Minnesota Department of Natural Resources
Division of Lands and Minerals
William C. Brice, Director

SIGNIFICANT AGGREGATE RESOURCE DEPOSITS*
BENTON COUNTY, MINNESOTA

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AGGREGATE POTENTIAL: For the purpose of this study, aggregate potential is defined as an assessment of the relative probability that an aggregate deposit exists within a given area, with almost all emphasis placed upon geologic evidence, parameters, and interpretation at the reconnaissance level, rather than upon economic feasibility evaluation or other parameters. This assessment does not imply that economic aggregate deposits exist everywhere within a given map unit designated as "Potential Aggregate Resources". Rather, that within such a map unit, geologic processes were active that could have created aggregate deposits at specific sites. Geologic measurements of aggregate deposits remain constant, but economic criteria and environmental permitting vary across time and place. Important site-specific factors such as ownership, zoning, protected waters and wetlands, environmental permitting, distance to markets, royalties, and individual site characteristics, such as access, all contribute to the final "potential" of a specific parcel; however, these factors were not included in this study.

POTENTIAL SAND AND GRAVEL RESOURCES: Geologic units that are inferred to contain moderately to highly desirable sand and gravel deposits. These units exhibit the geologic characteristics that typically produce sand and gravel deposits. Existing gravel pits and MN/DOT aggregate sources lying within these units indicate identified or known resources. The geologic units having potential for sand and gravel include alluvial features (flood plains, terraces, and fans), glacial outwash features (channels, terraces, and fans), and ice-contact features (eskers and kames). These units typically contain sorted sand and gravel with little silt or clay.

POTENTIAL CRUSHED STONE RESOURCES: Bedrock formations that consist of moderately and highly desirable granite that is suitable for crushing. These granite units consist of some of the highest quality crushed stone resources in the state of Minnesota. The units are inferred to be very thick (50 to several hundred feet), with overburden thicknesses of less than 30 feet. Quarries located within these units indicate identified or known resources. These bedrock resources are most commonly at or near the surface in the southwest and northeast parts of the county.

LIMITED POTENTIAL FOR AGGREGATE RESOURCES: Units that generally have less desirable, or little or no potential for aggregate resources. These units exhibit geologic characteristics that are typically not consistent with significant aggregate deposits. The geologic units that have less desirable potential include alluvial features (beaches and flood plains), glacial outwash features (outwash channels, fans, and deltas), and ice-contact features (eskers and kames) that are typically small, thin, or have too fine of a material to be of commercial value. The geologic units having limited potential include eolian (wind-blown), lacustrine (lake plains), moranic (till), small alluvial deposits, and bedrock with overburden thicknesses greater than 50 feet. These units typically contain clay, silt, fine sand, unsorted sediments (specifically in till), or very thin layers of sand and gravel. The units may include aggregate deposits that are too small to be mapped.

IDENTIFIED AGGREGATE RESOURCES: Areas where aggregate resources (sand, gravel, and/or crushed stone) have been or are currently being mined. Pit and quarry locations have been gathered from several different reference sources, including topographic maps, aerial photographs, county records, county highway department maps, soil surveys, MN/DOT files, fieldwork, gravel operators, and other miscellaneous sources. The pits and quarries range in size from less than 1 acre to greater than 50 acres and may be active, inactive, depleted, or redaimed. The aggregate quality of the pits varies.

Gravel Pits: Locations were gathered from several different reference sources. Any given pit may be active, inactive, depleted, or redaimed.

Gravel Pits - MN/DOT files: Locations gathered from ASIS, the Minnesota Department of Transportation's Aggregate Source Information System listing of aggregate sources. Test hole logs, sieve, and quality test data are available.

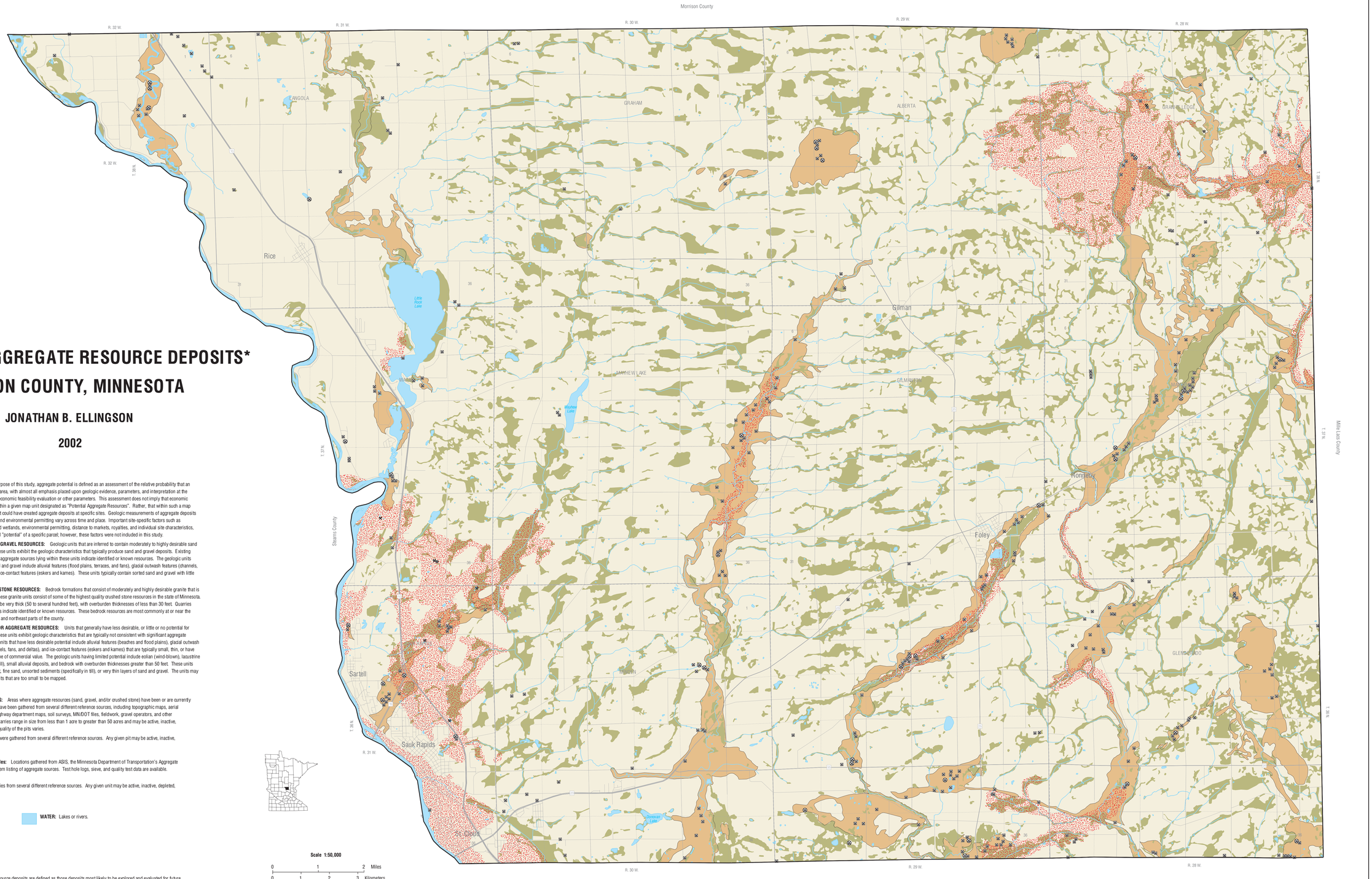
Quarries: Granite quarries from several different reference sources. Any given unit may be active, inactive, depleted, or redaimed.

OTHER FEATURES:

WETLANDS: Wetland area.

WATER: Lakes or rivers.

*Significant aggregate resource deposits are defined as those deposits most likely to be explored and evaluated for future commercial use; they include moderately and highly desirable sand, gravel, and crushed stone deposits.



Scale 1:50,000

0 1 2 Miles
0 1 2 3 Kilometers

(Surficial aggregate resource mapping units were delineated at 1:50,000)
(Buried aggregate resource mapping units were delineated at 1:100,000)

Aggregate Resources:
Aerial photograph interpretation, field work, and delineation of mapping units by Jonathan B. Ellingson, 2001-2002, County Aggregate Mapping Program, Division of Lands and Minerals, Minnesota Department of Natural Resources. Source information included aerial photographs from NAPP (National Aerial Photography Program), 1991-1992, 9" x 9" color infrared photos at 1:40,000; DOQs (Digital Orthophoto Quadrangles) at 1:12,000 from USGS (United States Geological Survey); DRGs (Digital Raster Graphics) at 1:24,000 from USGS; 7.5-minute USGS topographic quadrangles at 1:24,000 (dating from 1965-1993); and a digital version of the Soil Survey of Benton County, 1977, from the USDA-NRCS (United States Department of Agriculture - Natural Resources Conservation Service), captured into the Soil Survey Information System (SSIS) format by the University of Minnesota, Department of Soil, Water, and Climate.

Base map data sources:
Lakes, wetlands, and rivers from National Wetland Inventory, U.S. Fish and Wildlife Service, compiled at 1:24,000 from aerial photography (1979-1988) and spot field checked.
Public Land Survey - PLS Project, 2001, Minnesota Department of Natural Resources, Division of Lands and Minerals.
Roads from State of MN/DOT Basemap 2001 - Roads, Minnesota Department of Transportation, BaseMap Development Group, Surveying and Mapping Section.
Civil Townships and Municipal Boundaries from MN/DOT Basemap 2001 - Civil/twp and Muni, Minnesota Department of Transportation, BaseMap Development Group, Surveying and Mapping Section.

This project includes a CD-ROM of maps, data, and metadata in a digital format and the following plates:
Plate I, Report 356, Significant Aggregate Resource Deposits.
Plate II, Report 356, Aggregate Resources.
Plate III, Report 356, Surficial Geology.
Plate IV, Report 356, Data Sources and Mapping Methodology.

GIS database design and cartography by Renee Johnson. Database assistance by Erika Rowe. Field and drilling assistance by Ricco Rihiluoma.

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Projects are determined by a committee composed of Governor-appointed members from the public and private sectors.