

GeoWebFace Layers and Descriptions

Below is a list of GeoWebFace layers and brief description of each layer, along with links to more information. A number of the layers are available as geographic information system (GIS) data files compatible with popular GIS software and are available for download from the State of Michigan's MI Geographic Data Library at <http://www.mcgi.state.mi.us/mgd/>. Other layers may be available from different sources and they are noted in the layer description. Several layers are scale dependent or have labels which are scale dependent. This means that the layer or a label for that layer will only be displayed if the user has zoomed in enough to see that specific layer or label for that specific layer.

1. Oil and Gas Information	Layer Description
Bottom Hole Locations - Single Symbol	* C Bottom hole location for all oil and gas wells straight (vertical) holes and directional holes displayed as a single symbol irrespective of well type classification. ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Plugged Wells	C A well is plugged with cement when it is at the end of its useful life or if it is a dry hole. ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Directional Start Holes	C Surface location of a well that was directionally drilled. ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Lines for Directional Holes	C A line connecting the Directional Start Hole to its bottom hole location. The actual path from the Directional Start Hole (surface location for a directional well) to the bottom is not displayed. ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Drilling Applications	C Locations for which applications have been made and are being evaluated. ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Well Type - Bottom Hole Locations	C Bottom hole location for all oil and gas wells straight (vertical) holes and directional holes. Selecting this layer will display a different symbol for each well type listed below: ftp://ww2.deq.state.mi.us/geowebface/ShapeFiles/
Permitted Well Locations	Permitted well location. This is well type to use from the time the well permit is issued up to and including "drilling completion". The filing of a Record of Well Completion will change well type from LOC to DH, OIL, GAS, etc..
Oil Wells	A well capable of producing oil. Includes the high water cut "brine producing" wells and wells which produce both oil and gas regardless of brine production. Part 615 defines oil as "natural crude oil or petroleum and other hydrocarbons, regardless of gravity, that are produced at the well in liquid form by ordinary production methods and that are not the result of condensation of gas after it leaves the underground reservoir."
Natural Gas Wells	A well capable of producing natural gas but not crude oil.
Gas Condensate Wells	A natural gas producing well from which liquid hydrocarbons are condensed after the gas leaves the underground reservoir. Reservoir hydrocarbons are in the vapor phase.
Gas Injection Wells	A well used to inject natural gas (with or without inherent H ₂ S) under pressure into a producing reservoir as part of pressure maintenance or enhanced recovery.
Gas Storage Wells	A well in a designated storage reservoir used for input/output of natural gas brought in from other fields. These wells may or may not produce liquids incidental to the storage operations. Observation wells or brine disposal wells in gas storage areas are OBS or BDW type wells.
Liquefied Petroleum Gas Storage Welts	A well in a salt cavern used for storage of LPG. Observation wells or brine disposal wells in LPG storage areas are OBS or BDW type wells.
Gas Production and Brine Disposal Wells	A gas well constructed so that produced brine can be returned to the well and disposed of by injection into a nonproducibile formation.
Brine Disposal Wells	A well that returns brine to an underground formation for disposal purposes. "Brine" means all non-potable water resulting, obtained, or produced from the exploration, drilling, or production of oil or gas, or both.
Dry Holes	A drilled well which is not productive of oil and/or gas or cannot be used for the purpose or which it was drilled.
Water Injection Wells	A well used to inject water as part of a pressure maintenance or enhanced recovery. These wells inject produced brine or groundwater.
Other Injection Wells	Wells used to inject fluids other than water or gases into the subsurface
Observation Wells	A well used for observation of reservoir pressure, fluid interface, etc. Not associated with gas storage.
Other Well Types	Miscellaneous. This well type includes any well not properly described by one of the other well types
Hydrogen Sulfide (H ₂ S) Wells	A Wells that have a detectable level of H ₂ S present. Not all wells have been sampled for H ₂ S. Concentration of H ₂ S in PPM is displayed when zoomed in. http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-9162--,00.html
Oil and Gas Fields by Formation	A Producing oil and gas fields symbolized based on their producing formations John Esch, 2011, unpublished map
Other	Oil & gas field producing from formations listed below
Michigan Stray	Oil & gas field producing from the Michigan Stray
Berea Sandstone	Oil & gas field producing from the Berea Sandstone
Antrim Shale	Oil & gas field producing from the Antrim Shale prior to County-field designations
Traverse Limestone	Oil & gas field producing from the Traverse Limestone
Dundee	Oil & gas field producing from the Dundee
Reed City Zone	Oil & gas field producing from the Reed City Zone
Detroit River	Oil & gas field producing from the Detroit River
Detroit River Sour Zone	Oil & gas field producing from the Detroit River Sour Zone

Detroit River Richfield	Oil & gas field producing from the Detroit River Richfield
Amherstburg / Sylvania	Oil & gas field producing from the Amherstburg / Sylvania
Salina	Oil & gas field producing from the Salina
A-1 Carbonate	Oil & gas field producing from the A-1 Carbonate
Brown Niagaran	Oil & gas field producing from the Brown Niagaran
Burnt Bluff/Cin/Man	Oil & gas field producing from the Burnt Bluff / Clinton / Manitoulin
Trenton/Black River	Oil & gas field producing from the Trenton / Black River
PDC/Glenwood	Oil & gas field producing from the PDC / Glenwood
County Antrim Shale Fields	Oil & gas field producing from the Antrim Shale, county-wide field designations
General Spacing Order Antrim	Areas covered by the Antrim General Spacing Orders http://www.michigan.gov/deq/0,1607,7-135-3311_4111_4231-119972--00.html
General Spacing Order Niagaran	Areas covered by the Niagaran General Spacing Orders http://www.michigan.gov/deq/0,1607,7-135-3311_4111_4231-119972--00.html
General Spacing Order Trenton-Black River	Areas covered by the Trenton-Black River General Spacing Order http://www.michigan.gov/deq/0,1607,7-135-3311_4111_4231-119972--00.html
General Spacing Order Glenwood and below	Areas covered by the Glenwood and below General Spacing Orders http://www.michigan.gov/deq/0,1607,7-135-3311_4111_4231-119972--00.html
Gas Storage Fields	A Fields that are used to inject, store and recover natural gas. The outlines of these fields are subject to change. http://www.dleg.state.mi.us/mpsc/gas/storage.htm
Uniform Spacing Plans (USP)	A An area of land subject to S.O. 14-9-94, pooled in multiples of governmentally surveyed quarter, quarter sections, and controlled by one operator for the purpose of locating Antrim wells to minimize surface waste.
Active Oil and Gas drilling Units	A A regulated maximum area, composed of one or more governmentally surveyed quarter, quarter sections of land which may be efficiently and economically drained by one well and contains an unplugged well capable of production.

2. Mining and Minerals	Layer Description
Sand and Gravel Operations	A Locations of selected sand and gravel operations. This dataset is incomplete and will be updated in future. B
Critical Dune Areas	C High relief 'typical' dune structures found along the Great Lakes shorelines. Critical dune area" means a geographic area designated in the "atlas of critical dune areas" dated February 1989 that was prepared by the DEQ.
Designated Dune Areas	C Area that is regulated by part 637 and includes the Critical Dunes. Sand dune area" means that area designated by the DEQ that includes those geomorphic features composed primarily of sand, whether windblown or of other origin and that lies within 2 miles of the ordinary high-water mark on a Great Lake.
Coal Mine Shafts	A Locations of known coal mine shafts. This dataset is incomplete and will be updated in future. B
Coal Mines	A Locations and outlines of former coal mines. This dataset is incomplete and will be updated in future. www.michigan.gov/deqgeologyinmichigan B C
Coal Basin	Expected extent of the potentially economic coal deposits Michigan Coal Reserves, J. Kalliokoski, E. J. Welch, 1976, Coal, Southern Peninsula, geologic maps. http://www.michigan.gov/documents/deq/GIMDL-COAL-MAPS-USBM76_307761_7.pdf
Underground Mines	A Projected outline of selected underground mines. This dataset is incomplete and will be updated in future.

3. Geology	Layer Description
Michigan Watersheds	A Michigan watershed boundaries.
Great Lakes Watersheds	Great Lakes watersheds boundaries
Quaternary Geology Features	A Line features from Farrand, W.R. and Bell, D.L., 1984, Quaternary geology of Michigan, Michigan Department of Natural Resources, Geological Survey Division, 2 maps
End Moraines and Ice Contact Outwash	A End Moraines and Ice Contact Outwash subset from Farrand, W.R. and Bell, D.L., 1984, Quaternary geology of Michigan, Michigan Department of Natural Resources, Geological Survey Division, 2 maps. Distribution of high relief regional deposits.
Quaternary Geology	A Also called "Glacial" or "Surficial Geology" This map shows the glacial deposits which are found the surface. Farrand, W.R. and Bell, D.L., 1982, Quaternary geology of Michigan, Michigan Department of Natural Resources, Geological Survey Division, 2 maps C
Part 303 Final Wetlands Inventory	C Final Wetlands Inventory is a compilation of Hydric Soils, 1978 MIRIS Wetlands, and National Wetlands Inventory maps. http://www.mcgi.state.mi.us/wetlands/
MNFI Landcover, Circa 1800	Statewide database of original government land surveyor's tree data and descriptions of the vegetation and land between 1816 and 1856. Surveyors took detailed notes on the location, species, and diameter of each tree used to mark section lines and section corners. They commented on the locations of rivers, lakes, wetlands, the agricultural potential of soils and quality of timber. (MNFI = Michigan Natural Features Inventory) http://mnfi.anr.msu.edu/data/veg1800.cfm

Waterfalls	A	Waterfalls from: Penrose, Laurie, 2009, A guide to 199 Michigan waterfalls, and other unpublished sources
Outcrops and Thin Drift		Bedrock outcrops and thin glacial drift areas based on maps data from a variety of sources. Esch, J. M., 2011, Michigan bedrock topography, glacial drift thickness and bedrock outcrop maps: Geological Society of America Abstracts with Programs, v. 43, no. 1, p. 56. http://gsa.confex.com/gsa/2011NE/finalprogram/abstract_186034.htm Esch, J. M., 2011, Bedrock topography, glacial drift thickness and bedrock outcrop maps, Upper Peninsula of Michigan, Institute on Lake Superior Geology, May 2011, Ashland, Wisconsin, Programs and Abstracts, v. 57 http://mgmudrey.brinkster.net/ILSG/ILSG_57_2011_pt1_Ashland.pdf
Structural Lineaments		Linear subsurface structural features evident from formation structural contour mapping, residual formation structural contour mapping, formation isopach mapping and analyses of regional and local geophysical surveys. Esch, J.M., 2010, Michigan Basin Structural Lineaments Map, AAPG Eastern Section Meeting, September 2010 Kalamazoo, Michigan; Abstracts and Programs http://www.searchanddiscovery.com/abstracts/pdf/2010/eastern/abstracts/ndx_esch.pdf
Major Structural Features		Regional and large scale structural features which are known to exist across the Michigan Basin and Great Lakes area. Esch, J.M., 2010, Michigan Basin Structural Lineaments Map, AAPG Eastern Section Meeting, September 2010 Kalamazoo, Michigan; Abstracts and Programs http://www.searchanddiscovery.com/abstracts/pdf/2010/eastern/abstracts/ndx_esch.pdf
Cuestas		John Esch, 2011, unpublished map -- A cuesta is a ridge formed by tilted sedimentary strata where the rock layers are exposed on their edges, called an escarpment or, cliff.
Midcontinent Rift		Areas underlain by rifting in the midcontinent approximately 1.1 billion years ago, John Esch, 2011, unpublished map
Sedimentary Basins	A	Depression in the earth's crust as a result of tectonic activity in which sediments accumulate. Layer includes the Michigan Basin, Illinois Basin and the Appalachian Basin. John Esch, 2011, unpublished map
Bedrock Geology	A C	Milstein, R. L. (compiler), 1987, Bedrock geology of southern Michigan: Geological Survey Division, Michigan Dept. of Natural Resources Reed, R. C., and Daniels, J. (compilers), 1987, Bedrock geology of northern Michigan: Geological Survey Division, Michigan Dept. of Natural Resources
Elevation Shaded Relief Map	C	Digital elevation map based on USGS 30 meter Digital Elevation Model overlain on a 3 times vertically exaggerated hillshade of the digital elevation map. This gives the map a shaded relief or 3-D like appearance. http://seamless.usgs.gov/
Elevation (feet)		Digital elevation map based on USGS 30 meter Digital Elevation Model
Hillshade of Elevation		Hillshade of the digital elevation map, 3 times vertically exaggerated.
Bouguer Gravity Anomaly	C	The gravity geophysical method is a common geophysical method for measuring variations in density of the subsurface. Measurements of the earth's gravitational field vary from place to place due to the composition and structure of Earth's crust. Gravity anomalies are generally due to density variations of the Precambrian basement. Color grid of Bouguer Gravity Anomaly Map overlain on Hillshade of the Bouguer Gravity Anomaly Map gives the map a shaded relief or 3-D like appearance. http://pubs.usgs.gov/ds/ds411/mi_boug.htm
Bouguer Gravity Anomaly Map		Color grid of Bouguer Gravity Anomaly Map
Bouguer Gravity Anomaly Map Hillshade		Hillshade of the Bouguer Gravity Anomaly Map.
Magnetic Anomaly	C	The magnetic geophysical method is a common geophysical method for measuring variations in the earth's magnetic field. Magnetic anomalies are due to variations in the Earth's magnetic field caused by the uneven distribution of magnetic minerals (primarily magnetite) in rocks that make up the upper part of the Earth's crust. These magnetic anomalies are generally due to density variations of the Precambrian basement. Color grid of Magnetic Anomaly Map overlain on Hillshade of the Magnetic Anomaly Map gives the map a shaded relief or 3-D like appearance. http://pubs.usgs.gov/ds/ds411/mi_mag.htm
Magnetic Anomaly Map		Color grid of Magnetic Anomaly Map
Magnetic Anomaly Map Hillshade		Hillshade of the magnetic anomaly map.

4. Public Land Survey System	Layer Description
Town Range	A Michigan is divided into areas that are typically six miles on a side called Townships. C They are bounded by and described by Town (N/S) and Range (E/W) designations.
Public Land Survey System Sections	A Townships are divided into thirty-six one mile square areas called sections. C
Quarter-Quarter Section Subdivisions	A Sections are divided into quarters (160 acres), quarter-quarter (40 acres) and quarter-quarter-quarter (10 acres) and other configurations C
USGS Topographic Quadrangle Index (24K)	A Index of USGS 7.5 minute Topographic Quadrangle Map boundaries. C

5. Ownership and Mineral Leases	Layer Description																																					
State Ownership Type - Label	A B C	The amount of state owned acreage within a quarter-quarter section is identified by acreage labels in the upper-right corner of each quarter-quarter section																																				
Surface - Blue -Label		Label for number of acres the State owns the surface rights only																																				
FEE- Black -Label		Label for number of acres the State owns the mineral and surface rights																																				
Mineral - Red-Label		Label for number of acres the State owns the mineral rights only																																				
Reserved Minerals	B C	State owns the surface rights on parcel(s) within the quarter-quarter section. Mineral rights are held by private party for a specified period of time. Mineral rights will revert to the state when reservation period expires.																																				
Lease Number - Label	A B C	Label for DNR Lease Number																																				
Lease Classification Recommendation	B C	DNR description of the lease classification recommendation (for potential oil and gas production) for the quarter-quarter section. Either: Development, Development with Restrictions, Non-Development, Non-Leasable, or Mixed Classification.																																				
DNR Ownership	B C	<p>DNR Land and Mineral Ownership Categories:</p> <table border="1"> <thead> <tr> <th>Within the ¼ ¼ section the State has:</th> <th>m</th> <th>s</th> <th>f</th> </tr> </thead> <tbody> <tr> <td>Minerals - State has mineral (m) ownership only.</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Surface - State has surface (s) ownership only</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Fee - State has fee (f) ownership parcels only</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Minerals and Fee ownership</td> <td>✓</td> <td></td> <td>✓</td> </tr> <tr> <td>Minerals and Surface ownership</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Surface and Fee ownership</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Minerals, Surface and Fee ownership</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Easement Rights Only - no ownership</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>http://www.michigan.gov/dnr/0,4570,7-153-10371_14793-30698--,00.html</p>	Within the ¼ ¼ section the State has:	m	s	f	Minerals - State has mineral (m) ownership only.	✓			Surface - State has surface (s) ownership only		✓		Fee - State has fee (f) ownership parcels only			✓	Minerals and Fee ownership	✓		✓	Minerals and Surface ownership	✓	✓		Surface and Fee ownership		✓	✓	Minerals, Surface and Fee ownership	✓	✓	✓	Easement Rights Only - no ownership			
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Minerals, Surface and Fee ownership	✓	✓	✓																																			
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Federal Land	C	Areas that include federal land ownership																																				
National Forests	C	Areas included in National Forests which includes the Huron Manistee National Forest, Ottawa National Forest and the Hiawatha National Forest																																				

Ownership and Mineral Leases data is made available by the Michigan Department of Natural Resources (DNR). Parcel information in the LOTS database is compiled to the quarter-quarter section level, resulting in eight ownership categories. Mapping in this manner will NOT accurately reflect parcel boundaries; however it does identify the presence of state-owned property WITHIN a quarter-quarter section. Multiple parcels with varying types of ownership within a quarter-quarter section result in the combined ownership categories. The quality and completeness of LOTS data is unknown. It is suggested that this data be combined with a second source, such as plat maps, to further identify ownership. The information displayed on this map is intended for general planning purposes only. Specific ownership should be verified by contacting DNR Forest Management Division http://www.michigan.gov/dnr/1,1607,7-153-10371_14793-30698--,00.html <http://www.mcgi.state.mi.us/mgdl/?action=ext>

- * Oil and Gas Bottom Hole Locations - This is the only layer that the Map Tools-Identify and Selection Tools work with
- A Layer has text label which is scale dependent, must be zoomed in to see label.
- B Layer is scale dependent, must be zoomed in to see layer.
- C Layer is available as a download from the Michigan Geographic Data Library unless otherwise noted in the layer description.
<http://www.mcgi.state.mi.us/mgdl/>

Basemap Data includes: **Roads** - paved roads, highways, county, and gravel; **Water Features** -lakes, rivers, and streams; and **Political Jurisdictions** - village, city, and county boundaries are from the [State of Michigan, MI Geographic Framework Base](#).

GeoWebFace Background Map Options:

Street

Street is a map view providing information one would expect to find on a road map. The information includes streets, roads, cities, places as well as lakes, waterways, and political boundaries when sufficiently zoomed in.

2009 Aerial

2005 Aerial

Hi-Res Aerial

Aerial Photo is view providing a display based on the National Agriculture Imagery Program (NAIP) aerial photo mosaic. You can select from 2005, 2009 or Hi Resolution coverage may vary.

TOPO

Topographic map is a view providing a display based on U. S. Geological Survey 1:24,000 scale, 7.5 minute topographic quadrangle maps. These maps are more useable when you have zoomed in to the viewing area. Elevations are shown by the brown contour lines.

Notice: Always obtain permission before entering private property. **DO NOT TRESPASS.** Inclusion in the **GeoWebFace** does not grant or otherwise imply that access is allowed or authorized.