

PREPARED FOR  
THE ELKHART COUNTY  
DRAINAGE BOARD

PINE CREEK DRAINAGE SYSTEM  
INVESTIGATION  
MAY 1980

PREPARED BY  
THE ELKHART COUNTY  
SURVEYOR'S OFFICE

## INTRODUCTION

The Elkhart County Surveyor's Office has recently studied Pine Creek and its' watershed in compliance with the Elkhart County Drainage Board's 1979-80 proiority list for the reconstruction of ditches. Due to periodic flooding along the ditch, many residents of the area must tolerate frequent traffic hazards, crop and property damage, as well as generally unhealthy and unsafe conditions. The purpose of this study is to determine if any measures can be taken to relieve these drainage problems.

The Pine Creek drainage situation is relatively unique in that "strip development" along parts of the ditch, threatens to isolate and limit land use throughout the watershed. Such obstacles as private ponds, landscaped yards, parking lots and houses has greatly limited the options available for achieving the desired drainage throughout the watershed. Unless certain legal arrangements and/or financial settlements can be made, then relatively little reconstruction of the ditch is possible.

In addition, Pine Creek is greater than 10 miles in length and contains possibly significant wildlife and habitat, and therefore any reconstruction must be approved by the Department of Natural Resources. The conditions of this approval must be adhered to, and will likely futher limit the scope of this reconstruction.

This report, in conjunction with the Pine Creek reconstruction plans, will summarize the causes of the drainage problems and the existing and anticipated obstacles to reconstruction in order that suitable recommendations may be submitted. The results of this investigation are herewith presented to the Elkhart County Drainage Board for it's review.

## NATURAL CONDITIONS

### HISTORY

Pine Creek is a naturally occurring waterway emptying into the St. Joseph River. The greater length travels from Middlebury Township through Jefferson Township, eventually passing into Concord Township at the mouth.

The first sign we have of concern about a drainage problem is in 1881-82, when a petition was filed and established, presumably for reconstruction of a segment of the creek. This segment was 20,230' long and traveled through sections 21, 22, 23, 25, 26, and 27 of Jefferson Township. The construction of two laterals, 1370' and 3763' long, were also included in the petition. Apparently, further proceedings for this work were not begun until 1893, and then for some reason were indefinitely postponed. When or whether this work was continued and completed is uncertain.

In 1896-97 a petition was filed and clean-out work was done on a segment of Pine Creek. This segment, named Mast Ditch, extended from the North line of Section 20, Jefferson Township, North-west to the North line of Section 7, Jefferson Township. It was 14,000' in length.

From 1905 to 1909 the county was petitioned for the construction of several ditches in Jefferson Township which will empty into Pine Creek. These included Snively Ditch, Indian Creek, Rowell Ditch, Osborne Ditch, Barthol Ditch, and Karn Ditch. Kessler Ditch was reconstructed in 1918. (Note: Kessler Ditch is believed to be the original "Lateral B" to Pine Creek. Therefore, construction was probably done at the same time the initial work was done on Pine Creek, i.e., circa 1893.)

Other than limited and relatively uncoordinated cleaning efforts by private landowners, no work of record has been done on Pine Creek since the early 1900's. We do find that in 1962 the County was petitioned to reconstruct an 18,000 + foot segment of Pine Creek along the same route as that of 1893, and also to reconstruct 8164 feet of Kessler Ditch. This project was turned down.

Although very little work has been done on the Pine Creek System for many years, it is apparent from the 1972 petition and continuing communication with the inhabitants of the watershed area that erosion, siltation, and plant growth along the channel bottoms and banks are creating and increasing drainage problems within the watershed.



## LOCATION AND SIZE

The Pine Creek Ditch is a tributary to the St. Joseph River and is located in Section 36 of Osolo Township, Section 1 of Concord Township, Sections 6, 7, 18, 19, 20, 21, 22, 23, 24, 25, and 26 of Jefferson Township, and Sections 19, 20, 12, 29, and 30 of Middlebury Township. The main channel is approximately 12.5 miles in length along the south fork with additional 3.18 miles along the north fork.

There are several legal laterals to Pine Creek such as Snively Ditch, Indian Creek, Rowell Ditch, Osborne Ditch, Barthol Ditch, and Kessler Ditch. In addition, there are numerous private tiles and ditches which utilize Pine Creek as an outlet.

The Pine Creek watershed is composed of some 16,400 acres or 25.62 square miles, making this watershed one of the most significant in the county. Figure 1 delineates the watershed boundaries and sections incorporated within it.

## SOILS

The soils of the Pine Creek watershed are important to the hydrological condition of the ditch because of their influence on runoff volume. The infiltration and percolation characteristics of an individual soil series indicates their potential to absorb rainfall and thereby reduce the amount of direct runoff. This information is particularly important in order to determine suitable runoff coefficients for the area.

The Elkhart County Soil Survey (1974) identifies two different soil associations within the Pine Creek Watershed:

Oshtemo - Fox Association is located in the glacial outwash plain. Here water should slowly runoff the surface. As a result, this association is deep and moderately deep over sand and gravel, somewhat excessively drained to well drained, coarse textured and moderately coarse textured soils. Characteristic soil series of this association are Oshtemo, Rox, Tawas, Gliford, and Sevewa.

The Riddles - Crosby - Miami Association is located in the glacial moraine. This association is deep, well drained to somewhat poorly drained, moderately coarse textured and medium textured soils. Riffles, Corsby, Miami, Brookston, Carlisle, Delrey, Haskins, Metea, Oshtemo, and Rawson Soil Series make up the Riddles - Crosby - Miami Association.

Table 1 lists the individual soils series found in the basin, their hydrologic soil group, their permeability and approximate depth to groundwater.

FIGURE 1  
PINE CREEK WATERSHED  
LOCATION MAP

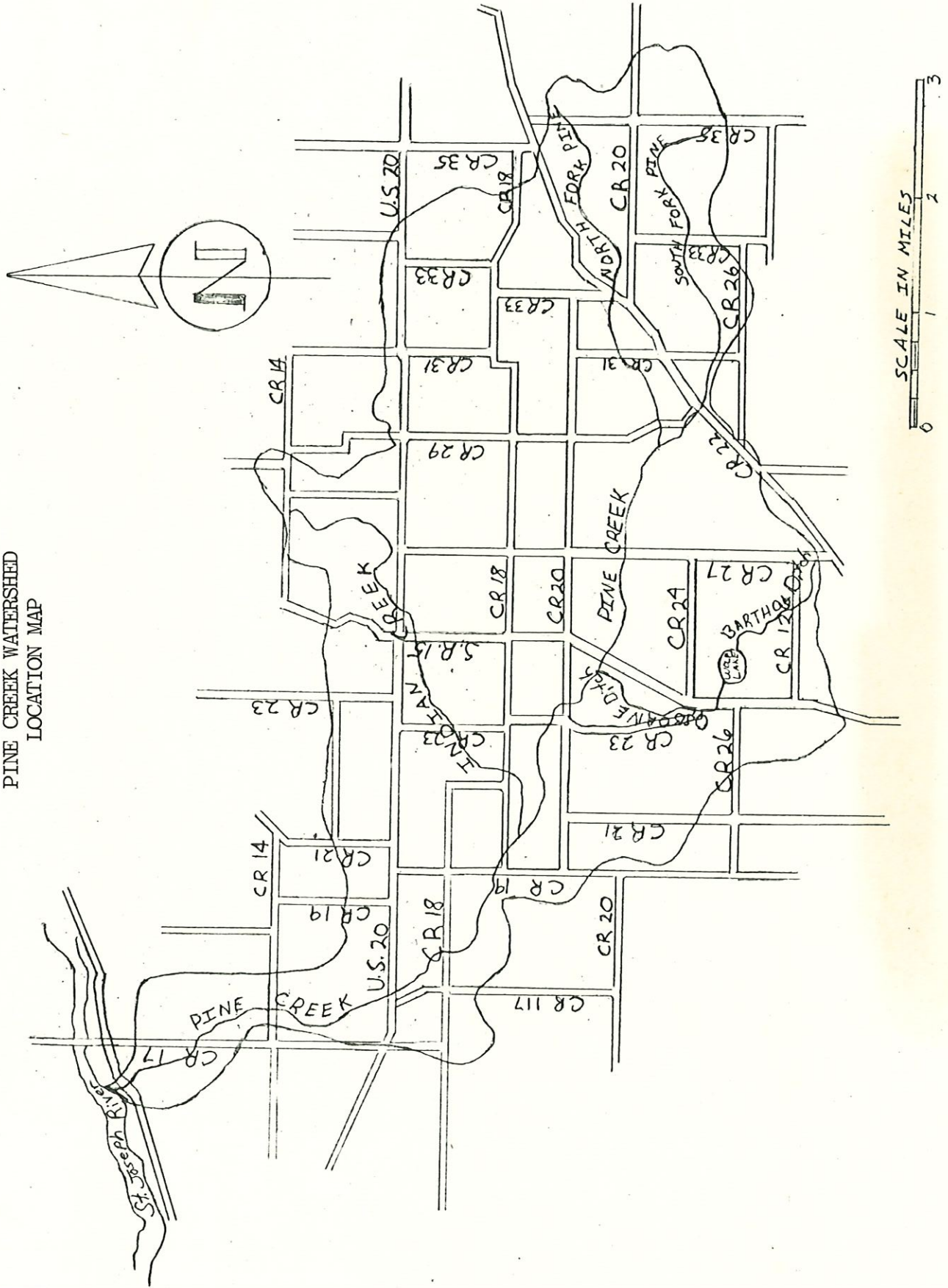


TABLE 1  
SOILS OF PINE CREEK WATERSHED

SOIL SERIES	SOIL GROUP	PERMEABILITY (in./hr.)	DEPTH TO GROUNDWATER
Oshtemo Loamy Sand	B	6.3-20.0	> 6'
Chelsea Fine Sand	A	20.0	> 6'
Gilford Sandy Loam	B	2.0-6.3	0-1'
Bronson Sandy Loam	B	2.0-6.3	3-6'
Edwards Muck	B/D	2.0-6.3	0-1'
Brady Sandy Loam	B	2.0-6.3	1-3'
Carlisle Muck	A/D	2.0-6.3	0-1'
Whitaker Loam	C	.63-2.0	1-3'
Miami Loam	B	.63-2.0	> 6'
Tawas Muck	A/D	2.0-6.3	0-1'
Crosby Loam	C	.63-2.0	1-3'
Brookston Silt Loam	B/D	.63-2.0	0-1'
Metea Loamy Fine Sand	B	.63-20.0	> 6'
Riddles Sandy Loam	B	.63-6.3	> 6'
Sebewa Loam	B/D	.63-2.0	0-1'
Haskins Loam	C	.63-2.0	1-3'
Fox Sandy Loam	B	2.0-6.3	> 6'
Delray Silt Loam	C	.63-2.0	1-3'
Rawson Loam	B	.63-2.0	> 6'
Tyner Loamy Sand	B	6.3-20.0	> 6'
Dowagiac Loam	B	.63-2.0	> 6'
Aubbeenaubbee Sandy Loam	B	2.0-6.3	2-3'
Shoals Loam	C	.63-2.0	1-3'
Linwood Muck	A/D	2.0-6.3	0-1'



The hydrological soil grouping is a technique established by the Soil Conservation service to assist planners in their assessment of runoff potential. The individual soil groups are define as:

A = A high rate of water transmission and low runoff potential.

B = Moderate infiltration rates and moderate rates of water transmission.

C = Slow infiltration and transmission rates.

D = Very slow infiltration rates; very slow rate of water transmission thus high runoff potential.

The Pine Creek Watershed can be generally described as one who's soils have moderate infiltration and transmission rates as well as moderate runoff rates. An accounting of the soils and their hydologic group reveals that soil group A makes up 13.09% of the watershed, soil group B makes up 73.37%, soil group C 11.5%, and soil group D makes up .20% of the watershed.

#### TOPOGRAPHY

The physiography of the Pine Creek Watershed was primarily formed by the glacial activities some 10,000 years ago during the Wisconsin Ice Age. Two dominant glacial geologic features form Pine Ceek Watershed. The nearly level glacial outwash areas along the channel and northwest portion of the watershed and the gently rolling glacial drift region throughout the remainder of the region.

Th U.S.G.S. Topographical map of the region illustrates the physiography of the Pine Creek watershed. The elevation extremes encountered in the area are 935+ to 750+. Slopes in the watershed average about 4% but steeper slopes of up to 12 - 18% are encountered.

#### LAND USE

Land use in the watershed is as important as the soil types in determining runoff quantities because of its influence on the infiltration rate of the soil. Fallow land yields more runoff then forested land for a given soil type. Covering areas with impervious material reduces surface storage and infiltration and increases the volume of runoff.

The land use data for Pine Creek Watershed has been collected from the Elkhart County tax records as well as from aerial photography. The results of this data collection are summarized below:

Open Tillable Land	Open Non-tillable Land	Woods	Wasteland	Homesites	Industrial, Roads, etc.
11,000 acres	1788.03 acres	1961.29ac.	443.72 ac.	1035.6 ac.	190.73 ac.

In the Pine Creek Watershed, agriculture is the predominate land use. As much as 12,788.03 acres of land is being utilized as tillable or pasture land in the watershed.

Although agriculture is the predominate land use, residential land use is growing steadily. Of particular significance is the homesite category. Another breakdown of the general land used indicates the political significance of lot owners in the watershed particularly for the assessment process.

Total Parcels In Watershed	Total # Lots	Total Ac. of Lots	Total Ac. not in lots	Total Ac.
1478	894	941.77	15,502.77	16,444.54

There are 1478 parcels of land in the Pine Creek Watershed of varying sizes. Of this number, some 60% or 894 parcels of land make up 941.77 acres of the watershed. In general terms this can be interpreted as indicating that 60% of the watershed population own or control only 5.73% of the land.



## HYDRAULIC INVESTIGATIONS

### HYDROLOGY

The first step in determining the suitability of the existing channel is to estimate the rate of flow which the channel is expected to transport during peak conditions.

The U.S. Department of Housing and Urban Development in its' recent Flood Insurance Study for Elkhart County studied Pine Creek and predicted its flow rates for periodic storms. The discharge - frequency of Pine Creek flow was determined from a plot which was developed by the Indiana Department of Natural Resources from gaging station data and flood insurance study information from northern Indiana and southern Michigan. A plot of the 100 yr. discharges versus the drainage area was then made on log - log paper. This plot was grouped around four curves each related to streams with various drainage area characteristics. The curve whose characteristics were most similar to Yellow and Puterbaugh Creeks was adopted as the 100 yr. discharge - frequency relationship for those creeks. For each stream, ratios were then formed between the 10 yr. and 100 yr., 50 yr. and 100 yr., and 500 yr. and 100 yr. curves for all the gages used in developing the 100 year curves. An average of these ratios weighted by gage record length was formed and used to set the 10 yr, 50 yr, and 500 yr. peak discharges on each creek. (Flood Insurance Study for Elkhart County, U.S. Department of Housing and Urban Development, 1978)

The predicted flow rates in the Pine Creek Ditch and their frequency of occurrence, as defined by the Flood Insurance Study are:

Pine Creek	Drainage Area	10 yr. Storm	50 yr, Storm	100 yr. Storm	500 yr. Storm
End of Study	10.0 sq. mi.	686 cfs	882 cfs	980 cfs	1176 cfs.
Upstrams of Indiana Cr.	15.1 sq. mi.	875	1125	1250	1500
Downstream of Indiana Cr.	18.1 sq. mi.	966	1242	1380	1656
Mouth of Pine Cr.	23.4 sq. mi.	1127	1449	1610	1932

In order to better describe the relationships involved in determining runoff quantities - stream flows, the Surveyor's Office has attempted to reconstruct empirically the discharge - frequencies for Pine Creek derived during the Flood Insurance Study. These computations are for discharges at the mouth of Pine Creek only.

The McMath formula:  $Q = Aci \sqrt[5]{s/A}$

Where:

Q = Runoff in c.f.s.

A = Area of watershed in acres.

c = Coefficient of runoff.

i = Intensity of rainfall in inches per hour.

s = Average slope of watershed in feet per thousands.

For a 10 year storm, intensity of 1.18"/hr.

$$Q = 14976 \text{ Ac.} \times .457 \times 1.18"/\text{hr.} \times \sqrt[5]{6.33/14976}$$

$$Q = 1127 \text{ c.f.s.}$$

For a 50 year storm, intensity of 1.6"/hr.

$$Q = 14976 \text{ Ac.} \times .457 \times 1.6"/\text{hr.} \times \sqrt[5]{6.33/14976}$$

$$Q = 1533 \text{ c.f.s.}$$

For a 100 year storm, intensity of 1.7"/hr.

$$Q=14976 \text{ Ac.} \times .457 \times 1.7"/\text{hr.} \times \sqrt[5]{6.33/14976}$$

$$Q=1628 \text{ c.f.s.}$$

#### HYDRAULIC GRADE

The current hydraulic condition of Pine Creek is relatively poor. Such problems as poor hydraulic grade, sedimentation, vegetation and structural barriers (dams), make Pine Creek inadequate to carry the quantities of water required of it.

The accompanying plans and profile of Pine Creek illustrate the particular hydraulic grade problems in the ditch. Topographic features of the area will permit achieving a more desirable grade through reconstruction of the ditch. Such proposed hydraulic grades are also illustrated on the plan and profiles.

In addition to inadequate slope, flows in the ditch are being obstructed in many spots by brush, logs, trees, debris as well as many intentional structures. When flows in the ditch are impeded by such structures, the flow velocity and momentum will be dramatically reduced. The result is a "damming" effect leading to flooding, erosion, and sedimentation.



## CULVERTS

The road crossing structures across Pine Creek are primarily bridges although some culverts do exist. In general these have adequate openings for flow and none severely restrict flow.

The culvert across County Road 27 is the most undersized. The existing opening of this culvert is 54.0 square feet, and the required opening is 64.0 square feet. This culvert should be enlarged by 10.0 square feet or a 48" dia. pipe added.

The culvert across County Road 22 is theoretically slightly undersized. The existing opening is 12.0 square feet and the required opening is 13.5 square feet. Despite this slight difference we feel at this time that this culvert should be enlarged in order to better take advantage of upstream openings.

Before this project reaches the implementation stage, all culverts and bridges will be closely examined to insure their proper functioning and stability under new hydraulic conditions.

## RECOMMENDATIONS

Based on the Elkhart County Surveyor's Office examination of the Pine Creek Ditch these recommendations are offered:

1. That the hydraulic grade of Pine Creek can be improved as proposed on the accompanying plans.
2. That all brush, logs, trees, and debris, be removed from the channel and on the banks. This material must be buried, burnt, or removed from the site.
3. Only the bottom of the ditch will be altered. The width of the ditch will remain basically unchanged.
4. The construction of fish/sedimentation traps along the ditch have been proposed.
5. Grass seeding of graded spoil is necessary.
6. The people along the ditch should be made aware of the easement along the ditch and the laws pertaining to it.
7. The Elkhart County Surveyor's Office also points out that although this project has been designed to minimize damages to the personal property of effective land owners, some adverse effects to private ponds and landscaping are anticipated. In our opinion, the hydraulic grade which we propose on our plans is minimum and must be maintained with out regards to private ponds in or near the 150 foot corridor. It is therefore recommended that the Drainage Board recognize this necessity and begin to consider solutions.



PINE CREEK

1. County Road 27

Existing opening	54.0 square feet
<u>Theoretical required opening</u>	<u>64.0 square feet</u>
Required enlargement	10.0 square feet

20'

Existing invert elevation 804.27 feet.  
This elevation is suitable.

2. County Road 22

Existing opening	12.0 square feet
<u>Theoretical required opening</u>	<u>13.5 square feet</u>
Required enlargement	1.5 square feet

10'

Existing invert elevation 847.24  
This elevation is suitable.