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Energy Facilities Screening in Illinois:

**Guide to Coal Availability and
Resource Development in Illinois**

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Goal

Use a Geographical Information System (GIS) to deliver a revised series (Gustison, et al. 2002) of statewide digital maps that graphically illustrate current coal availability, updated water resources information, coal powered electric plants, electrical transmission grid, transportation systems and relevant natural history data concurrently as they relate to resource development in Illinois. Funding for this project was provided by the Illinois Department of Commerce and Economic Opportunity through their Office of Coal Development.

Background

The recent emphasis on Illinois resource development and energy security was shown by the Illinois Legislature with the passage of Public Act 92-0012 (2001). At its heart is a bonding and grant program for building new coal-fired power plants that burn Illinois coal. Grants are also available for new transmission facilities that help move the power to market.

As of January 1, 2000, the Energy Information Administration (EIA) listed Illinois as having demonstrated reserve base of 88.2 billion short tons (bst) of coal, including 28.1 bst estimated as recoverable. The EIA showed 17 producing mines in 1999; only one of these was listed as a major coal mine in the United States (produced more than 4 million short tons in 2000). In 1999, Illinois generated 45.33% of its electricity using coal from 25 utility plants.

The Illinois State Geological Survey (ISGS) completed coal availability maps for mining the Springfield (no.5) Coal Member (Treworgy et al. 2000a) and the Herrin (no.6) Coal Member (Treworgy et al. 2000c) in Illinois. These maps documented key conditions, such as coal thickness, depth, and previously mined out areas that control new development of coal resources. Since completion, texts supporting these maps have been available for purchase as ISGS publications Industrial Minerals (IM) 118 (Treworgy et al. 1999a) and IM 120 (Treworgy et al. 2000b). All information used to create these maps is kept in a GIS as part of a larger database by the Coal Section of the Energy and Earth Resources Center of the ISGS in Champaign, Illinois. A previous joint publication by the ISGS and ISWS (Smith and Stall 1975) discussed coal and water resources but presented separate maps for each resource.

The Illinois State Water Survey (ISWS) updated water resource availability information in areas of the state selected by the ISGS as a result of its GIS investigations into geologically favorable sites for mining coal. This information was put into a GIS compatible format for use with ISGS coal availability maps and other GIS coverages to convey information to potential data users.

ISGS completed a study (Gustison, et al. 2002) using the GIS data from IM 118 and IM 120 as a basis to rescale and highlight selected areas in Illinois that are geologically favorable for mining significant volumes of new coal, to show updated water resources data from the ISWS, and to create a new data layer showing the location of electrical transmission lines. All three layers, in combination, are important information for locating new, mine-mouth electrical generation facilities.

This revised edition contains GIS layers supplied by the Illinois Natural History Survey (INHS) and the Illinois Department of Natural Resources (IDNR). Addition of these layers increases the value of this project by identifying potentially sensitive biological areas of concern.

Methodology

The ISGS Coal Section supplied coal data used to generate previous coal availability maps (Treworgy et al. 2000a, 2000c) in the form of ArcView© shapefiles. Criteria used to define the Springfield Coal (Treworgy et al. 1999a, table 3b, p.12) and the Herrin Coal (Treworgy et al. 2000b, table 3b, p.14) that were available for underground mining are a set of rules based on interviews with mining companies, observations of mining practice, and the assessments of individual quadrangle study reports completed by the Coal Section during 1994 through 1999. This information and ISWS water availability was used to produce a new series of statewide maps at a scale of 1:250,000. The United States Geological Survey (USGS), Digital Raster Graphics (DRG), 1:100,000 scale maps of Illinois were imported as a background image, and a new digital data layer representing the location of electrical transmission lines was created. The latter data were not enhanced beyond printed, publicly available existing maps because of security considerations.

Project Results

Current Coal Availability for the Springfield (no.5) and Herrin (no.6) Coal Seams

A revised series of statewide digital maps that graphically illustrate coal availability were created for the Springfield (no.5) Coal and Herrin (no.6) Coal seams at a scale of 1:250,000. For mapping purposes, the state was divided into three separate regions (fig. 1). These maps show the integration of coal data, water data, current plant locations, transmission line location, and natural history resources, all key elements for siting a mine-mouth power plant.

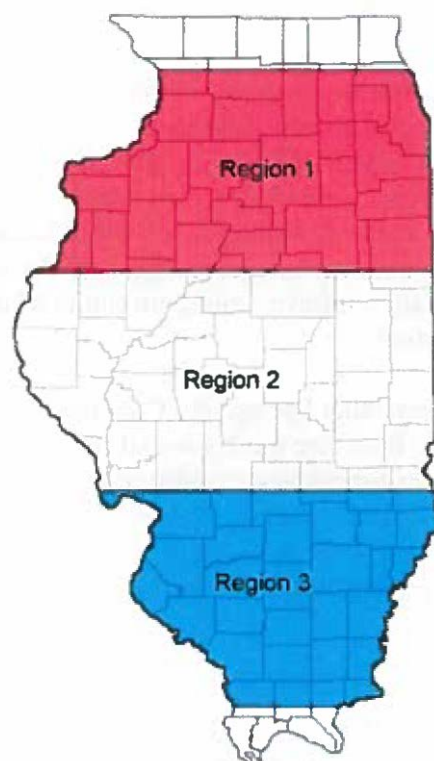


Figure 1. Statewide map showing the three regions used to map coal availability, water data, current plant locations, electrical transmission lines, and natural history information.

Summary of the Springfield (no.5) Coal Availability

Of the 65.1 billion tons of original resources of Springfield Coal in Illinois, 63 billion tons or 97%, remain, constituting the second-largest remaining coal resource in the state. The other 2.2 billion tons have been mined or were lost in mining during the more than 200 years of mining Illinois coal. The degree to which this remaining resource is utilized in the future depends on the availability of deposits that can be mined at a cost that is competitive with other coals and alternative fuels. The report by Treworgy et al. (1999a) identifies those resources that have the most favorable geologic and land-use characteristics for mining, shows the probable trend of future mining of these resources and alerts mining companies to geologic conditions that have a potential negative impact on mining costs.

Approximately 41% of the original Springfield Coal resources (27 billion tons) are available for mining (table 1). Available means that the surface land-use and geologic conditions related to mining of the deposit (e.g. thickness, depth, in-place tonnage, stability of bedrock overburden) are comparable with those of other coals currently being mined in the state. Of these resources, 23 billion tons are in seams 42 to 66 inches thick, and 4 billion tons are in seams greater than 66 inches thick.

The available resources are primarily located in the central and southeastern portions of the state and are well suited for high-efficiency longwall mining. The resources are relatively flat-lying; have a consistent seam thickness over large areas; are relatively free of faults, channels, or other geologic anomalies; are located predominantly in rural areas free from oil wells and other surface development; and are situated in minable blocks of hundreds of millions of tons. Whether or not this resource is ultimately mined is still dependent on other factors that have not been assessed, including willingness of local landowners to lease the coal, demands for a particular quality of coal, accessibility of transportation infrastructure, proximity of the deposit to markets and cost, and availability of competing fuels.

About 62 billion tons of the remaining Springfield Coal resources have greater than 2.5 pounds of sulfur per million BTU and are therefore mostly suited for the high-sulfur coal market. Only 1.4 billion tons of the Springfield resources have a sulfur content of 0.6 to 1.7 pounds per million BTU. However, the majority of these medium- to low-sulfur resources (1 billion tons) are classified as available or available with conditions. Technological factors, such as geologic conditions associated with faults and channels, are the primary restrictions on mining these lower-sulfur deposits.

Table 1. Availability of the Springfield Coal for mining in Illinois, billions of tons. Numbers in parentheses are percent of original resources. Note: surface and underground resources do not add to the total because coal that lies between 75 and 200 feet deep is included in both categories (Treworgy et al. 1999a, p. 1).

	Total	<u>Potential mining method</u>		<u>Sulfur (lbs./M BTU)</u>	
		Surface	Underground	<1.67	>1.67
Original	65.1	7.8	63.0	1.8	63.3
Mined	2.2 (3)	1.1 (15)	1.8 (3)	0.4 (23)	1.8 (3)
Remaining	63.0 (97)	6.7 (85)	61.2 (97)	1.4 (77)	61.5 (97)
Available	27.0 (41)	0.9 (12)	26.1 (41)	0.8 (46)	26.2 (41)
Available with conditions	2.6 (4)	<0.1 (<1)	2.6 (4)	0.2 (12)	2.4 (4)
Technological restrictions	30.1 (47)	4.5 (57)	29.4 (47)	0.3 (16)	29.9 (47)
Land-use restrictions	3.2 (5)	1.2 (16)	3.0 (5)	<0.1 (4)	3.1 (5)

An additional 3 billion tons of Springfield Coal resources are available, but have geologic or land-use conditions that may make them less desirable for mining (table 1). Technological factors (geologic conditions and engineering parameters such as size of reserve block) restrict mining of 47% of the resources, and land use (e.g. towns, highways) restricts mining of 5% of the resources.

Most of the available Springfield Coal resources will be mined by underground methods. Of the 63 billion tons of original resources that are at least 75 feet deep (and therefore potentially minable by underground methods), 41% (26 billions tons) are available for underground mining. An additional 4% are available but with conditions that make the resources less desirable. These conditions include the presence of closely-spaced oil wells, less stable roof strata, or close proximity to developing urban areas. The major technological factors that restrict underground

mining are thin interburden between the Springfield Coal and an overlying seam (17%), coal less than 42 inches thick (14%), and unfavorable thicknesses of bedrock and unconsolidated overburden (13%). Land-use restricts underground mining of 5% of the original resources, and 3% have already been mined or lost in mining.

Only about 8 billion tons of the original Springfield Coal resources lie at depths of less than 200 feet and are potentially minable by surface methods. Of these resources, 15% have already been mined, and 12% (just under 1 billion tons) are available for surface mining. Land-use factors, primarily towns, restrict 16% of the resources. Technological factors, primarily stripping ratio and thick unconsolidated material, restrict 57% of the surface-minable resources.

To avoid high mining costs resulting from unfavorable geologic conditions, companies siting underground mines should avoid areas of thick drift and thin bedrock cover, close proximity to the Galatia Channel and faults, areas of closely spaced oil wells, and areas at the margins of the Dykersburg Shale. The areas of low-cost surface minable resources (areas with low stripping ratios that are free of conflicting land users) are limited and will only support small, limited-term operations.

Treworgy et al. (1994, 1995, 1996a, 1996b, 1997a, 1997b, 1998, 1999a, 1999b, 2000a, 2000b, 2000c) assessed the availability of coal in 21 study areas. The study areas were 7.5-minute quadrangles that were representative of mining conditions found in various parts of the state. Coal resources and related geology were mapped in these study areas, and the factors that restricted the availability of coal in the quadrangles were identified through interviews with more than 40 mining engineers, geologists, and other mining specialists representing 17 mining companies, consulting firms, and government agencies active in the Illinois mining industry. The major restrictions identified in these individual study areas were used for this statewide assessment of the availability of the Springfield Coal for mining.

Summary of the Herrin (no.6) Coal Availability

Of the 88.5 billion tons of original resources of Herrin Coal in Illinois, 79 billion tons or 89%, remain, the largest remaining coal resource in the state. The other 9.4 billion tons have been mined or lost in mining during the more than 200 years of mining Illinois coal. The degree to which this remaining resource is utilized in the future depends on the availability of deposits that can be mined at a cost that is competitive with other coals and alternative fuels. The report by Treworgy et al. (2000b) identifies those resources that have the most favorable geologic and land-use characteristics for mining, shows the probable trend of future mining of these resources and alerts mining companies to geologic conditions that have a potential negative impact on mining costs.

Approximately 58% of the original Herrin Coal resources (51 billion tons) are available for mining (table 2). Available means that the surface land-use and geologic conditions related to mining of the deposit (e.g. thickness, depth, in-place tonnage, stability of bedrock overburden) are comparable with those of other coals currently being mined in the state. Of these resources, 21 billion tons are in seams 42 to 66 inches thick, and 30 billion tons are in seams greater than 66

inches thick. An additional 3 billion tons of Herrin Coal resources are available but have geologic or land-use conditions that are potential restrictions making them less desirable for mining. Technological factors (geologic conditions and economic parameters such as size of reserve block) restrict mining of 24% of the resources, and land-use factors (e.g., towns, highways) restrict mining of 4% of the resources.

The available resources are primarily located in the central and southern portions of the state and are well suited for high-efficiency longwall mining. The resources are relatively flat-lying; have a consistent seam thickness over large areas; are relatively free of faults, channels, or other geologic anomalies; are located predominantly in rural areas free from oil wells and other surface development; and are situated in minable blocks of hundreds of millions of tons. Whether or not the resources are ultimately mined still depends on other factors that have not been assessed including willingness of local landowners to lease the coal, demands for a particular quality of coal, accessibility of transportation infrastructure, proximity of the deposit to markets, and cost and availability of competing fuels.

About 74 billion tons of the remaining Herrin Coal resources have greater than 1.67 pounds of sulfur per million BTU and are therefore mostly suited for the high-sulfur coal market. Although only 9% of the original resources has a sulfur content of less than 1.67 pounds per million BTU, almost one-third of the past mining has been concentrated in these deposits. About 6 billion tons of these lower-sulfur coal resources remain, and about half of this is classified as available or available with potential restrictions. For the most part, these lower-sulfur resources are too deep for surface mining and will have to be mined by underground methods. Technological factors, particularly seam thickness and thickness of bedrock cover, are the primary restrictions on mining these lower sulfur deposits. About 5% of these resources are available but potentially restricted by land-use because of eastward expansion of development in the St. Louis metropolitan area.

Table 2. Availability of the Herrin Coal for mining in Illinois, billions of tons. Numbers in parentheses are percent of original resources. Note: surface and underground resources do not add to the total because coal that lies between 75 and 200 feet deep is included in both categories (Treworgy et al. 2000b, p. 1).

	Total	Potential mining method		Sulfur (lbs./M BTU)	
		Surface	Underground	<1.67	>1.67
Original	88.5	14.9	86.5	8.4	80.1
Mined	9.4 (11)	3.1 (21)	8.4 (10)	2.7 (32)	6.8 (8)
Remaining	79.0 (89)	11.8 (79)	78.1 (90)	5.7 (68)	73.6 (92)
Available	51.0 (58)	2.2 (15)	49.3 (57)	2.9 (34)	48.1 (60)
Available w/conditions	3.1 (3)	0.2 (2)	3.3 (4)	0.3 (4)	2.7 (3)
Technological restrictions	21.1 (24)	6.8 (45)	21.4 (25)	2.3 (27)	19.1 (24)
Land-use restrictions	3.8 (4)	2.6 (17)	4.1 (5)	0.2 (3)	3.7 (5)

Most of the available Herrin Coal resources will be mined by underground methods. Of the 86 billion tons of original resources that are at least 40 feet deep (Treworgy et al. 2000b, p.26), and therefore potentially minable by underground methods, 57% (49 billions tons) are available for underground mining. An additional 4% (3 billion tons) are available but with potential restrictions that make the resources less desirable. These potential restrictions include the presence of closely-

spaced oil wells, less stable roof strata, or close proximity to developing urban areas. The major technological factors that restrict underground mining are unfavorable thicknesses of bedrock and unconsolidated overburden (9% of original resources), coal less than 42 inches thick (8%), and thin interburden between the Herrin Coal and an overlying or underlying seam (4%). Land use restricts underground mining of 5% of the original resources, and 10% have already been mined or lost in mining.

Only about 15 billion tons of the original Herrin Coal resource lie at depths of less than 200 feet and are potentially minable by surface methods. Of these resources, 21% have already been mined (3 billion tons), and 15% (2 billion tons) are available for surface mining. Land-use factors, primarily towns, restrict 17% of the resources. Technological factors, primarily stripping ratio and thick unconsolidated material, restrict 45% of the surface-minable resources.

To avoid high mining costs resulting from unfavorable geologic conditions, companies seeking sites for underground mines should avoid areas with the following conditions: thick drift and thin bedrock cover, close proximity to the Walshville or Anvil Rock Channels or faults, areas of closely spaced oil wells, and areas at the margins of the Energy Shale or closely overlain by Anvil Rock Sandstone. Areas with low-cost surface minable resources (areas with low stripping ratios that are free of conflicting land users) are limited and will only support small, limited-term operations.

Treworgy et al. (1994, 1995, 1996a, 1996b, 1997a, 1997b, 1998, 1999a, 1999b, 2000a, 2000b, 2000c) assessed the availability of coal in 21 study areas. The study areas were 7.5 minute quadrangles that were representative of mining conditions found in various parts of the state. Coal resources and related geology were mapped in these study areas, and the factors that restricted the availability of coal in the quadrangles were identified through interviews with more than 40 mining engineers, geologists and other mining specialists representing 17 mining companies, consulting firms and government agencies active in the Illinois mining industry. The major restrictions identified in these individual study areas were used for this statewide assessment of the availability of the Herrin and Springfield Coals for mining.

Available Water Resources for Supplying Mine-Mouth Power Plants in Illinois

Although Illinois is generally considered a water-abundant state, the distribution of available water supply sources varies across the state, and, during years of drought, the amount of available water can be significantly reduced. For these reasons, the availability of sufficient water resources can be a limiting factor in locating facilities that require large amounts of water. In identifying existing and potential surface water resources that have the capacity to provide sufficient water for a mine-mouth electricity-generating facility, it is assumed that the facility will operate continuously and require at least 5 million gallons of water each day. Similarly, only locations where groundwater conditions are especially favorable (e.g., where yields of wells exceed 500 gallons per minute) were considered for groundwater development.

Surface Water Availability

Supply systems generally obtain surface water by one of four approaches: (1) direct withdrawal from a river, (2) impoundment of a stream to create a storage reservoir, (3) creation of an off-channel (side-channel) storage reservoir into which stream water is pumped for later use, or (4) a combination of the first three approaches. A fifth possible approach for providing water supply for industrial uses, discussed later, is to obtain water from one of several large municipal wastewater treatment plants, for reuse after treatment.

Direct Withdrawals from Rivers

The rivers of Illinois generally carry an abundant quantity of water for water supply during most conditions, even in cases of mild drought. However, during severe droughts, such as may occur only once every 25 to 50 years, the flow in these rivers can be reduced significantly. Low flow characteristics during these severe drought conditions, used here to define water supply availability, were estimated through analysis of long-term stream flow records at USGS stream gages or through regional equations that have been developed to estimate flows at ungaged sites. Low flows estimates used in this study that were developed by regional equations are presented by Knapp (1990, 1999). The rivers shown in figure 2 have an estimated minimum daily flow rate of at least 5 million gallons per day (mgd) during a 50-year drought, indicating that they could potentially provide a continuous supply of water during such a severe drought. However, minimum flow requirements may exist for many of these rivers that would limit water withdrawals during low flow conditions. These potential restrictions on withdrawals are discussed in the next section of this report.

There are significant variations in the quantity of low flows in rivers and streams in Illinois during severe drought; depending on the age and content of the unconsolidated glacial till that forms most of the Illinois landscape. In general, the rivers in the southern portion of the State have considerably less sustained flow during drought periods. The low flow in two major rivers in southern Illinois, the Big Muddy and Kaskaskia, are augmented by minimum flow releases from the large federal reservoirs that impound these two rivers. Table 3 lists the in-state rivers in central and southern Illinois with 50-year low flows greater than 5 million gallons per day (mgd) that potentially could serve as a water supply source for a mine-mouth facility. Many rivers in northern Illinois also have low flows in excess of 5 mgd, but these northern rivers are not considered because of their distance from available coal resources. Other rivers in central and southern Illinois have low flows in excess of 5 mgd except during severe drought conditions. Those could be considered if it is practical to discontinue withdrawals for periods during a 25- or 50-year drought.

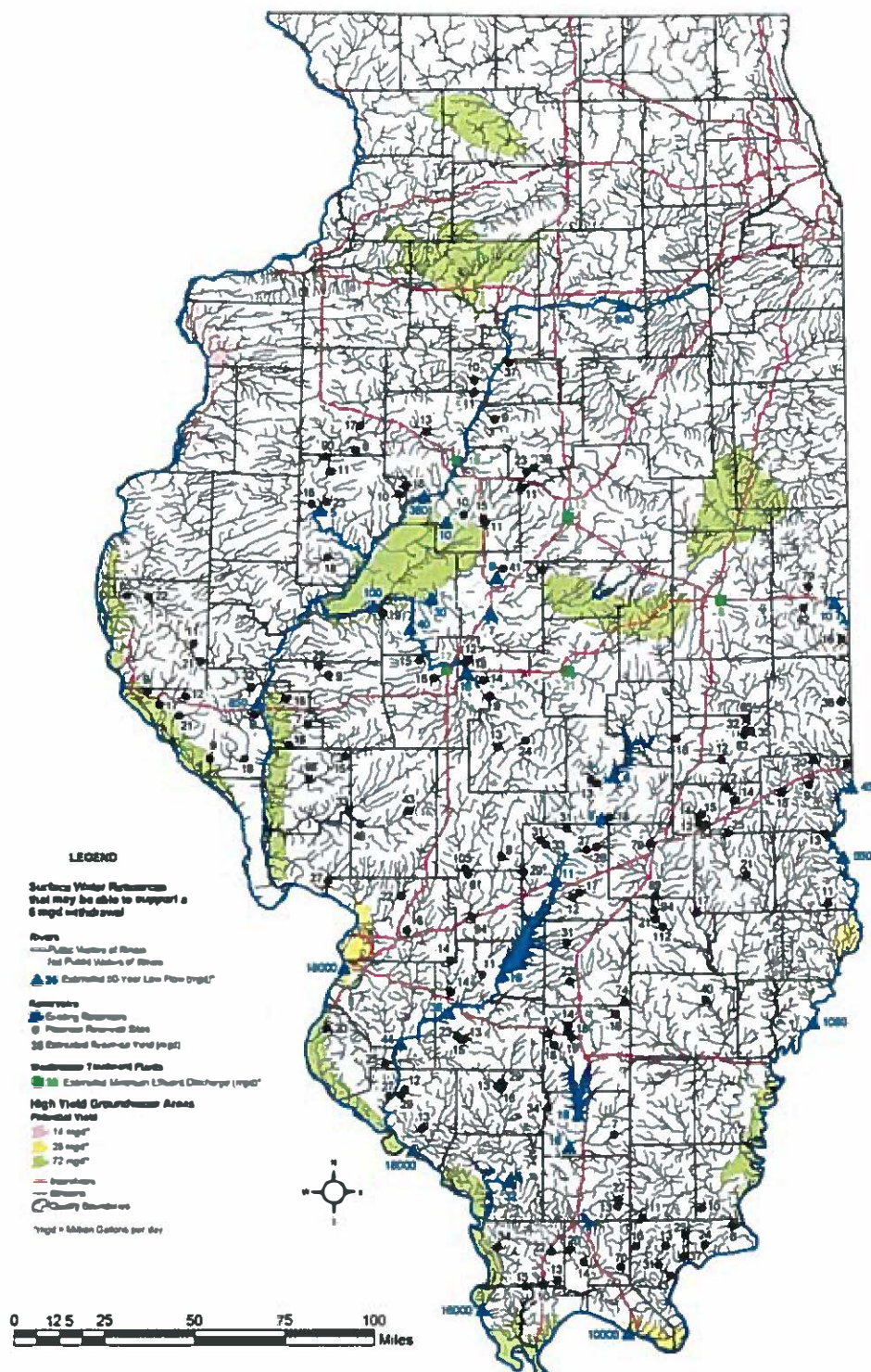


Figure 2. Water resources for Mine-Mouth Power Plants

Table 3. Rivers in southern and central Illinois with 50-year low flows greater than 5 mgd.

<u>River</u>	<u>Locations where the 50-year low flow exceeds 5 mgd</u>
Mississippi River	entire reach
Ohio River	entire reach
Wabash River	entire reach
Illinois River	entire reach
Sangamon River	downstream of Decatur Wastewater Treatment Plant
Salt Creek	downstream of confluence with Lake Fork
Sugar Creek	downstream of Bloomington Wastewater Treatment Plant
Spoon River	downstream of USGS Gage at Seville
Mackinaw River	downstream of confluence with Prairie Creek
Saline Branch	downstream of Urbana-Champaign Treatment Plant
Salt Fork Vermilion River	downstream of confluence with Saline Branch
Vermilion River	downstream of the Salt Fork Vermilion River
Big Muddy River	downstream of Rend Lake
Kaskaskia River	downstream of Lake Shelbyville

Restrictions on Withdrawals

The Rivers, Lakes, and Streams Act gives the Illinois Department of Natural Resources, Office of Water Resources, the responsibility and authority to protect the public interests, rights, safety, and welfare in the state's public bodies of water. The bodies of water in Illinois that have been designated as public waters are rivers, lakes, and streams that were navigable in their natural condition or were improved for navigation and opened to public use. For each designated river and stream, a head of navigation is described such that only locations downstream of the head of navigation are considered public waters. Most of the rivers presented in table 3 have reaches that are public waters. The locations of the public waters of the state that also have a 5 mgd minimum flow are listed in table 4 and shown in figure 2.

Construction of any withdrawal facility, whether or not in a public water of the state, must receive a permit from the Office of Water Resources as required by the Illinois Administrative Code, Part 3700: Construction in Floodways of Rivers, Lakes and Streams. When the withdrawal is from a public body of water, the Office of Water Resources will typically request that a protected flow be established such that the withdrawal must be discontinued when the flow in the river falls below the protected flow level. For many of these situations, the 7-day, 10-year, low flow level known as Q7,10 has been established by the Office of Water Resources as the protected flow level; however, a greater protected flow could be established to prevent impairment of the public water for specific interests or uses by the public.

If not practical for the proposed user to restrict the withdrawal during times of low flow, then one possible solution is to construct an off-channel storage reservoir with sufficient capacity that water from the reservoir could be used by the facility at times when river withdrawals are

restricted. Other alternative sources could also potentially be developed to manage withdrawals during periods of low flow.

Table 4. Rivers in Table 3 that are also designated as public waters of Illinois.

<u>River</u>	<u>Designated as Public Water</u>
Mississippi River	entire reach
Ohio River	entire reach
Wabash River	entire reach
Illinois River	entire reach
Sangamon River	downstream of the south line to the NE 1/4, Sec. 1, T15N, R4W, 3rd PM in Sangamon County (approximately one mile south of the Mechanicsburg Road bridge)
Spoon River	downstream of the north line to Sec. 24, T6N, R1E, 4th PM in Fulton County (approximately one-half mile upstream from the Illinois Highway 95 bridge)
Vermilion River	downstream of the west line to T19N, R11W, 2nd PM in Vermilion County (approximately one mile upstream from the junction with the North Fork)
Big Muddy River	downstream of the east line to T8S, R2W, 3rd PM in Jackson County (approximately one mile northwest of the Southern Illinois Airport)
Kaskaskia River	downstream of the East Line, SW 1/4, Sec. 31, T8N, R2E, 3rd PM (approximately nine miles south and two miles west of Herrick)

Withdrawals from Interstate (Border) Rivers

Withdrawals from the Mississippi and Ohio Rivers, although public waters, are not restricted because (1) the impacts of such withdrawals are expected to be minimal because of the large volumes of flows in these rivers, and (2) no other bordering states restrict withdrawals from these rivers. Withdrawals from the Wabash River, however, are restricted. A Memorandum of Understanding between Illinois and Indiana establishes the Q7,10 as the flow level to be protected from diversions or consumptive uses that would impair such flows.

Withdrawals from Rivers That Are Not Public Waters

Withdrawals from non-public waters are generally not restricted. However, the Office of Water Resources could possibly seek limitations on large withdrawals from river and stream reaches that are tributaries or located upstream of public water, if such a withdrawal could noticeably impair

low flows farther downstream within the public waters. As such, it is possible that direct withdrawals from many of the rivers listed in table 4 would be limited by a protected flow restriction.

Reservoirs

Existing Stream Impoundments

Most of the larger reservoirs in Illinois were built to provide a water supply function in addition to other possible functions such as flood control and recreation. As part of this project and other work conducted by the ISWS in recent years, estimates of water supply yield have been developed for all large water supply reservoirs in Illinois. The methodology given in Terstriep et al. (1982) was used to estimate the reservoir yield. The two primary factors that determine the yield of a reservoir are the storage capacity of the reservoir and the expected inflow from contributing streams during severe drought conditions. The availability of water is dependent upon the yield of the reservoir and the amount of yield that is already committed to existing water supply or to other uses.

There are numerous water supply reservoirs in Illinois, but in most cases the storage in these reservoirs has already been allocated to existing water uses. It is estimated that only six existing reservoirs in Illinois have a sufficient amount of unused capacity to support an additional withdrawal of at least 5 mgd (table 5). There is unallocated storage in these reservoirs, but details on the practicality of obtaining water from several of these reservoirs are not fully known, particularly when the water supply storage is not owned by the State of Illinois. A few other reservoirs in Illinois have large amounts of storage but were not included in this list because they strictly serve functions other than water supply. Crab Orchard Lake, which is owned by the U.S. Fish and Wildlife Service, is an example.

Rend Lake, Lake Carlyle, and Lake Shelbyville (table 5) are federally owned and operated, but the portion of each lake's storage that is apportioned to water supply is owned by the State of Illinois. The primary function of Lake Shelbyville and Carlyle Lake is flood control, and in each lake only about 14% of the storage is apportioned to water supply. The primary function of Rend Lake is water supply, and thus the water supply yield of that lake is significantly greater. Although the water supply storage in Rend Lake is owned by the State of Illinois, the Rend Lake Conservancy District has the authority to allocate and manage the use of this water.

Table 5. Existing reservoirs that could potentially support an additional withdrawal of at least 5 mgd.

<u>Reservoir</u>	<u>Owner</u>	<u>Estimated total yield, mgd (amount currently unallocated)</u>
Rend Lake	State of Illinois	70 (53)
Lake Shelbyville	State of Illinois	17 (8.5) *
Carlyle Lake	State of Illinois	24.5 (24.3) *

Clinton Lake	Amergen	55 (43)
Lake Kinkaid	State of Illinois	24 (21)
Lake of Egypt	Southern Illinois Co-op	12.5 (9)

Identification of a currently unallocated yield does not necessarily indicate that this water may be available to new users. Rights of allocation belong to the owners of the reservoirs and may include other entities that may have contracts for the use of that reservoir.

* Requests for additional allocations from Lake Shelbyville and Carlyle Lake have been submitted to the Illinois Department of Natural Resources, Office of Water Resources. Approval of these additional requests could potentially fully allocate the state-owned storage in these federal reservoirs.

Potential Stream Impoundments

Through the mid-1960s, the construction of a reservoir was a common method for developing water supplies. The three large federal reservoirs in Illinois (Rend Lake, Carlyle Lake, and Lake Shelbyville) and many other larger reservoirs, such as those used by power plants for cooling water, were all built in the 1960s and early 1970s. However, because of economic and environmental concerns since the early 1970s, the construction of reservoirs has become a less favored water supply alternative. In addition, the generally wetter climatic conditions and lack of severe droughts in Illinois over the past 30 years have made the development of additional water supplies less necessary.

The last major reservoir built in Illinois was Clinton Lake, completed in 1977, which was designed to provide cooling water for the Clinton nuclear power facility. In recent years, permit applications have been submitted for new water supply reservoirs in central and southern Illinois. The construction of any new impounding reservoir will likely be subject to a lengthy review process. The availability and proximity of alternative water supply sources must first be considered when evaluating any proposed reservoir.

The location of over 800 potential reservoir sites in Illinois was described in a series of reports in the 1960s by the ISWS by Dawes and Terstriep (1966a, 1966b, 1967) and Roberts et al. (1962). The majority of these sites were for smaller reservoirs with potential yields less than 5 mgd. Smith and Stall (1975) presented a list of 225 potential reservoir sites in Illinois that have expected yields in excess of 5 mgd. The locations of these 225 reservoirs were taken primarily from the four earlier ISWS reports, but Smith and Stall (1975) also include some additional potential reservoir sites identified specifically for inclusion in their study.

The present study uses the list of potential reservoir sites that were previously identified by Smith and Stall (1975). Estimates of reservoir yield were recalculated for each potential reservoir using the more recent data and methodology presented in Terstriep et al. (1982). In the present analysis, the maximum practical yield that can be provided by a reservoir is assumed to be 80% of the

mean annual flow of the stream(s) that provides inflow into the reservoir. Yield estimates for potential reservoir sites were analyzed for sites in the southern half of Illinois and other sites in north-central Illinois that were located within 20 miles of potential coal resources as identified elsewhere in this study. The locations of the 150 analyzed potential reservoirs are given in figure 2. These 150 sites do not represent all possible reservoir locations, but generally represent the maximum yields that could be developed from many of the streams in the State.

Side-Channel Reservoirs

It may not be possible to withdraw water directly from many rivers for short periods during droughts, either because of insufficient flow in the river or because of legal restrictions that limit withdrawals during extremely low flow conditions. Storage in off-channel storage reservoirs, also called side-channel reservoirs, can be a viable option to supply water during relatively short periods when pumping from rivers is limited.

The construction of side-channel reservoirs is generally not limited by local topography. These reservoirs can potentially be created in the floodplain in a river or in the valley of a small tributary that drains to the river, among other possibilities. But any existing lake or reservoir that has sufficient storage usually can also function as a side-channel reservoir, including, for example, lakes that have been formed by surface mining of coal.

The amount of storage needed in a side-channel reservoir has to be determined independently for every situation, and can vary significantly depending on the temporal distribution of flow in the river from which withdrawals are made, the ratio between the protected flow rate in the river and the withdrawal rate, and the recurrence interval of the drought for which the facility is designed. If, for example, the $Q_{7,10}$ is established as the protected flow for a river, then an alternative water source, such as a side-channel reservoir, may typically need to store the equivalent of 40 to 80 days of water use to be able to provide an uninterrupted supply of water during a 50-year drought.

Re-use of Effluent Discharges from Wastewater Treatment Plants

Wastewater of acceptable quality that is discharged by large municipal sanitary treatment plants can potentially serve as another source of water for mine-mouth power plants. In such situations, the wastewater, once treated, would presumably not be discharged into streams but piped to the mine-mouth plant for reuse. The primary benefits to such reuse are (1) there would be no need for a stream withdrawal, (2) the wastewater treatment plant would reduce its discharges, which may help the plant to better meet water quality requirements, and (3) there is the potential for environmental benefits to the stream through the reduction in the wastewater discharge.

Flow quantity data from monthly discharge reports, maintained in a database obtained from the Illinois Environmental Protection Agency, were examined to determine minimum flow amounts from each facility. Minimum 7-day effluent amounts were assumed to be equal to 80% of the minimum monthly effluent as reported over a 5-year period. Based on this assessment, six wastewater treatment facilities in southern and central Illinois should have sufficient effluent discharges to provide at least a 5 mgd water supply: Urbana-Champaign northeast plant,

Springfield Spring Creek plant, Bloomington-Normal plant, Decatur main plant, Danville plant, and Peoria plant. The estimated minimum discharge rates for these six facilities are given in table 6 and shown in figure 2.

Table 6. Estimated minimum 7-Day effluent discharge rates from large municipal wastewater treatment plants in southern and central Illinois.

<i>Treatment plant</i>	<i>Minimum effluent (mgd/week)</i>
Bloomington-Normal	12
Danville	8
Decatur main	21
Peoria	18
Springfield Spring Creek	12
Urbana-Champaign northeast	8

Groundwater Availability

The availability of large amounts of groundwater for mine-mouth facilities is very similar to the needs discussed by Smith and Stall (1975) in regard to groundwater availability for coal conversion. Therefore, the discussions of Smith and Stall (1975) are largely relied upon here, and the reader is referred to their report for additional information.

Only locations where groundwater conditions are very favorable can be considered for development for use by mine-mouth facilities. In Illinois, favorable conditions exist principally in areas where well yields are high (in excess of 500 gpm), where the aquifers are extensive and highly permeable, and where either the natural rate of recharge is high or water can be induced (by pumping of nearby wells) to flow from streams into hydraulically connected aquifers, a process called induced infiltration.

Conditions are not considered favorable for extensive groundwater development in areas where estimated wells yields are less than 500 gpm. Available geohydrologic data from such areas strongly suggest that an unreasonably large number of wells and well fields, placed with unusually small spacings, would be necessary to produce the large supplies of water needed for mine-mouth facilities.

Occurrence of Groundwater in Illinois

Groundwater availability in Illinois is largely affected by the geology of the state. Permeable rock formations such as sandstone, limestone, sand, and gravel serve as aquifers in which water is stored and ultimately supplied to wells. Impermeable beds, such as shale and clay, act as barriers to groundwater movement and maintain differences in pressure and quality between aquifers.

Groundwater in Illinois is commonly drawn (1) from unconsolidated deposits of sand and gravel in the glacial drift or in river valleys or (2) from bedrock formations of limestone or sandstone. The most favorable groundwater conditions are found in the northern third of the state, where dependable sandstone and limestone aquifers occur in the bedrock and extensive sand and gravel aquifers are found in the glacial drift. In most of the rest of Illinois, the only aquifers of high potential yield are sand-and-gravel deposits of the Mississippi, Illinois, Wabash, Kaskaskia, Embarras, and buried Mahomet River Valleys.

Groundwater from Sand and Gravel Aquifers

The distribution of sand and gravel aquifers and their estimated yields to individual wells are shown in figure 3. General areas are indicated where conditions are especially favorable for drilling wells with large yields. However, test drilling is required to locate satisfactory well sites because conditions vary from place to place.

Most of the areas in which conditions are favorable for drilling sand and gravel wells that will yield more than 500 gpm lie within major river valley systems. These systems include the Mississippi, Illinois, Ohio, and Wabash River Valleys, the buried Mahomet Valley in east-central Illinois, and several buried and surface valley systems in the northern third of the state. Large quantities of water are available from relatively shallow wells, many drilled to depths of less than 300 feet.

Groundwater from Bedrock Aquifers

Bedrock aquifers are most likely to be present in deep sandstones and shallow dolomites in the northern third of the state (figure 4). Because of their distance from available coal resources, these aquifers are generally not viable water sources for mine-mouth facilities. Limestones in Massac County in extreme southern Illinois may have development potential but will require extensive drilling and testing.

Selected Areas for Groundwater Development

Figure 2 shows 17 coded areas where water-well systems can be developed that are capable of yielding water for major supplies. In each region, a system of wells could be drilled, connected, and pumped together to produce the desired water supply. These areas were examined in detail by Smith and Stall (1975), and highlights are presented here. At that time, digital computer models or mathematical models, based on available hydrologic and geologic data, were constructed for each of the areas. Unfortunately, none of these models currently exists in ISWS historical files, and the Smith and Stall report is the principal record of model inputs and results. The models were used to determine the spacing of wells so that safe pumping levels could be maintained in a continuous pumping situation. Table 7 identifies the 17 areas by county, by the available supply, and by the source of the groundwater.

Table 8 gives the location of the 17 selected areas noted in table 5 and the major hydrogeologic properties of each area. The properties summarized in the table are relevant to the availability of groundwater. A high river infiltration rate, hydraulic conductivity, and thickness generally favor the conditions for pumping large quantities of groundwater. The river infiltration rates are a measure of the quantities of water that can be drawn from the river into the aquifer by pumping wells to supplement natural recharge and thus sustain the well field. The estimated river infiltration rates in Table 8 are based on a correlation study of known rates from hydrogeologically similar areas. The maintenance of low flows in the river was not considered in these groundwater availability estimates. The infiltration rates are expressed in gallons per day per acre of riverbed per foot of head difference between the head in the river and that in the aquifer (gpd/acre/ft). The hydraulic conductivity of the aquifer expressed in gallons per day per square foot of aquifer (gpd/ft²) is one measure of the rate of flow that the aquifer might transmit to a well. The hydraulic conductivity values were based on averages computed from pumping tests already conducted in each of the areas at the time of the Smith and Stall (1975) report and do not account for tests that may have been conducted since then.

All aquifers, except for those in areas 12 and 17, were assumed to be of a uniform thickness that was based upon the difference between known static water levels in the aquifers and estimated elevations of the bedrock at the base of the aquifers. Areas 12 and 17, the Havana Lowlands and the East St. Louis area, were modeled in some detail because data on aquifer thickness were available from previously published reports (Walker et al. 1965, Bergstrom and Walker 1965, Schicht 1965).

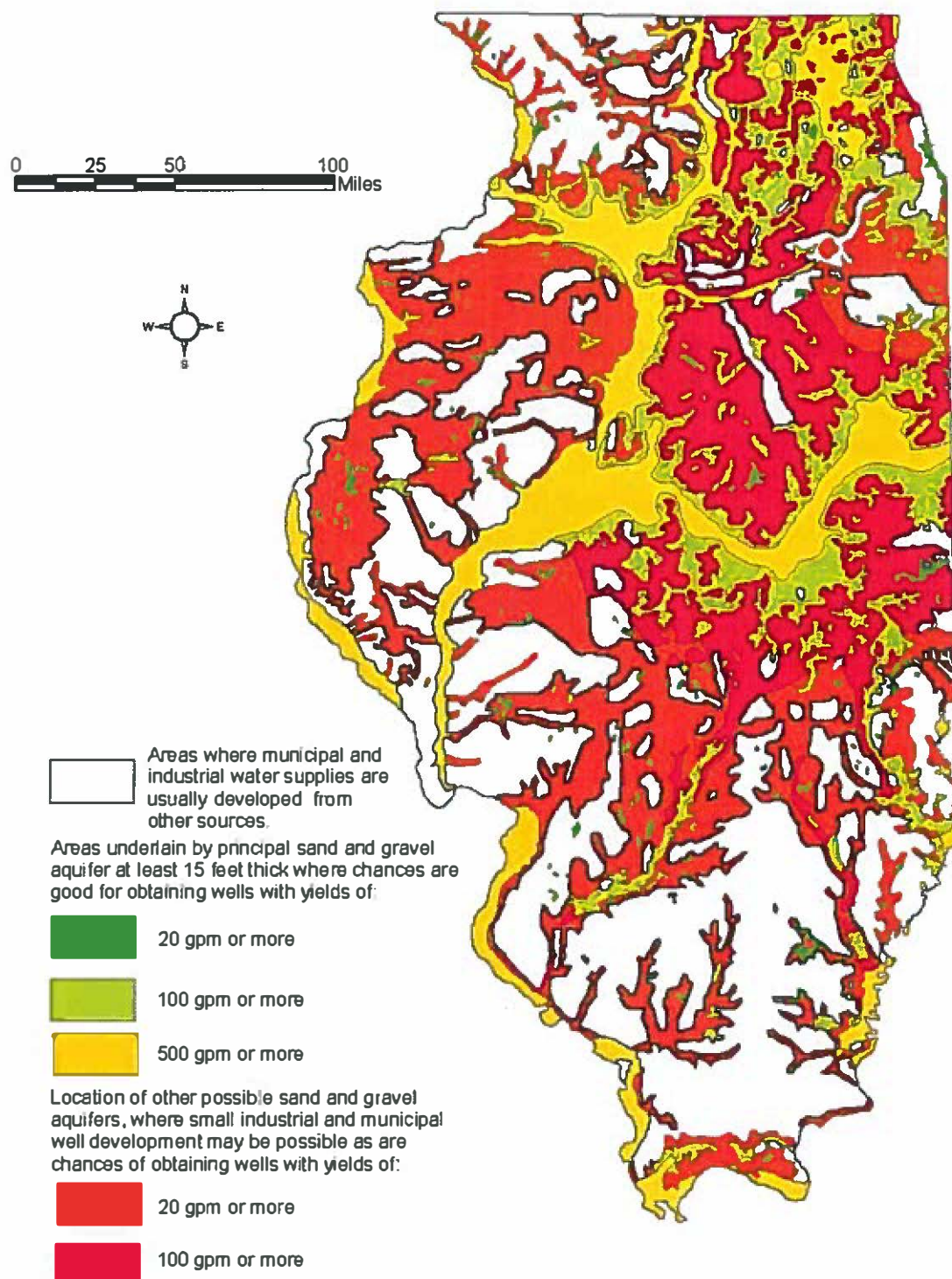


Figure 3. Statewide map showing estimated yields in individual wells in sand and gravel aquifers.

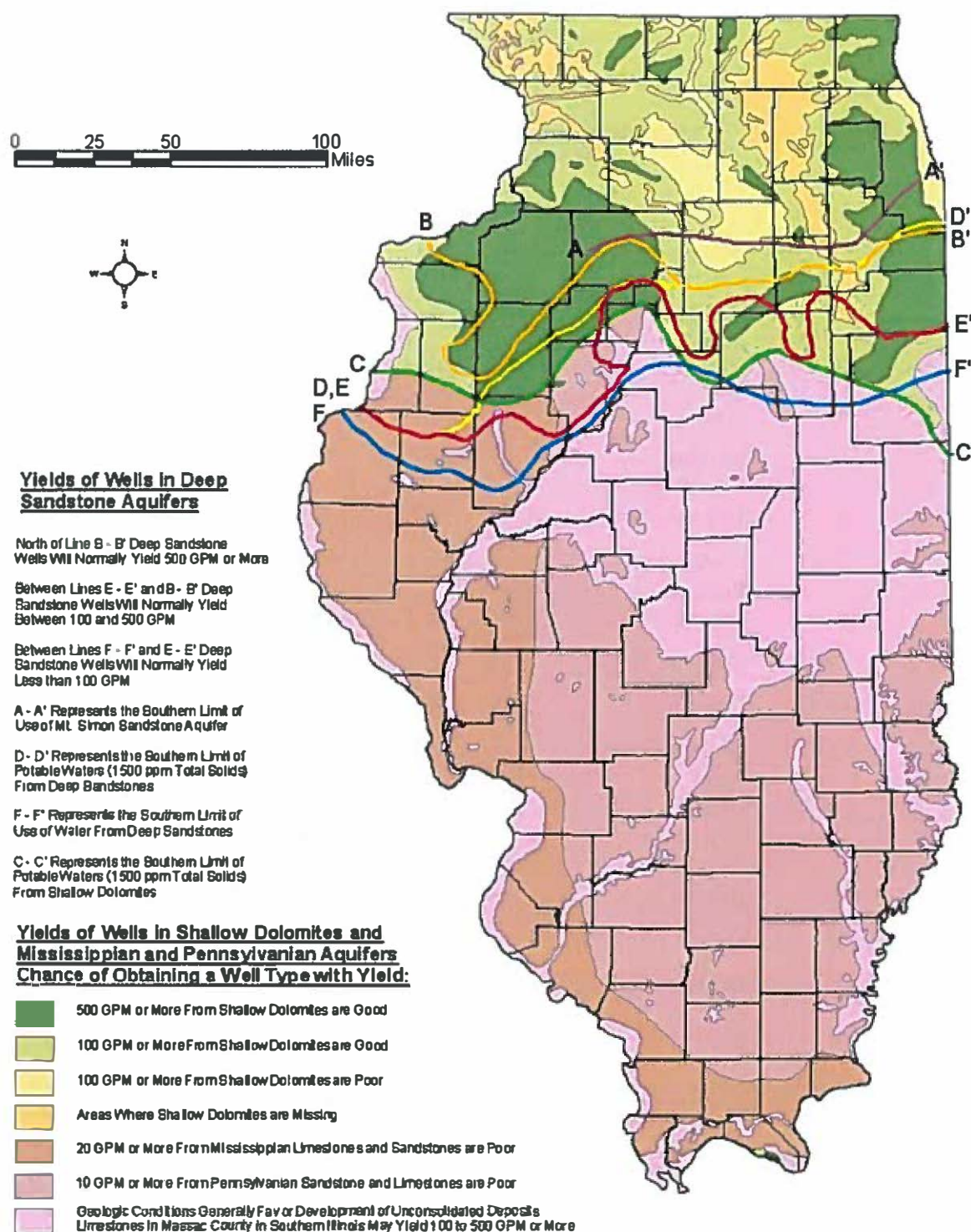


Figure 4. Statewide map showing yields of wells from bedrock aquifers.

Table 7. Water supplies available from groundwater*
(locations are shown in figure 2).

Location (fig. 2)	County	Amount (mgd)	Source
1	Carroll	14	Gravel near Mississippi River
2	Henderson, Mercer	14	Gravel near Mississippi River
3	Hancock	72	Gravel near Mississippi River
4	Pike	72	Gravel near Mississippi River
5	Monroe, Randolph	72	Gravel near Mississippi River
6	Jackson, Union	72	Gravel near Mississippi River
7	Alexander, Pulaski	72	Gravel near Mississippi River
8	Massac	28	Gravel near Ohio River
9	Gallatin, White	72	Gravel near Wabash River
10	Lawrence	28	Gravel near Wabash River
11	Greene, Jersey, Scott	72	Gravel near Illinois River
12	Mason	72	Gravel near Illinois River in Havana lowlands (Walker et al. 1965)
13	Bureau	72	Shallow glacial gravel
14	Ogle	72	Deep sandstone bedrock
15	De Witt, Piatt	72	Buried Mahomet Valley (Visocky and Schicht 1969)
16	Ford	72	Buried Mahomet Valley (Visocky and Schicht 1969)
17	Madison	28	East St. Louis area (Schicht 1965)

* From Smith and Stall (1975).

Table 8. Hydrogeologic properties of selected groundwater development sites*

Area on fig. 2	Location	Estimated river infiltration rate (gpd/acre/ft)	Estimated aquifer hydraulic conductivity (gpd/ft ²)	Estimated average aquifer thickness (ft)	General groundwater conditions
1	Along Mississippi River in Carroll County	450	2,700	100	Water table with induced infiltration from river
2	Along Mississippi River in Henderson County	450	3,500	100	Water table with induced infiltration from river
3	Along Mississippi River north of Quincy in Hancock County	22,500	3,500	100	Water table with induced infiltration from river
4	Along Mississippi River south of Quincy in Pike County	22,500	2,500	100	Water table with induced infiltration from river
5	Along Mississippi River between Valmeyer and Kaskaskia Island	45,000	2,000	90	Water table with induced infiltration from river
6	Along Mississippi River south of Grand Tower Island	45,000	1,800	110	Water table with induced infiltration from river
7	Along Mississippi River in southern Alexander County	45,000	2,000	125	Water table with induced infiltration from river
8	Along Ohio River in Massac County	45,000	2,500	70	Water table with induced infiltration from river
9	Along Wabash River in Gallatin County	22,500	2,000	95	Water table with induced infiltration from river
10	Along Wabash River in Lawrence County	22,500	3,000	85	Water table with induced infiltration from river
11	Along Illinois River centered in Greene County	22,500	2,000	110	Water table with induced infiltration from river

12	Havana lowlands, centered in Mason County	22,500	2,000 in east, 5,000 in west	150	
13	Princeton Valley in Bureau and Whiteside Counties	none	2,000	150	Water table
14	Deep sandstone area centered in Ogle County	none	23	800	
15	Along buried Mahomet Valley in DeWitt and Piatt Counties	none	2,120	120	Leaky artesian
16	Along buried Mahomet Valley in Ford and Iroquois Counties	none	2,500	150	Leaky artesian
17	East St. Louis area	45,000	2,500	80	Water table with induced infiltration from river

* From Smith and Stall (1975).

Inventory of Natural History Resources and Areas of Concern

The Illinois Natural History Survey (INHS) and the Illinois Department of Natural Resources (IDNR) provided GIS layers that identify potential areas of concern relating to siting a mine-mouth power plant. Details about each separate layer can be found under Appendix (Map Layers) below.

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Appendix (Map Layers)

Illinois County Boundaries

This is an Arc/Info polygon and Arc data set containing county boundaries in Illinois. County polygons are labeled with county names and FIPS designation. This data set was created to serve as base map information at scales of 1:62,500 or smaller.

Online linkage:

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/counties.e00>

Text (.txt) version of this Metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/counties.txt>

Illinois Township Boundaries

This is an Arc/Info polygon and Arc data set that contains township and range lines in Illinois. Individual townships are labeled with meridian, township, and range designations, and with x and y coordinates of the approximate section center point. This data set was created to serve as base map information at scales of 1:62,500 or smaller.

Online linkage:

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/townships.e00>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/townships.txt>

Illinois Municipal Boundaries

This is an Arc/Info polygon data set that contains municipalities with more than 250 people in Illinois. These data are appropriate for use in local and regional demographic analysis. Attributes include the name, FIPS code, and type of municipality. Boundaries are subject to change and should not be considered definitive. This data set was created to serve as base map information at scales of 1:100,000 or smaller.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/municipal90.e00>

Text (.txt) version of this Metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/municipal90.txt>

Coal Availability in Illinois

This is an Arc/Info polygon set that shows factors influencing the availability of coal for underground mining in Illinois. Data sets for both the Springfield and Herrin Coals are included.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/coalsec/coal/coalshapefiles.htm>

Text (.txt) version of this metadata file.

Contact Christopher Korose, 217-333-7256.

Groundwater Yields in Illinois

This is an Arc/Info polygon set that shows potential groundwater yield available in million gallons per day. Data for this coverage was obtained from "Coal and Water Resources for Coal Conversion in Illinois," Coop. Resources Report 4, p. 42–45. Additional questions regarding this layer should be directed to Mr. H. Allen Wehrmann, Illinois State Water Survey, 217-333-0493.

Online linkage

No downloadable data

Not currently available to public in this form

Surface Water Yields in Illinois

This is an Arc/Info data set that contains five different exchange files (.e00). Three of the files contain estimated yield values in million gallons per day (mgd). These files include point locations for wastewater treatment plant sites, low flow value sites, and from potential, new reservoir sites. Two additional coverages show the locations of existing reservoirs and major rivers. Additional questions regarding this layer should be directed to Mr. H. Vernon Knapp, Illinois State Water Survey, 217-333-4423.

Online linkage

No downloadable data

Power Transmission Lines in Illinois

This is a new Arc/Info data set that contains dashed lines showing locations of power transmission lines in Illinois. The student project members digitized these data using publicly available USGS 1:100,000 topographic maps as guides. Dates of these source maps are not uniform, thereby introducing possible errors. Data should not be used as a geodetic or engineering base. Additional questions regarding this layer should be directed to Mr. Steve Gustison, Illinois State Geological Survey, 217-244-9337.

Online linkage

No downloadable data

Pending release to public

Generalized Railroads in Illinois

This is an Arc/Info coverage of line features that represent the general railroad infrastructure in Illinois. This layer was recently acquired from the Interstate Commerce Commission, Division of Railroad Safety and all inquiries about this data should be directed to that agency at 217-782-7660.

Online linkage

No downloadable data

Coal-Burning Electric Power Plants

This is a new Arc/Info data set that shows locations of publicly owned, coal-burning, electric power plants along with the major coal-burning industrial and institutional plants listed as operating by Damberger (2001). Specific location information for each plant was derived from USGS 1:24,000 topographic maps. Additional questions regarding this layer should be directed to Mr. Scott Elrick, Illinois State Geological Survey, 217-333-3222.

Online linkage

No downloadable data

Pending release to public

Nature Preserves

This is an Arc/Info data set of polygons that depicts the nature preserves of Illinois, digitized from USGS 7.5 minute quadrangles. A nature preserve is an area of land or water in public or private ownership that is formally dedicated pursuant to the terms of the law, to be maintained in its natural condition. These areas can contain significant ecological, geological or archeological features. The original work on this data set was done in 1989 with an update completed in October, 1995, although metadata suggests updating every 1-2 years. These data are appropriate for use on local and regional thematic analysis but not official in the sense of determining the preserves boundaries. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/webdocs/st-naths.html>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/natarea.html>

Fish and Wildlife Area

This is an Arc/Info data set of polygons that depicts the State Fish and Wildlife Areas based on a list from Land and Water Report as of June 30, 1994 by the Illinois Department of Conservation. These areas were digitized from maps provided by DNR, County plat books, USGS TIGER files and 1:24000 quadrangle maps and assembled into a single coverage in December, 1995. Boundaries are approximate and do not indicate ownership or property boundaries. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/webdocs/st-naths.html>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/stfwa.html>

Conservation Area

This is an Arc/Info data set of polygons that depicts the State Conservation Areas based on data assembled from various sources in December 1995. These areas were digitized from maps provided by DNR, county plat books, USGS TIGER files and 1:24000 quadrangle maps. Boundaries are approximate and do not indicate ownership or property boundaries. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/webdocs/st-naths.html>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/stconsrv.html>

State Forest

This data set shows state forests in Illinois. These areas were digitized from maps in county plat books or from 1:24K quadrangle maps. Boundaries are approximate and do not indicate ownership or property boundaries. The Illinois Department of Conservation Land and Water Report of 30 June 1994 was used as a reference. Appropriate for use in local and regional thematic analysis. Data are not accurate enough to be used as a geodetic or engineering base. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/stforest.e00>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/stforest.txt>

State Park

This data set shows state parks in Illinois. These areas were digitized from maps provided by DNR, county plat books, USGS TIGER files, and 1:24,000 quadrangle maps. Boundaries are approximate and do not indicate ownership or property boundaries. The Illinois Department of Conservation Land and Water Report of 30 June 1994 was used as a reference. Appropriate for use in local and regional thematic analysis. Data are not accurate enough to be used as a geodetic or engineering base. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/stparks.e00>

Text (.txt) version of this metadata file.

<http://www.isgs.uiuc.edu/nsdihome/outmeta/stparks.txt>

Natural Area Inventory

Illinois Natural Areas Inventory (INAI) sites in Illinois, digitized from USGS 7.5 minute quadrangles or from aerial photographs. The INAI is a statewide inventory of outstanding examples of natural landscape features remaining in Illinois including high quality natural communities, specific suitable habitat of endangered and threatened (E&T) species, state-dedicated nature preserves, outstanding geological features, natural community revegetation, restoration and/or E&T species translocations, unusual concentrations of flora and/or fauna, and high quality aquatic systems. On-line access to this data set is not currently available. You may FAX or mail us a request for a copy of the data, which will require a data license agreement. Include a brief description of yourself, your project and the intended data use as well as maps/descriptions of the area of coverage you desire. Direct your request to the attention of Patti Malmberg Reilly: 217/785-8774 or 217/785-2438 (FAX), preilly@dnrmil.state.il.us.

Online linkage

Restricted downloadable data, see above for contact information

No public release of data

Federal Land

This data set shows federal lands in Illinois. These areas were digitized from maps provided by USFWS, county plat books, and 1:24,000 quadrangle maps. Boundaries are approximate and do not indicate ownership or property boundaries. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Downloadable data

<http://www.isgs.uiuc.edu/nsdihome/browse/statewide/fedland.e00>

Text (.txt) version of this metadata file

<http://www.isgs.uiuc.edu/nsdihome/outmeta/fedland.txt>

100 Year Floodzone

The 55 year, 100 year and 500 year floodzones for the unincorporated areas as indicated on the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (FIRM) maps and Flood Hazard Boundary maps were digitized from paper maps. The composite statewide data was created by combining the individual county data sets. Areas where vectors overlapped or snapped to the wrong node were corrected and the coverage built. Additional questions regarding this layer should be directed to Mr. Kingsley Allan, Illinois State Water Survey, 217-333-4952.

Online linkage

Downloadable data, by county datasets

<http://www.isgs.uiuc.edu/nsdihome/webdocs/county.html>

Text (.txt) version of this metadata file

<http://www.isgs.uiuc.edu/nsdihome/outmeta/fldzones.txt>

Resource Rich Watersheds

Watersheds, as identified by the Illinois Environmental Protection Agency (IEPA), were used as the geographic unit for evaluation and analysis of resource rich areas. These watersheds have the advantage of being an ecologically identifiable unit and are important administratively within the state. The boundaries for this layer were derived directly from the watershed boundaries.

Watersheds were evaluated on an equal weighted basis using the following variables: 1. Forest – percent of the watershed, 2. Wetlands, percent of the watershed, 3. Illinois Natural Areas Inventory – total area, and 4. Biologically Significant Streams, total length. Additional questions regarding this layer should be directed to Illinois Natural History Survey, 217-244-2160.

Online linkage

Restricted downloadable data, see above for contact information

No public release of data

Distribution Liability

The Illinois Department of Natural Resources (IDNR) provides these geographic data “as is.” The IDNR makes no guarantee or warranty concerning the accuracy of information contained in the geographic data. ISGS, ISWS and the INHS further makes no warranties, either expressed or implied as to any matter whatsoever, including, without limitation, the condition of the product, or its fitness for any particular purpose. The burden for determining fitness for use lies entirely with the user. Although these data have been processed successfully on computers of IDNR, no warranty, expressed or implied, is made by ISGS regarding the use of these data on any other system, nor does the fact of distribution constitute or imply any such warranty.

In no event shall the IDNR have any liability whatsoever for payment for any consequential, incidental, indirect, special, or tort damages of any kind, including, but not limited to, any loss of

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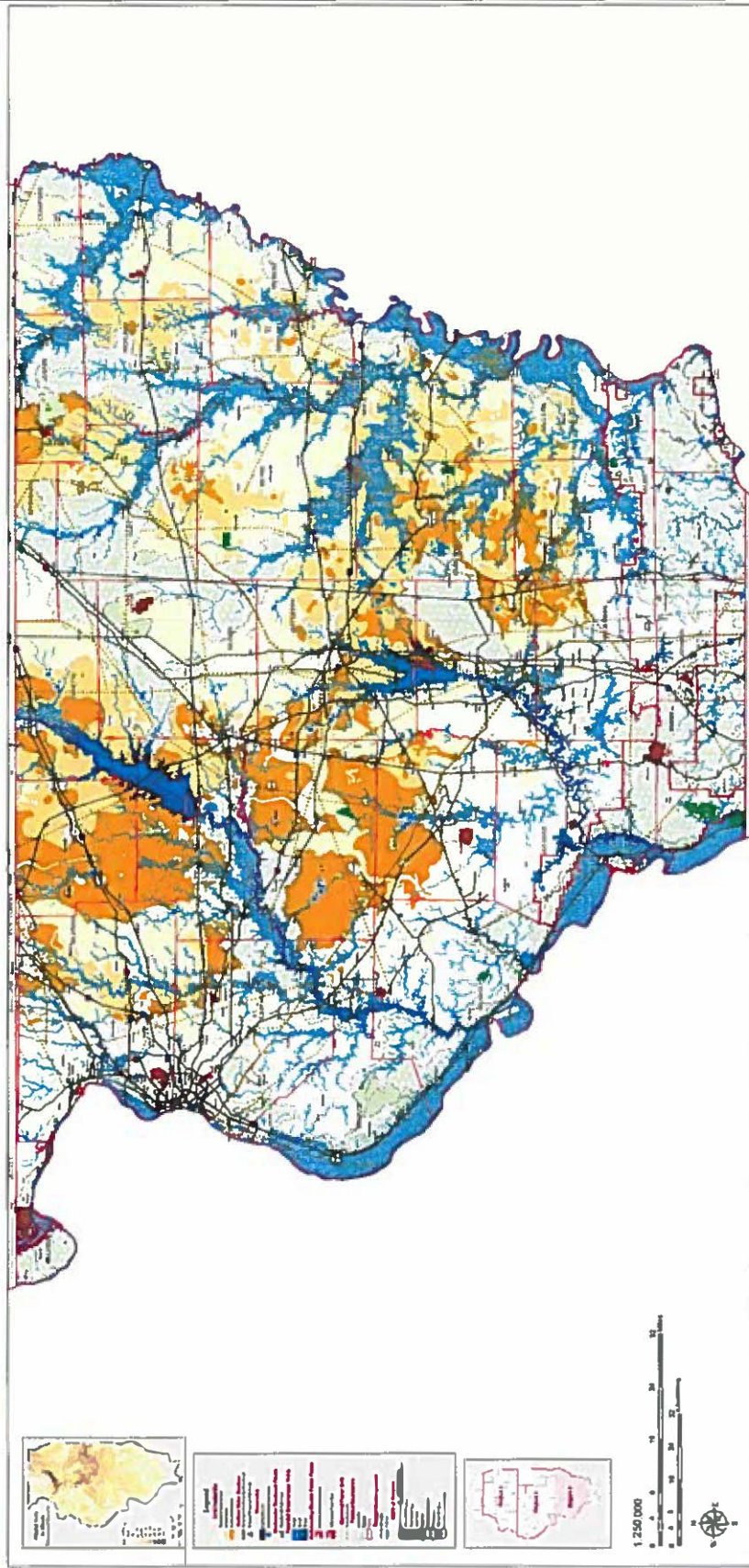
Acknowledgments

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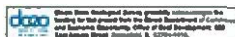


A Guide to Coal Availability and Resource Development in Illinois

Steven R. Gustison, Philip M. Johannek, Robert J. Finley, Illinois State Geological Survey

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A Guide to Coal Availability and Resource Development in Illinois Springfield (No. 5) Coal



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Abstract: This report provides a comprehensive overview of the coal resources of Illinois, with emphasis on the Springfield (No. 5) coal. The report includes a description of the coal resources of Illinois, a map of the coal resources of Illinois, and a table of the coal resources of Illinois. The report also includes a description of the coal resources of Illinois, a map of the coal resources of Illinois, and a table of the coal resources of Illinois.

Introduction: The coal resources of Illinois are one of the most important natural resources of the state. Coal is a fossil fuel that is used to generate electricity and to produce steel. The coal resources of Illinois are located in the central and southern parts of the state. The coal resources of Illinois are one of the most important natural resources of the state.

Geology: The coal resources of Illinois are located in the central and southern parts of the state. The coal resources of Illinois are one of the most important natural resources of the state.

Coal Resources: The coal resources of Illinois are one of the most important natural resources of the state. The coal resources of Illinois are one of the most important natural resources of the state.

Coal Availability: The coal resources of Illinois are one of the most important natural resources of the state. The coal resources of Illinois are one of the most important natural resources of the state.

Coal Development: The coal resources of Illinois are one of the most important natural resources of the state. The coal resources of Illinois are one of the most important natural resources of the state.

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