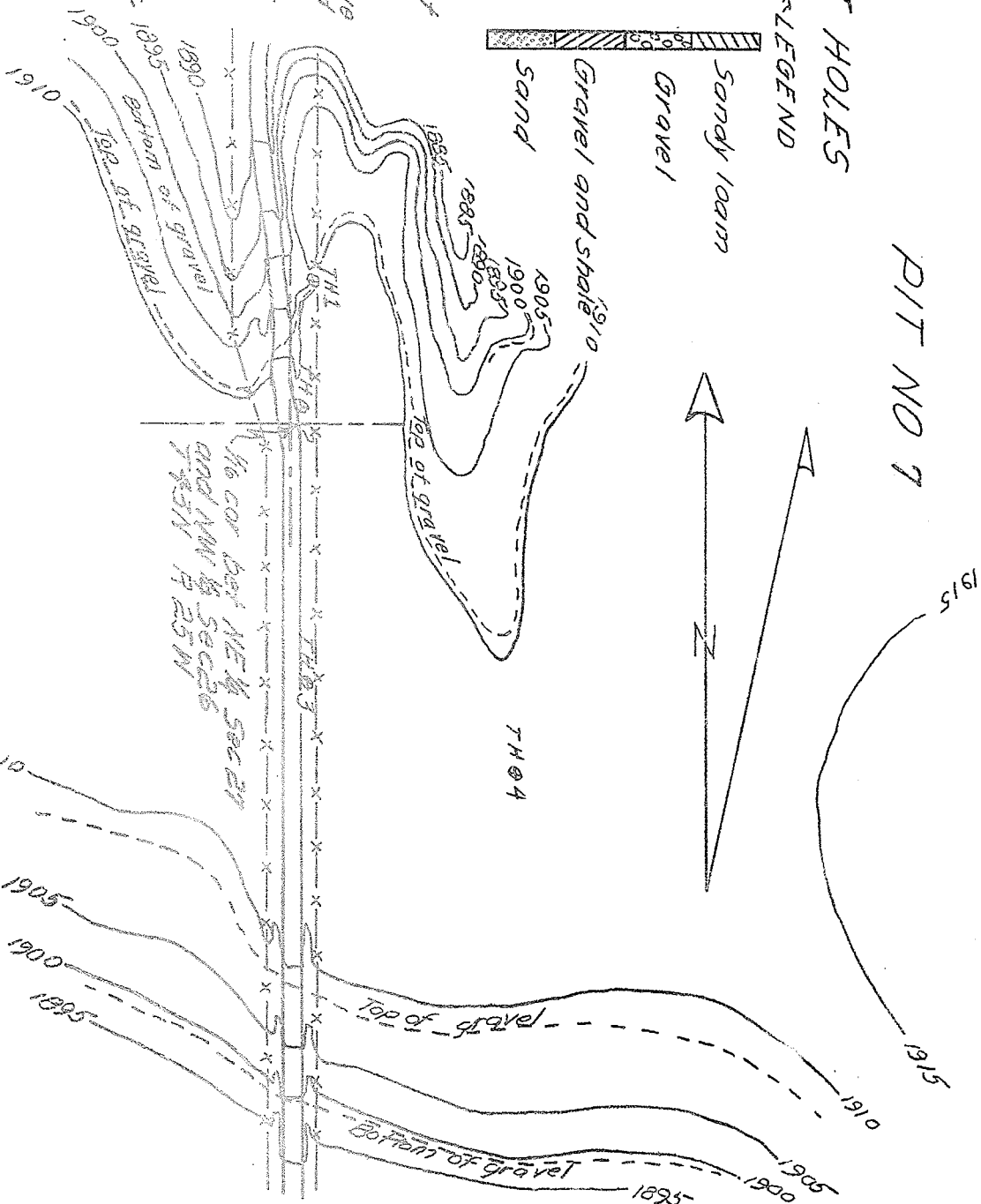
LOG OF TEST HOLES



LEGEND



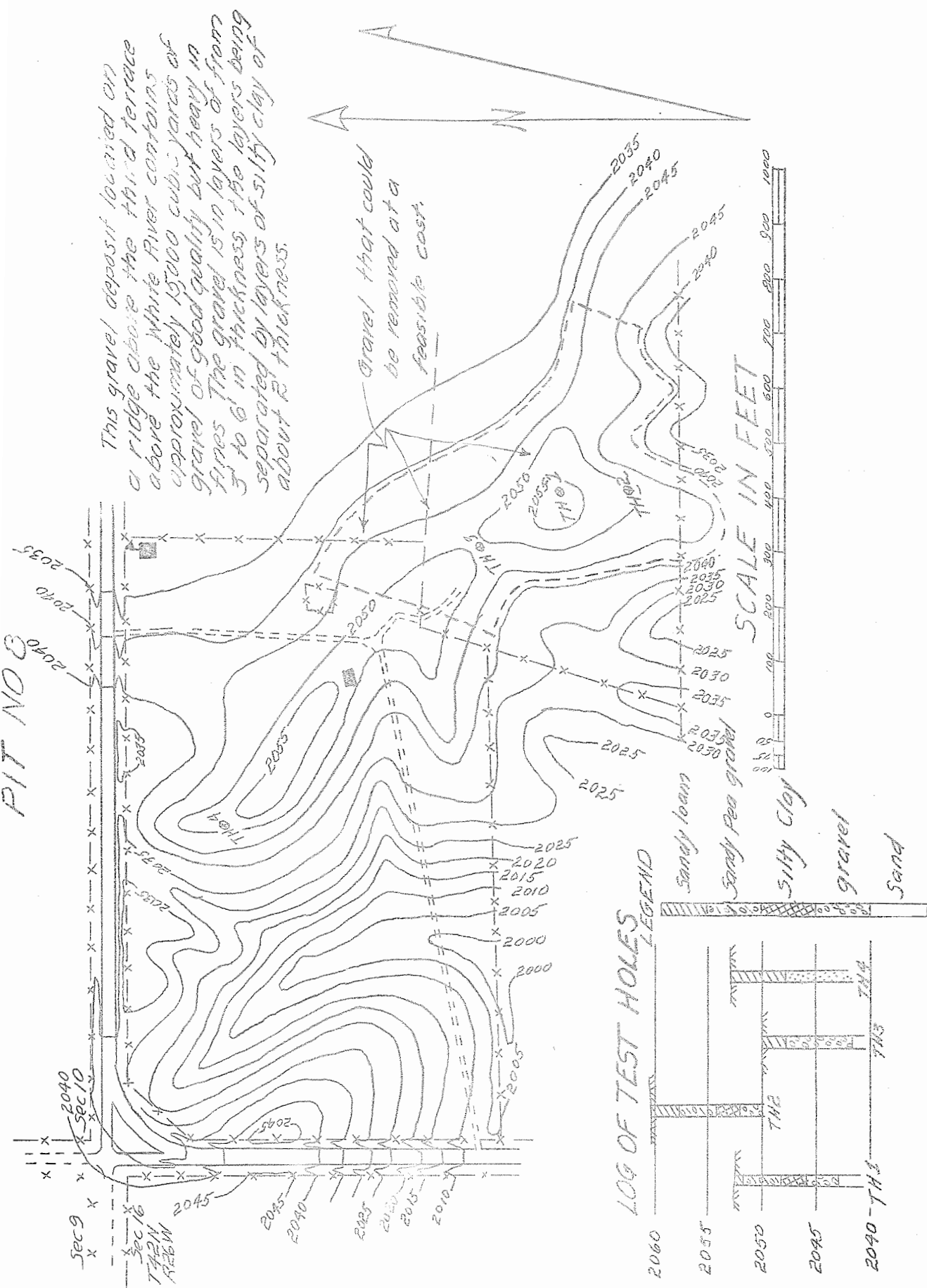
This gravel deposit is located on the North edge of the second terrace above the White River and contains about 150,000 cubic yards of good quality gravel. The gravel in the south part of the deposit is quite heavy in fines.



SCALE IN FEET



PIT NO. 3



This gravel deposit located on a ridge above the third terrace above the White River contains approximately 15,000 cubic yards of gravel of good quality but heavy in fines. The gravel is in layers of from 3' to 6' in thickness, the layers being separated by layers of silty clay of about 2' thickness.

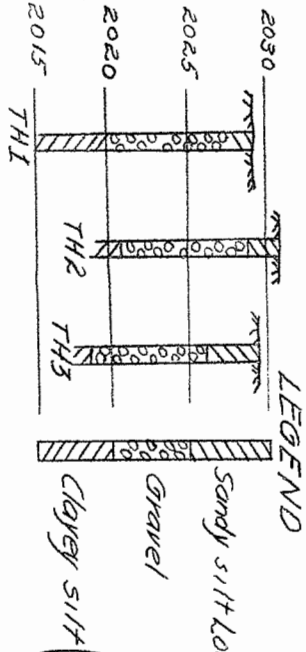
Gravel that could be removed at a feasible cost.

LOG OF TEST HOLES

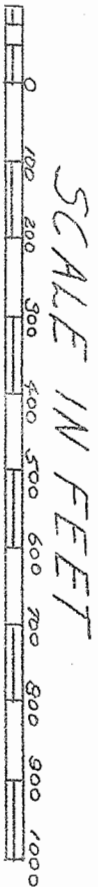
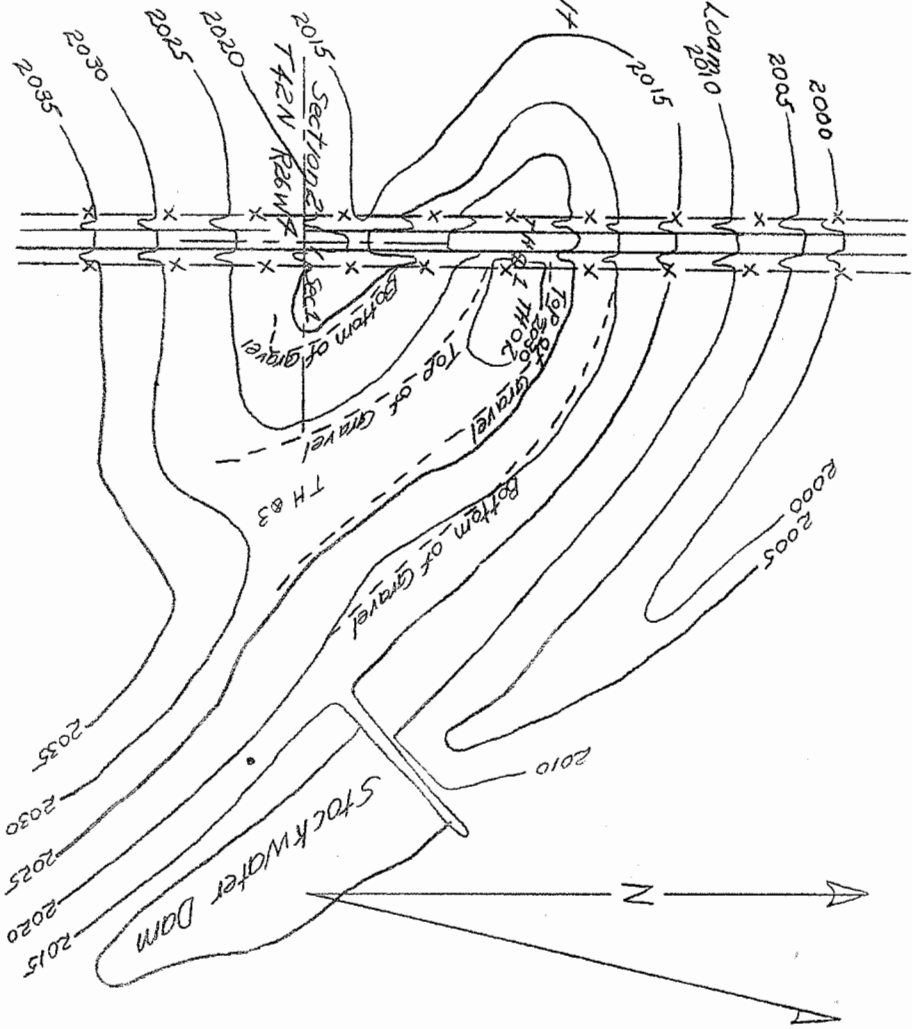
Depth (Feet)	Soil Layer	Notes
2060	Sandy loam	
2055	Sandy loam	
2050	Sandy Pea gravel	TH 1
2045	Silty Clay	TH 2
2040	gravel	TH 3
2035	Sand	

PIT NO 9

LOG OF TEST HOLES



This gravel deposit is located above the south edge of the third terrace above the White River. The material is of good quality but quite heavy in fines. Estimated quantity of gravel, removal of which would be feasible is 39,000 cubic yards.



Passing a No. 60 screen	6.0%
Passing a No. 100 screen	2.0%
Passing a No. 150 screen	1.3%
Passing a No. 250 screen	0.4%

Cross section No. 2 is a typical cross section of the area just described.

Area South of White River
Between Oak and Cottonwood Creeks

FIRST TERRACE: The first terrace lies about 175 feet above the flood plain of the White river and is from one half to one and one half miles wide. As in areas upstream, a three to four foot layer of good quality gravel outcrops along the river bluffs and has from 20 to 25 feet of cover. This cover is excessive. On small spurs extending out from the terrace along the White river and its tributaries most of this cover has been removed. Pits could be opened at such locations. The inaccessibility of these small deposits, due to lack of roads in the area, would make the cost of removal excessive under present conditions.

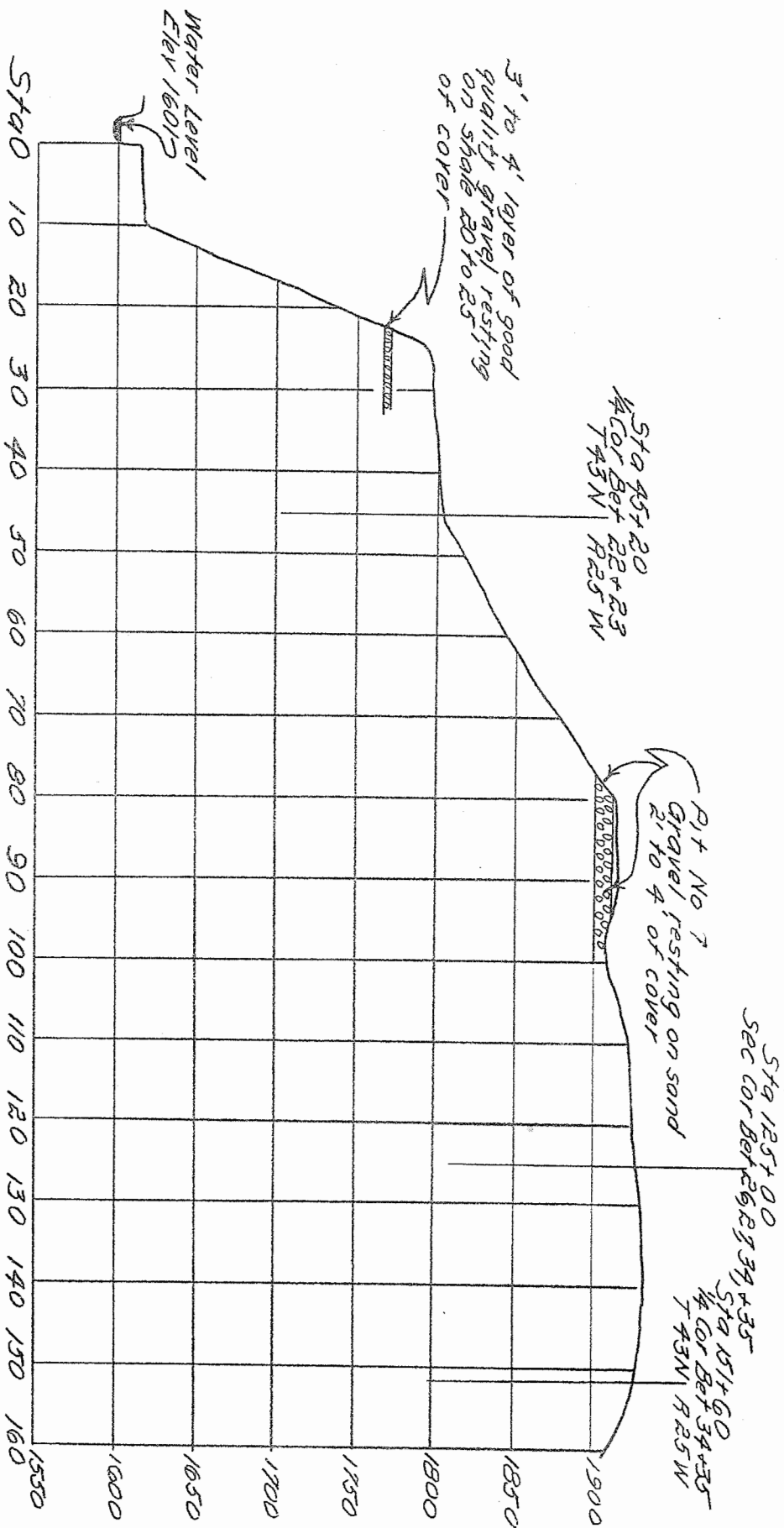
SECOND TERRACE: The second terrace, which lies about 100 feet above the first terrace and is from one to two miles in width, does not contain any deposits of gravel of sufficient size and depth for economical removal.

HILLS AND RIDGES ABOVE SECOND TERRACE: Almost all of the hills and ridges which lie above the second terrace contain small deposits of gravel. The material in these deposits is of good quality but quite heavy in fines. Most of the deposits are small in area and volume but have very little cover. It is doubtful whether the material could be removed at a feasible cost due to the inaccessibility of the area.

Area South of White River
Between Cottonwood and Dog Ear Creeks

FIRST TERRACE: The first terrace in this area lies about 130 feet above the flood plain of the White River, extends from about one mile below the mouth of Cottonwood creek to about one mile above the mouth of Dog Ear creek and has a maximum width of about three quarters of a mile. This terrace has a layer of good quality gravel about five feet in thickness, which rests on the Pierre shale and has from three to fifteen feet of cover.

CROSS SECTION NO 2 AREA SOUTH OF THE WHITE RIVER BETWEEN SECTIONS 14 + 15, 22 + 23, 26 + 27, 34 + 35



About 6000 cubic yards of gravel have been removed from Pit No. 10, which is in this deposit, but an estimated 12,000 cubic yards of good quality material remain.

SECOND TERRACE: The second terrace lies about 25 feet above the first and is the same as the first terrace in the areas upstream. It is about one half mile in width and, while it contains the same layer of good quality gravel as the areas upstream, it does not have any deposits that could be removed at a reasonable cost due to the cover of from 20 to 25 feet.

AREA ABOVE SECOND TERRACE: There are no well defined higher terraces in this area but there are a number of deposits of good quality gravel on the high ridge which lies about seven miles south of the White river.

Cross section No. 3, which is taken along United States Highway 183, is a typical section of this area.

Area South of White River
Between Dog Ear and Thunder Creeks

In this area there are no well defined terraces but the tops of almost all ridges within a distance of three miles south of the White river contain small deposits of gravel. These deposits are quite heavy in fines but have very little cover. This area is recommended for further investigation and prospecting.

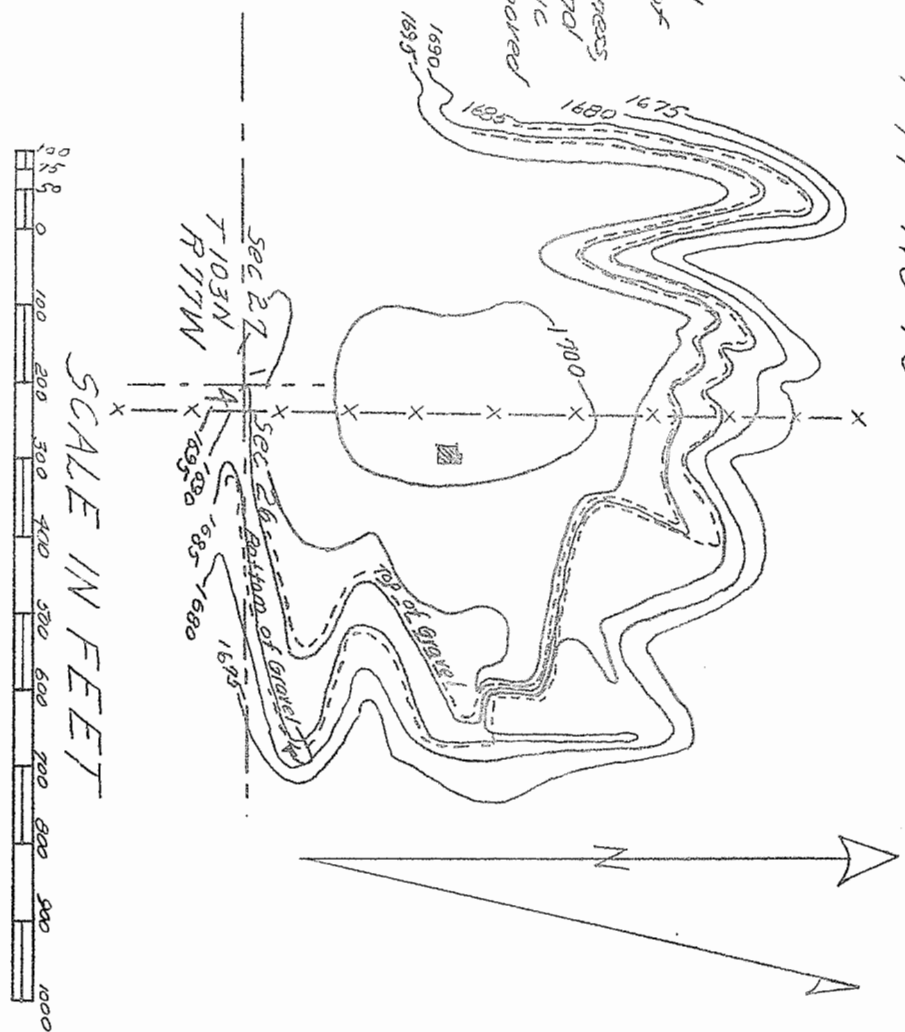
Area South of White River
Between Thunder Creek
And South Dakota Highway 47

No well defined terraces exist in this area but there are a number of quite large deposits of good quality gravel on the tops of ridges within three miles south of the river. These deposits are terrace remnants which now form the divides between the larger streams. Pits No. 11, No. 12 and No. 13 are the three largest and best of these deposits.

There has been considerable gravel removed from Pit No. 11, which lies in the southeast quarter of Section 33, Township 103 north, Range 75 west; the northeast quarter of Section 3 and Section 4, Township 102 north, Range 75 west, but approximately 1,800,000 cubic yards of good quality material remain. The material in this deposit is quite heavy in fines, is from eight to twenty feet in thickness and has only top soil cover.

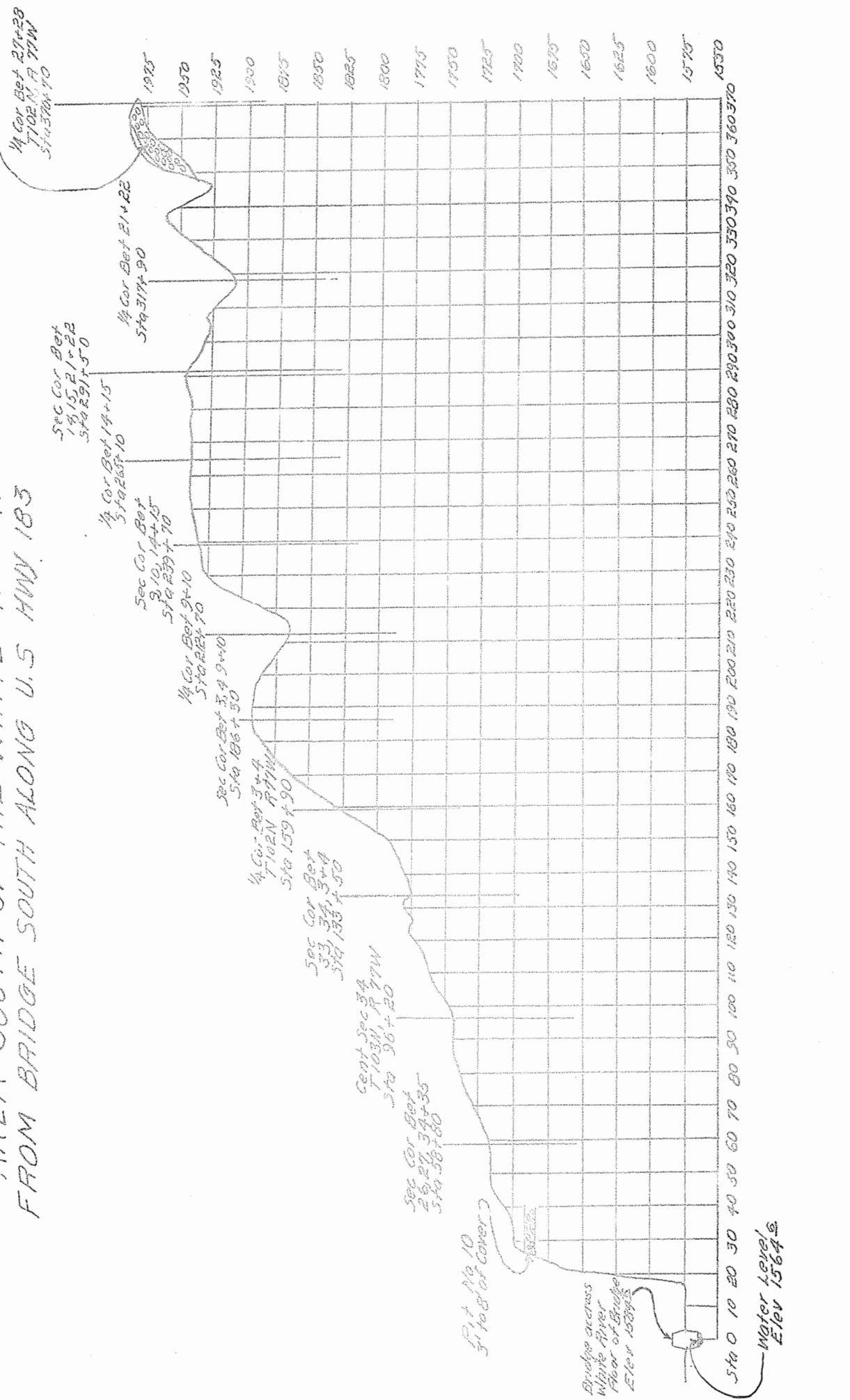
PIT NO 10

This deposit of gravel is located at the edge of the first terrace above the White River and just East of U S Highway 183. The gravel is of good quality, but stripping of most of the pit area is quite heavy. The layer of gravel is about 5m in thickness, is covered with a sandy loam and rests on shale. About 6000 cubic yards of gravel have been removed in the past but an estimated 12,000 cubic yards remain.

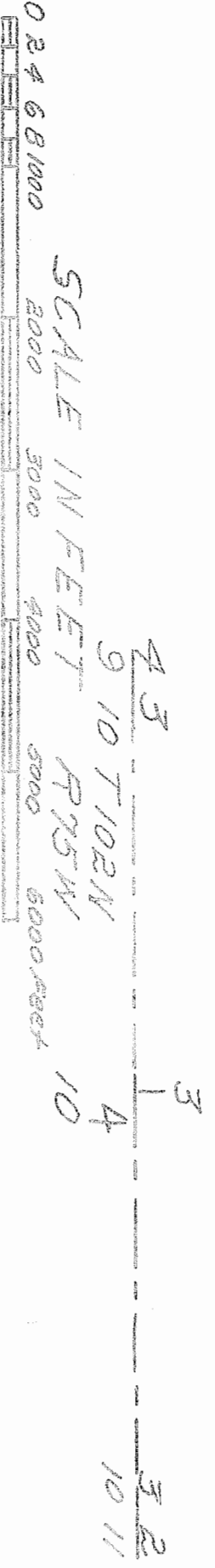
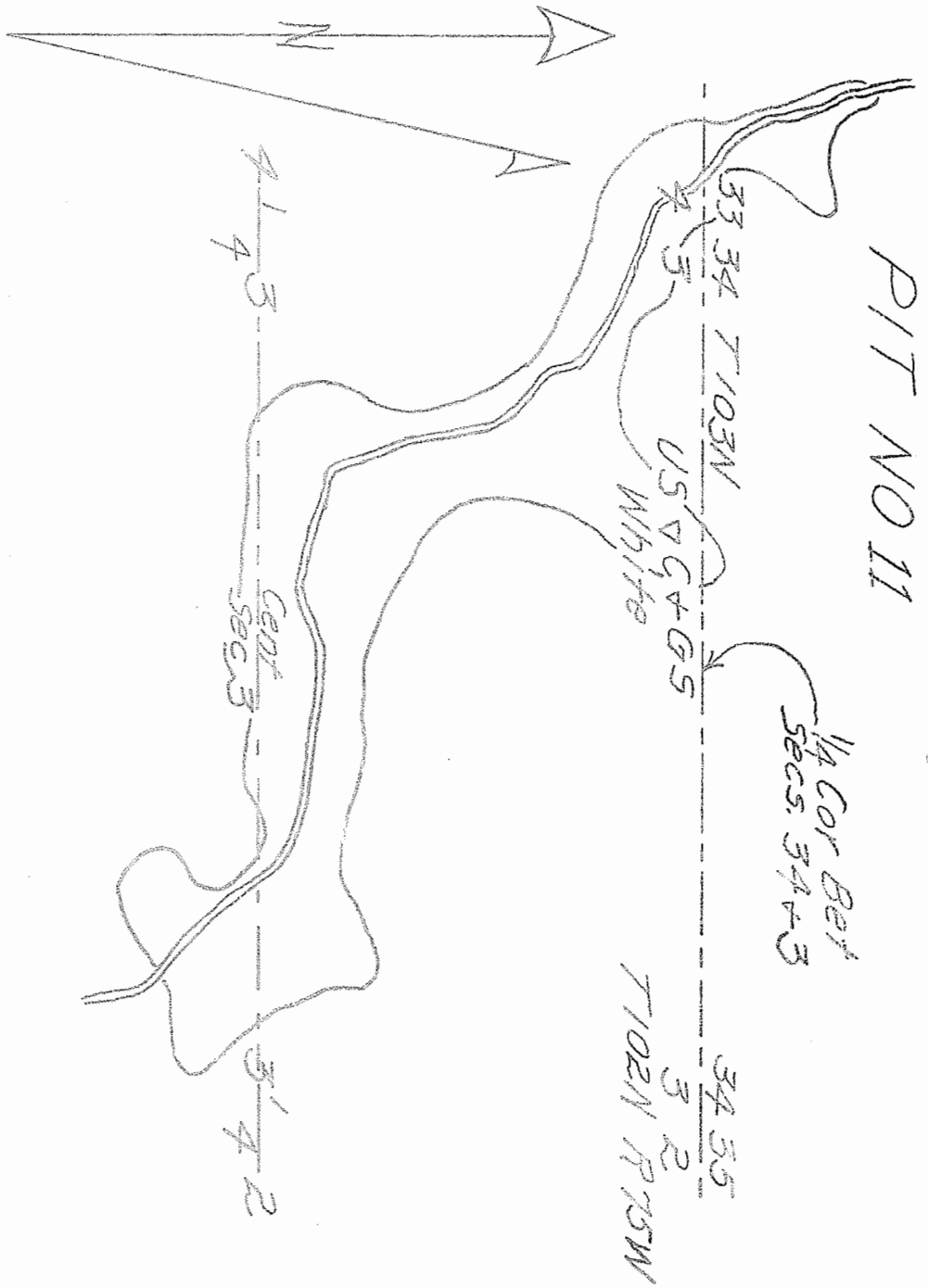


CROSS SECTION NO 3 AREA SOUTH OF THE WHITE RIVER FROM BRIDGE SOUTH ALONG U.S. HWY 183

Alternate layers of gravel
or sand, gravel and loam
1 1/2' of cover



This gravel deposit is located on a long narrow ridge about eight miles northwest of the town of Hammill and three miles south along a graded road of the White River bridge south of Hennebec. The north approach of this bridge is washed out. The gravel is of good quality, but quite heavy in fines, is from eight to twenty feet in thickness and has only top soil cover. Some gravel has been removed from this deposit but an estimated quantity of 1,800,000 cubic yards remain.

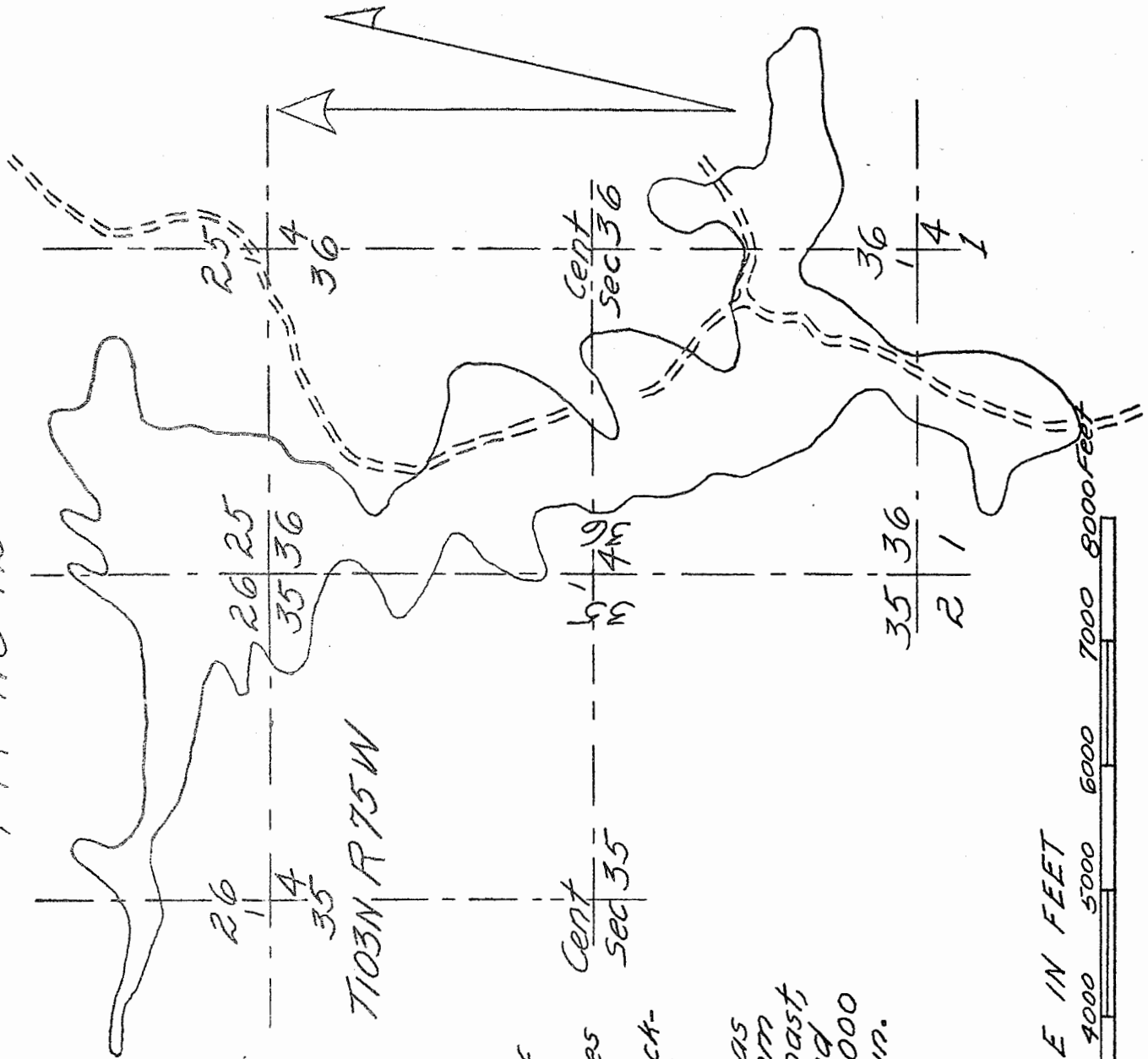


PIT NO 12

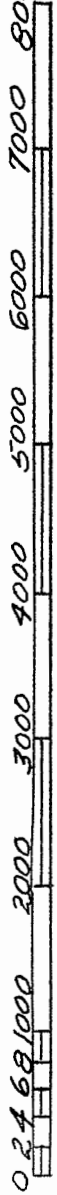
This gravel deposit is located on a long narrow flat topped ridge about seven miles north west of the town of Hannul and two miles southeast of the White River bridge south of Kennebec. The north approach of the bridge is washed out.

The gravel is of good quality, but quite heavy in fines is from eight to twenty feet in thickness and has only top soil cover.

Some gravel has been removed from this pit in the past, but an estimated quantity of 3,550,000 cubic yards remain.



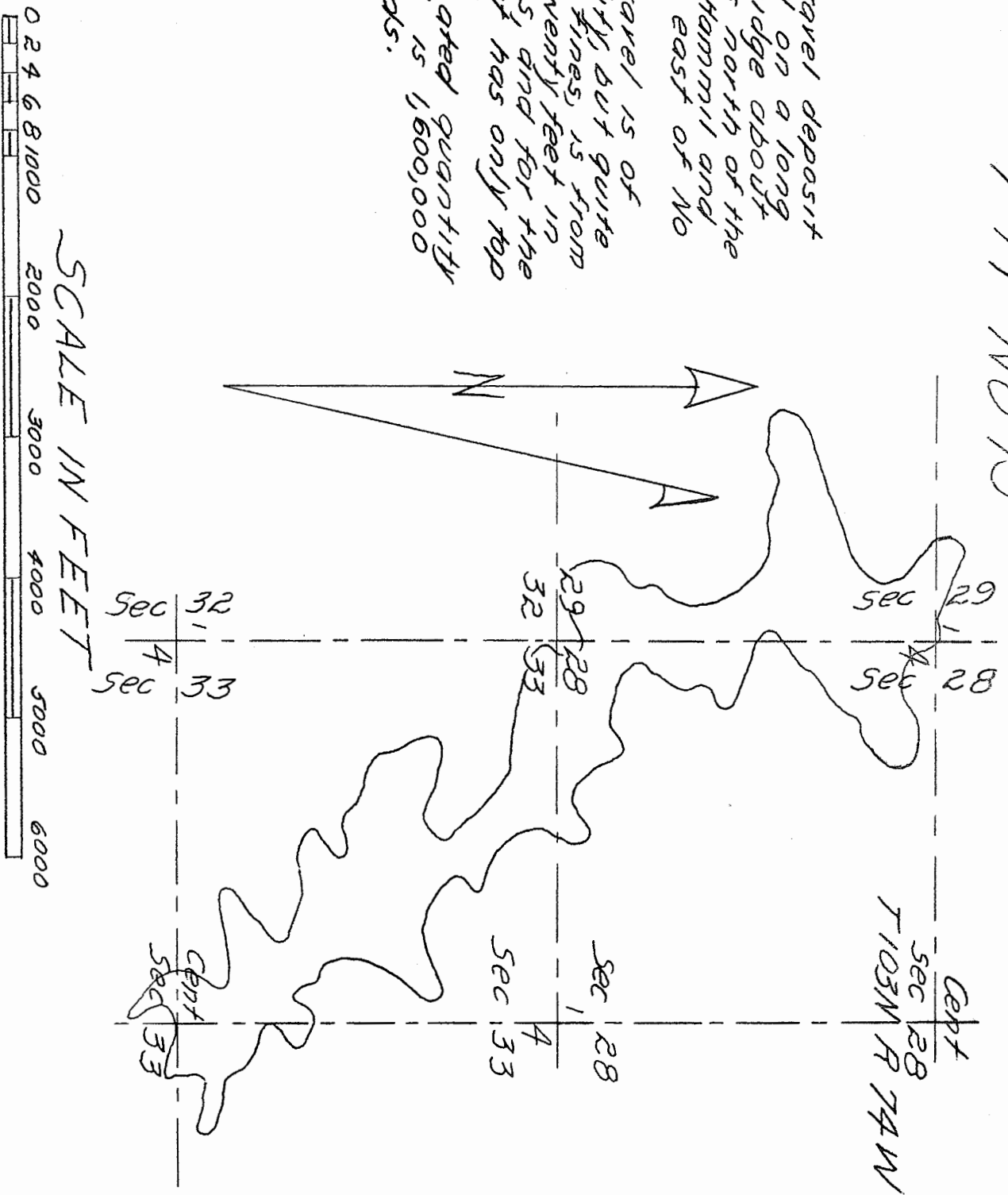
SCALE IN FEET



PIT NO 13

This gravel deposit is located on a long narrow ridge about six miles north of the town of Hammil and one mile east of No Creek.

The gravel is of good quality, but quite heavy in fines, is from six to twenty feet in thickness, and for the most part has only top soil cover. Estimated quantity of gravel is 1,600,000 cubic yards.



Pit No. 12 is located in the south half of Section 25, the southwest quarter of Section 25, the northeast quarter of section 35, the northwest quarter and the south half of Section 36, Township 103 north, Range 75 west. and the northwest quarter of Section 1, Township 102 north, Range 75 west. The deposit is from eight to twenty feet in thickness of good quality but heavy in fines and has only top soil cover. Some material has been removed in the past but an estimated 3,550,000 cubic yards remain.

Pit No. 13 is located in the southeast quarter of Section 29, the southwest quarter of Section 29, the southwest quarter of Section 28 and the north half of Section 33, Township 103 north, Range 74 west. The gravel in this deposit is of good quality but heavy in fines, is from six to twenty feet in thickness and has only top soil cover. Some material has been removed in the past but an estimated 1,600,000 cubic yards remain.

Area North of White River

In the area between the mouth of the south fork of the White River or United States Highway 83 and South Dakota Highway 53 there are no well defined terraces or no gravel deposits north of the White River with the exception of those in the flood plain of the river.

In the area from South Dakota Highway 53 to the east edge of the area covered by the survey there are a number of small deposits of gravel on spurs running towards the river. These spurs lie about 150 feet above the flood plain of the White River and are apparently the remnants of a narrow terrace north of the river.

Pit No. 14 is a deposit which was at one time south of the river in a deep bend but the river channel, during a heavy flood, cut through the low saddle and left the deposit as an island from which it subsequently changed to a knoll north of the river. The material of this deposit which lies in the east half of Section 15, Township 103 north, Range 75 west is of good quality, quite heavy in fines, about 15 feet in thickness and has from two to eight feet of cover. There is an estimated 280,000 cubic yards of gravel in this deposit.

PIT NO 14

This gravel deposit is on a knoll which is approximately 150 feet higher than the surrounding area. The knoll was formed by the river changing its channel from north of the knoll to south of the knoll, thus eliminating the deep bend which was formerly the river bed.

The deposit consists of a layer of good quality gravel approximately 15 feet in thickness covered with from 2 to 8 feet of stripping.

Estimated quantity of gravel is 360,000 cubic yards

