Chapter 3: Natural Features Assessment

Introduction

The natural environment is a significant factor when planning for future land development. Constraints such as steep slopes can prohibit the construction of a structure, while wetlands may affect the desired layout of a subdivision. Conversely, the natural environment can be impacted by land development. An example would be the increased water runoff and erosion potential caused by clearing vegetation. Thus, when preparing a master plan, it is important to examine the natural environment in order to determine where development is best suited, and where it should be restricted.

When integrated properly into development proposals, physical features serve to enhance the character and appearance of the constructed environment. Conversely, ignoring physical features, or misusing them, can have significant, long-term negative consequences. Therefore, it is usually better to design with nature than to attempt to substantially change an area's physical environment.

In particularly sensitive areas within a community, development should be prevented. Environmentally sensitive areas are lands whose destruction or disturbance will affect the life of a community by either:

1. Creating hazards such as flooding or slope erosion;
2. Destroying important public resources such as groundwater supplies and surface water bodies; or,
3. Wasting productive lands and non-renewable resources.

Each of these effects is detrimental to the general welfare of a community, resulting in social and economic loss.

Climate, geology, topography, woodlands, wetlands, and soil conditions are among the most important natural features impacting land use in the City of Yale. Descriptions of these features follow.

Climate

The climate of St. Clair County is seasonal, as the region experiences considerable changes in temperatures and precipitation throughout the year. The average temperature range for St. Clair County in January is between 17 and 30 degrees Fahrenheit, in July it is between 62 and 82 degrees Fahrenheit. The average number of days below zero degrees Fahrenheit is 5, while the average number of days above 90 degrees Fahrenheit is 13. The average growing season in St. Clair County lasts 170 days. In terms of annual precipitation, the County averages 31 inches of rainfall and 42 inches of snowfall per year.[1]

Geology

The geology of St. Clair County can be described in terms of quaternary (surface) geology and bedrock (sub-surface) geology. Quaternary geology refers to materials deposited by continental glaciers while bedrock geology relates to sedimentary rocks underlying the glacial deposits. The description below was derived through quaternary and bedrock maps and general summaries of Michigan geology prepared by the Michigan Department of Environmental Quality.

The quaternary (surface) geology of Michigan developed during the Pleistocene age as a result of glacial action. These surface deposits effectively blanket much of the bedrock geology of the State, except in a few instances where bedrock protrudes through to the surface (primarily in the western Upper Peninsula). Glaciers scoured out the Great Lakes, dumped piles of debris (moraines) along their edges and left flat plains of clay rich soils (glacial till) where the glaciers died and melted in place. The glacial meltwaters formed vast rivers that built wide, sandy plains of outwash. Many of Michigan's inland lakes were created when blocks of ice fell off the glacier, became covered by debris and eventually left a hole when the block melted. According to generalized quaternary geology data provided by the Michigan Geographic Data Library, the majority of the City of Yale consists of lake deposits (lacustrine) of sand, silt, clay and gravel. The eastern edge of the City consists of moraines of fine textured till.

The bedrock (sub-surface) geology of St. Clair County, as well as the entire Lower Peninsula of Michigan, is made up of Paleozoic and Mesozoic sedimentary rocks of the Cambrian to Jurassic age. These rocks constitute a large regional geological structure known as the Michigan basin. As described above, this bedrock is covered by glacial deposits and, generally, depending upon the thickness of the glacial deposits, is located at depths from 40 to 300 feet below the surface. The Paleozoic rocks of the Michigan basin contain many important resources such as petroleum, limestone, dolomite, shale, salt and gypsum. According to the bedrock geology data provided by the Michigan Geographic Data Library, the City of Yale is underlain by shale, a dark fine-grained sedimentary rock formed by the compaction of clay, silt and mud.[2]

Mature street trees are found throughout Yale's neighborhoods.

Woodlands

Woodland information for Yale is partially derived from the Michigan Resources Information System (MIRIS) 1978 Land Use Cover Data obtained by the Michigan Geographic Data Library (MiGDL). The MIRIS land cover data depicts general concentrations of various land uses including residential, commercial, institutional, agricultural, wetlands and woodlands. The MIRIS land use data further separates woodlands into additional categories of which two are found in Yale: central hardwood and lowland hardwood.

Because the MIRIS land use data was developed in 1978, Wade Trim utilized 2005 aerial photography to update the woodland information. By superimposing the 1978 MIRIS data on top of the aerial photographs, we were able to make modifications to the woodland information. Generally, we found that the extent of woodlands in Yale has not significantly changed between 1978 and 2005.

Map 2, Environmental Resources shows the location of woodlands in Yale. In total, 28.32 acres of woodlands are found within the municipal limits, equating to about 3 percent of the total land area of the City. Of the two MIRIS classified woodland categories, lowland hardwood is the most common, comprising 24.84 acres of land. A typical lowland hardwood forest features deciduous trees and is typically present just above floodplains or wetlands. Central hardwood forests cover 3.48 acres of land within the municipal limits of Yale. A typical central hardwood forest is comprised of deciduous tree species such as oak and hickory.

It is important to note that the MIRIS woodland data is general in nature, originally created by identifying the larger conglomerations of woodlands throughout the entire State of Michigan. Because of this, the data does not often account for smaller and less dense woodland areas that exist throughout Michigan. For example, the MIRIS data does not account for the mature trees that line many of Yale's streets or linear tree rows that are often found along creeks and the edges of properties. If these types of woodlands were accounted for, the City's overall percentage of woodland areas would be much higher.

Because of the many benefits associated with wooded areas, the significant amount of woodlands found in Yale should be considered an asset to the community. For human inhabitants, forested areas offer scenic contrasts within the landscape and provide recreational opportunities such as hiking and nature enjoyment. In general, woodlands improve the environmental quality of the whole community by reducing pollution through absorption, reducing the chances of flooding through greater rainwater infiltration, stabilizing and enriching soils, moderating the effects of wind and temperature, and providing habitats for wildlife.

Wetlands

Wetlands are often referred to as marshes, swamps or bogs. The US Army Corps of Engineers defines wetlands as "those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Residents of Michigan are becoming more aware of the value of wetlands. Beyond their aesthetic appeal, wetlands improve water quality of lakes and streams by filtering polluting nutrients, organic chemicals and toxic heavy metals. Wetlands are closely related to high groundwater tables and serve to discharge or recharge aquifers. Additionally, wetlands support wildlife, and wetland vegetation protects shorelines from erosion.

Wetland information was provided by the National Wetlands Inventory, U.S. Fish & Wildlife Service, and was obtained through the MiGDL. Of the wetland categories classified by the National Wetlands

Inventory, three are found within Yale: emergent wetland, forested wetland and scrub-shrub wetland. Emergent wetlands contain herbaceous plants that will only grow within water or damp environments, excluding mosses and lichens, and are often called marshes, meadows, or fens. Forested wetlands are characterized by woody vegetation that is 20 feet or taller, often including a canopy of mature trees, an under-story of young trees or shrubs, and a ground level herbaceous layer. Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet tall, including shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.[3]

In total, wetlands comprise 25.44 acres or about 3 percent of Yale. Wetland areas are primarily concentrated along the banks of the Mill Creek. The largest wetland variety is forested, which covers more 18 acres. **Map 2, Environmental Resources** shows the geographic location of wetland types in Yale.

View of the Mill Creek from the South Main Street bridge.

Topography

Topographic conditions can have a significant influence on land development patterns. Topography, for example, can impact the site location, orientation and design of buildings, roads and utilities. Where topography is extreme, slopes become an important consideration due to concerns relating to the ability of the land to bear the weight of buildings and the danger of erosion. Sometimes, topographic variations offer opportunities to appreciate the scenic environment, providing attractive views and recreational opportunities.

As shown on **Map 3, Topography**, the City of Yale is relatively flat, featuring only modest changes in elevation within the municipal limits. The only location within the City where steeper slopes are found is along the banks of the Mill Creek. In addition to the standard mapping of contour lines at 33 foot (10 meter) intervals, the map depicts the topography of Yale through a digital elevation model, displayed using a graduated color scheme that distinguishes the differing elevations within the community. In this scheme, the lowest elevations of the community are shown in light green, with the colors transitioning into yellows and oranges as the elevations rise, until reaching the highest elevations of the community, which are represented by red colors. Both the digital contour line data and digital elevation model were obtained through the Michigan Geographic Data Library (MiGDL).

As is expected, the Mill Creek represents the lowest elevation within the City of Yale, at approximately 765 feet above sea level. Elevations then quickly rise to between 780 and 790 feet on either side of the creek. Elevations within the rest of the City range from around 790 feet to a high of 835 feet, which is found on the north side of North Street, in the eastern portion of the City. This high point is part of a larger ridge or hill that extends through the eastern half of the City.

Map 4, Soil Conditions shows the location of steep slopes (greater than 10 percent), as derived by a computerized analysis of the digital elevation model. It is clear that both banks of the Mill Creek feature steep slopes, posing significant constraints to land development.

Soil Conditions

When planning for types and intensity of future land uses, the condition of soil is one important factor that determines the carrying capacity of land. Soils most suitable for development purposes are well drained and are not subject to a high water table. Adequate drainage is important in minimizing storm water impacts and the efficient operation of septic drain fields. Adequate depth to the water table is necessary to prevent groundwater contamination from septic systems or other non-point source run-off. The construction of roads, buildings and septic systems on poor soils requires special design considerations. In addition, costs for developing in these sensitive areas are greater than in less constrained parts of the landscape.

Hydric Soils information is obtained through the Soil Survey Geographic (SSURGO) Database, which is essentially the County Soil Survey prepared by the Natural Resource Conservation Service (NRCS) in digital format. The SSURGO soils data was made available through the Michigan Geographic Data Library (MiGDL) website. In practical terms, the NRCS defines hydric soils as soils that meet one of the following criteria:

1. Are poorly drained;

2. Have high water tables at or near the surface of the ground; or,

3. Are frequently ponded or flooded for long durations.

Because of these characteristics, hydric soils pose a significant constraint to urban development.

The geographic distribution of hydric soils is shown on **Map 4, Soil Conditions**. Although hydric soils are scattered throughout Yale, particular concentrations are found along the Mill Creek. Other lands that feature hydric soils are found in the northwest corner of the City, northeast corner of the City, and in the area to the south and west of McCall, Clark and Livingston Streets. In total, hydric soils comprise 117.98 acres or 13.5 percent of the land within the municipal limits of Yale.

In addition to hydric soils, soils located on steep slopes merit special consideration and are a major constraint to the development of land. Therefore, Map 4 also shows the location of steep slopes in excess of ten percent within Yale. As mentioned above, steep slopes are concentrated along the banks of the Mill Creek.

While the soil conditions map can be used as a general guide for determining soil constraints at the community level, it should not be applied on a property-specific basis. Such site-specific analysis can only be accomplished through detailed investigations and soil testing.

(Footnotes)

[1] *St. Clair County Profile*. Michigan Economic Development Corporation, 1995 NOAA Climate Summary. Http://www.michigan.org/medc/miinfo/places/SaintClairCounty/?section=all.

[2] Various Sources. *Geology in Michigan*, Michigan Department of Environmental Quality. October 2006. http://www.michigan.gov/deq/0,1607,7-135-3311_3582—,00.html

[3] *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services. December, 1979. http://www.fws.gov/nwi/Pubs_Reports/Class_Manual/class_titlepg.htm