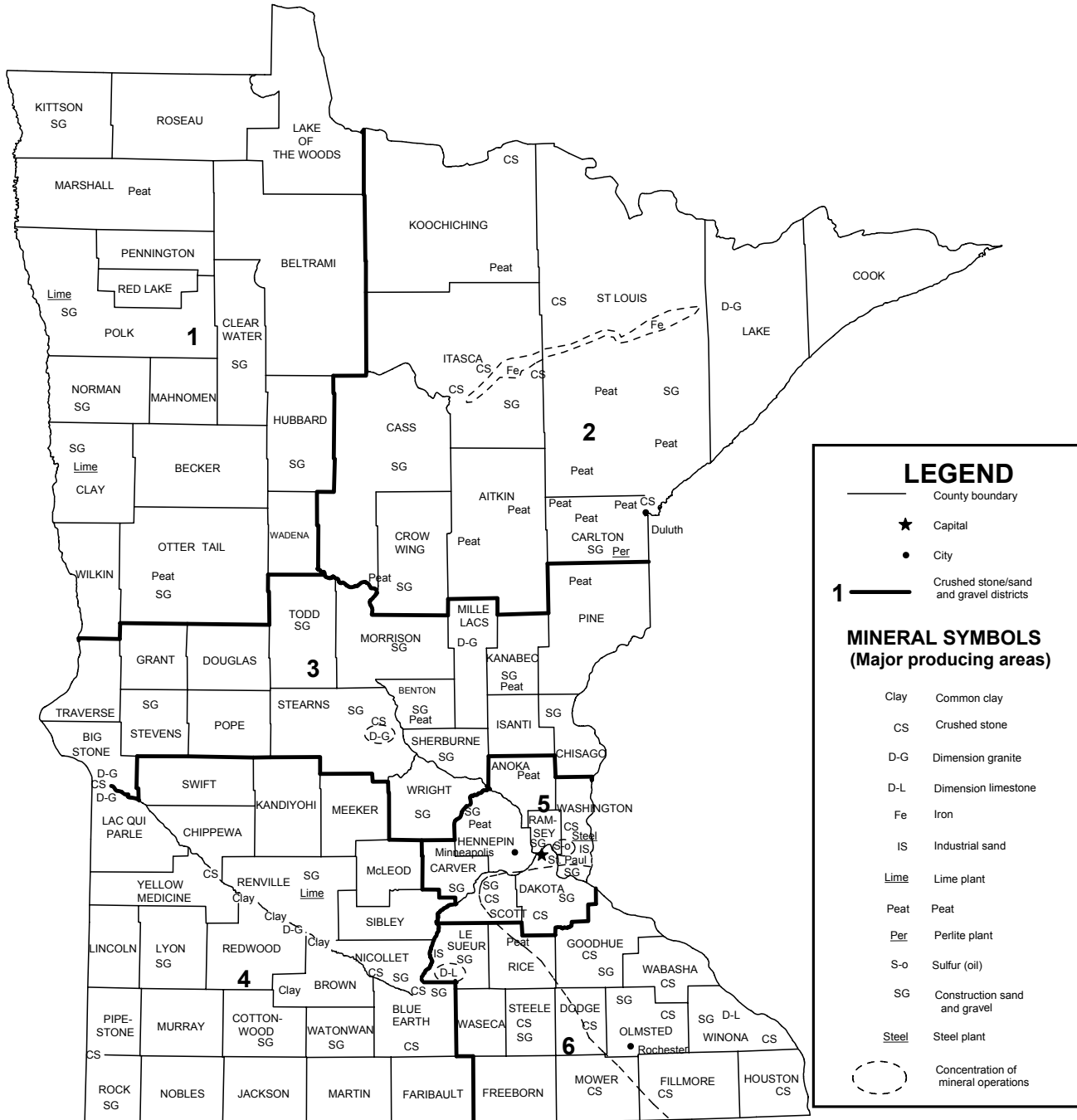


# MINNESOTA



# THE MINERAL INDUSTRY OF MINNESOTA

In 2004, Minnesota's nonfuel raw mineral production was valued<sup>1</sup> at \$1.89 billion, based upon annual U.S. Geological Survey (USGS) data. This was a nearly 43% increase from that of 2003<sup>2</sup> and followed a 1.5% increase from 2002 to 2003. The State rose to 7th from 10th in rank among the 50 States in total nonfuel mineral production value, of which Minnesota accounted for about 4.1% of the U.S. total. (Because data for industrial sand and gravel and lime have been withheld to protect company proprietary data, the actual total values for 2002-04 are somewhat higher than those reported in table 1.)

Minnesota continued to be the Nation's leading iron ore-producing State in 2004; based upon value, iron ore continued to be the State's leading nonfuel raw mineral, followed by construction sand and gravel, crushed stone, industrial sand and gravel, dimension stone, and lime (descending order of value). The State's substantial increase in nonfuel raw mineral production value largely resulted from iron ore's considerably higher average price per metric ton in 2004 as compared with that of 2003. With a 22% increase in production shipments, the commodity's value rose by more than \$530 million, more than 50% from that of 2003. Other particularly significant increases were those of crushed stone, the value of which was up by \$6.5 million, construction sand and gravel, value up \$24 million, and industrial sand and gravel, up more than \$10 million. There were no decreases in production or related value for any of Minnesota's nonfuel minerals for the year.

In 2003, a \$37 million increase in the value of construction sand and gravel and a more than \$4 million increase in crushed stone more than offset a \$20 million decrease in the value of iron ore, in part resulting from lowered production shipments of iron ore (table 1). Additionally, with significantly increased production, industrial sand and gravel value was up about \$8 million, and although with a slight drop in crushed stone production, its value increased by more than \$4 million. Lime had a small increase in production, but its value was down slightly.

In 2004, Minnesota continued to rank first in the quantities of iron ore produced, third in peat, and fifth in construction sand and gravel among other producing States. The State increased to 9th from 10th in the production of industrial sand and gravel and significant quantities of dimension stone were produced in the State.

The following narrative information was provided by the Minnesota Department of Natural Resources' (DNR) Division of Lands and Minerals (DLM).<sup>3</sup> Production data in the following text are those reported by the DLM, based upon its own surveys and estimates. The data may differ from some production figures reported by the USGS.

## Exploration and Nonferrous Metallic Leasing Activities

Advanced stage exploration continued in 2004 at three copper-nickel-platinum-group metal (PGM) deposits located near the western margin of late-Proterozoic mafic intrusions collectively referred to as the Duluth Complex. The three deposits were the NorthMet deposit, being explored by Polymet Mining Corp.; the Birch Lake deposit, being explored by Franconia Minerals Corp.; and the Mesaba deposit, held by Teck Cominco Ltd.

Polymet has formally begun the permitting process for the NorthMet deposit, and in early 2005, announced a 27,000-meter (m) infill drilling in the deposit area designed to add to the existing 56,000 m of existing drill core. A second large-diameter core sampling campaign was to provide raw materials for a second pilot test of Polymet's processing technology. Additional program information was available on the Internet at URL <http://www.polymetmining.com>.

The Birch Lake project, according to a 2004 technical report released by Franconia Minerals Corp., was at an advanced exploration stage. Drilling (40 holes and 49 wedges totaling 33,339 m) has outlined a large-tonnage, low-grade copper-nickel-PGE deposit in a resource area of approximately 260 hectares (ha). The deposit is in the upper portion of an ultra-mafic unit within the South Kawishiwi intrusive, at a depth of 350 m to 750 m in the resource area. The vertical thickness of the unit averages 53 m with mineralization consisting of disseminated sulfides. The palladium-to-platinum ratio is typically 2 to 1 in drill-core analyses. A 2002 estimate of inferred mineral resources (using a hydrometallurgical case and net smelter return cutoff of U.S. \$25.35 per metric ton) described 51 million metric tons (Mt) of inferred resources at a grade of 0.675% copper, 0.211% nickel, 0.01% cobalt, 216 parts per billion (ppb) gold, 972 ppb palladium, 460 ppb platinum, and 2.60 parts per million silver. Additional information was available on the company's Web site at URL <http://www.franconiaminerals.com>.

The Mesaba deposit being explored near Babbitt, MN, had been dormant since Polymet announced that it had reached an agreement with Cliffs-Erie LLC for use of the former LTV Steel mining and plant facilities at nearby Hoyt Lakes. The metals were to have been recovered using Teck Cominco's hydrometallurgical process. Additional information was available on the company's Web site at URL <http://www.teckcominco.com/research/index.htm>.

In other exploration activities, Kennecott Minerals drilled 11 holes totaling 3,600 m in mafic-ultramafic features outside the Duluth complex, in Aitkin, Carlton, Morrison, and Stearns Counties. WMC Exploration Inc. drilled one hole in Renville County totaling 370

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<sup>1</sup>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 2004 USGS mineral production data published in this chapter are those available as of December 2005. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

<sup>2</sup>Values, percentage calculations, and rankings for 2003 may differ from the Minerals Yearbook, Area Reports: Domestic 2003, Volume II, owing to the revision of preliminary 2003 to final 2003 data. Data and rankings for 2004 are considered to be final and are not likely to change significantly.

<sup>3</sup>Maryanna Harstad, Senior Planner, authored the text of the State mineral industry information provided by the Minnesota Department of Natural Resources' Division of Lands and Minerals.

m. There were 143 active State metallic minerals leases covering 18,900 ha as of December 31, 2004. A State metallic minerals lease sale was held on October 13, 2004, that resulted in 37 new leases. Fifteen of these were in Kanabec County (all by Kennecott Exploration Co., covering a total of 2,490 ha), 18 were in Mille Lacs County (all by Kennecott Exploration Co., covering a total of 2,540 ha), and four were in the Archean greenstone belts of St. Louis County (all by Lehmann Exploration Management, Inc., covering a total of 450 ha).

Five more metallic minerals leases were issued in 2004 through the negotiated lease process. Two of these (issued to Lehmann Exploration Management, Inc. and covering 146 ha) were in St. Louis County, and the other three (issued to Kennecott Exploration Company and covering 453 ha) were in Kanabec County.

A total of 90 leases (covering a total of 11,500 ha) was terminated in 2004. These included 10 leases (covering 1,270 ha) in Lake County and 80 leases (covering 10,200 ha) in St. Louis County.

## Commodity Review

### *Industrial Minerals*

The industrial mineral and construction materials mining industry in Minnesota produced commodities in seven general categories: aggregate, clays, granite, limestone, peat, quartzite, and industrial silica sand. Resources exist for the potential development of additional mine sites for most of these commodities. Minnesota's population continued to grow. At the 2000 census, Minnesota's population was 4,919,000. During the period 1990 to 2000, Minnesota's population grew an average of 54,000 per year. Minnesota was the fastest growing State in the Midwest and the Northeast during that period. The Greater Twin Cities Metropolitan Area, including collar counties, surpassed the 3 million population level in 1998. The Twin Cities area itself is clearly a large market even at the national scale. There are choices for modes of transportation: barge on the Mississippi River to the Gulf of Mexico, ports on the Great Lakes, rail to either coast, and truck via interstate highways to move industrial minerals to various markets. All of these factors created opportunities to develop industrial mineral resources in Minnesota.

**Clay and Shale.**— Since 1995, four new mines have opened. Clay production in 2004 was derived from seven mines for two general purposes. Kaolin was mined for use in portland cement production and also for making bricks and tiles. Common clay and shale were also mined for bricks and tiles.

**Crushed Stone and Sand and Gravel.**—Aggregate production in Minnesota was composed of three general categories: sand and gravel mined from glacial deposits or alluvial deposits, crushed dolomite or limestone mined from bedrock in southeastern Minnesota, and crushed rock mined elsewhere from diabase, gabbro, gneiss, granite, quartzite, rhyolite, taconite, or traprock. The materials are used for many construction purposes: asphalt pavement, landscape stone, precast concrete products, railroad ballast, ready mixed concrete, riprap, road base, and other fill material. Some of the same quarries that produce crushed carbonate rocks also produce granular carbonate (limestone or dolomite) rock, which is used for soil amendment or for cement.

Aggregate has been or is currently being mined in all of the State's 87 counties. The USGS conducts an annual survey whereby aggregate producers are requested to respond on a voluntary basis. This survey is the only available tool that portrays the general statewide trends. The survey data for year 2004 are available on the USGS minerals information Web site at URL [http://minerals.usgs.gov/minerals/pubs/commodity/stone\\_crushed/csmis4q04.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/stone_crushed/csmis4q04.pdf).

The following aggregate resource information is available on the DNR Web site at URL [http://www.dnr.state.mn.us/lands\\_minerals/aggregatemaps.html](http://www.dnr.state.mn.us/lands_minerals/aggregatemaps.html) in a PDF file format: aggregate resource maps for 12 counties; the seven-county Minneapolis-St. Paul metropolitan area aggregate resource map with a related report by the Minnesota Geological Survey and the Metropolitan Council on projected availability of aggregate resources; and the final report to the legislature of the Aggregate Resources Task Force from February 1, 2000.

Various types of State-owned stockpile material were sold to local companies for use as construction aggregates, such as road base material. State leases continued to be available from many other stockpiles along the 145 kilometers of the Mesabi Iron Range.

Landscape stone products have become a popular and valuable commodity in the Twin Cities market area. Many dolomite quarries offered landscape stone products. The New Ulm Quartzite Quarry offers purple quartzite landscape stone products. Natural glacial boulders and smaller fieldstone were supplied from many sources from as far away as the Mesabi Iron Range. Cliffs Natural Stone sold a line of landscape stone products obtained from various sources on the eastern Mesabi Iron Range. Cliffs Natural Stone had a State lease for a stockpile of flagstone material near Hoyt Lakes.

The Minnesota Department of Agriculture (MDA) analyzed the granular carbonate soil amendment, commonly called ag-lime, to report the neutralization potential. The analytical data for every ag-lime producer were available on the MDA Web site, [www.mda.state.mn.us](http://www.mda.state.mn.us), by searching for "Ag-lime analysis report." The MDA compilation listed 2004 total sales of 741,000 metric tons (t) of ag-lime, of which 348,000 t (47%) was primary production from Minnesota quarries.

**Dimension Stone.**—Dimension stone production in Minnesota included three general commodities: granite, limestone, and quartzite. Two granite producers operated nine quarries within the State. The quarries are in the vicinity of Babbitt, Bellingham, Isle, Morton, Ortonville, and St. Cloud. Dimension stone end products generally fall into two categories, building stone and memorials. The building stone products include curbing and paving tile, exterior and interior facing, countertops, and furniture. The memorial stone products include crypt fronts, markers, mausoleums, and monuments.

Three limestone producers operated eight quarries within the State. The quarries are located in the vicinity of Mankato and Winona. The limestone was used more commonly for building stone products.

Quartzite was quarried near Jasper in southwestern Minnesota and was used for abrasive products and dimensional products. The abrasive products included grinding media cubes and pebbles. The dimensional products included acid-resistant blocks, building

stone, chute and mill liners, and memorials. Cold Spring Granite Company's green stone (Lake Superior Green) was used in the National D-Day Memorial in Bedford, VA, and its black stone (Mesabi Black) significantly increased in popularity. The National Museum of the American Indian, Washington, DC, which opened in September 2004, contains two types of stone from Minnesota—pipestone mined by Travis Erickson and Oneota dolomite provided by Vetter Stone Company under the trade name Kasota-Mankato stone.

**Industrial Sand.**—Silica sand from sandstone bedrock formations east of the Twin Cities and north of Mankato was used in the petroleum industry, in the construction industry, in foundries, in glassmaking, and for sandblasting.

**Peat.**—Nine companies held active leases for horticultural peat on State lands. Berger Peat Moss Ltd. obtained permits to develop a new peat mine at the Pine Island Peat Bog in Koochiching County. Michigan Peat Company closed its mine in 2004 on a State lease east of Cromwell.

## **Metals**

**Iron Ore.**—Minnesota continued to rank first in the Nation in iron ore production, accounting for approximately 75% of the 2004 domestic iron ore shipments to the steel industry. Iron ore pellet production continued to rank among the State's largest industries, contributing more than \$1 billion annually to Minnesota's economy.

Iron ore production in Minnesota increased from 36 Mt in 2003 to 41 Mt in 2004. It is estimated that production for 2005 was approximately 42 Mt.

The steel industry has undergone dramatic change, which has resulted in a restructuring of Minnesota's taconite industry. U.S. Steel completed the purchase of National Steel Corp., which included National Steel Pellet Company (now operated by US Steel's Minnesota Ore Operations as Keewatin Taconite). The majority owner in Hibbing Taconite was previously Bethlehem Steel, which was International Steel Group in 2004. Eveleth Taconite Mining Company (EVTAC) ceased operation and filed for Chapter 11 bankruptcy in May 2003. However, in November 2003, Cleveland-Cliffs Inc. and Laiwu Steel Corporation Limited of China obtained the assets of EVTAC, restarted the plant and mine, and began producing pellets during December 2003 as United Taconite Company.

Several improvements and expansions at Minnesota taconite facilities were undertaken. USS Keewatin Taconite constructed a wet scrubber, which resulted in increased pellet production. United Taconite restarted a pellet line that had been idle since 1999. This will increase their United Taconite's pellet production by more than 1 million metric tons per year (Mt/yr). Northshore Mining had plans to restart a pellet line that has been idle for more than 20 years. This would increase Northshore pellet production by more than 1 Mt/yr. USS Minntac was in the planning stages to install a wet scrubber on its line 3 pellet furnace at Mountain Iron, which will result in increased pellet production.

Mesabi Nugget, LLC completed testing of its pilot demonstration plant (PDP) at Silver Bay, MN. The 25,000-metric-ton-per-year (t/yr) PDP was a joint venture between Cleveland Cliffs Inc., Kobe Steel of Japan, Steel Dynamics Inc., and Ferrometris Inc. The PDP began operation in June 2003 and had several successful campaigns. Several metric tons of pig iron nuggets were shipped to Steel Dynamics in Butler, IN, where they were successfully converted into steel. Planning and permitting were underway for the construction of a 510,000 t/yr iron nugget facility near Hoyt Lakes, MN. Construction of this plant was planned for the beginning of summer 2005.

## **Environmental Issues and Government Programs**

The Environmental Cooperative Research Program addressed environmental and land-use impacts associated with mining. Typical research projects were cosponsored by industry, Federal agencies, or other units of government on a cost-share or in-kind service basis. Projects undertaken in 2004 included the following: characterization and modeling of acid rock drainage, mercury removal from induration offgas by wet scrubbers, a hydrological and water-quality study on the in-pit disposal of taconite tailings, and the development of a hydrological database on mine hydrology. The State of Minnesota's biennial appropriation (July 2003 through June 2005) for mineral cooperative environmental research was \$172,000. Matching monies or in-kind contributions are required by the appropriation.

The Iron Ore Cooperative Research Program funded research supporting rapid improvements in iron ore and taconite processing. Research projects funded during the current biennium (July 2003 through June 2005) included dust suppression in iron ore processing plants, an improved pellet fines removal system, magnetically enhanced hydroseparation, greenball characterization, a Mesabi Range GIS workshop, utilization of hemicelluloses and cellulose as a pellet binder, taconite concentrator modeling, oxygen injection in a grate kiln, alternative fuels for traveling grate induration furnaces, accurate in-house ore characterization, iron ore greenball porosity measurements, mercury exchange mechanisms in taconite processing plants, and a tailings water study. The total biennial budget for iron ore cooperative research was \$825,000. The State appropriation was \$550,000, and the taconite companies' investment was \$275,000.

The Minerals Diversification Program funds research supporting the long-term health of the State's mining economy. This is achieved through improvements to the existing industry and by encouraging environmentally sound exploration and development of new mineral resources. Research projects funded during the current biennium (July 2003 through June 2005) included: Bedrock and Quaternary Geology of the Mesabi Range, Follow-up Mapping and PGM Evaluation of Mafic Intrusions (excluding Duluth Complex), and Mapping Aggregate Resources in two Minnesota counties. The State biennial appropriation for this program was \$344,000.

The Minnesota DNR, DLM, maintains an archive of drill-core and related exploration data at its Hibbing office. Scanned copies of these archives may be accessed through the DNR's Web site at URL <http://minarchive.dnr.state.mn.us>.

In addition to the “Public Access to Minerals Information” at the DNR’s Web site, other information is available on the DNR’s Web site at URL <http://www.dnr.state.mn.us>, including monthly data releases, information on mineral lease availability, aggregate resource maps, a seven-county Minneapolis-St. Paul metropolitan area aggregate resource map and report on projected availability of aggregate resources, and many online documents pertaining to mineral and mining research and exploration.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN MINNESOTA<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

| Mineral          | 2002     |           | 2003     |           | 2004     |           |
|------------------|----------|-----------|----------|-----------|----------|-----------|
|                  | Quantity | Value     | Quantity | Value     | Quantity | Value     |
| Clays, common    | 14       | 15        | 20       | 22        | 20       | 22        |
| Gemstones        | NA       | 6         | NA       | 6         | NA       | 6         |
| Iron ore, usable | 39,600   | 1,050,000 | 34,000   | 1,030,000 | 41,400   | 1,560,000 |
| Lime             | W        | (3)       | W        | (3)       | W        | (3)       |
| Peat             | 64       | 5,320     | 60       | 5,070     | 63       | 5,210     |
| Sand and gravel: |          |           |          |           |          |           |
| Construction     | 43,700   | 175,000   | 48,900   | 212,000   | 54,900   | 235,000   |
| Industrial       | W        | (3)       | W        | (3)       | W        | (3)       |
| Stone:           |          |           |          |           |          |           |
| Crushed          | 9,960    | 57,600    | 9,880    | 61,800    | 10,900   | 68,300    |
| Dimension        | 22       | 12,400    | 16       | 11,900    | 22       | 12,400    |
| Total            | XX       | 1,300,000 | XX       | 1,320,000 | XX       | 1,890,000 |

NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

<sup>1</sup>Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Value excluded to avoid disclosing company proprietary data.

TABLE 2  
MINNESOTA: CRUSHED STONE SOLD OR USED, BY KIND<sup>1</sup>

| Kind             | 2002               |                                 |                   |            | 2003               |                                 |                   |            | 2004               |                                 |                   |            |
|------------------|--------------------|---------------------------------|-------------------|------------|--------------------|---------------------------------|-------------------|------------|--------------------|---------------------------------|-------------------|------------|
|                  | Number of quarries | Quantity (thousand metric tons) | Value (thousands) | Unit value | Number of quarries | Quantity (thousand metric tons) | Value (thousands) | Unit value | Number of quarries | Quantity (thousand metric tons) | Value (thousands) | Unit value |
| Limestone        | 38                 | 4,550                           | \$21,800          | \$4.79     | 27                 | 3,830                           | \$21,200          | \$5.54     | 35                 | 4,300                           | \$24,300          | \$5.66     |
| Granite          | 4                  | W                               | W                 | 6.59       | 4                  | W                               | W                 | 6.09       | 4                  | W                               | W                 | 6.09       |
| Dolomite         | 8                  | 3,340                           | 22,000            | 6.59       | 5                  | 3,540                           | 24,500            | 6.92       | 6                  | 3,670                           | 25,100            | 6.83       |
| Quartzite        | 1                  | W                               | W                 | 6.96       | 1                  | W                               | W                 | 9.23       | 1                  | W                               | W                 | 8.55       |
| Total or average | XX                 | 9,960                           | 57,600            | 5.78       | XX                 | 9,880                           | 61,800            | 6.25       | XX                 | 10,900                          | 68,300            | 6.27       |

W Withheld to avoid disclosing company proprietary data; included in "Total or average." XX Not applicable.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 3a  
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE<sup>1</sup>

| Use  | Quantity<br>(thousand<br>metric tons) | Value<br>(thousands) | Unit<br>value |
|--|---------------------------------------|----------------------|---------------|
| <b>Construction:</b>                                   |                                       |                      |               |
| <b>Coarse aggregate (+1½ inch):</b>                    |                                       |                      |               |
| Macadam  | W                                     | W                    | \$6.35        |
| Riprap and jetty stone                                 | 59                                    | \$853                | 14.46         |
| Filter stone   | W                                     | W                    | 4.55          |
| Other coarse aggregates                                | 21                                    | 477                  | 22.51         |
| Total or average                                       | 95                                    | 1,400                | 14.75         |
| <b>Coarse aggregate, graded:</b>                       |                                       |                      |               |
| Concrete aggregate, coarse                             | 41                                    | 222                  | 5.44          |
| Bituminous aggregate, coarse                           | W                                     | W                    | 9.89          |
| Bituminous surface-treatment aggregate                 | W                                     | W                    | 12.97         |
| Railroad ballast                                       | W                                     | W                    | 9.10          |
| Other graded coarse aggregates                         | 983                                   | 9,140                | 9.30          |
| Total or average                                       | 1,120                                 | 10,300               | 9.19          |
| <b>Fine aggregate (-¾ inch):</b>                       |                                       |                      |               |
| Stone sand, bituminous mix or seal                     | W                                     | W                    | 7.24          |
| Screening, undesignated                                | W                                     | W                    | 3.58          |
| Other fine aggregate                                   | 133                                   | 916                  | 6.91          |
| Total or average                                       | 221                                   | 1,560                | 7.05          |
| <b>Coarse and fine aggregates:</b>                     |                                       |                      |               |
| Graded road base or subbase                            | 119                                   | 469                  | 3.96          |
| Unpaved road surfacing                                 | W                                     | W                    | 3.96          |
| Crusher run or fill or waste                           | 32                                    | 261                  | 8.22          |
| Terrazzo and exposed aggregates                        | W                                     | W                    | 10.21         |
| Other coarse and fine aggregates                       | 2,340                                 | 13,600               | 5.85          |
| Total or average                                       | 2,650                                 | 15,100               | 5.68          |
| <b>Agricultural:</b>                                   |                                       |                      |               |
| Limestone  | 138                                   | 823                  | 5.95          |
| Poultry grit and mineral food                          | (2)                                   | (2)                  | 35.07         |
| Other agricultural uses                                | 4                                     | 24                   | 6.00          |
| Total or average                                       | 142                                   | 847                  | 5.96          |
| Other miscellaneous uses and specified uses not listed | 5                                     | 9                    | 1.80          |
| <b>Unspecified:<sup>3</sup></b>                        |                                       |                      |               |
| Reported   | 3,850                                 | 21,400               | 5.56          |
| Estimated  | 1,800                                 | 11,000               | 6.25          |
| Total or average                                       | 5,650                                 | 32,700               | 5.78          |
| Grand total or average                                 | 9,880                                 | 61,800               | 6.25          |

W Withheld to avoid disclosing company proprietary data; included in "Total or average."

<sup>1</sup>Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

<sup>2</sup>Withheld to avoid disclosing company proprietary data; included in "Unspecified: Reported."

<sup>3</sup>Reported and estimated production without a breakdown by end use.



TABLE 3b  
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE<sup>1</sup>

| Use                                    | Quantity<br>(thousand<br>metric tons) | Value<br>(thousands) | Unit<br>value |
|--|---------------------------------------|----------------------|---------------|
| <b>Construction:</b>                   |                                       |                      |               |
| <b>Coarse aggregate (+1½ inch):</b>    |                                       |                      |               |
| Macadam                                | W                                     | W                    | \$6.34        |
| Riprap and jetty stone                 | 55                                    | \$872                | 15.85         |
| Filter stone                           | 31                                    | 185                  | 5.97          |
| Other coarse aggregates                | 56                                    | 916                  | 16.36         |
| Total or average                       | 142                                   | 1,970                | 13.89         |
| <b>Coarse aggregate, graded:</b>       |                                       |                      |               |
| Concrete aggregate, coarse             | 77                                    | 386                  | 5.01          |
| Bituminous aggregate, coarse           | (2)                                   | (2)                  | 8.72          |
| Bituminous surface-treatment aggregate | (2)                                   | (2)                  | 7.89          |
| Railroad ballast                       | (2)                                   | (2)                  | 9.28          |
| Other graded coarse aggregates         | 1,020                                 | 8,580                | 8.41          |
| Total or average                       | 1,380                                 | 11,500               | 8.32          |
| <b>Fine aggregate (-¾ inch):</b>       |                                       |                      |               |
| Stone sand, concrete                   | (2)                                   | (2)                  | 4.61          |
| Stone sand, bituminous mix or seal     | (2)                                   | (2)                  | 2.48          |
| Screening, undesignated                | (2)                                   | (2)                  | 1.54          |
| Other fine aggregates                  | 126                                   | 898                  | 7.13          |
| Total or average                       | 241                                   | 1,180                | 4.89          |
| <b>Coarse and fine aggregates:</b>     |                                       |                      |               |
| Graded road base or subbase            | 287                                   | 1,480                | 5.15          |
| Unpaved road surfacing                 | (2)                                   | (2)                  | 3.65          |
| Crusher run or fill or waste           | (2)                                   | (2)                  | 8.23          |
| Terrazzo and exposed aggregates        | (2)                                   | (2)                  | 14.17         |
| Other coarse and fine aggregates       | 2,340                                 | 14,100               | 6.06          |
| Total or average                       | 2,790                                 | 16,400               | 5.86          |
| <b>Agricultural:</b>                   |                                       |                      |               |
| Limestone                              | 152                                   | 849                  | 5.59          |
| Poultry grit and mineral food          | (3)                                   | (3)                  | 43.53         |
| Other agricultural uses                | 16                                    | 344                  | 21.50         |
| Total or average                       | 168                                   | 1,190                | 7.10          |
| <b>Unspecified:<sup>4</sup></b>        |                                       |                      |               |
| Reported                               | 4,000                                 | 22,200               | 5.56          |
| Estimated                              | 2,200                                 | 14,000               | 6.39          |
| Total or average                       | 6,180                                 | 36,200               | 5.85          |
| Grand total or average                 | 10,900                                | 68,300               | 6.27          |

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

<sup>1</sup>Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

<sup>2</sup>Withheld to avoid disclosing company proprietary data; included in "Total or average."

<sup>3</sup>Withheld to avoid disclosing company proprietary data; included with "Other agricultural uses."

<sup>4</sup>Reported and estimated production without a breakdown by end use.

TABLE 4a

MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE AND DISTRICT<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

| Use                                      | District 2 |        | District 3 |        | District 4 |        |
|--|------------|--------|------------|--------|------------|--------|
|  | Quantity   | Value  | Quantity   | Value  | Quantity   | Value  |
| <b>Construction:</b>                     |            |        |            |        |            |        |
| Coarse aggregate (+1½ inch) <sup>3</sup> | --         | --     | --         | --     | W          | W      |
| Coarse aggregate, graded <sup>4</sup>    | --         | --     | --         | --     | W          | W      |
| Fine aggregate (-¾ inch) <sup>5</sup>    | --         | --     | --         | --     | W          | W      |
| Coarse and fine aggregates <sup>6</sup>  | --         | --     | --         | --     | W          | W      |
| Agricultural <sup>7</sup>                | --         | --     | --         | --     | (8)        | (8)    |
| Other miscellaneous uses                 | --         | --     | --         | --     | --         | --     |
| <b>Unspecified:<sup>9</sup></b>          |            |        |            |        |            |        |
| Reported                                 | --         | --     | 1,470      | 8,890  | 913        | 5,210  |
| Estimated                                | 3          | 17     | 320        | 2,000  | 600        | 3,700  |
| Total                                    | 3          | 17     | 1,780      | 10,900 | 1,750      | 11,000 |
|  | District 5 |        | District 6 |        |            |        |
|  | Quantity   | Value  | Quantity   | Value  |            |        |
| <b>Construction:</b>                     |            |        |            |        |            |        |
| Coarse aggregate (+1½ inch) <sup>3</sup> | 59         | 1090   | W          | W      |            |        |
| Coarse aggregate, graded <sup>4</sup>    | W          | W      | 40         | 191    |            |        |
| Fine aggregate (-¾ inch) <sup>5</sup>    | W          | W      | W          | W      |            |        |
| Coarse and fine aggregates <sup>6</sup>  | W          | W      | 291        | 1,110  |            |        |
| Agricultural <sup>7</sup>                | W          | W      | W          | W      |            |        |
| Other miscellaneous uses                 | --         | --     | 5          | 9      |            |        |
| <b>Unspecified:<sup>9</sup></b>          |            |        |            |        |            |        |
| Reported                                 | 1,470      | 7,290  | --         | --     |            |        |
| Estimated                                | 79         | 490    | 810        | 5,100  |            |        |
| Total                                    | 5,110      | 33,000 | 1,240      | 6,880  |            |        |

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

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.<sup>2</sup>No crushed stone produced in District 1.<sup>3</sup>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregates.<sup>4</sup>Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregates.<sup>5</sup>Includes screening (undesignated), stone sand bituminous mix or seal, and other fine aggregate.<sup>6</sup>Includes crusher run (select material or fill), graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.<sup>7</sup>Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.<sup>8</sup>Withheld to avoid disclosing company proprietary data; included in "Unspecified: Reported."<sup>9</sup>Reported and estimated production without a breakdown by end use.

TABLE 4b

MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE AND DISTRICT<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

| Use                                      | District 2 |        | District 3 |        | District 4 |        |
|--|------------|--------|------------|--------|------------|--------|
|  | Quantity   | Value  | Quantity   | Value  | Quantity   | Value  |
| <b>Construction:</b>                     |            |        |            |        |            |        |
| Coarse aggregate (+1½ inch) <sup>3</sup> | --         | --     | --         | --     | W          | W      |
| Coarse aggregate, graded <sup>4</sup>    | --         | --     | --         | --     | W          | W      |
| Fine aggregate (-¾ inch) <sup>5</sup>    | --         | --     | --         | --     | W          | W      |
| Coarse and fine aggregates <sup>6</sup>  | --         | --     | --         | --     | W          | W      |
| Agricultural <sup>7</sup>                | --         | --     | --         | --     | W          | W      |
| <b>Unspecified:<sup>8</sup></b>          |            |        |            |        |            |        |
| Reported                                 | --         | --     | 1,610      | 9,770  | 948        | 5,310  |
| Estimated                                | 3          | 17     | 360        | 2,300  | 680        | 4,300  |
| Total                                    | 3          | 17     | 1,970      | 12,000 | 2,050      | 13,200 |
| Use                                      | District 5 |        | District 6 |        |            |        |
|  | Quantity   | Value  | Quantity   | Value  |            |        |
| <b>Construction:</b>                     |            |        |            |        |            |        |
| Coarse aggregate (+1½ inch) <sup>3</sup> | W          | W      | W          | W      |            |        |
| Coarse aggregate, graded <sup>4</sup>    | W          | W      | W          | W      |            |        |
| Fine aggregate (-¾ inch) <sup>5</sup>    | W          | W      | W          | W      |            |        |
| Coarse and fine aggregates <sup>6</sup>  | W          | W      | W          | W      |            |        |
| Agricultural <sup>7</sup>                | W          | W      | W          | W      |            |        |
| <b>Unspecified:<sup>8</sup></b>          |            |        |            |        |            |        |
| Reported                                 | 1,440      | 7,140  | --         | --     |            |        |
| Estimated                                | 67         | 420    | 1,100      | 7,000  |            |        |
| Total                                    | 5,210      | 33,600 | 1,670      | 9,530  |            |        |

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

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.<sup>2</sup>No crushed stone produced in District 1.<sup>3</sup>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregates.<sup>4</sup>Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregates.<sup>5</sup>Includes screening (undesignated), stone sand bituminous mix or seal, stone sand (concrete), and other fine aggregate.<sup>6</sup>Includes crusher run or fill or waste, graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.<sup>7</sup>Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.<sup>8</sup>Reported and estimated production without a breakdown by end use.

TABLE 5a  
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003,  
BY MAJOR USE CATEGORY<sup>1</sup>

| Use   | Quantity<br>(thousand<br>metric tons) | Value<br>(thousands) | Unit<br>value |
|---|---------------------------------------|----------------------|---------------|
| Concrete aggregate (including concrete sand)                | 8,460                                 | \$54,000             | \$6.39        |
| Plaster and gunitite sands                                  | 135                                   | 1,670                | 12.34         |
| Concrete products (blocks, bricks, pipe, decorative, etc.)  | 177                                   | 2,090                | 11.79         |
| Asphaltic concrete aggregates and other bituminous mixtures | 4,500                                 | 27,500               | 6.12          |
| Road base and coverings                                     | 7,780                                 | 25,000               | 3.22          |
| Road and other stabilization (cement and lime)              | 418                                   | 2,430                | 5.80          |
| Fill  | 4,150                                 | 8,640                | 2.08          |
| Snow and ice control  | 218                                   | 997                  | 4.58          |
| Other miscellaneous uses <sup>2</sup>                       | 90                                    | 631                  | 6.99          |
| Unspecified: <sup>3</sup>                                   |                                       |                      |               |
| Reported  | 10,800                                | 41,000               | 3.78          |
| Estimated   | 12,000                                | 48,000               | 3.94          |
| Total or average  | 48,900                                | 212,000              | 4.33          |

<sup>1</sup>Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

<sup>2</sup>Includes roofing granules, railroad ballast, and filtration.

<sup>3</sup>Reported and estimated production without a breakdown by end use.

TABLE 5b  
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004,  
BY MAJOR USE CATEGORY<sup>1</sup>

| Use   | Quantity<br>(thousand<br>metric tons) | Value<br>(thousands) | Unit<br>value |
|---|---------------------------------------|----------------------|---------------|
| Concrete aggregate (including concrete sand)                | 9,500                                 | \$61,200             | \$6.44        |
| Plaster and gunite sands                                    | 103                                   | 666                  | 6.43          |
| Concrete products (blocks, bricks, pipe, decorative, etc.)  | 208                                   | 2,010                | 9.64          |
| Asphaltic concrete aggregates and other bituminous mixtures | 4,520                                 | 22,300               | 4.93          |
| Road base and coverings <sup>2</sup>                        | 9,980                                 | 29,400               | 2.95          |
| Fill  | 4,540                                 | 10,900               | 2.39          |
| Snow and ice control  | 116                                   | 456                  | 3.93          |
| Roofing granules  | 14                                    | 108                  | 7.52          |
| Other miscellaneous uses <sup>3</sup>                       | 62                                    | 366                  | 5.85          |
| Unspecified: <sup>4</sup>                                   |                                       |                      |               |
| Reported  | 13,900                                | 58,500               | 4.21          |
| Estimated   | 12,000                                | 49,000               | 4.11          |
| Total or average  | 54,900                                | 235,000              | 4.28          |

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes road and other stabilization (cement and lime).

<sup>3</sup>Includes filtration and railroad ballast.

<sup>4</sup>Reported and estimated production without a breakdown by end use.

TABLE 6a  
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

| Use   | District 1           |        | District 2 |        | District 3 |        |
|---|----------------------|--------|------------|--------|------------|--------|
|   | Quantity             | Value  | Quantity   | Value  | Quantity   | Value  |
| Concrete aggregate (including concrete sand)                            | 961                  | 5,450  | 436        | 2,230  | 2,130      | 11,000 |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | W                    | W      | W          | W      | 82         | 1,210  |
| Asphaltic concrete aggregates and other bituminous mixtures             | W                    | W      | 143        | 450    | 1,830      | 6,830  |
| Road base and coverings <sup>3</sup>                                    | 1,290                | 3,250  | 620        | 2,110  | 3,070      | 11,600 |
| Fill  | 308                  | 743    | 111        | 235    | 1,230      | 1,940  |
| Snow and ice control  | W                    | W      | 22         | 59     | 36         | 170    |
| Other miscellaneous uses <sup>4</sup>                                   | 605                  | 1,370  | 38         | 288    | 55         | 307    |
| Unspecified: <sup>5</sup>   |                      |        |            |        |            |        |
| Reported  | 774                  | 2,320  | 1,140      | 3,280  | 2,060      | 9,330  |
| Estimated   | 2,500                | 9,600  | 1,500      | 5,800  | 3,000      | 11,000 |
| Total   | 6,480                | 22,700 | 3,980      | 14,500 | 13,500     | 53,800 |
|   | District 4           |        | District 5 |        | District 6 |        |
|   | Quantity             | Value  | Quantity   | Value  | Quantity   | Value  |
| Concrete aggregate (including concrete sand)                            | 337                  | 1,890  | 3,490      | 26,400 | 533        | 3,800  |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | W                    | W      | W          | W      | W          | W      |
| Asphaltic concrete aggregates and other bituminous mixtures             | 416                  | 2,740  | 899        | 14,100 | 159        | 997    |
| Road base and coverings <sup>3</sup>                                    | 1,230                | 3,650  | 522        | 2,740  | 281        | 1,160  |
| Fill  | 220                  | 729    | 2,130      | 4,550  | 117        | 281    |
| Snow and ice control  | 8                    | 31     | W          | W      | 43         | 147    |
| Other miscellaneous uses <sup>4</sup>                                   | 24                   | 181    | 261        | 2,610  | 40         | 352    |
| Unspecified: <sup>5</sup>   |                      |        |            |        |            |        |
| Reported  | 259                  | 1,250  | 716        | 2,640  | 39         | 326    |
| Estimated   | 1,500                | 6,300  | 1,400      | 6,000  | 2,200      | 8,600  |
| Total   | 3,970                | 16,800 | 9,460      | 59,000 | 3,370      | 15,700 |
|   | Unspecified district |        |            |        |            |        |
|   | Quantity             | Value  |            |        |            |        |
| Concrete aggregate (including concrete sand)                            | 322                  | 902    |            |        |            |        |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | --                   | --     |            |        |            |        |
| Asphaltic concrete aggregates and other bituminous mixtures             | W                    | W      |            |        |            |        |
| Road base and coverings <sup>3</sup>                                    | 1,180                | 2,890  |            |        |            |        |
| Fill  | 1                    | 6      |            |        |            |        |
| Snow and ice control  | --                   | --     |            |        |            |        |
| Other miscellaneous uses <sup>4</sup>                                   | 463                  | 1,040  |            |        |            |        |
| Unspecified: <sup>5</sup>   |                      |        |            |        |            |        |
| Reported  | 5,860                | 21,900 |            |        |            |        |
| Estimated   | --                   | --     |            |        |            |        |
| Total   | 7,820                | 26,700 |            |        |            |        |

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes plaster and gunite sands.

<sup>3</sup>Includes road and other stabilization (cement and lime).

<sup>4</sup>Includes filtration, roofing granules, and railroad ballast.

<sup>5</sup>Reported and estimated production without a breakdown by end use.

TABLE 6b  
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

| Use   | District 1            |        | District 2 |        | District 3 |        |
|---|-----------------------|--------|------------|--------|------------|--------|
|   | Quantity              | Value  | Quantity   | Value  | Quantity   | Value  |
| Concrete aggregates (including concrete sand)                           | 1,470                 | 8,580  | 466        | 1,660  | 2,410      | 14,400 |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | W                     | W      | 30         | 269    | W          | W      |
| Asphaltic concrete aggregates and other bituminous mixtures             | W                     | W      | 405        | 1,420  | 1,970      | 8,260  |
| Road base and coverings <sup>3</sup>                                    | 1,650                 | 4,000  | 1,140      | 3,820  | 3,840      | 12,000 |
| Fill  | 470                   | 1,050  | 69         | 269    | 1,330      | 3,440  |
| Snow and ice control  | W                     | W      | 21         | 80     | 12         | 29     |
| Other miscellaneous uses <sup>4</sup>                                   | 734                   | 1,830  | --         | --     | 140        | 737    |
| Unspecified: <sup>5</sup>   |                       |        |            |        |            |        |
| Reported  | 3,580                 | 14,900 | 971        | 4,250  | 4,590      | 20,100 |
| Estimated   | 2,100                 | 8,400  | 3,000      | 11,000 | 2,200      | 9,400  |
| Total   | 9,960                 | 38,700 | 6,060      | 22,800 | 16,500     | 68,300 |
|   | District 4            |        | District 5 |        | District 6 |        |
|   | Quantity              | Value  | Quantity   | Value  | Quantity   | Value  |
| Concrete aggregates (including concrete sand)                           | 463                   | 2,610  | 3,560      | 26,900 | 945        | 6,560  |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | 18                    | 111    | W          | W      | W          | W      |
| Asphaltic concrete aggregates and other bituminous mixtures             | 713                   | 5,150  | 590        | 4,900  | W          | W      |
| Road base and coverings <sup>3</sup>                                    | 805                   | 2,570  | 637        | 3,220  | 276        | 1,160  |
| Fill  | 480                   | 1,540  | 1,820      | 3,920  | 368        | 643    |
| Snow and ice control  | 7                     | 24     | W          | W      | 33         | 80     |
| Other miscellaneous uses <sup>4</sup>                                   | 12                    | 122    | 167        | 1,870  | 147        | 956    |
| Unspecified: <sup>5</sup>   |                       |        |            |        |            |        |
| Reported  | 329                   | 1,390  | 687        | 3,290  | 78         | 507    |
| Estimated   | 1,500                 | 6,500  | 1,500      | 6,500  | 1,800      | 7,700  |
| Total   | 4,300                 | 20,000 | 8,960      | 50,600 | 3,670      | 17,600 |
|   | Unspecified districts |        |            |        |            |        |
|   | Quantity              | Value  |            |        |            |        |
| Concrete aggregates (including concrete sand)                           | 183                   | 403    |            |        |            |        |
| Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup> | --                    | --     |            |        |            |        |
| Asphaltic concrete aggregates and other bituminous mixtures             | 27                    | 60     |            |        |            |        |
| Road base and coverings <sup>3</sup>                                    | 1,630                 | 2,690  |            |        |            |        |
| Fill  | --                    | --     |            |        |            |        |
| Snow and ice control  | --                    | --     |            |        |            |        |
| Other miscellaneous uses <sup>4</sup>                                   | --                    | --     |            |        |            |        |
| Unspecified: <sup>5</sup>   |                       |        |            |        |            |        |
| Reported  | 3,640                 | 14,000 |            |        |            |        |
| Estimated   | --                    | --     |            |        |            |        |
| Total   | 5,480                 | 17,200 |            |        |            |        |

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes plaster and gunite sands.

<sup>3</sup>Includes road and other stabilization (cement and lime).

<sup>4</sup>Includes filtration, railroad ballast, and roofing granules.

<sup>5</sup>Reported and estimated production without a breakdown by end use.