



# 2007 Minerals Yearbook

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VIRGINIA [ADVANCE RELEASE]

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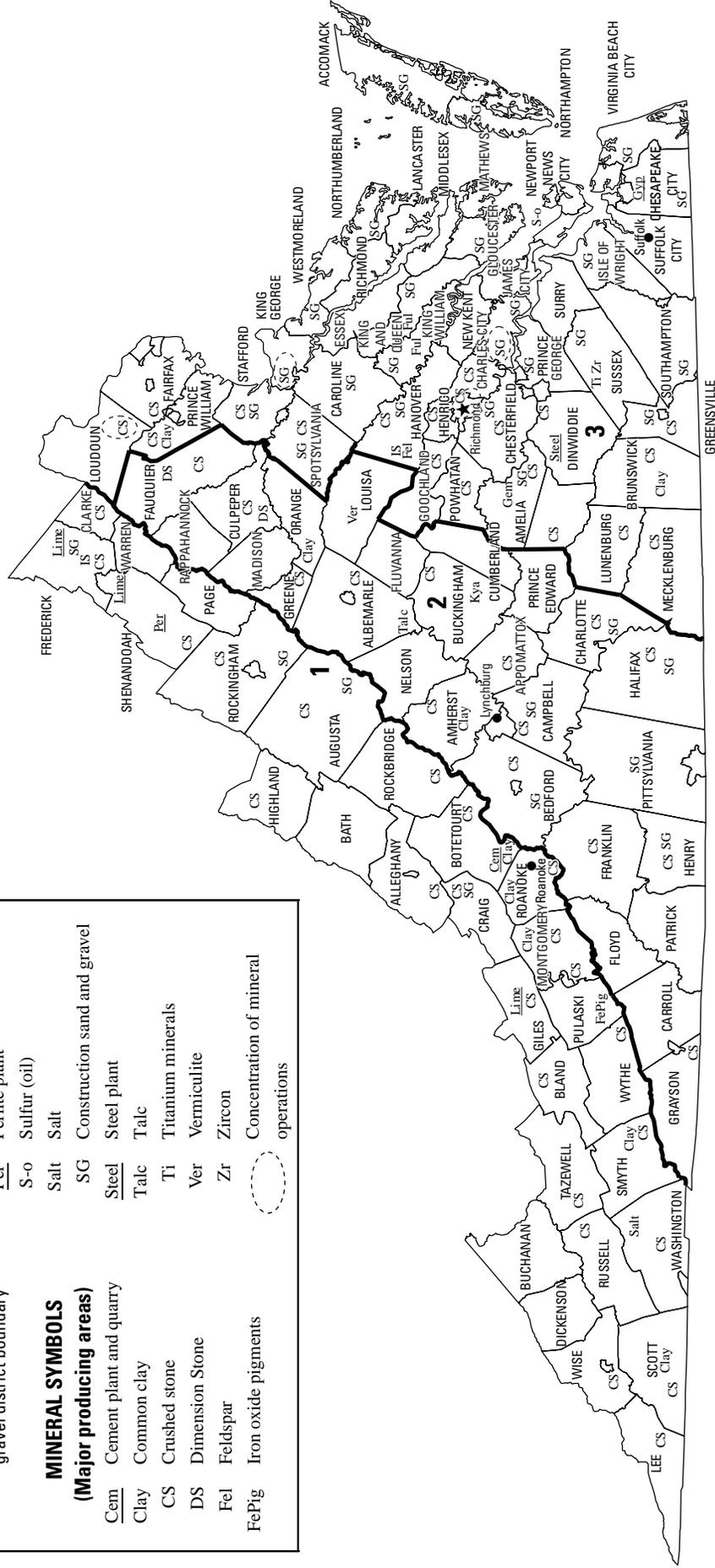
# VIRGINIA

**LEGEND**

— County boundary  
 ★ Capital  
 • City  
 1— Crushed stone/sand and gravel district boundary

**MINERAL SYMBOLS**  
**(Major producing areas)**

Cem	Cement plant and quarry	Full	Fuller's earth
Clay	Common clay	Gem	Gemstones
CS	Crushed stone	Gyp	Gypsum plant
DS	Dimension Stone	IS	Industrial sand
Fel	Feldspar	Kya	Kyanite
FePig	Iron oxide pigments	Lime	Lime plant and quarry
		Per	Perlite plant
		S-o	Sulfur (oil)
		Salt	Salt
		SG	Construction sand and gravel
		Steel	Steel plant
		Talc	Talc
		Ti	Titanium minerals
		Ver	Vermiculite
		Zr	Zircon
			Concentration of mineral operations



Albers equal area projection

Source: Virginia Department of Mines, Minerals, and Energy/U.S. Geological Survey (2007).

# THE MINERAL INDUSTRY OF VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Virginia Department of Mines, Minerals and Energy for collecting information on all nonfuel minerals.

In 2007, Virginia's nonfuel raw mineral production<sup>1</sup> was valued at \$1.15 billion, based upon annual U.S. Geological Survey (USGS) data. This was a decrease of \$140 million, or nearly 11%, from the State's total of \$1.29 billion in 2006, which was up by \$140 million, or 12%, from that of 2005. Virginia was 22d in rank (18th in 2006) among the 50 States in total nonfuel raw mineral production value and accounted for nearly 2% of the U.S. total.

Crushed stone was, by value, Virginia's leading raw nonfuel mineral, accounting for about 60% of the State's total nonfuel mineral value in 2007. From 1990 through 2007, the State produced nearly 1.12 billion metric tons of crushed stone, or an average of 62.4 million metric tons per year (Mt/yr) during that 18-year period. Cement (masonry and portland) was, by value, the second leading nonfuel mineral commodity produced (data withheld—company proprietary data), followed by construction sand and gravel, lime (data withheld—company proprietary data), and zirconium concentrates (data withheld—company proprietary data). These five mineral commodities represented 90% of the State's total nonfuel mineral value.

Several of the State's nonfuel mineral commodities increased in value in 2007, led by increases in the values of portland and masonry cement, fuller's earth clays, vermiculite, iron oxide pigments, and zirconium concentrates. Although production did increase for a majority of the mineral commodities, much of the increase in 2007 resulted from higher average unit prices for most of the mineral commodities. The quantities of several mineral commodities produced by the State decreased, led by titanium ilmenite (data withheld—company proprietary data); crushed stone, down by 15.2 million metric tons (Mt); and zirconium concentrates (data withheld—company proprietary data), listed in order of descending magnitude of production decrease. Significant decreases in production also took place for construction sand and gravel, down by 1.9 Mt; common clay, down by 37,000 metric tons (t); and masonry cement (data withheld—company proprietary data) (table 1).

In 2007, Virginia continued to be the only State to mine and produce kyanite. The State also continued to rank second in the production of zircon and vermiculite (of two producing States for both commodities), as well as in feldspar. The State remained the top ranking State for the production of ilmenite of the two ilmenite-producing States, third in iron oxide pigments, and fourth in fuller's earth clays. Virginia also ranked fifth in mica production and ninth in the production of common clay

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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 2007 USGS mineral production data published in this chapter are those available as of March 2009. 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>.

and crushed stone (within same rankings, mineral commodities are listed in descending order of value). Additionally, significant quantities of portland cement, construction sand and gravel, masonry cement, and gemstones (in descending order of value) were produced in the State. Although the only producing kyanite mine and calcined kyanite (mullite) facilities in the United States were in Virginia, synthetic mullite, which in USGS terminology is a calcined bauxitic kaolin, was produced in one other State. About 90% of the U.S. kyanite and mullite output was used in refractories, mostly for the smelting and processing of a variety of metals (60% to 65% in iron making and steelmaking), as well as in the manufacture of chemicals, glass and high-temperature ceramics, and other materials.

The following narrative information was provided by the Virginia Division of Geology and Mineral Resources<sup>2</sup> (VDGMR) of the Commonwealth of Virginia's Department of Mines, Minerals and Energy (DMME); much of the data are based on DMME's own estimates, surveys, and information gathered from company annual reports. Data or information as reported by the DMME are based on the Department's own estimates and information gathering processes and may differ from USGS estimates and production figures.

## Commodity Review

### *Industrial Minerals*

**Clay and Shale.**—In 2007, mines produced a total of about 1.1 Mt of common clay and shale for brick, tile, clay pipe, and other clay products reported. General Shale Brick Inc., the leading producer of shale in the State, reported more than 382,000 t produced from three active shale mining operations. General Shale's Roanoke Mine 15, located in Botetourt County, reported more than 207,000 t, and was the largest single shale producing operation. Two operations mined fuller's earth (montmorillonite) with combined production reported of about 240,000 t in 2007. Nestle Purina Petcare Company continued operations from an open pit mine in King William County, and Bennett Mineral Company mined deposits located in King and Queen County. These clay deposits occur in the Tertiary Calvert Formation in Virginia's Coastal Plain region.

**Iron Oxide Pigments.**—Production of natural iron oxide pigments continued during 2007 at three locations in Virginia. Hoover Color Corporation produced crude iron oxide pigments from the Painter Mine open pit in Wythe County and both crude and finished iron oxide pigments at the Hiwassee Mine and processing facility in Pulaski County. Total production of crude iron oxide pigments from both mine facilities for 2007 was about 600 t. In Goochland County, Minerals and Chemicals

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<sup>2</sup>William L. Lassetter, Jr., Economic Geology Section Manager with the Virginia Division of Geology and Mineral Resources, authored the text of the State mineral industry information provided by that State agency.

Corporation mined ochreous oxides from soil developed over amphibolite gneiss bedrock at the Whaley Mine. The company reported production of about 23 t.

**Kyanite.**—Kyanite Mining Corporation produced kyanite from two surface mining operations at Willis Mountain and East Ridge, located in central Virginia. In 2007, the company remained the leading domestic producer of kyanite products. The ore is derived from kyanite-bearing quartzites that occur in the Ordovician-age Arvonian Formation (Marr and others, 1981). The ore is crushed and blended to produce a range of mesh-sized kyanite concentrate and calcined kyanite products. For 2007, the company reported production of about 118,000 t of commercial-grade kyanite concentrates.

**Salt.**—Food and agricultural grade salt is produced in southwest Virginia from evaporating brines extracted from underground salt caverns that are used to store natural gas. In 2007, Saltville Gas Storage Company, LLC in Washington County was acquired by the Texas Brine Company, LLC. Texas Brine reported about 105,000 t of salt produced in 2007, about the same quantity that was reported in 2006. The salt deposits are located in the Saltville Valley in southwestern Virginia and have been commercially exploited since the late 1700s and early 1800s. Salt from the region was a critical resource during the American Civil War as it was used for food preservation for the Confederate Army (Whisonant, 1996). The deposits occur in the Mississippian-age McCrady Formation.

**Sand and Gravel.**—A total of about 12.6 Mt of sand and gravel construction aggregate were reported by mine operators producing from 251 mines under active permits in 2007. This quantity represents an 11% reduction from the total production reported in 2006. Most of these mines are located in the Coastal Plain physiographic province of the State. Vulcan Construction Materials LP was the production leader, reporting 2.1 Mt from seven permitted sites, only three of which were active in 2007. Vulcan's Puddledock sand and gravel pit located in Prince George County was the largest single producing operation, reporting 1.1 Mt. Charles City County led the State in sand and gravel production with a total of 1.3 Mt from six active operations. Three other mine sites in the county are under active permits and reported no production in 2007.

**Stone, Crushed.**—Annual reports to DMME from mine operators in Virginia indicated a total of 61.7 Mt of crushed stone produced by 128 mines under active permits in 2007. This quantity represents a 16% reduction from the total production reported in 2006. About 43% of Virginia's crushed stone comes from granite, 31% from limestone and dolomite, 21% from trap rock, and 5% from other rock types including sandstone, marble, and aplite. Vulcan remained the leading producer of crushed stone in the State, reporting a total of 15.9 Mt from 20 operations under active permits. Luck Stone Corporation was second in production with 13.5 Mt from 17 active mine permits. Martin Marietta Aggregate's Doswell quarry located in Hanover County was the largest producing operation, reporting about 2.6 Mt for 2007. Loudoun County led the State in crushed stone production with a total of 6.4 Mt from five active operations.

## *Mineral Fuels and Related Materials*

**Uranium.**—In late 2007, DMME issued a Uranium Exploration Permit to Virginia Uranium, Inc. to conduct exploratory drilling in the Coles Hill area located in north-central Pittsylvania County. The permit authorized up to 40 exploration drill holes in two main target areas of the permitted area of about 80 hectares. The permit requires protection of water quality and reclamation plans for surface disturbances related to exploration activities. The permit includes a radiation management plan for both exploration workers and the site. Bonding is required for each hole and disturbed surface land at the rate of \$10,000 per hole and \$5,000 per hectare of disturbed land. The exploration sites are inspected by DMME personnel during the drilling process, subsequent plugging of the holes, and reclamation of disturbed areas. Virginia placed a moratorium on uranium mining permits in 1983, and the moratorium remains in effect. The Coles Hill uranium deposit was discovered in the late 1970s by Marline Uranium Corporation while conducting regional scale exploration in central Virginia. From 1979 to 1982, Marline completed an extensive drilling program that included 182 rotary percussion and 74 diamond core holes, totaling 58,000 meters. In 1982, Marline announced geologic reserves in the South Coles Hill (Swanson) Deposit that included 27 Mt averaging 0.093%  $U_3O_8$ , with about 25,000 t contained  $U_3O_8$ , at the cutoff grade of 0.025% (Chenoweth, 1983). In 1983, the Virginia General Assembly enacted a moratorium prohibiting the acceptance of mining permit applications until a regulatory program was established. By early 1985, facing significant opposition in the Virginia General Assembly to lift the moratorium coupled with a sustained downturn in the uranium market, Marline abandoned the Coles Hill project and relinquished leases on the mineral rights.

During 2007, the VDGMR participated in the USGS National Coal Resources Database System (NCRDS) State Cooperative Program. Working with USGS scientists from the Eastern Energy Resources Team, coal resource information is re-correlated with the revised stratigraphic framework for the Virginia portion of the Appalachian Basin. The VDGMR also provided geospatial information for many of the most productive coal beds in the Southwest Virginia Coalfield to support ongoing coal bed assessment studies.

## **Government Programs and Activities**

The VDGMR serves as Virginia's geological survey. During 2007, the VDGMR continued activities in support of the Department's mission to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner to support a more productive economy. These activities included geologic mapping programs, compilation and analysis of mineral production statistics, inventorying the locations and geologic characteristics of historic mining activities, and quantitative mineral resource

assessments. With cooperative funding from the USGS STATEMAP program, geologic mapping and digital map compilation were focused along the Interstate 81 corridor, a nearly 500-kilometer highway slated for expansion. STATEMAP is a component of the congressionally mandated National Cooperative Geologic Mapping Program (NCGMP), through which the USGS distributes Federal funds to support geologic mapping efforts through a competitive funding process. The NCGMP has three primary components: (1) FEDMAP, which funds Federal geologic mapping projects, (2) STATEMAP, which is a matching-funds grant program with State geological surveys, and (3) EDMAP, a matching-funds grant program with universities that has a goal to train the next generation of geologic mappers. The ongoing survey of active and abandoned mine sites in the State has provided new records for the Mineral Resources of Virginia database. This database serves as a critical resource for analyzing the spatial distribution of a wide variety of mineral resources and the implications for public safety and environmental concerns. The VDGMR also surveys locations of active and abandoned underground coal mines, adding this data to a Departmental Geographic Information System (GIS) that contains scanned, catalogued, and georeferenced mine maps acquired from coal companies, State and Federal agencies, consultants, and the general public. Funding from the Federal Mine Safety and Health Administration, as well as the Federal Office of Surface Mining, has supported this project. In 2007, the VDGMR introduced a Web page as part of a project to support comprehensive land-use planning by Virginia's cities, counties, and regional planning commissions. The Web page, <http://www.dmme.virginia.gov/DMR3/compplanning.shtml>, provides a map-based interface to mineral resources information for specific planning jurisdictions. Downloadable information for each planning area includes a narrative summary of active and historic minerals production, a geologic map showing locations of active and historic mine sites, and tables

containing mineral production tonnage, estimated mineral value, and employment statistics. Publications released in 2007 included a report on the early history of mineral exploration in Virginia, coal mine roof stability, guidelines for mapping projects, the evolution of geologic mapping in Virginia, and a map of the Lexington quadrangle (Byington, 2007; Campbell, 2007; Heller and others, 2007; Heuvel, 2007; Wilkes, 2007). More information on these and other publications of the VDGMR can be found at <http://www.dmme.virginia.gov/divisionmineralresources.shtml>.

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

(Thousand metric tons and thousand dollars)

Mineral	2005		2006		2007	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	983	4,690	762	1,810	725	6,360
Kyanite <sup>3</sup>	90	13,400	90	14,000	90	19,000
Mica, crude	--	--	--	--	(3)	1
Sand and gravel, construction	12,000	85,800	14,200	110,000	12,300	115,000
Stone:						
Crushed	85,700	772,000	77,400 <sup>r</sup>	845,000 <sup>r</sup>	62,200	693,000
Dimension	6	631	6	631	6	631
Talc, crude	1	15	W	W	--	--
Combined values of cement, clays (fuller's earth), feldspar, gemstones (natural), iron oxide pigments (crude), lime, salt (2007), sand and gravel (industrial), titanium concentrates (ilmenite), vermiculite (crude), zirconium concentrates, and value indicated by symbol W	XX	272,000	XX	317,000 <sup>r</sup>	XX	320,000
Total	XX	1,150,000	XX	1,290,000 <sup>r</sup>	XX	1,150,000

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data. Withheld value included in "Combined value" data. XX Not applicable. -- Zero.

<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>Less than 1/2 unit.

TABLE 2  
VIRGINIA: CRUSHED STONE SOLD OR USED, BY TYPE<sup>1</sup>

Type	2006			2007		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone <sup>2</sup>	43 <sup>r</sup>	22,800 <sup>r</sup>	\$251,000 <sup>r</sup>	40	18,400	\$202,000
Dolomite	6	2,870	21,000	4	2,910	16,800
Granite	29	29,300	329,000	27	25,200	305,000
Sandstone and quartzite	5	1,860	17,200	6	1,210	13,000
Traprock	11 <sup>r</sup>	18,500 <sup>r</sup>	203,000 <sup>r</sup>	11	12,800	147,000
Slate	2 <sup>r</sup>	200 <sup>r</sup>	2,170 <sup>r</sup>	2	229	2,550
Miscellaneous stone	5 <sup>r</sup>	1,900 <sup>r</sup>	20,800 <sup>r</sup>	4	1,480	6,140
Total	XX	77,400 <sup>r</sup>	845,000 <sup>r</sup>	XX	62,200	693,000

<sup>r</sup>Revised. XX Not applicable.

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

<sup>2</sup>Includes limestone-dolomite reported with no distinction between the two.

TABLE 3  
 VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2007, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Macadam	W	W
Riprap and jetty stone	297	2,520
Filter stone	313	3,190
Other coarse aggregate	1,370	20,200
Coarse aggregate, graded:		
Concrete aggregate, coarse	2,010	20,900
Bituminous aggregate, coarse	1,720	10,500
Bituminous surface-treatment aggregate	W	W
Railroad ballast	W	W
Other graded coarse aggregate	9,160	121,000
Fine aggregate (-¾ inch):		
Stone sand, concrete	594	4,040
Stone sand, bituminous mix or seal	W	W
Screening, undesignated	W	W
Other fine aggregate	2,240	22,500
Coarse and fine aggregates:		
Graded road base or subbase	2,950	25,900
Unpaved road surfacing	W	W
Crusher run or fill or waste	1,690	8,140
Other coarse and fine aggregate	7,090	80,100
Other construction materials	371	4,040
Agricultural:		
Limestone	W	W
Other agricultural uses	56	2,780
Chemical and metallurgical:		
Lime manufacture	W	W
Dead-burned dolomite manufacture	W	W
Chemical stone	W	W
Special:		
Mine dusting or acid water treatment	W	W
Other fillers or extenders	W	W
Unspecified: <sup>2</sup>		
Reported	18,400	209,000
Estimated	9,700	108,000
Total	62,200	693,000

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

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

<sup>2</sup>Reported and estimated production without a breakdown by end use.

TABLE 4  
VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2007, 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
Construction:						
Coarse aggregate (+1½ inch) <sup>2</sup>	681	5,300	W	W	W	W
Coarse aggregate, graded <sup>3</sup>	2,560	23,500	W	W	W	W
Fine aggregate (-¾ inch) <sup>4</sup>	1,450	13,300	W	W	W	W
Coarse and fine aggregate <sup>5</sup>	3,880	29,000	W	W	W	W
Other construction materials	5	39	3	5	363	4,000
Agricultural <sup>6</sup>	616	8,370	W	W	W	W
Chemical and metallurgical <sup>7</sup>	W	W	--	--	--	--
Special <sup>8</sup>	W	W	--	--	--	--
Unspecified: <sup>9</sup>						
Reported	788	8,700	3,450	39,000	14,200	161,000
Estimated	9,100	101,000	473	5,300	138	1,500
Total	19,900	212,000	8,810	75,500	33,600	405,000

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>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregates.

<sup>3</sup>Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregates.

<sup>4</sup>Includes screening (undesignated), stone sand (bituminous mix or seal), stone sand (concrete), and other fine aggregates.

<sup>5</sup>Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

<sup>6</sup>Includes limestone and other agricultural uses.

<sup>7</sup>Includes chemical stone, lime manufacture, and dead-burned dolomite manufacture.

<sup>8</sup>Includes mine dusting or acid water treatment and other fillers or extenders.

<sup>9</sup>Reported and estimated production without a breakdown by end use.

TABLE 5  
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregates and concrete products	4,160	\$44,900	\$10.81
Plaster and gunite sands	25	265	10.60
Asphaltic concrete aggregates and other bituminous mixtures	702	4,760	6.78
Road base and coverings	39	219	5.62
Fill	1,170	5,200	4.45
Snow and ice control	5	37	7.40
Golf course	33	426	12.91
Other miscellaneous uses	1	9	9.00
Unspecified: <sup>2</sup>			
Reported	2,900	28,400	9.79
Estimated	3,260	30,700	9.40
Total or average	12,300	115,000	9.35

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

TABLE 6  
 VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007,  
 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 and concrete products <sup>2</sup>	W	W	W	W	4,030	43,500
Asphaltic concrete aggregates and road base materials	W	W	W	W	497	3,290
Fill	10	29	(3)	3	1,160	5,170
Other miscellaneous uses <sup>4</sup>	357	3,070	43	354	35	440
Unspecified: <sup>5</sup>						
Reported	72	555	68	412	2,760	27,400
Estimated	1,050	10,400	1,480	13,500	729	6,830
Total	1,490	14,000	1,590	14,200	9,210	86,600

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

<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>Less than ½ unit.

<sup>4</sup>Includes golf course and snow and ice control.

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