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Surface Mine Lakes: An Important Water Resource For Iowa[1]

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A survey, in 1981, revealed that Iowa had 1,215 active surface mines. Of the active and abandoned surface mines, 625 had water withdrawal permits from the Iowa Natural Resources Council. The majority of these permits were for dewatering and/or processing water but several were for other beneficial uses. Several of the surface mines are also used for recreation. This usage, for water supply and recreation, indicates the value of surface mine lakes as a water resource for the people of Iowa.
INDEX DESCRIPTORS: Surface mine lakes, beneficial water use, water resource

TERMINOLOGY

The extraction of materials from the earth by man leads to the creation of depressions, called surface mines, that can be either wet or dry depending upon their relationship to the water table. Surface mines located on valley terraces or on the uplands above the water table are usually dry, whereas those extending below the water table are wet and frequently require pumping to keep the water levels low enough for the extraction equipment to operate. As these wet surface mines are abandoned and the pumping stops, the original water level reestablishes itself and lakes develop. Hutchinson (1957) classified these lakes as Lake Type 74; lakes in artificial depressions which are produced by the complex behavior of higher organisms. Man in this case is the higher organism.

The names used to describe surface mines vary widely and are dependent upon the type of material which is being extracted from them. Historically, quarries were called quarpits (Rice, 1955). Over time, this term has been divided to become quarry and pit. Quarries are surface mines from which building stone such as marble, granite, slate or limestone is extracted (American Geological Institute, 1976), whereas surface mines for iron ore, clay, coal or sand and gravel are called pits (American Geological Institute, 1962). The lakes that are created when these surface mines are abandoned acquire the name of the parent mine type. Stripmine lakes result from extraction operations at surface coal mines, quarry lakes from quarries, gravel-pit lakes from sand and gravel pits and borrow-pit lakes from clay or dirt borrow pits.

BENEFICIAL USAGE OF SURFACE MINE LAKES

Surface mine lakes are being used for many beneficial purposes in countries around the world. Sandpits in the Netherlands are being used for the dumping of waste and sludge, the discharge of sewage water, the storage of drinking water, recreation and nature conservation (Leentvaar, 1973). Numerous gravel-pit and borrow-pit lakes exist on the Rhine River flood plain between Mannhein, Germany and Basle, Switzerland; many being used for recreation (Jansen et al., 1979). The United States, not being unlike these other countries, also makes use of its surface mine lakes, especially in areas where natural surface waters are scarce (Reed, 1975).

In the United States, the major usage of surface mine lakes appears to be recreational fishing. Although these lakes usually do not support large thriving fish populations (Lewis and Peters, 1954; Stockinger and Hays, 1960; Bennett, 1967; Gash and Bass, 1973), unusually large fish populations can sometimes be found (Carlander, 1951). These are usually due to artificial stocking from nearby rivers during flood periods rather than from natural reproduction. The reduced natural production of fish is related to the basin morphometry of the surface mine lakes. They are usually steep-sided with reduced littoral zones for fish spawning. This in turn sharply reduces the productivity of the fisheries (Burner and Leist, 1953; Maupin et al., 1954; Bell, 1956; Davis, 1971). It is possible to manage surface mine lakes to produce a recreational fishery. The State of Nebraska Game and Parks Commission is accomplishing this with good success with the Interstate 80 borrow-pit lakes in the Platte River Valley (McCarraher et al., 1974).

IOWA SURVEY

The Iowa Department of Soil Conservation reports that the State of Iowa contains 1,215 active surface mines (Iowa Department of Soil Conservation, 1981). The location of these surface mines is shown in

Table 1. Summary of material produced and number of sites of surface mines in Iowa, 1981

Material produced	Number of sites
Limestone	490
Gravel	286
Sand and gravel	234
Sand	63
Coal	34
Clay	20
Limestone and gravel	14
Limestone, sand and gravel	14
Gypsum	14
Crushed rock	11
Limestone and sand	10
Gravel and fill dirt	6
Sand, gravel and dirt	4
Clay and shale	3
Fill dirt	2
Clay, gravel and dirt	2
Shale	1
Sand and fill dirt	1
Clay and sand	1
Limestone, clay and gravel	1
Dolomite	1
Clay and gravel	1
Limestone and shale	1
Limestone and clay	1
Total	1,215

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[2] Present addess: School of Forest Resources; The Pennsylvania State University; University Park, Pennsylvania 16802.

Table 2. Dominant type of water use authorized by the water withdrawal permits at the sand and gravel pits and rock quarries in Iowa, 1981

Water use	Sand and gravel	Rock	Total
Material production			
Dewatering	28	36	64
Processing	127	94	221
Dewatering and processing	90	148	238
Power production			
Electrical energy	1	1	2
Irrigation			
General farm crops	82	9	91
Specialty crops	3	1	4
Golf course	3	1	4
Municipal water supply	1	0	1
Totals	335	290	625

Fig. 1 and a summary of the material produced from these surface mines is presented in Table 1. The mines are scattered over the state with the majority of them located in the northeastern section and along the interior rivers. This geographical distribution is not surprising since over 90 percent of Iowa's surface mines produce either limestone, sand and/or gravel and it is in the northeast and along the interior rivers where these resources are found at or near the surface making extraction economically attractive.

Six hundred and twenty-five sand and gravel pits and rock quarries have water withdrawal permits from the Iowa Natural Resources Council (Iowa Natural Resources Council, 1981). Their location is shown in Fig. 2. Most of these surface mines are located in the interior river valleys where the natural water table causes them to fill with water. A summary of the dominant type of water use authorized by these permits is presented in Table 2. Over 84 percent of these permits are for either dewatering and/or processing water. The remaining permits are for other beneficial uses such as power production, municipal water supply or irrigation.

In addition to the withdrawal of water from Iowa's surface mine lakes for beneficial uses, the surface water and land areas associated with several surface mines are being used for outdoor recreational activities. Specific examples of this type of usage occurs at Scharnberg Park in Clay County, the May City and Ocheyedan Pit areas in Osceola County, Gray's Lake and Avon Lake in Polk County, Blackhawk Pits in Sac County, the "Old Grand River" quarry in Decatur County and the Peterson Pits area in Story County.

CONCLUSIONS

The State of Iowa has numerous surface mines scattered across its

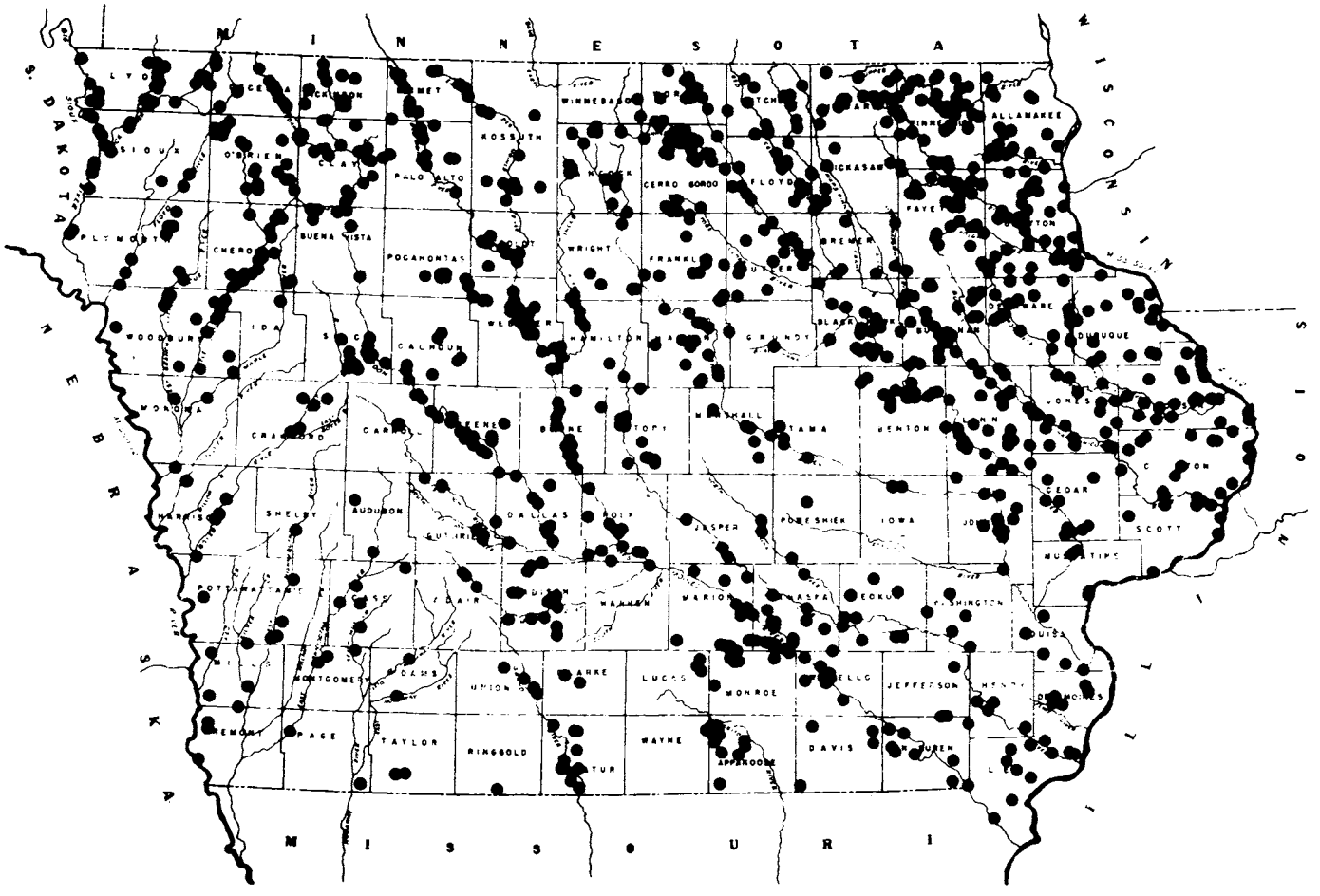

Fig. 1. Location of existing active surface mines in Iowa, 1981

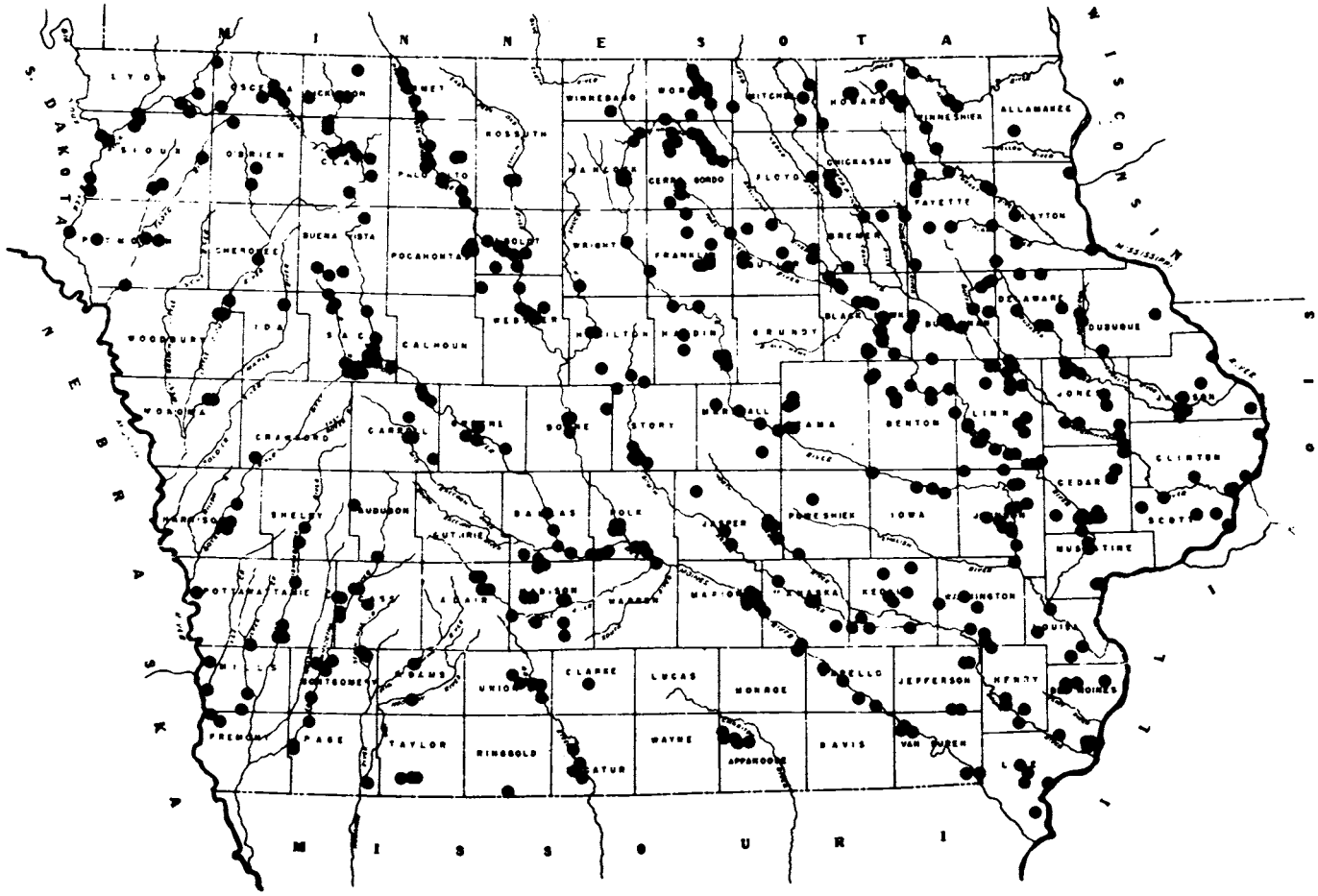

Fig. 2. Location of INRC permits authorizing water withdrawal from gravel pits and rock quarries in Iowa, 1981

surface. Several of these are being used beneficially as surface water supplies or as recreational areas. The degree of this type of usage implies that surface mine lakes are an important water resource for the people of Iowa. Their greatest physical and economic value occurs in the sections of the state where natural lakes or constructed impoundments are lacking.

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