

# Appendix A

# ENVIRONMENTAL FEATURES

## GEOLOGY & TOPOGRAPHY

During the Paleozoic era of geological history, Hillsdale County and the state as a whole was inundated by successive warm, shallow seas during which large amounts of sediment were deposited. These deposits were subsequently lithified to form bedrock. Hillsdale Township sits upon bedrock of the Mississippian system and consists of Marshall Sandstone and Coldwater Shale. The Ice Age brought four successive continental glaciers across the Great Lakes area. As these ice sheets moved southward from Canada, they scoured and abraded the surface of the land leaving behind deeper valleys and more rounded hilltops. The advancing glaciers carried large quantities of rock materials scraped and gouged from the land's surface. These materials were then deposited during the melting of the ice to form drift materials covering the bedrock below. The depth of the drift layer deposited above the bedrock is typically fifty feet or less throughout the Township. Evidence of exposed bedrock can be seen in the Township's southeast corner.

The Township's topography can be generally described as gently rolling. The vast majority of the Township reflects grades of 5% or less though nearly every square mile section of the Township includes areas where slopes approach 10% or more. Those individual areas exhibiting grades approaching 10% or more do not typically cover a large land area but rather are often associated with drainage courses and hillsides where elevational differences do not typically exceed thirty to fifty feet. No areas in the Township appear to exceed 20% grades and those individual areas which approach 15% to 20% grades typically do not cover more than several acres in area. The northern and eastern thirds of the Township do not generally reflect as great of an ex-

tent of grades approaching 10% or more. Grades approaching 10% or more can present particular challenges for larger scale urban developments. Development upon sloped areas can lead to excessive soil erosion, sedimentation of water courses, and increased construction costs, and often result in heightened alteration of the natural landscape. It is generally recommended that urban development be strongly discouraged where grades approach 15% or more.

The Township's topography reflects a distinctive pattern of bottomlands and upland areas. The Township generally falls in elevation as one travels across the Township in a westerly direction toward the City of Hillsdale. The land rises again to the west of the city before it falls approaching the North, Middle, and South Sand Lake area. There are approximately 180 feet in total topographic relief between the Township's highest and lowest elevations. The lowest elevation in the Township is approximately 1,049 feet above sea level and is found along the edges of North Sand Lake in the Township's northwest area. The highest elevation in the Township, approximately 1,230 feet above sea level, is evident along Hallett Road east of Lake Wilson Road.

## DRAINAGE & WATER COURSES

Drainage in the Township is facilitated through wetlands, lakes, small streams, and the St. Joseph River (see Figure A-1). The St. Joseph River originates in the City of Hillsdale, fed by Baw Beese Lake and other nearby lakes and wetland areas. Baw Beese Lake is the largest body of water in the Township, located in the Township's southeast corner and covering more than 400 acres, 165 of which are included in the Township. The Township includes four other lakes which exceed 10 acres in size

(see Table A-1). North Sand Lake, Middle Sand Lake, and South Sand Lake form a north-south chain of lakes near the Township's western periphery. King Lake is situated along the Township's southern border one and a half miles west of Baw Beese Lake.

Nearly the entire eastern two thirds of the Township drains into the St. Joseph River, which ultimately empties into Lake Michigan. The balance of the Township drains into the North, Middle, and South Sand Lake chain, which serve as the headwaters for the Sand Creek. Sand Creek travels in a northwesterly direction upon exiting the Township and empties into the St. Joseph River in the northwest corner of Hillsdale County. There are numerous creeks and other small tributaries which collect runoff and feed into these lakes and primary drainage courses.

Lands abutting or in close proximity to drainage courses, including streams, ponds, and lakes, are subject to flood conditions where the drainage courses do not have the capacity to accommodate the rate of runoff from a single rainfall or numerous rainfalls over a relatively short

period of time. Historically, no flooding of any large scale significance has occurred in Hillsdale Township. This is due in large part to the comparatively limited development within the Township and the existence of a township-wide network of drainage courses and wetlands to carry and store runoff. Flooding is further curtailed because many of the area water courses originate near or in the Township, making it a headwaters area (initial waters collection point for area drainage courses) where comparatively limited amounts of runoff need to be accommodated as opposed to larger drainage areas further downstream.

A FEMA study has been completed to identify areas of the Township which may be susceptible to flooding brought on by particularly intense rainfalls. It should be noted that though Hillsdale Township may be relatively free of the threat of flooding, improperly managed land development practices within the Township, as within any community, can impact flood conditions both in the Township and in communities downstream.

**TABLE A-1**  
**Township Lakes of 10 Acres or More**

Lake	Section Location	Approximate Elevation	Approximate Acreage
Baw Beese Lake	35, 36	1,097	165*
King Lake	34	1,123	25*
Middle Sand Lake	19, 30	1,051	75
North Sand Lake	19	1,049	35
South Sand Lake	30, 31	1,051	90

\*that portion of the lake within Hillsdale Township

## GROUNDWATER

As runoff flows across land surfaces and travels through drainage courses, a portion of the runoff seeps into the ground and collects in great quantities within the underlying soils and deeper bedrock. These reservoirs of water are referred to as aquifers and serve as the sources of drinking water for nearly all residents of Hillsdale Township. Aquifers can be "confined" or "unconfined" systems. Confined systems have an impermeable soil layer (typically clay) above them which acts to confine the aquifer and protect the aquifer from contaminants seeping into the subsurface above the confining soil layer, such as petroleum products, fertilizers, and improperly disposed household liquids. Unconfined

systems do not have this protective confining layer of clay soil and, as such, are much more prone to contamination. The first useable aquifer throughout the vast majority of the Township is a protected aquifer. Water quality in Hillsdale Township is generally considered good.

## VEGETATION

Approximately 90% of the total Township acreage is characterized by vegetation. Vegetative cover in Hillsdale Township can be generally classified into five categories: wetland vegetation including lowland woodlands, upland woodlands, open fields, farm-land, and lawn areas. The most abundant of these vegetation

types is farmland, including cropland, orchards, and pasture lands, and comprises approximately 40% of the Township area.

Approximately 18% of the Township area is characterized by upland woodlands, the majority of which consist of hardwoods. The primary exception is the approximately 150 acres of Christmas tree plantings in the Township's northwest corner. The vast majority of the Township's woodlands are located within a mile of its southern and western boundaries, and some of the larger woodland stands cover 100 to 200 acres (see Figure A-1).

Approximately 15% of the Township area is characterized by wetlands (see Figure A-1). The wetland areas vary in size from one or two acres to in excess of 200 acres. The majority of the wetlands are situated along the Township's lakes and drainage corridors and located within one mile of the North, Middle, and South Sand Lake chain. Some of the wetland areas extend more than a mile in length. The Township's wetland areas consist of approximately equal amounts of both lowland hardwoods and low lying shrub-aquatic bed environments.

The expansiveness of the Township's wetlands is important in light of the vital role this resource plays in flood control, runoff purification, groundwater recharge, wildlife habitats, recreational opportunities, and supporting the rural character of the Township. Of particular significance is the extensive network of woodlands and wetlands in the Township's northwest and southwest corners. These combined areas provide for more than 1,000 acres of mixed wetland-woodland environments which are ideal wildlife habitats. As wetlands are environmentally sensitive resources, degradation or pollution of a wetland area can have a destructive impact upon wetlands and related woodland resources further distances away due to the often network character of these resources. Wetlands present severe environmental and physical constraints toward land development.

Herbaceous and shrub fields account for approximately 8% of the Township area and lawn areas account for approximately 5% of the Township area.

## SOILS

The U.S. Department of Agriculture, Natural Resources Conservation Service, has prepared an interim soil survey for Hillsdale County which will be finalized and

published in the next several years. According to the interim survey, the vast majority of the Township is composed of three basic soil types: 1) Hillsdale Riddles complex consisting primarily of sandy loam; 2) Fox sandy loam; and 3) Coloma sandy loam. The character of soils can have a profound impact upon the suitability of future uses of land in regard to groundwater contamination, buckling and shifting of foundations and roads, erosion, on-site sewage disposal, and agricultural productivity.

The Natural Resources Conservation Service has identified specific individual soil units throughout the County based upon the characteristics of the upper soil layers (approximately five feet in depth) and this provides a reliable basis for Township planning purposes.

According to the Natural Resources Conservation Service, approximately half of the Township is characterized by soil conditions which present severe limitations to septic systems due to high water tables, poor soil filtration characteristics, limited permeability or excessively high permeability, ponding, and/or soil wetness (see Figure A-2). The Township's western third, and northern third west of the City of Hillsdale, reflect the greatest concentrations of these severe conditions. Soils which present limitations to septic systems can often be overcome with specially engineered septic systems at additional costs.

The Hillsdale County Health Department is responsible for issuing permits for on-site sewage disposal and will not do so unless all county requirements for the septic system have been met. A primary concern is the soil's ability to absorb and break-down the leachate from the septic drain fields before it reaches underground water supplies. This can be particularly troublesome where soils are characterized by high water tables and/or high percolation rates. Under typical conditions, sites approaching three quarters to one acre in size generally provide adequate opportunities for effective septic systems. However, where development in greater density is proposed, or where the soils present severe limitations, a public sewer system may be necessary.

Soil limitations toward building construction in the Township may be present on a site due to severe wetness, shrink-swell potential, and low strength, and can threaten the structural stability of buildings and substantially increase the cost of construction. Soils presenting severe limitations to buildings with basements are not nearly as evident in the Township as those soils presenting severe limitations to on-site sewage disposal (see Figure A-2).

July 1936, 107°F

It should be noted that while a site may be classified by the Natural Resources Conservation Service as presenting a certain level of limitation to septic systems and building construction, on-site investigation may show the classification to be less than fully accurate and/or show that the deeper soils (more than five feet deep) present differing characteristics than the upper layer soils and thus, varying limitations. On-site investigations should be carried out before specific land development projects are initiated.

## **P.A. 307 SITES**

The Michigan Environmental Response Act (MERA), P.A. 307 of 1982, provides for the identification of and clean-up of sites of environmental contamination. Act 307 sites are characterized by the *“release of a hazardous substance, or the potential release of a discarded hazardous substance, in a quantity, which is or may become injurious to the environment, or to the public health, safety, or welfare”*. At the time this Plan was prepared, no 307 sites had been identified in the Township by the Michigan Department of Natural Resources.

## **CLIMATE**

The climate of Hillsdale Township is not excessive throughout the year and can be generally described as mild. Hillsdale Township does experience some lake-effect weather from Lake Michigan; the effect is moderated temperatures and increased cloudiness in the late fall and early winter. Periods of lake-effect snow can occur during the winter months. The average yearly temperature is 47.3°F (By comparison, the average yearly temperature in Sault St. Marie in the Upper Peninsula of Michigan is 41.7°F). Average humidity throughout the year ranges from 55% in May to 77% in December. Average sunshine ranges from 28% in December to 70% in July.

The following provides an overview of climatic conditions of Hillsdale Township:

### **Temperatures:**

Coldest Month: January,  
average 22°F

Warmest Month: July,  
average 71°F

Lowest Rec. Winter Temperature:  
January 1994, -22°F

Highest Rec. Summer Temperature:

### **Precipitation:**

Annual Rainfall Average:  
37.9 inches.

Annual Snowfall Average:  
46.0 inches.

Wettest Month (rain): May,  
average 4.13 inches.

Driest Month: February,  
average 1.97 inches.

Heaviest Snowfall Months Average:

December - 11 inches

January - 13 inches

February - 11 inches