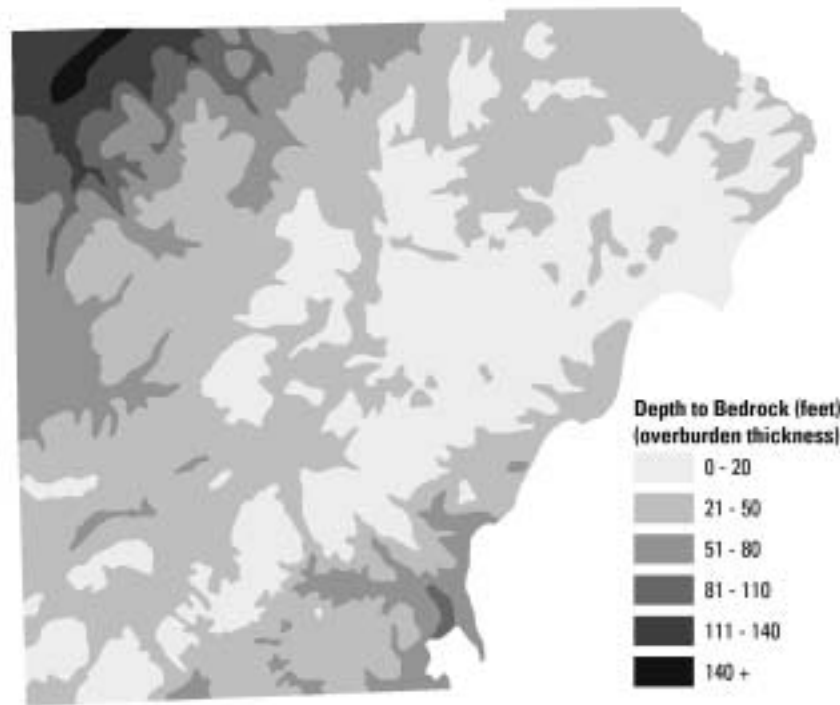


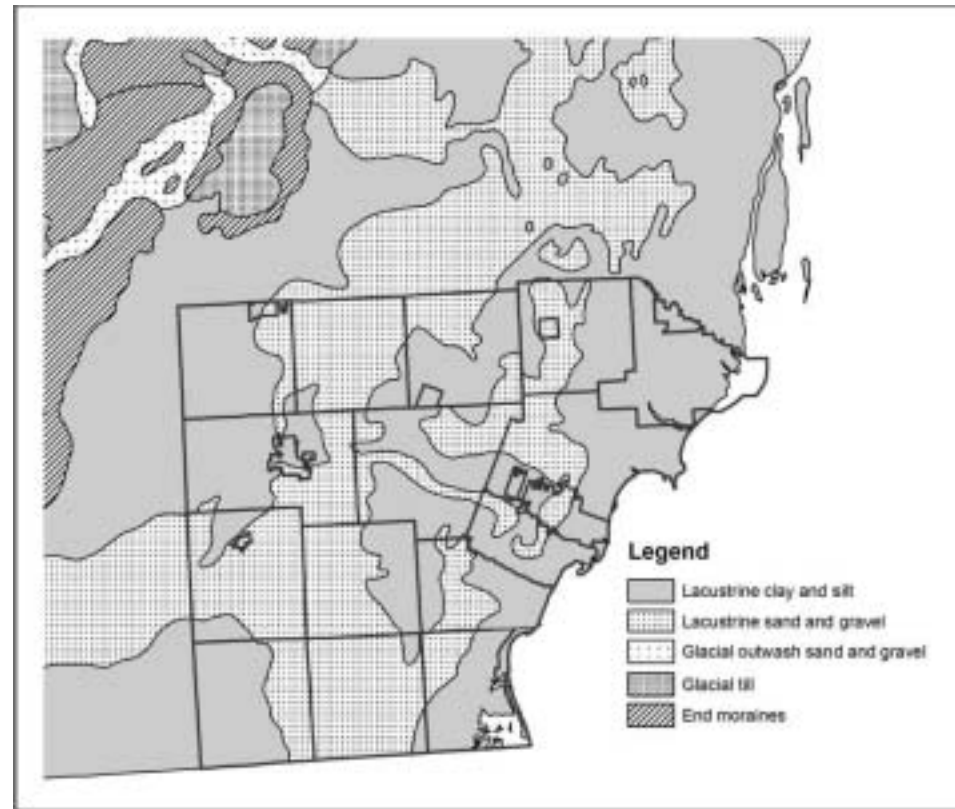
Appendix 5

Geology

Luna Pier (and much of Monroe County) is located on former lake beds related to fluctuating Lake Erie water levels. Bedrock is some distance from the surface in the Luna Pier area, so the proximity of bedrock to the surface does not typically present a limitation for development area in terms of subsurface construction activity.

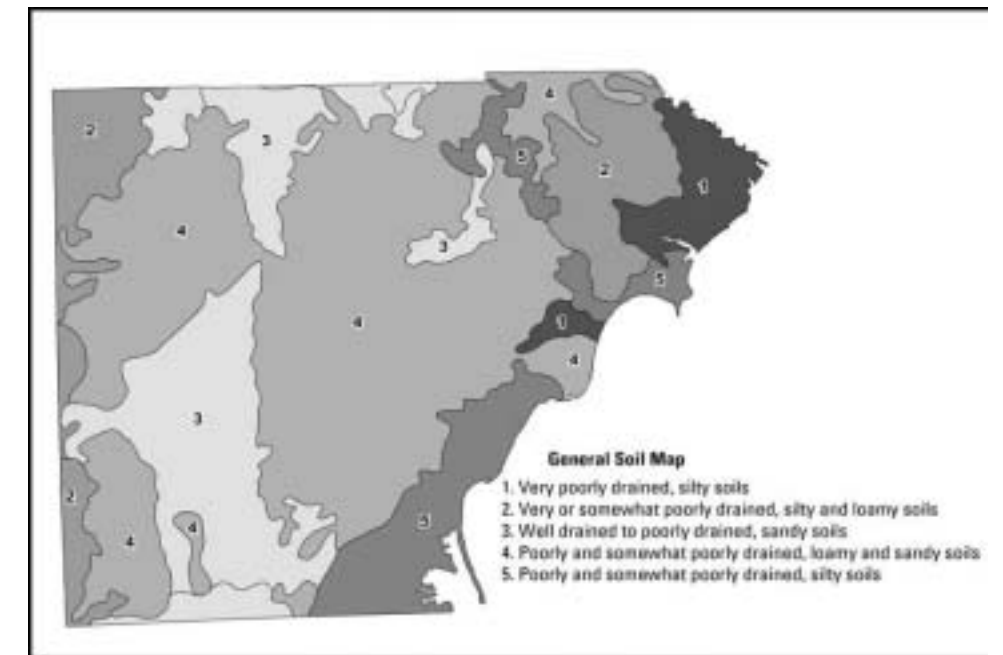


The bedrock in Monroe is generally overlain by glacial material deposited by receding glaciers.



Soils

Soils in the Luna Pier area are generally very poorly drained silty soils. Very poorly drained soils typically remain wet long after rain events and present limitations for development that need to be overcome with various construction and land development practices. The existence of these very poorly drained soils in Luna Pier, coupled with a high percentage of impervious surfaces (rooftops, pavement and other hard surfaces) mean that drainage issues should receive particular attention. This is true not only from the standpoint of problems associated with standing water in a community, but also in terms of pollution of local waterways and Lake Erie. Local drainage problems are also exacerbated by the flat topography. Measures to deal with very poorly drained soils from a development standpoint include substituting impervious materials with pervious or porous surfaces that can help reduce surface flow and increase infiltration. Collectively, these measures are often referred to low impact development (LID) techniques.



Floodplains

Luna Pier is almost entirely located within the regulatory floodplain established by the Federal Emergency Management Agency (FEMA). In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. Luna Pier is among the many Michigan communities who participate in the national program.

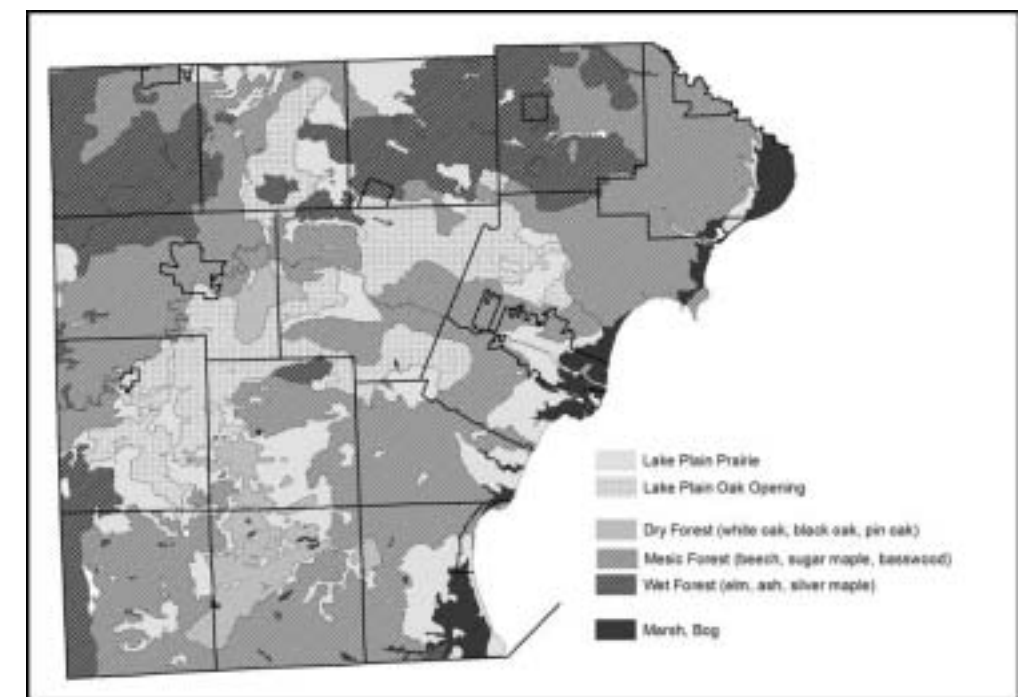
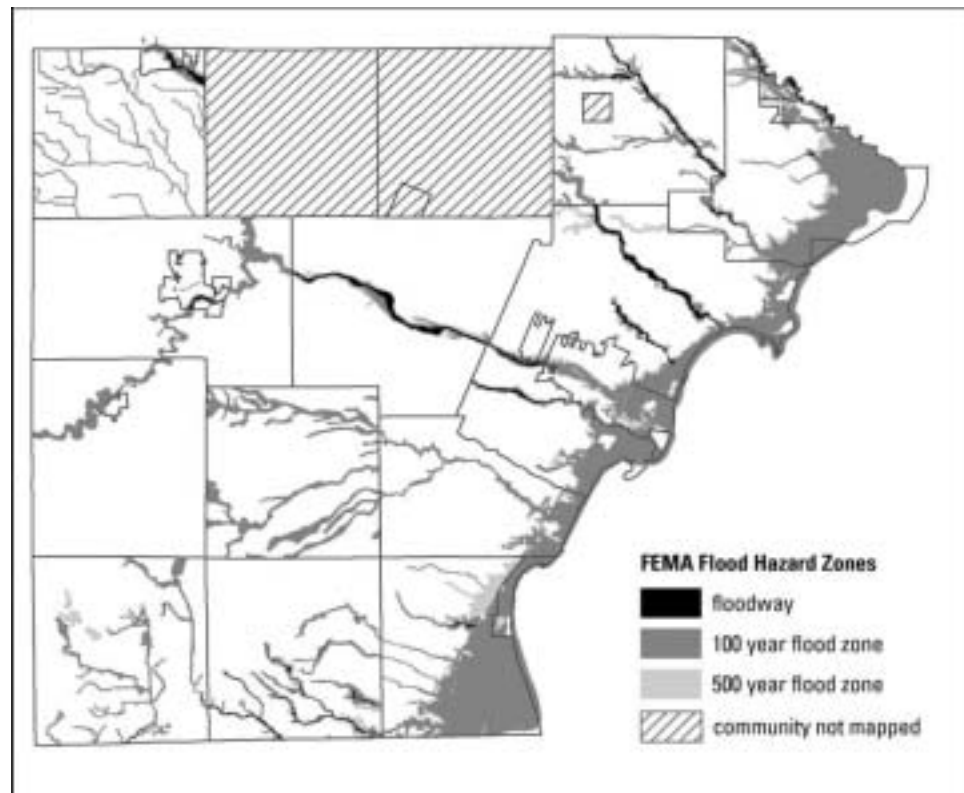
The regulatory floodplain refers to land area that will be inundated by water resulting from a 100-year flood (a flood which has a 1% chance of occurring any given year). To identify a community's flood risk, FEMA conducts studies and generates data to create the flood hazard maps that define different flood risk areas. These maps are called Flood Insurance Rate Maps (FIRMs). Community officials use FIRM maps to administer floodplain management regulations and lending institutions use FIRM maps to determine if flood insurance is required when making loans.

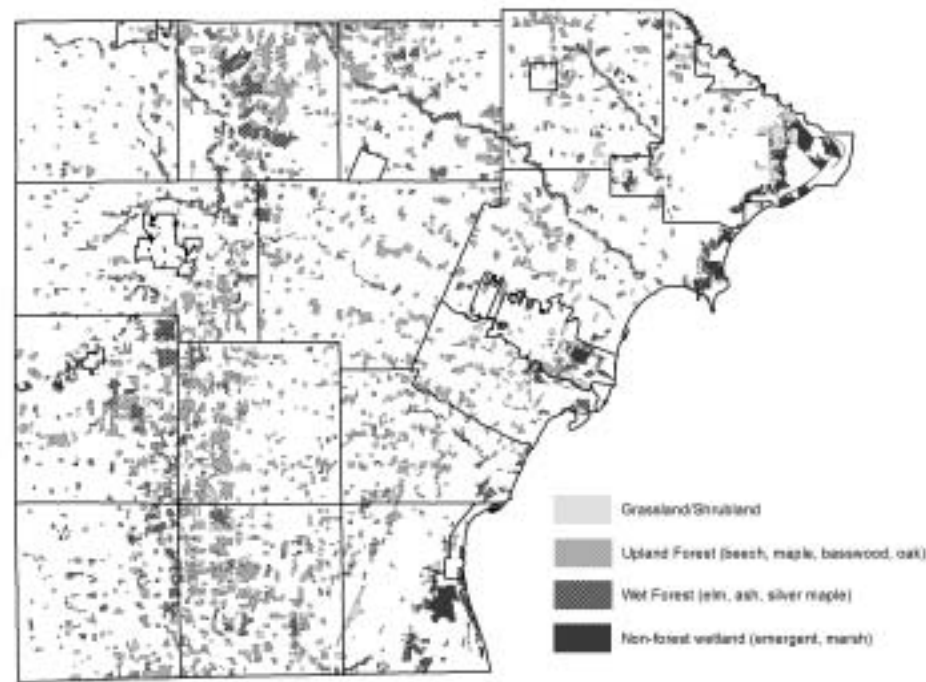
In general, construction and fill may be permitted in the portions of the floodplain that are not floodway, and the minimum standard for residential construction requires that the lowest floor of a structure be elevated one-foot above the 100-year flood elevation. New residential construction is specifically prohibited in the floodway. Floodplain permitting review is done by the Michigan Department of Environmental Quality.

Flood events are part of Luna Pier's history. According to the National Weather Service, Flooding hit Luna Pier and eastern Monroe County hard in 1998. East winds gusted as high as 45 mph, pushing the Lake Erie water level to 3.5 feet above normal which was topped by 6 foot waves. The high water and waves destroyed private docks and flooded many roads near the lakeshore. Luna Pier's new fire siren is equipped with a special tone to alert residents as to when flooding is a strong possibility. The flood alert is a fast up and down sound and completely different from fire, rescue, and tornado warnings.

Vegetation

Like most of the Midwest, natural pre-settlement vegetation has changed dramatically. To the south, in Northwest Ohio and even extending westward into Indiana along the Maumee River, the Great Black Swamp was a huge area of extensive swamps and marshes. This natural feature gradually drained and is now highly productive farm land. In Monroe County, much of the area was forested with both upland and lowland forest types and vast coastal wetlands that once existed have been significantly reduced. Today, isolated pockets of natural vegetation remain that include grasslands and shrub land, upland forest, wet forest and non forested wetland.





Wildlife & Wildlife Areas

The wildlife of the area includes deer, and a variety of other small mammals. A part of the Erie State Game Area is located in Luna Pier, and it is one of Monroe County's three state game areas (others include Pointe Mouillee to the north and Petersburg to the west). In 2005, the Michigan Department of Natural Resources purchased 66 acres of land to expand the Erie State Game Area to provide additional wetland wildlife habitat and increased public recreation opportunities.

Along with the State Game Areas, Luna Pier is located at the southern end of the first International Wildlife Refuge in North America which was created in 2001. This refuge, includes islands, coastal wetlands, marshes, shoals, and

riverfront lands along 48 miles of the Detroit River and western Lake Erie. This refuge has grown from 304 acres to nearly 5,000 and is managed by staff at the refuge office in Grosse Ile, Michigan. The refuge is situated in what was once one of the most significant migratory staging areas for diving ducks in the United States. The Detroit River International Wildlife Refuge Comprehensive Conservation Plan (2005) identifies key remnant coastal wetlands, islands, and other wildlife habitats that could be protected and/or restored through partnership efforts. It also sets forth a goal that by 2015, no less than 40% of the remaining coastal wetland and island habitat on public and private lands within the Refuge boundary will be protected through fee, easements, and cooperative agreements.

Groundwater

Not surprisingly, groundwater is relatively close to the surface in Luna Pier. However, concerns over the quality and quantity of groundwater are diminished as residents and businesses rely on a public water system provided by the South County water distribution system, and ultimately the City of Toledo.

Surface water

All waterways in Monroe County drain generally from west to east into Lake Erie. The LaPointe Drain empties into Lake Erie and is an important waterway in the Luna Pier area. It bisects the City north of the Consumers Power Plant and receives the effluent from the Luna Pier Wastewater Treatment Plant located on Harold Drive. The Luna Pier Waste Water Treatment Plant is considered to be a relatively significant point source of conventional pollutants. According to a report from the Michigan Department of Environmental Quality Water Bureau titled *Total Maximum Daily Load for Dissolved Oxygen and Total Phosphorus for Lapointe Drain Monroe County* (dated July 2007), Lapointe Drain has a drainage area of approximately 18.4 square miles at the mouth of Lake Erie. This document also describes the relationship between pollution sources and in-stream water quality conditions.



Water Quality at Luna Pier Beach

In Michigan, county health departments routinely collect water samples at beaches to determine if the water is safe for swimming. Water samples are taken and a laboratory performs an analysis to determine levels of Escherichia coli (E. coli). E.coli bacteria live in the digestive systems of humans and other warm-blooded animals and are an indicator of the presence of waterborne pathogens in fresh water. A beach is closed if levels of bacteria exceed the limits established by rules promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. These limits define that all waters of the state protected for total body contact recreation shall not contain more than 130 E. coli per 100 milliliters (ml), as a 30-day geometric mean.

Common sources of E. coli contamination include sanitary sewer overflows (CSO's). CSO's are discharges of raw or inadequately treated sewage from municipal sanitary sewer systems, which are designed to carry domestic sanitary sewage but not storm water. Collection systems that contain cracks, obstructions, storm water connections, or that are undersized with sewers and pumps too small to carry all the sewage may leak or overflow raw sewage from manholes, bypass pump stations and wastewater treatment plants into the surrounding waters, particularly during extreme hydrologic events. Other sources include failing septic systems urban storm water runoff from roads, roofs, construction sites and parking lots that may contain fecal matter from pets and wildlife. Excessive waterfowl near the beaches and animal waste runoff from farms and fields can also contribute to elevated bacterial levels, along with connections of pipes containing sewage to storm sewers or surface waters.

According to the Michigan Department of Environmental Quality Water Bureau (April 2009 Staff report on Michigan Beach Monitoring), monitoring was conducted at 208 Great Lakes public beaches in 37 counties in Michigan in 2008. Out of 2,549 daily samples collected, 74 (2.9 percent) exceeded Michigan's Water Quality Standards. The cases were reported from 34 beaches (16.3 percent of monitored Great Lakes beaches), 26 of which reported beach closures or advisories (52 incidents lasting a total of 327 days).

The Luna Pier Beach was among the 208 Great Lakes public beaches monitored in 2008 and levels (along with the Beach at Sterling State Park to the north). Recent results from this testing are shown below and are well below levels that would involve closure or the posting of an advisory.

2008 Beach Monitoring Data

<u>Sample Date</u>	<u>Sample Type</u>	<u>Result Value</u>
8/25/2008	30-Day Mean	23
8/19/2008	30-Day Mean	31
8/11/2008	30-Day Mean	31
8/4/2008	30-Day Mean	29
7/29/2008	30-Day Mean	17
7/22/2008	30-Day Mean	7
7/14/2008	30-Day Mean	5
7/7/2008	30-Day Mean	4
6/30/2008	30-Day Mean	5
6/23/2008	30-Day Mean	10
6/16/2008	30-Day Mean	5
6/9/2008	30-Day Mean	3
6/2/2008	30-Day Mean	8
5/27/2008	30-Day Mean	7

Acceptable limit: less than 130

Source: Michigan Department of Environmental Quality

