Vermilion River Watershed

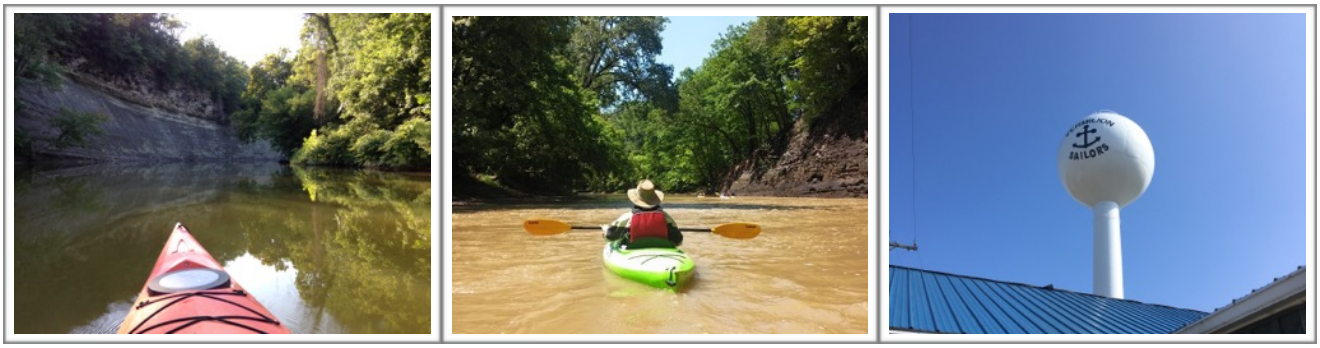
A Watershed Profile & Historical Overview

Col. Matthew W. Nahorn | 2015

At the prehistoric Franks Site on the Vermilion River. Photo courtesy of Vito Cammarata, May 2015

Introduction

The word confluence fits well in describing the Vermilion River Watershed. The Watershed is a confluence of beauty, nature, commerce, geology, varied history, and a variety of lifeforms. The intent of this report is to present an introduction to the Watershed, including its geography, geology, other technical aspects, native vegetation, an overview of the area's prehistoric history, an overview of the early historic history and associated towns, and finally current environmental issues and recommendations. Few in-depth reviews of this area have been conducted; therefore, a report fulfilling each of these topics is warranted. Previous investigations into this Watershed include "Living in the Vermilion River Watershed" (Cooper & Garvin 2008), a useful publication for residents and students alike. Other studies include "The Geology of the Vermilion Quadrangle, Ohio" (Herdendorf 1963) and "The Immortal Eries" (Vietzen 1945). Having kayaked, hiked, and spent countless hours within various locations of Vermilion's Watershed, I present this Watershed Profile and Historical Overview. A concise and complete introduction to, and an overview of, the Vermilion River Watershed, is presented here for current knowledge and future research. The Vermilion River Watershed is a confluence of dynamic parts that must be studied in order to understand and appreciate the Watershed and the choices that we maintain.



Geology, Geography, & Technical Overview

The Vermilion River Watershed is located in north-central Ohio, immediately south of Lake Erie. Its location on the southern shore of Lake Erie lends its Watershed to drain entirely and directly into this Lake. Shale and sandstone outcroppings in the northern portion of the Watershed are relatively common, especially along exposed, weathered, and eroded sections of land along which the River and its channels flow and have cut. To the

east, the next major watersheds include that of the Beaver Creek and Black River, and to the west being that of Sugar and Chappel Creeks and the Huron River. A special thank you to Dr. Charles E. Herdendorf III for allowing me to review his "Geology of the Vermilion River Quadrangle, Ohio" (1963) in order to gain a better understanding and appreciation of this Watershed's geologic history. Research materials, documents, artifacts, geological specimens, and other library resources were extensively used from the collection of the New Indian Ridge Museum, in preparation of this document.

Landuse within the Vermilion River Watershed is largely characterized by agricultural activities. Residential, natural, and park land would rank a close second. Developed/commercial land ranks as a group, as a tertiary use. Generally, a well-vegetated riparian buffer exists along the main River channel and most of its tributaries. The only major city within the Watershed is Vermilion, accounting for a large amount of impervious surfaces and higher density landuse.

Two main soil types that are encountered within the Watershed include dark-colored poorly drained soils of the Lake Erie Plain and lighter, more mottled Till Plain soils. The Lake Plain soils (poorly drained) are found along Lake Erie; whereas, the Till Plain (somewhat better drained and more rolling topographically) soils are located to the south. Within the Till Plains, the ancient glacial ice moved over this landscape and retreated rapidly without being interrupted and stopping. Tiling activities of these soils are usually necessary to create optimal crop production in the area. Till Plain soils are generally composed of clay loam. These two main soil types are impeded by the ancient sandy beach ridges. Particularly, in the northern portion of the Watershed, the Lake Plain soils become divided by these sandy soils, which parallel each other (and the soils they cut through), themselves, and are parallel to the present Lake Erie shoreline. The sand comprising these ancient ridges originated from the youngest rock formation in this section, known as the Berea Sandstone (medium to fine-grained quartz). This sandstone formation had a significant causal effect in the shapes of these glacial lakes. These sandy soils of the beach ridges are the only well-drained soils found in the immediate area and are remnants of earlier glacial lakes, among them, Lakes Maumee (the oldest at 760-780' above sea level or about 190-210' above Lake Erie datum), Arkona (information unavailable), Whittlesey (735' or 165' above Lake Erie datum), Wayne (the youngest at 660' or 90' above Lake Erie), Warren (680-665' or 110-95' above Lake Erie), and Lundy. These shorelines are fairly close in proximity, often within two miles. Their importance to Northern Ohio has transcended from ancient times to present day.

This document would be incomplete without addressing and reviewing the topic of glacial geology, briefly, because we see aspects of it persist today throughout the Watershed. A majority of the material atop bedrock in this region came from the glacial era. It was put down on the landscape via ice sheets or ancient glacial lakes in front of end moraines. It is thought that ice sheets moved through southern Canada and the northern portion of the United States during the Pleistocene epoch, four separate times. Ice sheets continuously flow forward and only melt backwards. The last two (Illinoian and Winconsinian) are more easily evidenced than the first two. Eventually, the final ice sheet did melt extensively north to the area of the St. Lawrence-Ohio River separation at a time when excess water collected in front of the ice — this collection of various glacial lakes then filled the Erie basin during the stages previously mentioned. Known as Lake Maumee I, this was the initial lake stage, which had an elevation of 230' above present-day Lake Erie (or 800' above sea level). After this glacial lake event, new outlets were closed and opened with the advances and retreats of ice, causing dramatic changes in water level, accounting for some changes of over 300.' The lowest level was found to be about 80' lower than the current Lake Erie level. As a result of compression from the presence of glacial ice, the Niagara outlet was some 80' lower in that region. The ice moved back over this area causing the lake water to once more rise. Eventually, the ice sheet melted back allowing the Niagara outlet to uplift. Its current elevation is approximately 572.'

Remnants left behind by these lakes include beaches of sand and gravel and silt and clay which would have been deposited further north at a distance from the lake shores. The majority of the dried lake beds consist of clay and silt, while sand makes up the remainder. The mouths of the pre-glacial streams, which fed these earlier lake versions, were located much farther lake-ward (now drowned out about 2 miles upstream). This earlier lake stage

was likely below 490.' Deposition within the glacial lake structures has been found to be gray silt and clay. Hard, pebbly ground moraine (glacial till) that is found is difficult to infiltrate. This till is rock debris that was scoured by glacial ice. Currently, the Vermilion River drains into a measurably higher lake having mouths that are significantly drowned out. Finally, there are three basins within the current boundaries of Lake Erie which are a result of the bedrock of the Lakebed. Generally, these basins are a result of an erosional situation set up between the dolemite/limestones versus the softer shales. As the glaciers slowly flowed in, especially in the Central Basin, where the bedrock is a softer shale, the glacier took the opportunity to cut more deeply here as compared to the harder and more erosion-resistant limestone bedrock of the Eastern and Western Basins.

Today, the Watershed is characterized by gently northward-rolling terrain except near major stream channels such as Chance Creek (a tributary of the Vermilion) and of course the Vermilion River, where relief is dramatic from the erosional factors of these watercourses. The River's valley ranges from a width of 500-1500.' Shale cliff heights range from 50' in Wakeman Township to 150' in Brownhelm Township. Near the mouth, the cliffs dramatically drop to only 30.' The average gradient of the mainstem of the Vermilion River is 7.7'/mile, and it flows within a valley, created post-glacially, lined in rock. This relatively slight drop allows the flow of the River to carve through the Ohio Shale (members subdivided into Huron - lowest member, Chagrin, and Cleveland - present along Lake shoreline), siltstones, Bedford Shale, and Berea sandstone in the northern reaches of the Watershed. Cone-in-cone limestone formations, pyrite, and marcasite nodules may be found eroding out of the Vermilion River Watershed channel between the Ohio State Turnpike and State Route 2 in the black and gray shale beds. These thin, clay-like layers of limestone, having cone-in-cone features (mostly of calcite) can be found within portions of the Cleveland shale. Septarian concretions or "turtle rocks" may also be found along the River, especially near Swift's Hollow. It is believed that these Ohio shale concretions began to form before the sediments were compacted into muds. The formation or precipitation initiated around a mass, like a fossil or other mass, then moved out. Essentially, water was forced out and ejected at the time that the "colloidal mass" center crystallized and hardened. At this time, that original center around which the material collected and precipitated, shrunk allowing the outside portion to crack and fissure. Then, different mineral crystals filled those cracks, which turn out to be more resistant to erosion, as compared to the background material or ground mass (barite), allowing that material to erode away more readily.

Moving south to north throughout the Vermilion's Watershed, the mainstem flows a length of approximately 58.7 miles (this figure includes meanders) and drains approximately 271.7 square miles. It is the third largest watershed within the Geologic Vermilion Quadrangle and general area. Within this quadrangle, it has only the second least gradient or drop in feet per mile as compared to the total of thirteen watercourses surveyed. This may have an impact on the reason the Vermilion River often has issues with ice floes during the early Spring season.

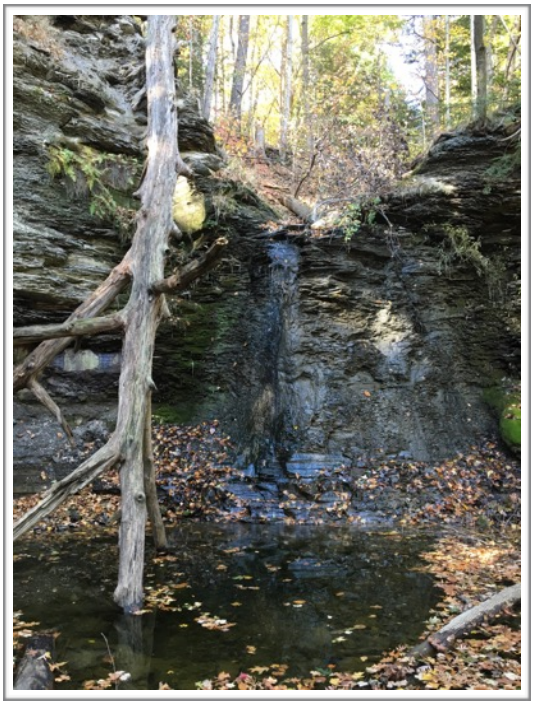
A gentle relief characterizes the southern portion of the Watershed, where the waters of the Vermilion River begin to gather. The headwaters of the River emerge in the Savannah Lakes region of Ashland County, only about 31 miles directly south of Lake Erie. The Vermilion, as most in this area, is known as a "consequent stream" which channels its water in a "dendritic pattern" traversing the slopes of the land that became visible from under the glacial ice and subsequent lake. It is evident that the stream channels meander both within their floodplains and from one shale joint system to another. For example, moving through the Brownhelm area, looking at the River's bluff where the Vermilion River has nicely eroded the wall, the Cleveland shale has been exposed (lower portion); then the Euclid siltstone is visible; and finally the red Bedford shale is located at the top portion of the bluff, immediately under the soil layer. Millions of years ago, as a result of the collision of two continental tectonic plates, the initial mountain building episode of the Appalachians commenced. Major erosion of rock and soils occurred, deltas were created downstream, and this material was a significant contributor to the material that comprises the shales we see today. This collision in the eastern part of North America and the eventual erosion provided sediment from the Appalachian Mountains to create shale and siltstone in *this* region. A deep sea was located here, allowing those sediments to collect in this space.

About 3,000-4,000 years ago, the present-day Lake levels were established. The Vermilion River's mouth is drowned at Lake Erie, where a seasonal estuary originally formed. This higher water level is thought to be a result of a dramatic rise in Lake Erie's outlet at the time of glacial retreat from that area. Interestingly, these events of isostatic rebound are still occurring today in areas once covered by the ancient glaciers. Erosional factors continue to work in conjunction with this phenomenon, cutting into the bedrock as the landscape slowly continues its rebound. At its mouth at Lake Erie, the River makes a sharp westward curve, just after flowing under the present location of the Route 6 Bridge, having just flowed north for a short distance. Immediately before emptying into the Lake, the River channel turns northward. North of the Route 6 Bridge to the Lake Shore, on the

Eastern edge of the River channel originally existed a large complex of low-lying swampland (River floodplain). On the immediate opposite side, the elevation of the Western edge of the River is slightly higher than the Eastern side, which allowed this area to be initially developed. In the 1930s, the floodplain space just mentioned was channeled, and generally dry pieces of land were created for housing. This area, of course, is largely prone to flooding and contains durable steel break walls to protect structures against major ice floes that make their way through the channel in the early Spring.

Dredging activities have influenced the River levels for a significant distance upstream. By deepening and widening the main channel, this segment of the River's flow and ultimate height, is largely dependent on the Lake level and predominant winds at any given time.

With regard to paleontology, very few fossils have been found within the exposed rock formations along the Vermilion River. Some fossil corals have been located along with deposition of limestones, including cone-in-cone limestone, which indicate remnants of a marine environment. This is direct evidence of the area now known as Ohio having been located south of the Equator, covered by a warm ocean environment, including a Cambrian inland sea (about 520 million years ago). There is further evidence, showing deposition of Silurian evaporite sediments which occurred between major ocean reef structures that essentially surrounded Ohio. Deposition also occurred during the late Devonian period, about 375 million years ago, when a shallow sea covered Ohio.

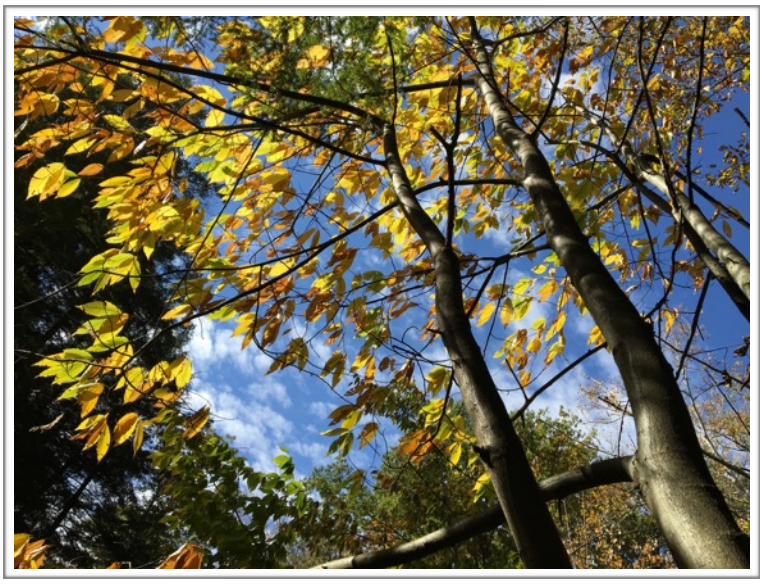


A unique feature along the River that should be explored is a hanging waterfall, which has been captured in an antique postcard — it looks very similar today. The waterfall is located between Schoepfle Gardens in Birmingham and the Ohio Turnpike bridge. This particular type of waterfall forms along the River course because the water continues to seek its local base-level, while attempting to "catch up" with the erosion of the main River course and reach *that* particular, ultimate base-level.

The humid climate of the Vermilion River Watershed maintains a generally stable rainfall amount throughout the year. The area's climate is largely dictated by its location and proximity to Lake Erie. Regarding temperatures, extremes are lessened and comparatively decreased in the area near the Lake as compared to conditions farther inland.

Native Vegetation

The Native vegetation of the Vermilion River Watershed mirrors that of its location in North-central Ohio. It is argued that the majority of the vegetation within the Watershed is of native origin. This particular area is included in the Beech-maple climax forest, intermixed with various hardwoods. Examples of components of the original, hard-wood-dominated forested land encountered by early settlers from the East included ash, oak, maple, walnut, elm, chestnut, poplar, sycamore, and hickory. Fine examples of most of these tree species and the woodlots they comprise (being early- to mid-successional stands) are still extant today throughout the region and especially near the Vermilion River mainstem. Here, near the mainstem, and more specifically in the region of the floodplain forests, mid- to even late-successional woodlots may be encountered. One section of this forest type is particularly



prevalent in the floodplain forest just below the Franks Site. This type is relatively similar to the composition that the early settlers were met with upon arrival.

Location of vegetation is determined by soil composition, topography, sunlight/climate, elevation, and soil saturation. A brief overview of the Beach-hard maple forests reveals their location is generally on land sites that maintain good drainage but remain moist. The hard maple species (sugar maple) are more readily found on gently rolling portions as compared to the more poorly-drained Lake plain locales. Swampy sites are characterized by soft maples (silver maple), elms, and willows (black, pussy). Remnants of the ancient glacial lakes, which are the sandy beaches of which we are familiar today, are often dominated by oak-hickory forests. Dominant floodplain forest species, which must be tolerant of frequent inundation of water include, American sycamore (*Platanus occidentalis*), black willow (*Salix nigra),* elm (*Ulmus* spp.), and black walnut (*Juglans nigra*). A variety of sedges, rushes, and blackberries may be found on land where soil is thin and underlain with shale. This landscape may be referred to as a brush-type of vegetation located upon this generally wet prairie. The grey dogwood (*Cornus racemosa*) is a common shrub found throughout the Watershed and particularly, forest edges.

As a side note and of particular interest, the ash (*Fraxinus* spp.) tree population has been largely devastated by the Emerald ash borer (*Agrilus Planipennis*). Their introduction and eventual migration into this Watershed affected nearly all ash trees larger than 15"CBH. Those of smaller size were generally spared as they were not favored by the borer upon which to lay its eggs. A second tree that once was understood to be fairly common within this Watershed includes the American chestnut tree (*Castanea dentata*), above. After the

introduction of the American chestnut blight (*Cryphonectria parasitica*) in the early 1900s from overseas lands into the New York area, the disease quickly spread throughout these United States, having a major impact on the native Chestnut populations. The Chestnut wood was largely used and valued as an important lumber source for various purposes. Today, it is very rare but possible to encounter shoots of the American chestnut within the Vermilion River Watershed. On an expedition through the Chance Creek Watershed, a tributary of the Vermilion River, our team located an ancient stump having three stalks of an American chestnut high above the Creek, on a well-drained shale cliff. This was a significant find. Further research will continue.

A giant white oak (*Quercus alba*) persists in the area of Swift's Hollow high atop a bluff of the Vermilion River. The tree has been estimated to be in excess of 500 years old. It is a superbly giant example that once existed in a cleared area and has now had to survive in an emergent woodlot.

South of Mill Hollow and especially around the area of Chance Creek's confluence at the Vermilion River, Eastern hemlock (*Tsuga canadensis*) are quite abundant along the high, well-drained shale cliffs along the Vermilion and especially up the Chance Creek mainstem. The cliffs along Chance Creek are extremely high and sheer, and the channel itself winds sharply from side to side within the confines of its floodplain. On one occasion, our expedition found Canada yew (*Taxus canadensis*) flourishing on the higher portions of the floodplain that are not

as often prone to flooding. Chance Creek Watershed provides excellent study opportunities.

Prehistory Overview

Prehistoric Native American Indians called the Vermilion River Watershed their home for thousands of years. Evidence of their existence has been found readily throughout the Watershed, especially on the high, scenic cliffs overlooking the mainstem of the River.

As already mentioned, the sandy, well-drained beach ridges of the ancient glacial lakes are important features of this area. They were often used as pathways for Native peoples, as they could traverse these ridges while moving from one place to another and during hunting or other related activities. These spaces were of great importance because the soils on either side of the beach ridges were often soggy and poorly drained.

Several prehistoric archaeological sites are located within the bounds of the Vermilion River Watershed. Many of these were excavated by the late archaeologist Col. Raymond C. Vietzen. These sites include the Franks Site and Brownhelm Site (Lorain County). Other prehistoric Native American Indian sites located along the banks of the Vermilion River include: Franks Site, Moes Site, Swift Hilltop Site, and Leimbach Site. It is necessary to provide a brief overview of the prehistoric inhabitants of this region before going forward. When the term prehistoric is used, it simply refers to those peoples who did not have direct contact with European settlers or those of European descent who had settled in the East and eventually relocated this way. As a result of these native peoples not having a written language or documentation such as we know today, we must study the tools and remnants left behind by them in order to gain a clear picture of their lifestyles, rituals, &c.

Chronology in Ohio is basically straight forward. The first people to come to this area are known as the Paleo people (12,000 B.C. - 10,000 B.C.). Next, in order are, Archaic (7,500 B.C. - 2,500 B.C.), Woodland (including the highly advanced Hopewell culture) (1,000 B.C. - A.D. 600), Erie (in northern Ohio; Fort Ancient in southern Ohio) (A.D. 1,000 - A.D. 1,600), then the historic Native Americans (at the time of the contact period between the prehistoric Native Americans and the European settlers) (A.D. 1,600 - A.D. 1,700). These early people were “prehistoric” and thus did not not have contact with white man or Europeans. Therefore, we do not know what they called themselves. The names you see here are simply group names that archaeologists and anthropologists have assigned to these native peoples. They left no written records, &c. — the only evidence they left includes their village or camp sites and the tools they made and used.

How did these first people arrive here, one many ask. This is an interesting question, and has been the center of much debate. This question and others will be attempted to be answered. A long-established theory is presented here.

The Paleo people were nomadic hunters, who followed the herds of "food" — the mammoth and mastodon. They did not live in permanent village sites such as the later culture of the Eries. The climate in the Bering Strait area was quite cold. So, as the mammoths and mastodons decided to follow the sun, to the warmer weather in search of more food for themselves, they wandered northeast, ever getting closer to what we now know as Alaska. As a result of this freezing weather, much of the water in the area had become locked up as ice. This aided in the formation of the "land bridge" that formed with ice and land to connect the Old World and the New World. As the mammoths and mastodons wandered this way (into the Americas), so did the Paleo people. These animals were the people's main source of food but were not native to the Americas. So, there they came, the prehistoric Paleo people entering the New World, about 15,000 years ago.

The **Paleo** people used fluted or unfluted projectile points, spears, and knives to hunt, cut, and for numerous utilitarian purposes. The fluted point is older than the unfluted point. The flute was utilized to affix the shaft in place when projecting the arrow point. Large, thick hand axes of flint were used as well as finely fashioned flint square knives.

The majority of prehistoric tools were made of varying qualities of flint. Flint occurs all over the country. Flint Ridge Flint, occurring in Southeastern Ohio, is some of the finest. Flint is a glass, mostly silica. Flint is like man's window glass of today. Old flint, that is, flint that has been quarried and exposed to the air for a time, is very difficult to cut and shape (just like old glass). Glass manufactured years ago is much more difficult to work with, compared to glass that was made recently. The Flint Ridge comprises about three counties in Ohio. Its flint occurs in all colors, from black to white.

The Paleo people evolved and changed over the years into the **Archaic** people. The Archaic people transformed the Paleo people's unfluted spearpoints into a notched projectile point that was more reliable and easier to tie to shafts. The Archaic people's tool box included the grooved axes. Dr. H. C. Shetrone, formerly of the Ohio State Museum (now Ohio Historical Society) once stated that all grooved axes are from the Archaic period. This holds true; Col. Vietzen also agreed with this statement. Celts, an ungrooved axe, were the successor to the fully-grooved, three-quarter-grooved, and half-grooved axes. These tools ranged greatly in size and shape. Overall, they were a heavy-duty tool crafted of a hard stone, being granite or other hard stones. Sometimes celts were of slate or even flint. An Archaic bifurcate projectile point was found not far from the Swift Hollow area atop a high, well-protected plain. The style of this piece dates to 6,900 B.C., indicating an Archaic site (seen below).

The **Archaic** people slowly evolved into the Woodland people. These people are characteristic of developing a much improved form of pottery. The Adena and the Hopewell lived during the **Woodland** time. The Adena people had developed a stemmed projectile point or spear. The Hopewell were highly developed. Their use of mica (from the Carolinas) and highly sought after obsidian (volcanic glass) for ceremonial pieces, are characteristics of this culture. Throughout Col. Vietzen's more than sixty-five years in archaeology, he came to believe that this culture, the **Hopewell**, was at the pinnacle of the prehistoric peoples, largely because of their advanced artwork and tools. Col. Nahorn preserves a (fine-grained sandstone) stone smoking pipe that was found along Gore Orphanage Road in this Watershed. Unfortunately we are unable to determine the time period or age of this particular artifact, but it is of prehistoric origin.

The Hopewell developed the birdstone, an ornament's use that is still questioned today. Some archaeologists have found these in burials on top of the individual's skull. This has forwarded the idea that it was used to carry the person's spirit to the heavens. More research is needed to recognize the intended use of these intriguing artifacts.

After the Woodland period, the **Eries**, Heries, or "Cat Nation" people were located in Northern Ohio, on the Southern shores of Lake Erie. They were called the "Cat Nation"

because they wore furs of cat-like animals — probably raccoons. These were always an abundant animal in the area. On an early map that the author recently studied, the area located within the southern shore of Lake Erie was labeled as "Nation du Chat" or literally "Nation of the Cat" (French). Numerous remains of raccoons have been recovered on these local sites. In the Southern part of the state, the Fort Ancient people inhabited that area. These two groups of people evolved to live in sizeable agricultural villages, rather than being nomadic hunters. The Erie's style of "arrowhead" was a more or less equilateral triangular point that was numerous on their village sites. There were several of these village sites located in the Northern part of Ohio. The Eries were ultimately defeated by the Iroquoian people circa 1654.

The English and Dutch had begun trading with the Iroquois for furs in the East. Large trading posts had been established. With the "richest" hunting and trapping grounds being located to the West, and controlled by the Eries, the Iroquois needed this land to fulfill their orders at the trading posts. The Eries wanted to retain their land and therefore this commenced a long, bloody war.

Obviously there are numerous other sites in the area that are worthy of inclusion here, however the author has chosen one to highlight in this work. The Franks Site has been classified by Col. Vietzen as an "Erie village" because of the extent of archaeological material recovered at this site that is related to the Eries. "The Franks Site is by far the largest and most extensive site … in northern Ohio," stated Col. Vietzen in his The Immortal Eries, a 1945 publication. The site is located in the Brownhelm area, Lorain County. Further description takes us to the eastern bank of the Vermilion River, on land that is approximately 150 feet above the river – a perfect place to live. It is believed that the site encompassed about 80 acres of land. In the 1940s when Oberlin College worked on this site, Col. Vietzen worked there as the site supervisor.

Much of the evidence of the Erie's inhabitance has been documented by the Jesuit priests who visited here, at that time. The range of the Eries has long been believed to have extended from Erie, Pennsylvania and Ripley, New York to approximately the Maumee River at Toledo, Ohio. We maintain that this range of territory is still valid and true. There has been much dispute as to whether the Eries inhabited this area, this far west in Ohio. But, with the documentation that

Col. Vietzen uncovered and the research we have conducted, along with the Jesuit records, it is only right to, at this time, recognize and acknowledge that the Eries did inhabit this area. We must not forget what previous archaeologists have uncovered — this will light the way to the future and provide all of us with better knowledge. "A backward glance in history will light the way to the future," Col. Vietzen once stated.

Evidence of Erie inhabitance has been largely noted by Vietzen, but Col. Nahorn has also located similar backup evidence such as locating a triangular projectile point on a high bluff near the Vermilion River. The Eries always chose elevated, scenic spots upon which to settle.

After the Eries were defeated by the Iroquois, about 1654, Ohio was void of Native Americans. As Williams describes in his 1879 "History of Lorain County," the land in Northern Ohio was hunted over by many different peoples, but it was owned and controlled by none of them — unlike when the Eries called this place home. Now, this was a period in Ohio's history when the state was again without people living here. Native American groups from out-of-state then moved into Ohio. When the European settlers came to this area, there were very few Native Americans; they had gone. The Native Americans who had contact with the Europeans, during the "Contact Period," are now known as Historic Native Americans. The author wants to make it clear that the prehistoric Native Americans who inhabited Ohio are not in direct relation to the Historic Native Americans.

Early Historic History Overview of Towns

The original townships (and their settlement dates or dates of arrival of first settlers) drained by the Vermilion River include: Vermilion (1808), Florence (1811), Townsend (1811), Wakeman (1816), Hartland (1817), Clarksfield (1817), Fitchville (1817), New London (1817), Ripley (1825), and Greenwich (1817). Also included are Brownhelm (1816), Camden (1829), and Henrietta (1817). Vermilion was once known as Vermillion. Originally all encompassed within Huron County (formed February 7, 1809), which extended to the Black River where it met Cuyahoga County, Erie County was later carved and divided (in 1838) from Huron. The first most accurate survey of the Firelands area, a parcel of land encompassing 500,027 acres, was completed by Almon Ruggles in 1808 after a few inaccurate surveys. At the time this was measured as east to west: 25 miles, 51 chains, and 25 links. Thundershower mills were very important operations, as in many early settlements. Particularly, one was located at the mouth of Chance Creek at the Vermilion River (as shown in an 1857 Township map).

Upon entering the Vermilion area today, one may note the sign stating they are "Entering the Firelands." The Firelands, within the Vermilion River Watershed, adds a unique early history to the area; therefore, it is necessary to understand how the Firelands came about. The Firelands were separated from the Western Reserve of Connecticut to be awarded to New Englanders in the East. A large portion of the land within much of the western portion of the Vermilion River Watershed was 'reserved' by the State of Connecticut for the 'sufferers' whose property was damaged during the Revolutionary War. This section of land, essentially encompassing Erie and Huron Counties, was separated from the Western Reserve before Connecticut sold the Reserve to the Connecticut Land Company. Nine towns had been burned and otherwise destroyed by British troops coming in to Connecticut from New York. The Firelands portion of the Western Reserve of Connecticut was essentially set aside for those individuals. The eastern portion of the Watershed, in Lorain County, was originally part of the Western Reserve of Connecticut.

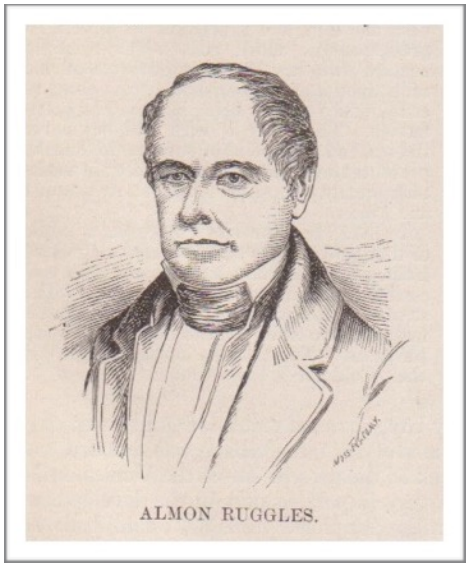
The histories of the Firelands area and the Western Reserve are traced back to the early 1800s, and a complete history to present-day would encompass several pages. The intent and purpose of this document is not to recount a complete history of the entire Vermilion River Watershed but rather only endeavor to focus more upon the history of the land generally contained within Vermilion Township and its City. It is not the intent of this report to act as a complete history, and we would direct you to "History of Huron and Erie Counties" and "History of Lorain County, Ohio" both by Williams (1879) for a broader documentation of other history within this area. Here, a brief enough outline is provided of the early days of Vermilion in order to orient oneself with the area's history.

The first settlers in Vermilion came to that place early in 1807 during the time of the great survey by Almon Ruggles and his surveying party. Just a few miles west of the Vermilion River they constructed a small, temporary structure of logs for shelter and a rude surveying office; this was the first log structure in the vicinity. We learn from Ruggles' diary that, "Today I crossed a swamp and a cranberry bog and came to the river called the Vermilion. I swam across with my clothes on my back, then returned for my instruments. I put my initials, A.R., on the trunk of a black oak tree on a perpendicular bluff, east side of the river, near the lake [this marked the northeast corner of the Firelands]." After traversing back and forth throughout the region, the survey was completed in the fall of 1808, and they headed back East.

It is interesting to think that over 200 years later the cranberry bog and swampy area that Ruggles crossed is today dredged out, cleared out, and has several high dollar houses

that occupy its once soggy soil, now known as the Vermilion Lagoons. The River he swam across now is traversed hundreds of times per day by the horseless carriage — and, it is still swam in today, on occasion.

The Township of Vermilion had its first official settler, William Haddy, take root on the land in 1808. The next year, William Austin, George and John Sherarts, Enoch Smith, and Horatio Perry settled here. In 1810, Almon Ruggles, Solomon Parsons, Benjamin Brooks, Barlow Sturges, Deacon John Beardsley, and James Cuddeback settled in the Township. The year 1811 welcomed other settlers, including Peter Cuddeback. Judge Ruggles was land agent for many years for the Firelands' proprietors. Ruggles was the first recorder for Huron County (in 1809, when the County was organized) and started the post office in Vermilion, being its first postmaster. A Mr. Leach carried the mail on foot at first. In 1809 Almon Ruggles constructed a mill on a southern section of the Vermilion River close to the southern line of Florence Township. This mill was washed away, and in 1811-12 he built one on La Chapelle Creek. This was an important improvement for local settlers and those to come. Williams' historical record provides an account that the Judge was practical, honorable, and trustworthy. In 1815 he was appointed as the associate judge of Huron County, became State


ALMON RUGGLES.

Senator in 1816, being re-elected in 1818. Ruggles lived on the Lake shore, between the Vermilion and Huron Rivers — today this area is commonly known as Ruggles Beach. He is buried in the cemetery near here (d. July 17, 1840).

Let us review a few of the early settlers in this area: Capt. Barlow Sturges settled with his wife Eunice and their son, Frederick and wife Charlotte, at the mouth of the

Vermilion River. Here they opened a hotel and began a ferry. It is hard to say how this endeavor would have continued if the Captain had not died a few years later, along with his son as well. Deacon Beardsley lived on lot 12 in section 2 and was "fully devoted to his Christian duties." In Vermilion he was the first to organize religious meetings in neighborhoods, before organized churches were established. Rufus Judson came in 1811-12 and was an early blacksmith in this area. In 1809, John Sherarts was the first pioneer child to have been born in the Township. And the first marriage was Catherine Sherarts to Bud Martin in Spring 1814. 1812 saw the first death of a Vermilion settler, Solomon Parsons. William Hoddy erected the first house of logs, upon the Lakeshore near the mouth of the Vermilion in 1808; Capt. William Austin built the second, just west. The first frame house was built in 1818 by Peter Cuddeback, and a stone house was raised in 1821 by Capt. Austin; then the first brick house was constructed by Horatio Perry. Peter Cuddeback cleared land for and planted the first orchard in 1812, then his son, J. J., took over the operation. Capt. Wm. Austin started the first public house near the mouth of the River.

The first church in the Township was that of the Congregational, organized February 20, 1818. The first structure of worship or meetinghouse was near the center of the Township in Spring 1828 and Rev. Harvey Lyon was in charge. In Spring 1814, the first schoolhouse was raised on the Lakeshore. Miss Susan Williams was the teacher. The Village school district finally erected a "substantial brick structure" in 1874, which still stands today, albeit empty and in rough shape. It cost about $18,000, including property and furniture. Dr. Strong, Amherst's first physician, was also the first doctor in Vermilion.

The City of Vermilion, officially recorded, surveyed, platted, and incorporated in 1837, located at the mouth of the River has been built around the River itself, using the important water resources provided, as can be noted on early maps. Joseph B. Clarke was the first mayor. Originally built on the shipbuilding and fishing industry, the town of Vermilion grew steadily along the banks of its River. Today, recreation, tourism, and otherwise pleasure boating are major factors of the town's economy. For example, the West River Paddle Sports Company provides exceptional touring opportunities and views of the Vermilion River. Guided tours offered, provide a perfect time to view the River and its geologic, natural, and scenic features.

A number of years passed before any upgrades were made for the ease of using the River or the harbor as a resource. In circa 1841-42, Mayor Borns had a pier built and proceeded in dredging the channel. About 1847, the first lighthouse was erected by Deputy Collector of Customs Charles Judson — albeit a crude structure, 25' high, it was actually

portable. More dredging occurred, leaving the channel at about 14.' The "Friendship" was the first boat of any type constructed here, and it was built by Capt. William Austin about 1815. She was 30 tons in capacity. Much of the wood for these early vessels was milled at Brownhelm Mills, operated by the Bacon Family just to the south. Numerous sail and steam vessels originated from Vermilion. In 1849, the Federal government appropriated funds for a thin, white lighthouse, which served in its capacity until a storm destroyed it in 1854. A stronger, octagonally-shaped iron-made lighthouse took the place of the wooden structure by 1877-78. This one was shorter and not as thin as the previous structure. In 1874, the Corps dredged the channel 60' wide and 11' deep at the request of Congress. Again in 1875 this action took place, along with the construction of longer piers.

Railroads are a fact of daily life in Vermilion today. In 1851, the first train rumbled across Vermilion tracks that were begun to be laid in 1848. These were the tracks of the Junction Railroad, chartered in 1846 by Ebenezer Lane from Elyria, traversing from Erie to Cleveland to Sandusky to Toledo to Chicago. Trains went through Vermilion on Columbus Street. This Railroad merged with the Toledo, Norwalk, and Cleveland (started in 1850) into the Cleveland and Toledo, Northern and Southern Divisions. The divisions then turned into the Lake Shore Railroad in 1869. Several bridges for both railroads and other traffic (persons, horses, automobiles) have been constructed over the Vermilion River connecting the two sides. Ferry services were also common at one time or another (one being Cloudy's). For

example, a 4 cents charge was required to use Frederick Sturgis' ferry in 1817, and it was 9 cents for a horse and its rider. Later, a covered bridge is noted on early maps of the Town. A previous version of the present Route 6 bridge stood just south of the present bridge, and a similar bridge was immediately south of that upon which the Lake Shore Electric Railway passed. Some of these abutments are still visible today. Finally, a steel-beamed bridge was erected to the north of the previous bridge in the 1920s — the Route 6 bridge used today.

The area around Linwood Park has its own history, and it is not the purpose of this publication to delve into the rich and interesting history of that section of town. You would be directed to "Through These Gates and Down the Path: Linwood Park" (Boas & Boas 2009) for a more complete history. Linwood has been home to people since prehistoric times. Interestingly enough, early Amherst settlers, the Dute family, are integrally connected with the establishment of what later became Linwood Park. Some of the early "camp meetings" for church and religious activities (including evangelism and revivalism) were held at the Dute Homestead about 1854 until 1872. Eventually the group decided on a formal meeting place, and in 1883 the property that is Linwood today, was purchased for $11,000. The group's constitution was read and accepted at the Dute Homestead. Linwood Park accounts for some of the early and most important recreation industry of the town, which continues there to this day. It is located on the high bank of the eastern side of the Vermilion River.

The Olympic Outing Club is another unique, private spot within the northern reaches of the Watershed. Originally started as a private club for men and their sons in the early 1900s, today it welcomes entire families, albeit remaining a private club within the floodplain of the Vermilion.

Now let us delve into a bit of history on a few other notable locales within the Watershed:

No history of the Vermilion River Watershed area would be complete without a section on the Swift property. Swift's Hollow, or Rosedale, located in the Vermilion River bottomland, traces its history back to the early 1800s when Joseph Swift (1794-1878) came to this area from Williamstown, MA. in 1817. His father was a founder of Williams College. Upon arrival he constructed a "utilitarian" house before eventually building the expansive estate later known as Rosedale. This impressive, 14-room Greek Revival structure was on a slightly higher plateau in the

floodplain along the Vermilion River on Gore Orphanage Road in Brownhelm Township. It was designed and built in 1840-41 by architect and first Village of Elyria mayor, Judge Ozias Long. The house was surrounded by a lattice fence and large sandstone posts on the corners and at the gate posts. The walls were brick lined with approximately 90,000 for insulation — these were made on-site. Seven fireplaces heated the house along with two bake ovens. The framing wood came from local sawmills, and whitewood trim was brought in to the area. Notably, a large barn on the property was sided with black walnut wood. An extensive rose garden was established on the property, and one of the Swifts later recalled the place as, "a healthy place" where there were no doctors summoned for 14 years.

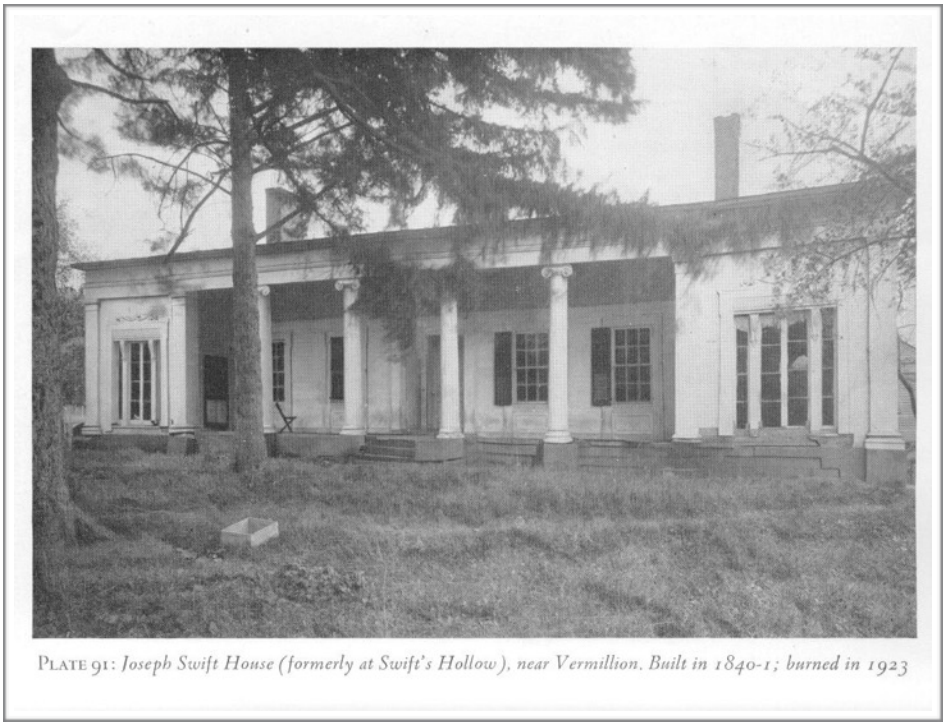


PLATE 91: *Joseph Swift House (formerly at Swift's Hollow), near Vermillion. Built in 1840-1; burned in 1923*

The Swifts were losing their money in poorly invested railroad stock, and by 1853, Joseph Swift moved to Detroit. By 1866 documents reveal that the property was completely out of the Swift family. The Wilbur family occupied the place until 1895. A Sutton purchased the homestead, then Rev. Sprunger (who operated the Orphanage of Light and Hope, which was not located on this property) owned it. Cleveland's First Church Society acquired it later, and finally E.L. Coen owned the homestead about 1916. His wife, E.M., eventually took possession. After being abandoned sometime after 1901, it burned in 1923, likely due to homeless individuals taking refuge there or kids playing around the place. The Ritter Public Library in Vermilion (1958) was designed after Rosedale. As a side note the "Gore Orphanage" name for the Road lends itself to ghost stories, when, in fact the word 'Gore' only refers to a mistake in surveying (a strip of land left out) and 'Orphanage' referring to an orphanage in the area but never burned and where no children were killed (the Swift house burned, but no one was killed in that blaze).

Bacon's Hollow (Bacon's Corners or more commonly known as Mill Hollow, the first Lorain County MetroPark, donated by Dorothy Bacon DeMuth) is a popular and expansive park today. Benjamin Bacon (1789-1868), a sergeant in the War of 1812, initially lived above the Vermilion River Valley, coming here about 1817. His large, rectangular, white house still stands today, east of the Mill Hollow area. A stage coach stop (Goodrich Inn built c. 1825, pictured, demolished in the 1940s) was located on top of the hill before entering the present-day park. Benjamin Bacon moved to the wood frame house that stands today in the valley, c. 1843-45. Mr. Bacon was one of the first Lorain County Commissioners when the County was organized in 1824. He was also a farmer in the valley there, now known as Bacon Woods/ Mill Hollow Park, and here he operated saw and gristmills (Brownhelm Mills). There also

was a Potash Mill and a Tannery. The sawmill was built in 1820 by Brownhelm's first settler and namesake, Col. Henry Brown (1773-1843), and the gristmill was built in 1821 by George Hinkley and George A. Morse. A raceway to direct water flow from the River, across the oxbow bend was cut through the floodplain valley in order to direct and more easily use the powerful force of the waterpower to power the early "Brownhelm Mills." Later, as waterpower became less reliable, these types of mills became known as "thunder shower mills," and were retrofitted to be operated by both a water wheel and steam engines, like

many milling operations of the time. This was after the mills had been rebuilt by the new owner John Heymann, following an 1876 devastating fire.

In the North, when entering this portion of the Watershed, one of the most recognizable features of the landscape is the 312,000 gallons capacity water sphere towering over the River and town — a fine monument to welcome both the motorist and boater that has been preserved and maintained for posterity and is still used for navigational purposes.

Current Environmental Issues & Recommendations

Just as in nearly every area watershed, environmental issues play a factor in the health of the Vermilion River Watershed. Non-native and invasive plants, especially, are the focus of this section. These plants were brought into this area, generally by humans often for use in their particular landscaping projects. Some of these plants have escaped from those confines and populated areas not originally intended. Other environmental issues within the Watershed include flooding, erosion, water quality and sedimentation, and overall loss of natural areas.

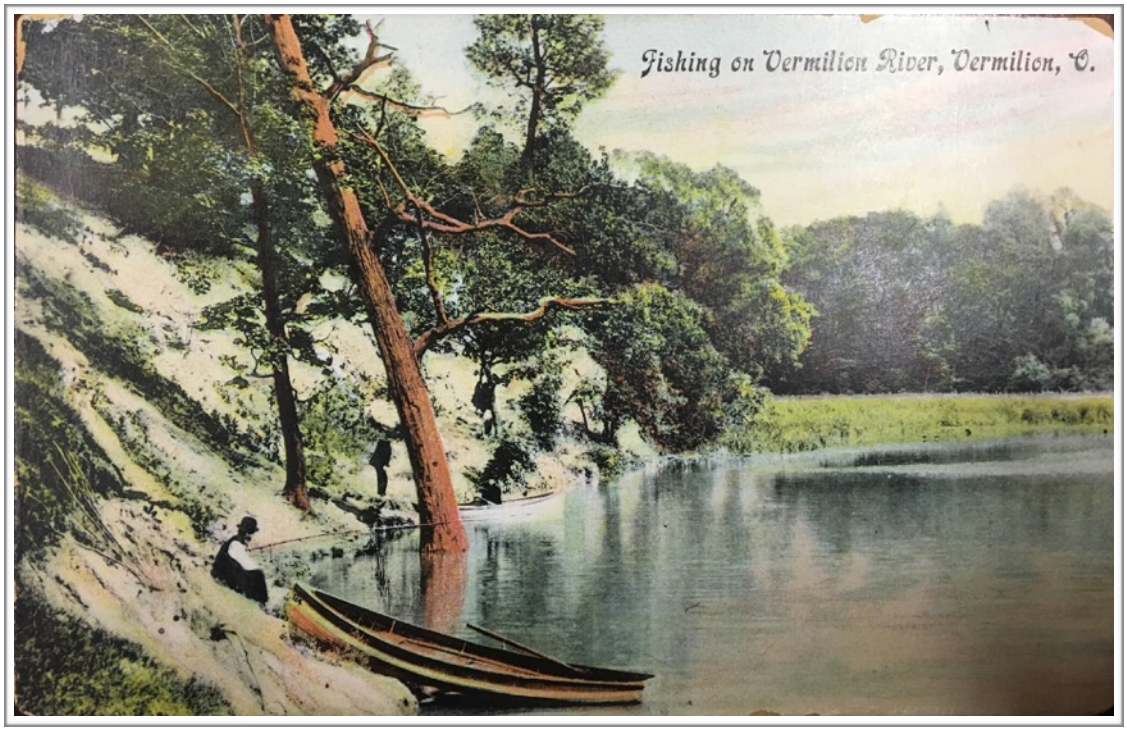
Some non-native plants within the Watershed include the presence of Japanese knotweed (*Fallopia japonica*) and phragmites (*Phragmites australis*). These plants, which spread both via seeds and rhizomes, have been found beginning to colonize the banks of the

River and thus spreading via water flow and wind. Other invasive plants include the presence of garlic mustard (*Alliaria petiolata*) and narrow-leaved cattails (*Typha angustifolia*).

Landuse affects water quality and stream bank integrity

Flooding, erosion, property loss, water quality, and overall health of our local watersheds are largely determined by the manner in which you use your property. Whether you are a farmer who owns a few hundred acres, own a large parcel of land along a creek or river, or live on a small lot within the city, the activities that take place on your land will necessarily affect many aspects of the watercourse that receives the rainwater runoff from your property. Possessing and exercising private property rights are an integral part of being an American citizen. Landowners who understand and exercise all of the options of best land management available to them have the ability to still enjoy and use their land while simultaneously contributing little negative impact to the watershed as a whole.

It is imperative to understand the definition of a watershed and its role within land use. Watersheds contain all of the land that drains or "sheds" its water to a central stream, creek, or river. Watersheds such as the Beaver Creek Watershed, Black River Watershed, and Vermilion River Watershed are common ones located in Northern Ohio. As an example, the Vermilion River Watershed contains all of the land that will eventually drain its water into the mainstem of this River. Understanding the features of a watershed is crucial before reviewing types of land use and how they contribute to the health of a watershed. We will focus on the Vermilion River Watershed for this matter. However, much of the information in this section can be used to refer to any area watershed.



In the South

Most watercourses in this area generally drain and flow south to north, with some minor exceptions. Let's explore the Vermilion River Watershed and land use within it, in that manner — from south to north. Water that drains into the headwater streams from the southern-most portion of the watershed originates from natural and farmed areas in extreme southern Huron County and a bit of northern Ashland County. The land use in this portion of the Watershed is characterized by light residential use, with a focus on agriculture.

Agriculture greatly contributes to the area's economy. However, many common agricultural practices contribute negatively to the health of the watershed. Historically, this land was covered with natural areas referred to as upland woods and "forested wetlands." These forested wetlands are wooded areas wet enough to support many water-loving species (like pin oaks) while still providing a habitat for many traditional, drier forest plant and tree species. Lush forest floors along with mature trees filled these regions. When farming came to the area, the land was cleared, drained, and tiled so that the water would continuously and efficiently be shed from the land at a faster rate.

This "unnatural" rate of drainage can contribute to flooding in many other areas of the watershed. Quick drainage leads to higher river levels during times of rain and unnaturally lower river levels during drier times. But, we must understand that farmers need dry fields to grow crops. There is a fine line between productively efficient fields and fields that

contribute to increased flooding. Drier and more "efficiently" drained fields mean that this land will shed its water more quickly, not allowing it to slowly percolate into the ground, naturally recharging ground water and thereby recharging the River's water levels. Slow percolation of water through soil also acts as a natural filter, sorting out any pollutants. Other farm practices such as plowing directly to the edge of a creek or river can also negatively affect water quality while simultaneously contributing to erosion and loss of land from the farm field. When a "riparian area" or buffer strip along any watercourse is not left intact in its natural state or is nonexistent, water will quickly rush over the banks and enter the stream. Riparian areas (of at least twenty-five feet but ideally a couple hundred wide along the mainstem of the River) should be left in their natural state or planted with trees and grasses having strong root systems and over-hanging members. These vegetated buffers act to slow down water entering the adjacent stream, while simultaneously strengthening the bank against erosion and shading the water, keeping it cooler. The root systems provide perfect habitats for fish spawning, and cooler water contributes to better oxygenated water.

Dredging is another technique that many farm operations use in order to efficiently drain their fields. The Vermilion River has sustained dredging operations throughout its recent past and in various portions of the Watershed. Dredging works well to drain farm fields, but it destroys the important habitats that the slow-moving, "inefficient," headwater streams provide for certain organisms. This activity will also promote more flooding and erosion in the northern reaches of the watershed, as the water is quickly whisked from the southern portion of the landscape.

Moving North

As we travel northward in the Vermilion River Watershed, somewhat denser residential land use with some commercial and industrial venues are encountered, along with certain other agricultural land use practices. Many similar problems will be found here, but they are caused by other factors. Here, impervious surfaces, such as rooftops, parking lots, and roadways lead to flooding. Impervious surfaces include any material that does not allow water to soak through but rather forces water to quickly run off of its surface. These include concrete, asphalt, and rooftops of buildings. Also, property owners along a stream will many times mow directly to the edge of the creek. This action will once again eliminate those important riparian areas referenced in the farm section. Without these preserved areas, water will rush off the landscape into the watercourse. The absence of a well-vegetated riparian buffer will lead to a destabilized stream bank that will promote increased erosion while also eliminating important bank-side habitats.

We all Contribute

Property owners along any watercourse must understand that the process of erosion *is* natural. Creeks and rivers will move, over the course of hundreds of years, from side to side within the confines of their floodplain (or low-lying area that is prone to frequent flooding) by the erosive forces of the River's thalweg. However, the rate at which erosion is taking place can be directly related to and accelerated by the aforementioned human activities. Accelerated erosion results in loss of land along the watercourse. Erosion will also result in increased turbidity and an increase in the scouring action of the stream beds. Turbidity simply is a measure of the total amount of suspended solids that are present in the River's water at a specific point in time. When excess amounts of dirt (sediment) enter the water, levels of turbidity increase as the water becomes brown and dirty looking. This sediment-laden water can affect aquatic life by clogging fish gills and clouding the water making it more difficult for organisms to photosynthesize. Higher than normal levels of turbidity can result from numerous aspects, including soil entering the River from stream bank erosion or stormwater runoff from construction sites having bare ground.

Increases in flooding can also allow for an increase in the "scouring" action of the floor of a watercourse. This scouring action will negatively impact the integrity of the stream channel's banks and its bed. Healthy creeks and rivers are naturally divided into discrete sections. These sections include: riffle, run, and deep pools. There are aquatic organisms that maintain

specific niches (lifestyles) and will only inhabit one of these areas of the stream. A riffle is an area where the water tumbles over rocks, providing fast water action and acting as a natural aerator, bubbling and dissolving oxygen into the water for use by aquatic organisms. Runs are shallower strips of the stream that are slower moving and usually unobstructed by rocks, exposing the shale floor below. Finally, deep pools are just that — they are pools of water that are slow moving and are the deepest portions of the watercourse. All of these portions of a stream are important in providing specific habitats for certain life forms. With increased severe flooding, these areas become "jumbled" and often destroyed, as floods basically clear out the floor of the stream, creating a singular environment.

Another Important Feature

When you observe naturally occurring watercourses, they almost always contain meanders and do not flow straight in a certain direction. These meanders act to hold more water than a straight channel. Also, they slow water down: imagine a straight pipe transporting water compared to a pipe with a series of obstructions forcing the water to flow back and forth and not straight ahead. The pipe that forces the water to take a longer route will hold more water and decrease the speed at which it flows through the channel.

Often, over many years, these meanders are naturally changed and cut through. This allows for the creation of what are called "ox-bow wetlands." These are areas where the river

once flowed but still contain a depression in the ground. Wetlands form in these areas as a result of this depression and former channel.

At the Mouth

Creeks and rivers in the northern third of Ohio flow into Lake Erie. Naturally and historically, the "mouths" of these watercourses were rich and biologically diverse, containing many stream-side wetlands and flooded mouths. Over the years, many major river systems, including the Vermilion River, have experienced extreme degradation at their mouths. This degradation often is a result of dredging and the construction of marinas and other boat venues. The dredging and marina construction eliminate many species of plant and animal habitats, while effectively scouring the substrate of the watercourse. Furthermore, as the mouth is cleared out and boat slips are dug into the banks of the watercourse, the area is not only degraded biologically, but this also allows more water to flow out of the river much more "efficiently" than before these activities have taken place.

Often these areas can contain important coastal wetlands. Wetlands will occur all throughout the watershed and act as the landscape's "kidneys," storing, cleansing, and slowly releasing water. When these wetlands are destroyed or degraded, this is yet another factor that leads to decreased river levels during drier times and increased flooding during rain events. One way to remedy the loss of freshwater estuaries at the mouth of places like

the Vermilion River is to install hanging bags that are durable enough to withstand shipping and boating operations but also maintain ample pockets for native vegetation growth, where fish can find refuge and more normal habitat, as compared to the flat, steel bulkheads.

Why Care?

In addition to allowing for more dirt to enter the stream and increase flooding, the lack of a well-vegetated riparian area can allow excess levels of nutrients to enter the water, also degrading the stream quality. Excess amounts of chemicals applied to lawns and farming operations, especially those close to watercourses, can easily enter the streams, contributing to more-than-natural nutrient loading levels in the water. These nutrients can result in an increase in the growth of algae. As these large algal blooms die, their decomposition requires oxygen. A limited amount of oxygen is naturally contained within the water and is used by many organisms. Decreasing levels of oxygen in the water can lead to stagnant, anoxic water and stinking cesspools that no one wants to be near. This process of adding nutrients to the water system, leading to anoxic conditions is called eutrophication (nutrient enrichment).

So what can you do?

-Maintain a well-vegetated riparian area (at least twenty-five feet or as much as possible) along all watercourses on your property.

-Reduce use of lawn fertilizer/farm field fertilizer and apply it at appropriate times of the year.

-Install a rain barrel at your house to collect stormwater runoff from your roof.

-Install brick pavers instead of concrete to reduce runoff.

-Work to preserve natural areas in your community, especially those near watercourses.

-Do not build in floodplains, which are lands along watercourses that are prone to flooding. These areas are naturally designed to flood as there is a low and high wall to all naturally designed watercourses. The low wall always leads to the floodplain where the river will naturally spread out, allowing flood waters to collect, decrease their erosive forces, and be stored while slowly percolating back into the watercourse.

-Maintain the "bends" in rivers and creeks — do not straighten or channelize streams. Bends or meanders of streams act to hold more water than a straight-lined stream.

It is necessary to reiterate and explore more deeply a few of the points mentioned above. Moderate and usual erosion along the mainstem of the Vermilion River banks is evidenced. However, worse erosion may be encountered if landuse in the Vermilion River Watershed included more extensive impervious surfaces and associated commercial or industrial uses. The Watershed, as earlier reviewed, is actually largely sparsely developed.

Overall, well-vegetated riparian buffer zones along the mainstem exist, and in some areas they are extensive. Several preserved and other maintained natural areas exist within the Watershed. These practices have led to good and in some instances extremely positive water quality results. A few years ago, the Vermilion River was a candidate to become an Ohio Scenic River, meaning it is among the cleanest and most scenic in the State of Ohio.

Recommendations for landowners within the Vermilion River Watershed include several points as briefly reviewed above. It is crucial that when selecting plants, trees, shrubs, and grasses for a property, that these plantings are native to the region in which they are being planted. Soil type, terrain and grade, and climate are crucial for understanding what to plant and where to plant it. It is not the intent of this publication to delve in to specifics of that particular topic. This is a general, overview, and background-providing document — something meant to provide knowledge and expose opportunities that are

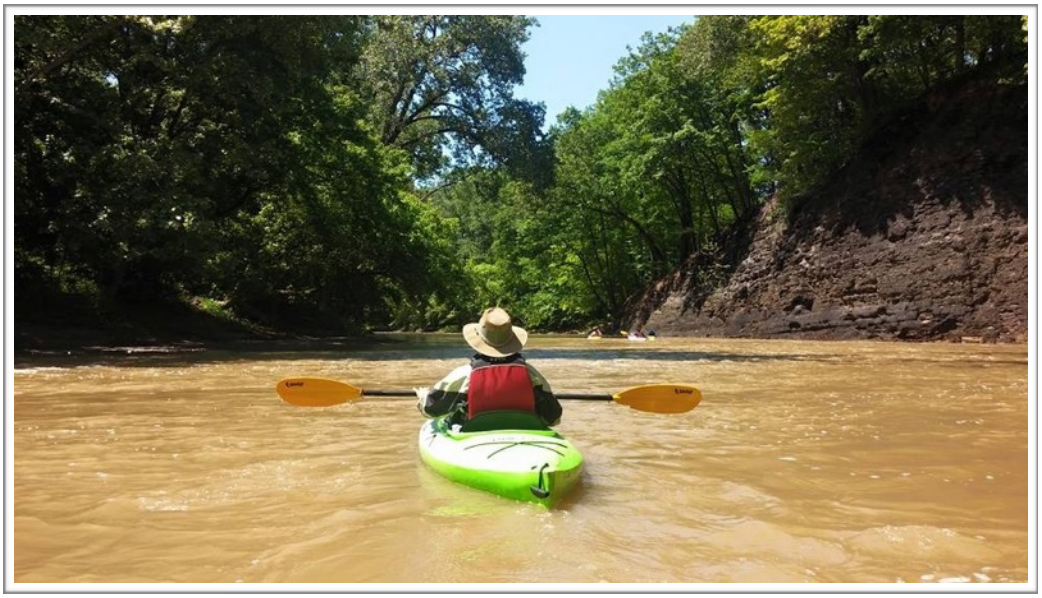
available for future research.

With regard to landuse, a well-vegetated riparian buffer of, in general, a couple of hundred feet, should be set aside when planning any land clearing activities and construction near the mainstem of the Vermilion River. This cannot be emphasized enough. Riparian buffers of less width ought to be considered for smaller tributaries and feeder streams to the mainstem. Formulas exist to calculate the best case scenario in determining the most effective buffer strip widths. Overhanging vegetation, including root masses and low-hanging branches are just a few positive aspects to these buffer strips. Over-hanging vegetation aids in cooling the water and reducing the amount of sunlight that reaches the

water's surface (cooler water allows oxygen to more readily dissolve into the water). Root mats along the edge of the channel (especially near the mouth) provide perfect spots for fish to hide, live, and lay eggs. These riparian buffers also retard stormwater runoff entering the watercourse. One major recommendation is to review the feasibility of installing hanging vegetative bags and fish shelves along the bulkheads near the mouth of the River. A similar situation has been successfully employed in the Black River Watershed.

Conclusion

We have taken a rather comprehensive journey through the Vermilion River Watershed. This journey can be comparable to a kayak trip down the mainstem of the Vermilion River, from a point upstream to its mouth — an excursion that is literally *through* time, that being geologic time and through prehistoric and historic time into the more recent



past. While floating down the Vermilion in a kayak, the kayaker passes enormous geologic features, in a matter of moments, which represent millions of years. He passes high bluffs — sites that have been used in a multitude of ways from hunting and gathering lifestyles or warring conflicts of days bygone, to pleasure boating and relatively peaceful events of today. This relatively in-depth overview of the Vermilion River Watershed uncovers the fact that the Watershed itself is a confluence of many aspects, as clearly described. Understanding what a watershed is; how we interact with its aspects; and what choices we may make, empower us. It is our intent that you will understand and appreciate that empowerment through those confluences that have been described.

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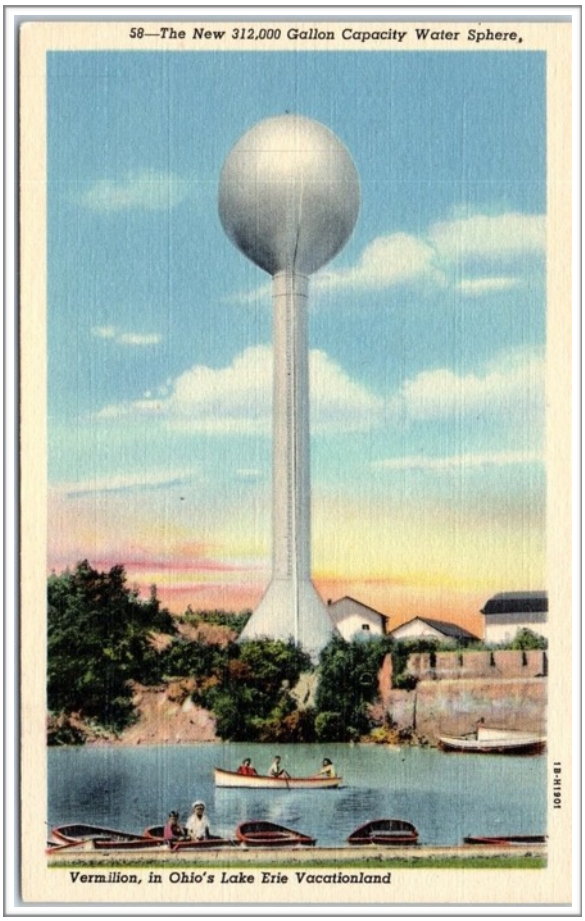

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Layout and publishing by Col. Matthew W. Nahorn of the New Indian Ridge Museum, 2015.

Citation:

Nahorn, Col. M. W. 2015. *Vermilion River Watershed: A Watershed Profile and Historical Overview*. The New Indian Ridge Museum, Amherst, OH. 28 pp.