ENVIRONMENTAL GEOLOGIC STUDY OF THE PROPOSED US 131 CORRIDOR

From M 46 to the Vicinity of Ashton;
Montcalm, Mecosta, Newaygo, and Osceola Counties

MICHIGAN
HIGHWAY RESEARCH LABORATORY SECTION

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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GENERAL GEOLOGIC SETTING

This report presents the results of a general geologic and hydrogeologic investigation of an area affected by proposed US 131. The study was made by F. J. Chenier, Geologist, Testing Laboratory Section, at the request of J. H. Raad, Supervisor, Environmental Liaison Unit, Transportation and Planning Division, to aid in evaluating the environmental impact of the proposed highway.

Information Sources

The environmental geology of the US 131 project area was partially determined from Michigan Department of Natural Resources maps and publications. The surface drainage was obtained from U.S. Geological Survey topographic quadranges and the soils information is from U.S. Department of Agriculture Soil Survey Reports. This information was plotted on the various maps included in this report. Figure 1 is a general location map of the area under study.

GENERAL GEOLOGY

The geographical area under study for proposed US 131 lies in the central uplands of Michigan's lower peninsula. The various geomorphic features which make up the surface geology of the area were formed as a result of glaciers that once covered the northeastern United States, including Michigan. Although several ice invasions occurred, present topography resulted almost entirely from the most recent invasion, the Wisconsin Glacier.

In Michigan, this glacier was made up of four different lobes which converged together covering the entire state. The area under study was affected by two of these; the Michigan and Saginaw Lobes, which deposited a thick cover of glacial drift. A generalized distribution of the various landforms left by this glacier within the proposed corridor and its surrounding area, are shown in Figure 2.

The landforms and their major features are given below.

Moraines

Moraines are deposits of unsorted glacial debris, usually in ridges, and formed at the margin of an ice sheet where melting is equal to flow. They are characterized by rugged topography, often high relief, and mark the borders of an ice lobe. Because of their high relief they are usually well drained. The corridor under study is located in an interlobate morainic area where the moraines of two different glacial ice lobes have been deposited. The moraines west of the Muskegon River valley and the Hersey River were deposited by the Michigan Ice Lobe while those to the east were deposited by the Huron Ice Lobe.

Ground Moraines

Ground moraines are level to gently undulating plains of unstratified glacial drift spread out behind the moraines. Their relief is usually under 20 feet. They are composed of a mixture of clay, silt, sand, and gravel with occasional boulders. Because of their moderate relief they are usually well drained, but often contain closed, local swampy depressions.

Outwash Plains

Outwash plains are level to gently undulating plains composed of sorted and stratified sand and gravel deposited, usually on ground moraine, by water flowing from the edge of the melting glacier. They are important sources of sand and gravel. Due to their porous nature, they are generally well drained. They may contain lakes which are often indicators of water table elevations.

Glacial Drainageways

Glacial drainageways are channels or valleys which were formed by the glacial meltwaters. The Muskegon River along with two of the major tributaries, the Little Muskegon and Hersey Rivers, lie in old glacial drainageways which are within the study area. These old valleys are often much larger than the present rivers. Like outwash plains they can be important sources of sand and gravel.

MINERAL RESOURCES

Several sand and gravel pits are scattered throughout the study area. Most of these are located in the granular deposits of the old glacial drainageways and outwash plains as can be seen in Figure 1.

Throughout the entire corridor, many wells have been drilled for gas and oil. The majority of them are either dry or have been abandoned. Most of the active wells are located just south of Paris in Green Township and north of Reed City in Lincoln Township (Fig. 1).

SOILS

Within the study area a wide variety of soil types have been recognized and mapped. However, only a brief look at soils will be made here for purposes of this report. In general, within the study area, composition of surface deposits can be correlated with surface features. In other words certain soil types are characteristic of certain glacial landforms.

The soils here are divided into four different classifications based on soil texture. They are: granular, granular-cohesive, cohesive, and organic soils. The granular soils comprise the outwash plains and glacial drainageways. These soils are porous and drain well. They are basically composed of granular water-sorted materials, chiefly sand and gravel. The different soil series which predominate within these glacial landforms are Plainfield, Kalkaska, Rubicon, Grayling, and Ottawa Soils Series. Generally they are deep sandy soils which may possess a deep water table.

The granular-cohesive soils comprise the moraines and ground moraines. Granular-cohesive soils are various mixtures of sand and clay. The cohesive soils are composed basically of clays. The soil series which predominate in these surface features are Isabella, Montcalm, McBride, Coloma, Kent, and Nester Soils Series. They vary from being well to poorly drained and range from highly granular to highly cohesive in texture.

Next to be considered are the organic soils. They are found throughout the corridor and do not necessarily correlate with certain glacial surface features, such as moraines or outwash plains as the soil series mentioned above. Organic soils are characteristic of the poorly drained lands and are composed of deposits of mucks and peats. The organic deposits found here are classified as Houghton, Carlisle, and Carbondale Mucks, and Carbondale and Greenwood Peats.

Treating the corridor as a whole, the soils are generally of a granular nature with many areas of organic soils included.

SURFACE WATER

The area under study is drained by the Muskegon River system except for the extreme northern end of the corridor, which is in the Pine River system. The Muskegon River, the most predominant drainage feature of the area, lies in an old glacial drainage channel whose width varies from one to three miles.

The river itself, within the corridor, varies from a few hundred feet to approximately one-half mile in width, where its waters have been impounded by a dam. The river has floodplains which for the most part are fragmentary and extend intermittently along the river channel, alternating from one side to the other as the river meanders. The river is dammed at one place within the corridor, at Rogers Pond. The impounded water covers the lowlands for some distance upstream.

The Little Muskegon and Hersey Rivers are the major tributaries of the Muskegon River in this region. For the most part their river valleys are narrow and contain few floodplains. The Hersey River has impounded waters at two different places in the vicinity of Reed City. Along with the major rivers already mentioned, many creeks and intermittent streams contribute to the drainage system of the area.

The land within the corridor is well to poorly drained with swamps and wetlands scattered throughout most of the area. There are two areas of extensive swamp and wetlands. The first is in Aetna Township, the other is scattered throughout Lincoln and LeRoy Townships (Fig. 3). These large areas of poorly developed drainage are due to the porous nature of the granular surface deposits, a youthful stage of drainage development, and also are depressions in the topography which often extend below the water table.

Several lakes are characteristic of the study area. They, like the swamps, are depressions in the topography which extend below the water table. Most are intermingled between the swamps and wetlands, and contain neither inlet nor outlet. The relatively recent exposure of the State beneath glacial ice partly explains why there are many areas of extensive swampland and ponded waters.

GROUND WATER

The water table within this region is a subdued replica of the surface topography; that is, it is higher beneath the hills and lower beneath the valleys. The water table lies at a fairly shallow depth throughout most of the area and is generally within 100 feet of the surface.

The water table is somewhat irregular because of the slow rate of flow due to friction between the water and soil particles; that is, the water table cannot flatten out quickly enough to offset the continued addition of water from above. Underground water tends to flow from higher elevations on the water table toward the lower. The rate of flow is highly variable depending upon the water supply gradient and the permeability of the underground materials. Granular materials such as sand and gravel have a high permeability and are capable of a high rate of internal drainage, while clays are of very low permeability and have a low rate of ground water flow.

Within the corridor are several ground water highs, or recharge zones, which are areas where ground water supplies are replenished. A contour map showing the regional water table elevations for the area under study is shown on Figure 4. The regional movement of ground water is shown by the arrows on the map.

ANALYSIS OF GEOLOGIC AND HYDROGEOLOGIC IMPACT FACTORS

Mineral Resources

Several gravel pits are scattered throughout the corridor as may be seen in Figure 1. Most of them are developed in the old glacial drainageways and outwash plains. Discretion should be used in freeway alignment so as not to cover major deposits which would prevent them from being mined.

Rare Fossil Occurrances

Rare bedrock fossil beds are of no significance here because of the thick cover of glacial drift found in the area. Rare fossils are occasionally found in the glacial drift throughout Michigan. Excavations associated with highway construction have unearthed many significant remains of flora and fauna that would otherwise have gone undetected and would therefore have a positive impact.

Soils Impact

Highways have significant impact upon certain soil types. Of major concern are the granular soils which make up the outwash plains and glacial drainageways. These soils are susceptible to wind erosion where vegetation has been removed. The granular soils of the moraines and ground moraines are included within this group. Preventive measures should be taken to eliminate wind erosion to granular soils which have been disrupted by highway construction.

Surface Water Impact

Highway crossings of rivers, streams, swamps, and wetlands can have significant impact and should be minimized wherever possible. Freeways crossing these open-water areas can adversely affect water quality in the proximity of the highway, during and after construction. These sensitive areas are susceptible to pollution from highway deicing and maintenance programs.

The many natural streams and rivers of the study area should be left undisturbed as much as possible. Narrowing and deepening them should be avoided unless modifications can prove to be beneficial. Care should be exercised to minimize siltation during and after construction as the sediment will affect the river. Of major concern are the effects of constructing a freeway over the Muskegon and Little Muskegon Rivers. The problems that may arise here are siltation and disruption of the natural flow.

Wherever alignments through any of the sensitive areas mentioned above cannot be avoided, certain precautions should be taken to prevent surface water degradation. They are:

1) Highway embankment materials should be prevented from surface erosion and causing siltation of rivers and streams.

2) Highway embankments through swamps and wetland should be constructed so as not to disrupt their natural flow or drainage. The permeability of the embankment should be as great as that of the swamp or wetland itself.

3) The drainage for highway runoff should be designed to minimize water pollution from winter deicing chemicals.

Ground Water Impact

Highway construction and maintenance can have impact upon ground water quality. Impact is most severe in areas where highways pass through ground water recharge zones. Two recharge areas exist within the corridor. The first is in Aetna and Mecosta Township, the other is in LeRoy Township at the northern end of the corridor as seen in Figure 4.

Recharge areas are considered to be sensitive because infiltration of pollutants into these zones could mean degradation of ground water quality. Chemicals for deicing, defoliation, and fertilization programs are of major concern. These chemicals can be picked up by surface waters in the proximity of the highways and enter the ground water, the result of which could be the degradation of ground water quality. Every effort should be made to avoid alignment through these recharge areas.

GENERAL LOCATION MAP
Oil and Gas Fields
Gravel Pits
SCALE
0 1 2 3 MILES
FIGURE I
HOWARD CITY
MORLEY
STANWOOD
BORLAND
BIG RAPIDS
BYERS
PARIS
REED CITY
HERSEY
ASHTON
LE ROY
TUSTIN


SURFACE GEOLOGY MAP
Moraine
Ground Moraine
Outwash Plains & Drainageways
0 1 2 3 4 Miles
NEWAYGO COUNTY
MONTCALM COUNTY
MECOSTA COUNTY
LAKE COUNTY
OSCEOLA COUNTY
Croton
Big Prairie
Goodwell
Norwich
Chase
Pinora
Reynolds
Mecosta
Big Rapids
Green
Richmond
Winfield
Deerfield
Colfax
Hardy Lake
Muskegon River
HOWARD CITY
MORLEY
STANWOOD
BIG RAPIDS
REED CITY
HERSEY
TUSTIN
Ryan Creek
Austin Lake
Robinson Lake
Hewitt Lake
US-131
M-46
M-20
US-10
FIGURE 2


SURFACE DRAINAGE AND WETLANDS MAP
Rivers
Major Tributaries
Small & Intermittant Drainage
Swamps & Wetlands
0 1 2 3 4 Miles
Z
APPROXIMATE TOPOGRAPHIC DIVIDE
Croton
Big Prairie
Goodwell
Norwich
Barton
Chase
Pinora
NEWAYGO COUNTY
MONTCALM COUNTY
MECOSTA COUNTY
NEWAYGO COUNTY
MECOSTA COUNTY
LAKE COUNTY
OSCEOLA COUNTY
Muskegon
Hardy
Reynolds
Aetna
Mecosta
Big Rapids
Green
Richmond
Lincoln
Burdell
Winfield
Deerfield
Austin
Colfax
Grant
Hersey
Cedar
Rose Lake
Sherman
HOWARD CITY
MORLEY
STANWOOD
BIG RAPIDS
REED CITY
TUSTIN
US-131
US-10
M-46
M-20
Muskegon River
Ryan Creek
Townline Lake
Young Lake
Robinson Lake
Hogback Lake
Lincoln Lake
Todd Lake
Austin Lake
Hewitt Lake
Diamond Lake
Brady Lake
Doyle Lake
MONTCALM MECOSTA
MECOSTA OSCEOLA

FIGURE 3

INFERRED WATER TABLE MAP
Contour interval — 50'
Inferred direction of water flow.
Ground water recharge area
FIGURE 4
0 1 2 3 4 Miles
NEWAYGO COUNTY
MONTCALM COUNTY
MECOSTA COUNTY
LAKE COUNTY
OSCEOLA COUNTY
Big Prairie
Goodwell
Norwich
Barton
Chase
Pinora
Reynolds
Aetna
Mecosta
Big Rapids
Green
Richmond
Lincoln
LeRoy
Burdell
Winfield
Deerfield
Austin
Colfax
Grant
Hersey
Cedar
Rose Lake
Sherman
HOWARD CITY
MORLEY
STANWOOD
BIG RAPIDS
REED CITY
HERSEY
TUSTIN
Brady Lake
Townline Lake
Young Lake
Lincoln Lake
Austin Lake
Todd Lake
Robinson Lake
Hogback Lake
Hewitt Lake
Diamond Lake
Muskegon River
US-131
M-46
M-20