2006 Minerals Yearbook

MICHIGAN

U.S. Department of the Interior
U.S. Geological Survey

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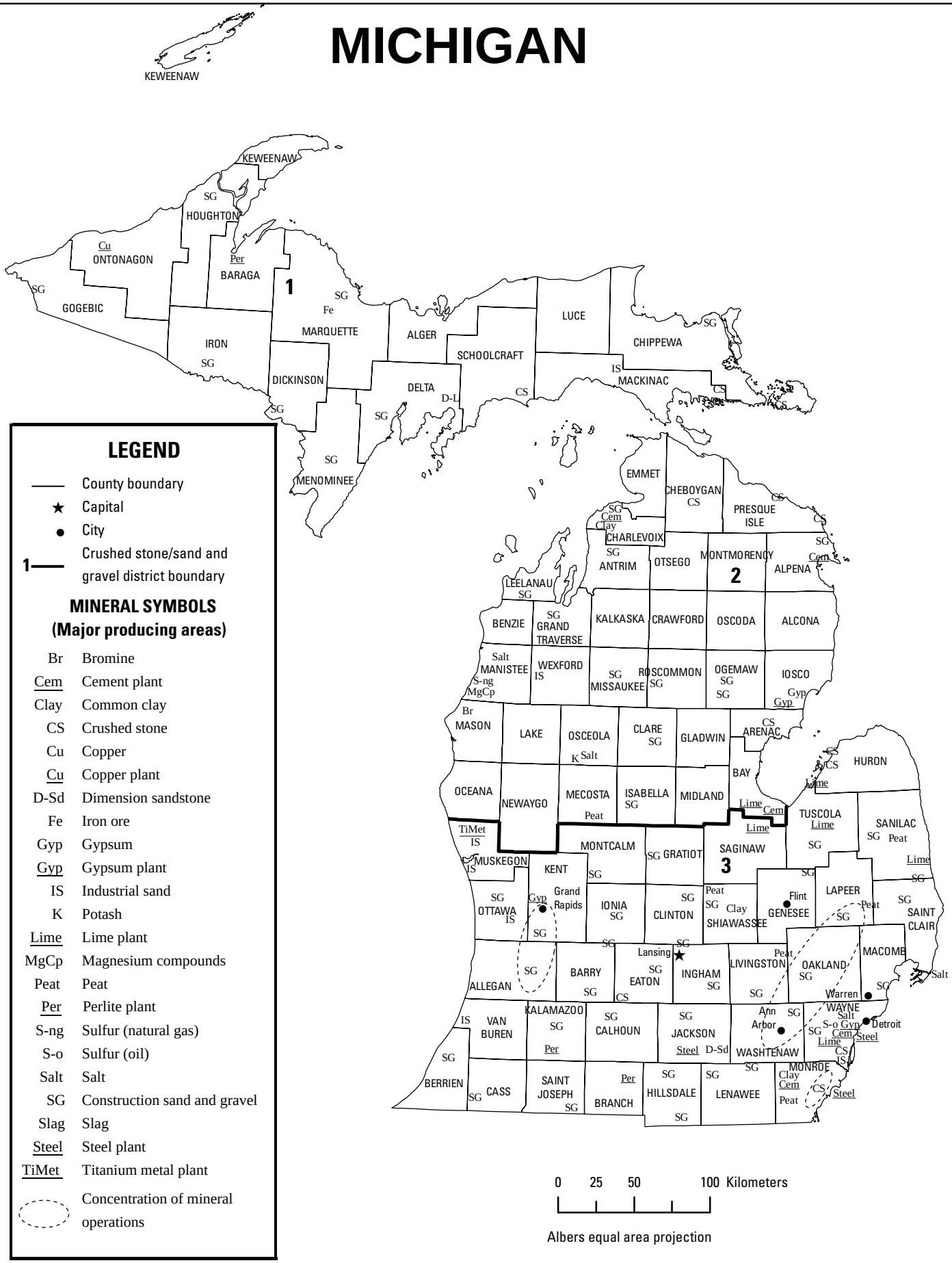
MICHIGAN



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel district boundary

MINERAL SYMBOLS
(Major producing areas)

Br	Bromine
Cem	Cement plant
Clay	Common clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-Sd	Dimension sandstone
Fe	Iron ore
Gyp	Gypsum
Gyp	Gypsum plant
IS	Industrial sand
K	Potash
Lime	Lime plant
MgCp	Magnesium compounds
Peat	Peat
Per	Perlite plant
S-ng	Sulfur (natural gas)
S-o	Sulfur (oil)
Salt	Salt
SG	Construction sand and gravel
Slag	Slag
Steel	Steel plant
TiMet	Titanium metal plant

Concentration of mineral operations

Source: Michigan Department of Environmental Quality, Office of the Geological Survey/U.S. Geological Survey (2006).

The Mineral Industry of Michigan

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Michigan Department of Environmental Quality, Office of Geological Survey, for collecting information on all nonfuel minerals.

In 2006, Michigan's nonfuel raw mineral production[1] was valued at $1.93 billion, based upon annual U.S. Geological Survey (USGS) data. This was a $180 million, or 10.3%, increase from the State's total nonfuel mineral production value for 2005, which had increased by $70 million, or 4.2%, from 2004 to 2005. For the second consecutive year, the State was 11th in rank (ninth in 2004) among the 50 States in total nonfuel mineral production value, of which Michigan accounted for nearly 3% of the U.S. total.

Michigan continued to be the Nation's second leading iron ore-producing State in 2006, based upon value, and iron ore remained Michigan's leading nonfuel mineral commodity followed, in descending order of value, by cement (portland and masonry), construction sand and gravel, salt, crushed stone, magnesium compounds, and lime. The values of these nonfuel mineral commodities, combined, accounted for about 96% of the State's nonfuel raw mineral production value, the first five alone accounting for about 90% (table 1).

In 2006, increases in the values of iron ore, portland cement, and salt led Michigan's increase in nonfuel mineral production value. The production value of iron ore rose by significantly more than $120 million, despite a slight decrease in the quantity produced, and cement and salt also rose in value, by more than $20 million each, these the result of increases in both the production and the unit values of each of those nonfuel mineral commodities. Smaller yet significant increases took place in the values of bromine, crushed stone, industrial sand and gravel, lime, and magnesium compounds. The most substantial decrease took place in construction sand and gravel. Although the commodity's unit value rose by an annual average of nearly 14%, its total production value decreassed by $28 million (almost 12%), because of a 14.4 million metric ton (Mt), or 22%, decrease in the quantity produced. Significantly smaller decreases took place in the values of peat and potash (table 1).

In 2006, Michigan continued to be first in the quantities of magnesium compounds produced and second in the production of iron ore. The State again was second in bromine of two bromine-producing States, although production ceased in the State following the closing of Dow Chemical Co.'s bromine recovery facility in Mason County in December. The State continued to be third of three States that produce potash, fourth in construction sand and gravel, fifth in portland cement, seventh in salt, and ninth in masonry cement. The State rose to eighth from ninth in crude gypsum production but decreased to fifth from second in the production of peat and to ninth from sixth in industrial sand and gravel. Additionally, the State was a significant producer of crushed stone, lime, and common clays. Michigan was fourth in the Nation (third in 2005) in the manufacture of raw steel, with a nearly identical output in 2006 of 6.04 million metric tons (Mt) (6.05 Mt in 2005) (American Iron and Steel Institute, 2007, p. 74).

The following narrative information was provided by the Michigan Department of Environmental Quality (MDEQ), Office of the Geological Survey (MOGS), the Michigan Department of Natural Resources (MDNR), and the Forestry, Mineral, and Fire Management Division[2] (FMFM). Production, data and other information in the following text are those reported by the MOGS and the MDNR, based upon those agencies' own research, surveys, and estimates. Mineral production data may differ from some production figures reported to the USGS.

Exploration, Development, and Reclamation

The MDEQ reported that three companies drilled 95 exploration drill holes for a total depth of 30,400 meters on State and private metallic mineral leases in 2006 (Hoane, 2007).

Kennecott Eagle Minerals applied to the MDEQ in early 2006 for permits to further develop its proposed nickel-copper Eagle Mine. The proposed mine would be located in the Yellow Dog Plains area of northern Marquette County. Three permit applications covering environmental assessments related to air and water quality and mining operations were submitted for regulatory review to the MDEQ (Kennecott Eagle Minerals, 2006a). The review process, however, was delayed several months pending a court ruling on legal challenges made by groups opposed to the development of the mine. In October, the Michigan Court of Appeals ruled that the review by the MDEQ could be resumed. Upon completion of this review process (including approval), additional MDEQ permits and MDNR approvals will be required prior to the start of mining (Kennecott Eagle Minerals, 2006b).

Aquila Resources Inc. completed a takeover transaction with JML Resources, Ltd. in May, and was accepted on the Toronto TSX Venture Exchange. In the transaction, JML Resources Ltd. acquired 100% of the shares of Aquila Resources Corp. in return for issuing more than 49 million common shares of JML (JML Resources Ltd., 2006a). The company name changed to Aquila Resources Inc. with its common shares listed under the trading symbol AQA and JML Resources was delisted (Aquila Resources Inc., 2006). The resulting issuer of stock

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2006 USGS mineral production data published in this chapter are those available as of March 2008. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL http://minerals.usgs.gov/minerals.

[2]The text of the State mineral industry information was compiled and edited by Milton A. Gere, Jr., Geologist and Supervisor, Metallic and Nonmetallic Minerals and Underground Gas Storage Leasing Unit, Minerals and Land Management Section, Forest, Mineral, and Fire Management Division, Michigan Department of Natural Resources.

Aquila Resources controlled the mineral and surface rights to the Back Forty project in Menominee County. The project was in an advanced stage of exploration, targeting copper, gold, and zinc volcanogenic massive sulfide (VMS) mineralization (JML Resources Ltd., 2006b). Further drilling by Aquila Resources during the year on the Back Forty property intersected additional copper, gold, silver, and zinc VMS mineralization. The company planned to initiate a 2-year environmental monitoring program prior to applying for a mining permit (Whyte, 2006).

Bell Resources Corporation completed a seven-hole exploration-drilling program on its "A-Train Project" in the Upper Peninsula. The project area is regarded as highly prospective for deposits of copper, nickel, and platinum-group metals. All drill holes intersected intervals containing several volume percentage of disseminated to net-textured magmatic ore minerals. Platinum- and palladium-rich intersections were coplanar with copper- and palladium-rich outcrops (Bell Resources Corporation, 2006).

Bitterroot Resources Ltd. received and executed metallic mineral leases covering 1,980 hectares (ha) in the Upper Peninsula. Bitterroot and its joint-venture partner Cameco Corporation were expected to begin drill tests by yearend in several areas prospective for unconformity-hosted uranium deposits. These areas had previously been defined by electromagnetic and seismic geophysical methods (Bitterroot Resources Ltd., 2006).

A former sand and gravel mining pit complex was being reclaimed into wetland and residential lakefront living areas in Ypsilanti Township, Washtenaw County. In October, the series of lakes in the 144-ha property were stocked with six species of fish and cricket frogs. Earlier the banks of the former pit were graded and vegetated, replacing steep barren slopes. Several price levels of housing were planned for the reclaimed area. About 50% of the area was to remain as open space and natural habitat (Gordon, 2006).

Commodity Review

Industrial Minerals

Limestone and Dolomite.—Oglebay Norton announced that its subsidiary (Oglebay Norton Marine Services Company, LLC) had completed the sale of six of its nine marine vessels. The sales transaction also included contract provisions for transporting limestone from Oglebay's Michigan quarries. According to a company spokesperson, the move was intended to provide the company with an increased focus on its industrial sand, limestone, and limestone filler operations (Oglebay Norton, 2006). In another company action, Oglebay's limestone operations subsidiary (O-N Minerals Company) granted Wolverine Power Marketing Cooperative an option to purchase a 178-ha area at its Calcite Quarry near Rogers City. Wolverine was considering the use of the site for its clean energy projects, including a clean-coal technology process for electrical power generation. O-N Minerals would supply the high-quality chemical limestone for the process (Wolverine Power Marketing Cooperative, 2006).

Sand and Gravel, Construction.—The MDNR announced an agreement with Aggregate Resources Inc. permitting Aggregate Resources to lease the rights to produce sand and gravel from lands within the Waterloo State Recreational Area in Jackson County. The State, as part of the agreement, acquired the rights to the adjacent land previously mined by Aggregate Resources. The agreement required that Aggregate Resources would eventually reclaim all the mined land into a natural area with habitat for sand hill cranes and other wildlife (Hepker, 2006).

Balkema Excavating Inc. proposed a comprehensive plan that would involve transporting of its mined gravel through a piping system constructed under the Kalamazoo River at Plainwell. The plan was prompted by the need to reduce the flow of truck traffic during the periods of mining operation. Under the plan, a dredge would remove sand and gravel from a pit resulting in the creation of a manmade lake. The dredged material would travel in a pipe under the nearby river to a processing plant. The gravel would then be sold and the waste sand returned by pipe to build a beach area around the created lake. Included in the Balkema proposal was the construction of residences around the lake. The Plainwell City Planning Commission recommended that the Plainwell City Council approve the preliminary plan submitted by Balkema. A plan proposed by Balkema in 2003 that would have increased local truck traffic was opposed by nearby residents. The current proposed project would take 3 to 5 years to complete and require various permits from the MDNR and the MDEQ. The developer would also need to receive permits from the city for the project (Sturdevant, 2006).

Sand and Gravel, Industrial.—Nugent Sand Co. announced plans for a rail-loading facility in the Muskegon County Industrial Park facility in Dalton Township in order to significantly increase rail shipment from the industrial sand mine operated nearby. The rail-loading project would require road improvements and land purchases in the industrial park area, and installation of water and sewer facilities. A special use permit would be required for Nugent to conduct business at the site (Lemieux, 2006).

The MDEQ issued a permit to Nugent Sand Co. allowing the company to mine an additional 1.6 million cubic meters of industrial sand from Nugent's mine at Norton Shores, Muskegon County. The permit, which extends to 2011, would allow Nugent to expand its manmade North Lake by 7.7 ha through dredging to below the water table (Aggregates Manager, 2006).

A ruling by the Ingham County Circuit Court upheld a 2005 decision by the MDEQ to deny approval of a pipeline through a protected critical sand dune. The pipeline, requested by Nugent Sand Co., would have allowed the company to discharge the water from its high-grade sand processing plant into Lake Michigan. The circuit court judge agreed that the Michigan law requires the protection of critical dunes and that the proponents of the pipeline did not have a right to a special exemption from the law (Lake Effect, The, 2006).

Metals

Copper.—Michigan had a long history of being a major copper-producing State from about 1845 until about 1995. In 2006, there was no copper production. However, the Caledonia Mine in Ontonagon County operated by Red Metal Minerals produced limited amounts of copper and other related mineral specimens for sale to collectors and museums.

White Pine Copper Refinery, Inc., White Pine, MI, was purchased by HudBay Minerals Inc., Winnipeg, Manitoba, Canada. Purchase of the refinery allowed Hudson Bay Mining and Smelting Co., Ltd. (wholly owned subsidiary of Hudbay Minerals Inc.) to have a captive facility for refining the copper anodes produced at its operations in Manitoba (Hudbay Minerals Inc., 2006).

Iron Ore.—Cleveland-Cliffs Inc celebrated the production of its 500 millionth long ton of iron ore pellets in Michigan. From 1956 until March 2006, the company had operated a total of six separate iron ore pelletizing plants in Marquette County. In 2006, Cleveland-Cliffs operated two pelletizing plants as components of its Empire Mine and Tilden Mine. Cleveland-Cliffs employed about 1,400 people in the State during the year (Grand Rapids Press, The, 2006).

Cleveland-Cliffs continued to market its Republic iron mine property, which contained the Republic Dam, raising concerns by some residents of Republic Township, Marquette County. Changes in water levels controlled by the dam could affect properties owned by about 70 landowners in the area. The dam, which facilitated much of Republic Township's waterfront property, could not be removed without State permits. In January 2007, the property was sold to an undisclosed private party; the sale did not include 931 ha (2,300 acres) that made up the Republic Wetlands Preserve (Skillings Mining Review, 2007).

Government Activities

Cleveland-Cliffs and the MDEQ reached a negotiated settlement regarding a mercury pollution remediation case at Deer Lake in Marquette County. The action amended an existing 1984 judgment related to mercury levels in the lake. As part of the settlement, Cleveland-Cliffs volunteered additional remediation at Deer Lake including surrounding easements, land, and property. The company would also establish a lake restoration fund, and a program for testing the mercury levels in the resident fish. The MDEQ indicated that possible sources of mercury in the lake included waste rock from a former gold mine that used mercury in its ore processing, atmospheric deposition, and Cleveland-Cliff's disposal of heavy metals used for testing in its research laboratory (Skillings Mining Review, 2006).

The U.S. Federal Emergency Management Agency provided a $33,750 grant, 75% of the $45,000 cost to prevent ground water from flooding the lowest levels of the Cornish Pumping Engine and Mining Museum, Iron Mountain, MI. The balance of the repair cost was to be paid by the Menominee Range Historical Foundation. The flooding problem was attributed to the collapse of a mine shaft adjacent to the museum in 1999. That subsidence had been capped in 2000 with $150,000 from the MDNR's Abandoned Mine Fund.

There were 111 metallic mineral leases on State-owned mineral lands covering nearly 10,700 ha. An additional 96 leases covering about 9,310 ha were pending, owing to a hold on issuing new leases while a new lease document was under preparation and review. Total income from the metallic mineral leasing program was nearly $296,000 in 2006. There were 36 nonmetallic mineral leases on State-owned mineral lands covering nearly 1,190 ha in 2006, with an income of $778,686. An additional $29,400 income was obtained from Forest Management Division Mineral Permit activities (Hoane, 2007).

Most of the income from the Metallic and Nonmetallic Mineral Leasing programs is directed to the Michigan Natural Resources Trust Fund, which gives grants to the State and local governments to purchase and develop public recreational properties within the State.

The Millie Mine, Millie Hill, Dickinson County, MI, was reported to be the winter hibernating and breeding place for up to 50,000 Big Brown and Little Brown Bats. The Millie Hill location is one of several bat-inhabited abandoned mines in Michigan. It has become the first bat interpretive center within the State (Michigan Department of Natural Resources, 2006).

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TABLE 1

NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN[1, 2]

(Thousand metric tons and thousand dollars)

Mineral	2004		2005		2006	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	231	27,100 [e]	228	27,500 [e]	176	22,700 [e]
Portland	W	W	W	W	5,440	536,000 [e]
Clays, common	605	3,070	334	514	405	1,010
Gemstones, natural	NA	1	NA	1	NA	2
Gypsum, crude	452	5,660	1,050	10,700	1,050	9,980
Peat	122	3,360	117	3,300	W	W
Sand and gravel:						
Construction	69,500	254,000	64,800	243,000	50,500	215,000
Industrial	1,690	25,200	1,610	24,500	1,460	30,400
Stone, crushed	36,700 [3]	143,000 [3]	36,000 [r]	139,000 [r]	32,500	142,000
Combined values of bromine, iron ore (usable shipped), iron oxide pigments (crude), lime, magnesium compounds, potash, salt, stone [crushed marl (2004), dimension dolomite and sandstone], and values indicated by the symbol W	XX	1,210,000	XX	1,300,000	XX	970,000
Total	XX	1,680,000	XX	1,750,000	XX	1,930,000

[e]Estimated. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2

MICHIGAN: CRUSHED STONE SOLD OR USED, BY KIND[1]

Kind	2005			2006		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone	25	27,900	$108,000	25	25,300	$108,000
Dolomite	5	7,230 [r]	29,700 [r]	5	6,620	30,300
Calcareous marl	1	W	W	1	W	W
Traprock	--	--	--	1	W	W
Miscellaneous stone	2	W	W	1	19	150
Total	XX	36,000 [r]	139,000 [r]	XX	32,500	142,000

[r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 3

MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE[1]

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Riprap and jetty stone	70	624
Filter stone	W	W
Other coarse aggregate	2,110	7,810
Total	2,180	8,430
Coarse aggregate, graded:		
Concrete aggregate, coarse	3,340	19,100
Bituminous aggregate, coarse	515	4,220
Bituminous surface-treatment aggregate	(2)	(2)
Railroad ballast	(2)	(2)
Other graded coarse aggregate	48	532
Total	3,900	23,900
Fine aggregate (-⅜ inch):		
Stone sand, concrete	(3)	(3)
Stone sand, bituminous mix or seal	729	3,700
Screening, undesignated	361	1,300
Other fine aggregate	455	1,730
Total	1,550	6,740
Coarse and fine aggregates:		
Graded road base or subbase	1,110	5,740
Unpaved road surfacing	474	2,830
Crusher run or fill or waste	21	96
Other coarse and fine aggregates	53	397
Total	1,660	9,060
Agricultural:		
Limestone	(4)	(4)
Other agricultural uses	(4)	(4)
Chemical and metallurgical:		
Cement manufacture	(2)	(2)
Lime manufacture	(2)	(2)
Flux stone	(2)	(2)
Total	9,530	31,400
Special, other fillers or extenders	(4)	(4)
Unspecified:[5]		
Reported	1,650	7,000
Estimated	12,000	53,000
Total	13,600	60,200
Grand total	32,500	142,000

W Withheld to avoid disclosing company proprietary data; included with "Other coarse aggregate."

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Withheld to avoid disclosing company proprietary data; included in "Total."

[3]Withheld to avoid disclosing company proprietary data; included with "Other fine aggregate."

[4]Withheld to avoid disclosing company proprietary data; included in "Grand total."

[5]Reported and estimated production without a breakdown by end use.

TABLE 4

MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate (+1½ inch)[2]	W	W	W	W	W	W
Coarse aggregate, graded[3]	W	W	W	W	W	W
Fine aggregate (-⅜ inch)[4]	W	W	W	W	W	W
Coarse and fine aggregate[5]	W	W	W	W	W	W
Agricultural[6]	W	W	W	W	W	W
Chemical and metallurgical[7]	W	W	W	W	W	W
Special[8]	--	--	W	W	--	--
Unspecified:[9]						
Reported	--	--	--	--	1,650	7,000
Estimated	19	150	9,200	39,000	2,700	14,000
Total	9,590	49,200	13,200	46,900	9,730	45,700

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes filter stone, riprap and jetty stone, and other coarse aggregate.

[3]Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregate.

[4]Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.

[5]Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

[6]Includes agricultural limestone and other agricultural uses.

[7]Includes cement and lime manufacture and flux stone.

[8]Includes other fillers or extenders.

[9]Reported and estimated production without a breakdown by end use.

TABLE 5

MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006, BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	7,010	$32,500	$4.63
Plaster and gunite sands	18	85	4.62
Concrete products (blocks, bricks, pipe, decorative, etc.)	239	755	3.16
Asphaltic concrete aggregates and other bituminous mixtures	4,490	24,500	5.46
Road base and coverings	6,700	30,700	4.59
Road and other stabilization (cement)	186	969	5.22
Road and other stabilization (lime)	58	186	3.19
Fill	6,250	15,200	2.43
Snow and ice control	370	1,690	4.56
Filtration	44	217	4.91
Other miscellaneous uses	78	520	6.65
Unspecified:[2]			
Reported	4,390	19,800	4.52
Estimated	20,700	87,600	4.23
Total or average	50,500	215,000	4.25

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Reported and estimated production without a breakdown by end use.

TABLE 6

MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products[2]	427	2,950	712	3,490	6,130	26,900
Asphaltic concrete aggregates and road base materials[3]	1,770	8,170	2,670	11,500	6,990	36,700
Fill	247	382	340	755	5,660	14,100
Snow and ice control[4]	32	92	154	465	229	1,350
Other miscellaneous uses	4	47	3	28	71	444
Unspecified:[5]						
Reported	325	1,470	64	763	4,000	17,600
Estimated	976	4,140	3,700	15,600	16,000	67,900
Total	3,780	17,300	7,640	32,700	39,100	165,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes plaster and gunite sands.

[3]Includes road and other stabilization (cement and lime).

[4]Includes filtration.

[5]Reported and estimated production without a breakdown by end use.