IOWA-CEDAR

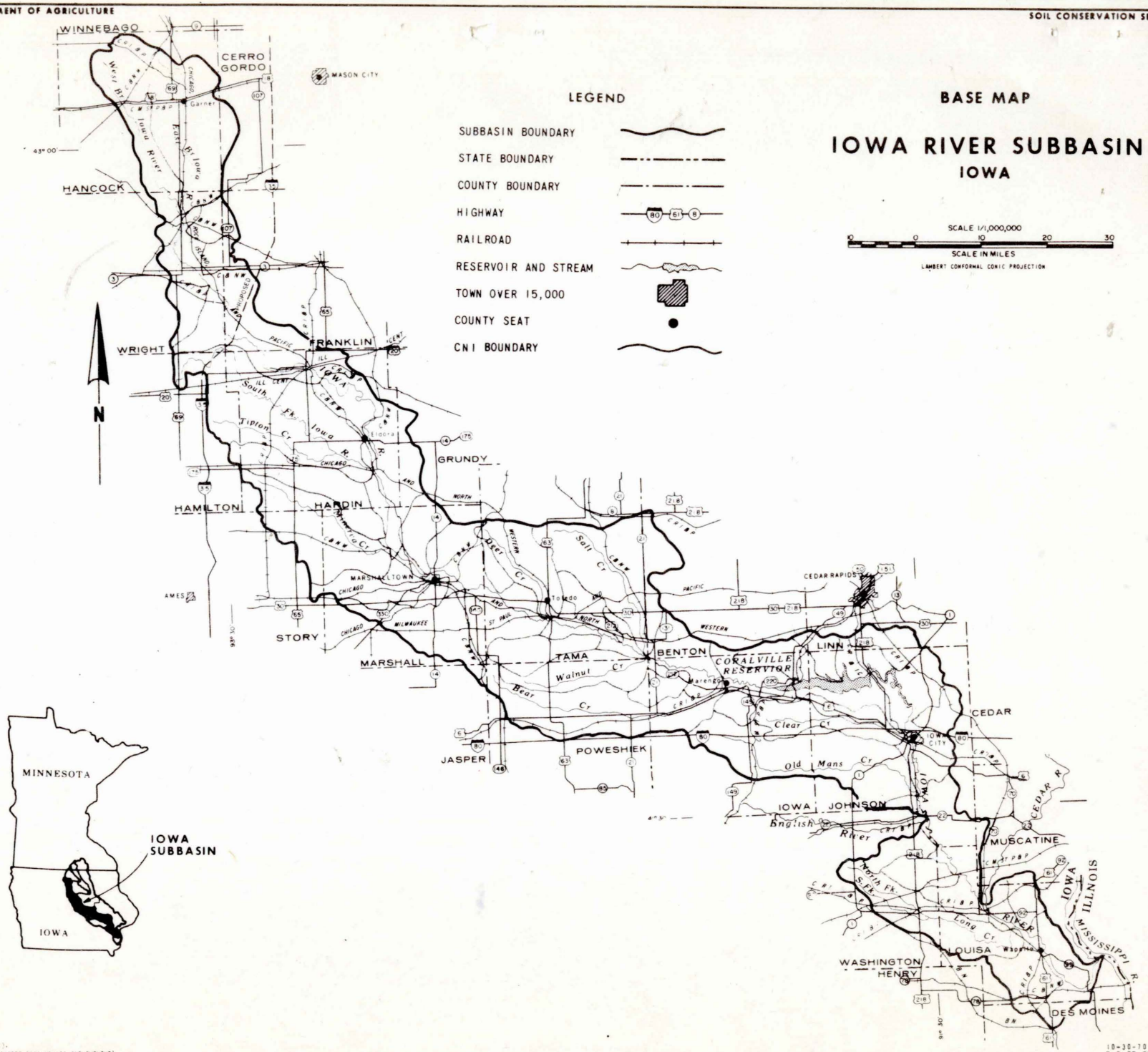
RIVERS BASIN STUDY

INVENTORY REPORT
IOWA RIVER SUBBASIN

U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Economic Research Service
Forest Service

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



SOURCE:
U.S.G.S. 1:500,000 BASE MAP (IOWA).
U.S.C.G.S. 1:500,000 AERONAUTICAL CHARTS (DES MOINES AND DUBUQUE).

10-30-70
5-0-28,278.1

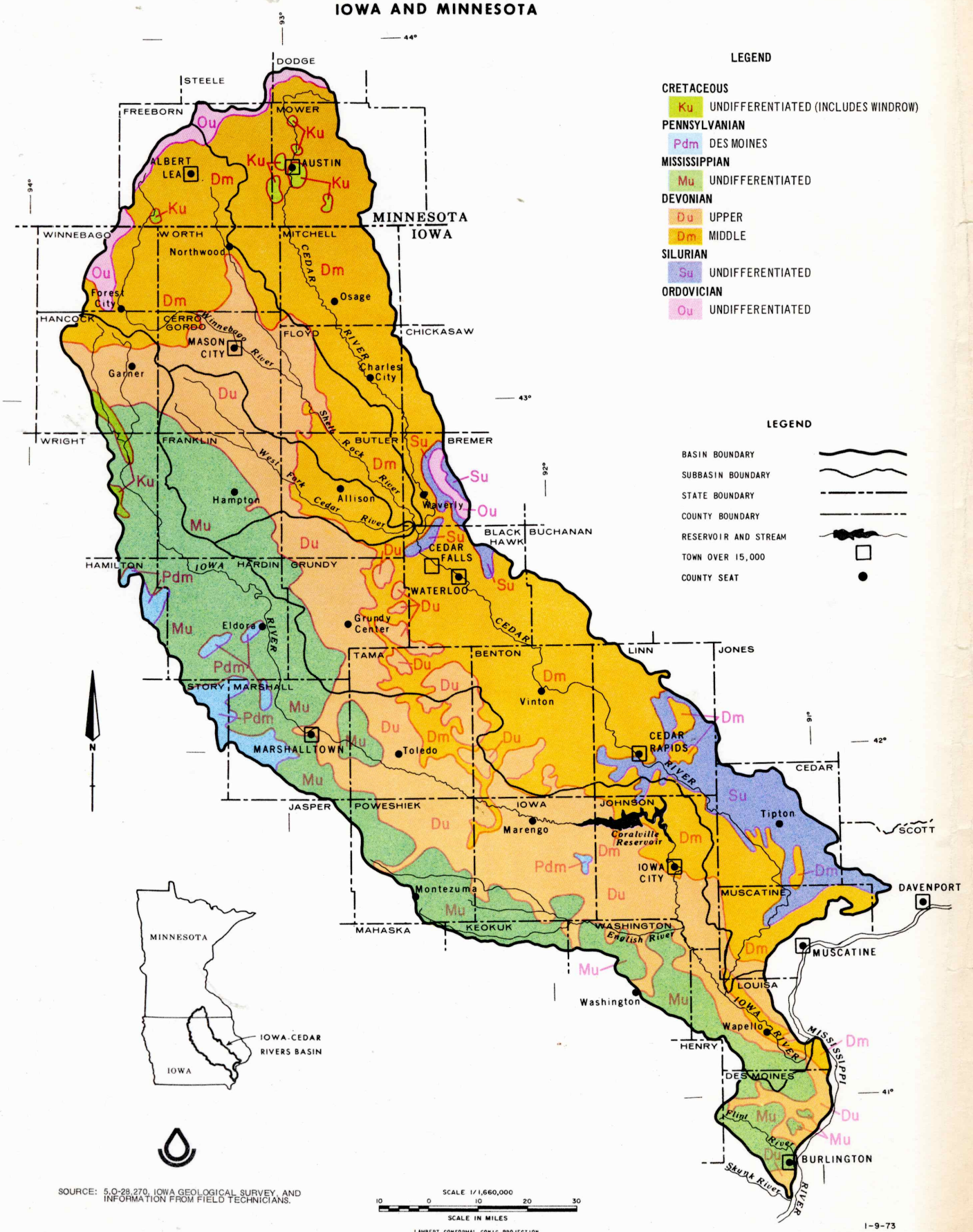
USDA SCS-LINCOLN, NEBR. 1970

Figure 1

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

BEDROCK MAP
IOWA-CEDAR RIVERS BASIN
IOWA AND MINNESOTA



SOURCE: 5,O-28,270, IOWA GEOLOGICAL SURVEY, AND INFORMATION FROM FIELD TECHNICIANS.

USDA-SCS-LINCOLN, NEBR. 1973

1-9-73

5,P-31,095

INVENTORY REPORT

IOWA RIVER SUBBASIN
Iowa-Cedar Rivers Basin

I. DESCRIPTION

A. Drainage Area

The Iowa River begins at the junction of the East Branch and West Branch at Belmond in Wright County. It flows in a generally southeast direction into the Mississippi River between Muscatine and Burlington, Iowa (Figure 1). The Iowa River Subbasin lies entirely within the state of Iowa. At Fredonia, about 30 miles upstream from its mouth, the Iowa is joined by the Cedar River. The Iowa River Subbasin drains 4,818 square miles, or 3,083,520 acres.

The Subbasin has a long, narrow shape which is characteristic of other streams in the eastern part of the State. The Subbasin has a maximum width of about 40 miles with an average width of 20 miles.

Excluding the Cedar River, other streams tributary to the Iowa are generally short in length and have relatively small drainage areas. The English River is an exception draining 638 square miles. Other tributaries with drainage areas larger than 200 square miles are Old Mans Creek, Bear Creek, Salt Creek, and the South Fork of the Iowa River.

B. Climatic Data

The climate of the Subbasin is typical continental. At the northern part of the Subbasin, the average annual temperature is about 47° F. The frost-free growing season averages 148 days. In the southern part, the average annual temperature is 51° F. and the frost-free growing season is 179 days.

In the north, the average annual precipitation is 30 inches and the mean snowfall is about 38 inches. In the south, the precipitation averages 35 inches and snowfall 26 inches.

C. Economy

The 1970 population of the Iowa Subbasin was 210,000. Of this, 68 percent, or 142,000 persons reside in urban areas. Ten percent, or 21,000 persons are rural non-farm residents. There are 22 percent, or 47,000 of the total population classified as living on farms.

The Subbasin makes up 37 percent of the total Iowa-Cedar Rivers Basin and has 25 percent of its population.

INVENTORY REPORT

IOWA RIVER SUBBASIN

Errata Sheet

Page 39 - Delete the last sentence of the last paragraph.

Page 46 - Location of sites should be corrected:

Site No.	Sec	Twp	Range
52-26	15	81N	7W
52-28	32	78N	6W
52-29	20	78N	6W

Pages 48 & 49 - Township and range numbers for Marshall County reversed.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
823 Federal Building, Des Moines, Iowa 50309

Mr. William H. Greiner
Chairman
Iowa-Cedar Rivers Basin Coordinating Committee
Grimes Building, E. 14th and Grand Avenue
Des Moines, Iowa 50319

Dear Mr. Greiner:

The cooperating Federal and State agencies have been accumulating data for various subbasins within the Iowa-Cedar Rivers Basin since the beginning of the river basin study. Much of this data and information is useful to local decision makers in its present form. We have summarized this data in report form and are furnishing to you an Inventory Report for each subbasin.

The Inventory is not a finished report. It is merely a collection and summarization of data from many sources. We, the cooperating agencies, have recommended no action in this report.

We do not recommend widespread distribution of the Inventory Reports. We do feel that the reports will be useful to local units of government, planning agencies and others who need resource inventory information on which to base land use decisions.

Copies are being furnished so that you may make distribution as you see fit within the subbasin areas.

Sincerely,

Kenneth G. McManus
actg.

Wilson T. Moon
State Conservationist
Chairman
USDA Field Advisory Committee

Agriculture, wholesaling and retailing, and manufacturing are the three largest sources of employment in the Subbasin (Table 6). Agriculture, the largest employer, decreased 23 percent between 1950 and 1960. Wholesaling and retailing, the next largest employer, increased 9 percent during this period. Manufacturing, ranked third in employment, but increased 56 percent from 1950 to 1960. Finance, insurance and real estate were up by one-fifth as a category during this time period, while transportation, utilities and construction remained about constant.

Family income in the Subbasin is distributed as follows:

Income Category	Iowa River Subbasin Percent	Iowa-Cedar Rivers Basin Percent
Less than $3,000	29	27
$3,000 to $10,000	62	63
More than $10,000	9	10

The total number of farms declined from 15,872 farms in 1950 to 11,186 in 1970, a 30 percent decrease.

Livestock farms, other than dairy or poultry, are the largest group and represented 25 percent of the farms in 1965 compared to 66 percent in 1950. The decline in actual number of farms classified in this category was 4,009 farms or 38 percent from 1950. Poultry farms also decreased 45 percent over this period but dairy increased 55 percent.

Cash grain farms have increased from 1,959 farms in 1950 to 3,022 farms in 1965. This represents a 54 percent increase and a change from 12 to 25 percent of the total number of farms.

Farms classified as other farms increased from 904 to 1,132 farms, an increase of 25 percent between 1950 and 1965. This category increased from 6 to 9 percent of the total number of farms.

Average farm size in the Subbasin was 237 acres in 1970, an increase of 53 acres per farm from 1950. The 1970 average value of land and buildings in the Subbasin is approximately $433 per acre. This represents a value of $103,000 in land and buildings for each farm.

The trend in the Subbasin in farm tenure from 1950 to 1970 has been decreased in the percentage of full owners and tenants, and an increase in the percentage of part owners (Table 1).

In 1950, full owners accounted for 45 percent of the farm tenure. This increased to 48 percent of the farm tenure in 1970. At the same time the percentage of part owners has increased from 16 percent in 1950 to 26 percent in 1970. This may be explained by the consolidation of farm units and capital accumulation. The number of tenants has dropped 53 percent during this 20 year period and has dropped from 39 to 25 percent of total tenure.

TABLE 1 - FARM TENURE - 1950-70
Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Numbers)

Year	Full Owners	Part Owners	Managers	Tenants	Total
1950	7137	2512	69	6155	15873
1954	6783	2522	45	5869	15219
1960	5985	2666	43	5293	13987
1964	5327	2849	45	4025	12246
1970	5396	2916	--	2874	11186

Source: United States Department of Commerce. Bureau of Census, Agriculture Census: 1950, 1954, 1959, 1964 and 1970.

Crop and livestock sales in the Subbasin total $208 million in 1970 (Table 2). Livestock and livestock product sales accounted for 75 percent of crop and livestock sales by farmers in the Subbasin. This share of total sales was down from 83 percent in 1950. Receipts from dairy products have remained constant in actual numbers but has dropped from 7 to 4 percent of total livestock sales. Receipts from poultry and poultry products have declined sharply both in actual numbers and as a share of total livestock sales. Other livestock and livestock products sales have increased both in numbers and as a share of total livestock sales -- increasing from 84 to 94 percent of livestock sales.

Crop sales have tripled during the period 1950-70. Field crops are by far the largest source of crop receipts accounting for 98 percent in 1950 and 1970.

The use of commercial fertilizers and agricultural chemicals in recent years has been one means by which the farmer could increase production without expanding the size of operation. These factors have helped to make expenditures for fertilizers and chemicals a very important input to agriculture. The amount of fertilizer used in the Subbasin has more than doubled between 1955 and 1970 (Table 3), although the number of farms has declined. The use of lime decreased by 7 percent for this period.

The use of herbicides and insecticides has become increasingly more important to the agriculture industry. The use of chemicals is expected to be more extensive in the future. Prior to 1964, census data are not available, but the use of chemicals to control insects has doubled between 1964 and 1969. Chemical control of weeds during this period is up almost 60 percent.

The wood-using industries in the Subbasin, while not extensive, contribute to the total economy of the area through increased employment, income, and expenditures.

Thirteen sawmills, producing over nine million board feet annually, are located within the Subbasin. Also, several other large mills are located adjacent to the Subbasin and utilize hardwood timber resources growing in the Subbasin

In addition to these primary wood-using mills, there are twelve secondary plants located inside the subbasin including six furniture and cabinet plants, four pallet plants, one producer of agricultural structures, and one crate manufacturer. Several of the furniture plants are known at least regionally for their fine custom-made walnut and cherry furniture.

TABLE 2 - CROP AND LIVESTOCK SALES
Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Dollars)

	1950	1955	1960	1965	1970
Crop sales	24,256	34,226	38,642	61,874	75,040
Grains	24,252	35,782	38,074	61,480	73,233
Field seeds & roughage					1,842
Other crops					128
Vegetables	243	129	153	143	154
Fruit, nuts, & berries	52	34	69	38	40
Nursery & greenhouse	262	226			202
Forest products	48	54	346	213	178
Livestock sales	115,572	123,995	158,687	155,253	221,990
Poultry & poultry products	10,334	8,186	8,909	8,786	5,295
Dairy products	8,196	7,447	8,377	9,888	8,162
Dairy cattle & calves					3,325
Other cattle & calves					109,798
Hogs, sheep, & goats					95,165
Other livestock & products					245
Livestock & livestock products other than dairy	97,041	108,362	141,402	136,579	208,533

Source: U. S. Department of Commerce, Bureau of Census, Agriculture Census: 1950, 1954, 1959, 1964, 1969

TABLE 3 - FERTILIZER AND LIME USED ON FARMS
Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Number)

	1955	1960	1965	1970
Fertilizer				
Number of farms	7,773	7,005	8,797	7,430
Amt. in tons	45,070	48,745	76,666	132,863
Amt. applied in tons	481,654	537,210	719,677	792,854
Lime				
Number of farms	3,491	1,547	2,246	1,728
Amt. in tons	181,037	93,953	169,083	169,154
Area applied in acres	85,383	42,539	71,095	72,911
Agricultural chemicals				
Control of crop insects (acres)			193,786	392,698
Control of weeds, grass, and brush (acres)			399,448	634,911
Control of livestock insects (farms)			6,407	2,412

Source: U. S. Department of Commerce, Bureau of Census, Agriculture Census: 1954, 1959, 1964, 1969

The total annual timber harvest from forest land within the Subbasin includes the following:

Sawlogs and veneer logs	169,000 board feet
Pulpwood	8,695 cords
Fence posts	10,859 number
Firewood and fuelwood	3,626 cords
Christmas trees	189 number

Additional markets for low-quality hardwoods and wood residues are needed for better management and utilization of the forest resource.

D. Physiography and Geology

The Iowa River has its origins in the lakes and ponds of the recently glaciated and poorly drained plains of north-central Iowa. At Belmond, in northern Wright County, the river acquired its formal name at an elevation of approximately 1,200 feet, and in a terrain very nearly as it existed when the Wisconsin age glacial ice melted from the area. The Iowa River leaves the bouldery glacial till and the "knob and kettle" topography of the glacial end moraines in Hardin County. From there to Johnson County, the river valley traverses the rolling, dissected terrain of the Kansan age glacial materials. The terrain of this area no longer bears any resemblance to its glacial origins, for it is well drained and dissected by stream erosion. The underlying glacial tills are weathered and a thick mantle of wind-blown silt, called loess, caps the uplands and side slopes. In Johnson County, the Iowa River valley flares into the broad, flat plains of extinct Lake Calvin. This topographic lowland with its broad floodplains and terraces, sand dunes, and backwater sloughs, is underlain by water-deposited clay, silt, sand, and gravel. Within the Lake Calvin basin in northern Louisa County, the Iowa receives the tributary drainage of the Cedar River. The Iowa River valley then continues on through the loess-covered and stream-dissected glacial drift of Illinoian age, coming shortly to its confluence with the Mississippi River in southern Louisa County at an elevation of 540 feet.

The terrain through which the Iowa River passes was derived from glacial activity and the subsequent stream erosion of the unconsolidated materials left by the ice. However, beneath these deposits of loess, till, sand and gravel, lies an irregular bedrock surface, occasionally outcropping in the valley sides where stream erosion has progressed deep enough to permit exposure. The bedrock formations encountered along the Iowa valley are dominantly limestones, dolomites, and shales belonging to the Pennsylvanian, Mississipian, and Devonian Systems. The younger Pennsylvanian and Mississipian formations underlie the northwestern portion of the river valley, and the older formations of Upper and Middle Devonian age underlie the southeastern portions of the Iowa valley. Isolated remnants of coal-bearing strata occur in the areas underlain by the Pennsylvanian outliers, primarily in Hardin and Marshall Counties. Limestone quarries are developed in the carbonate rocks of the Mississipian and Devonian formations throughout the area. These carbonate rocks are also fractured and creviced, and

may produce high yields of groundwater for municipal and individual wells. Sand and gravel pit operations also tap the sand and gravel resources found in glacial drift or in the alluvial materials of the river floodplain and terraces.

E. Land Resources

The total land and water area of the Subbasin is 3,083,520 acres. The following tabulation shows the total land use distribution.

Land Use	Acres	Percent
Cropland	2,390,560	77
Pasture	280,300	9
Forest	141,170	5
Other	80,710	3
Urban	156,330	5
Federal	27,270	1
Water	7,180	*
	3,083,520	100

* Less than 1 percent

A total of 2,892,740 acres is in cropland, pasture, forest, or other uses. There are 2,448,986 acres in Land Capability Classes I, II, and III which are suitable for regular cultivation (Table 4 and Figure 2). Nearly 88 percent of this land, 2,145,307 acres, is being cultivated. Urban and Federal land and water areas are not included in this total.

About 226,792 acres of the land in Classes I, II, and III are in pasture and woodland. Some of this acreage would be available, if needed, for crop production, but much of it requires clearing, draining or other improvement to fit the land for cultivation. Some of this land is located in small or irregular areas which cannot be farmed efficiently with modern machinery. It would not be economically feasible in the foreseeable future to bring many of these small areas into cultivation. Operating farm units usually need a reasonable amount of pasture and woodlots, even on soils suitable for more intensive cultivation.

An area of about 380,526 acres, or 13 percent, is high quality Class I land with a minimum of problems as far as erosion, drainage, and continuing use are concerned. About 90 percent of this acreage is being cultivated. The 2,068,460 acres in land Classes II and III require moderate to intensive treatment for protection, improvement, and continuing production. About 87 percent of this acreage is being cultivated.

There are 132,781 acres in Class IV land suitable for limited or occasional crop production with intensive conservation treatment. Much of it is considered marginal for the common cultivated crops but is suitable for other uses. Nearly three-fourths of this land is being presently cultivated.

TABLE 4

LAND CAPABILITY CLASSES BY LAND USE INVENTORY ACRES[1/]
Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Thousand Acres)

Class	Cropland	Pasture	Forest	Other	Total
I	342,579	25,469	4,802	7,676	380,526
II	1,086,288	93,553	27,615	37,409	1,244,865
III	716,440	57,045	18,308	31,802	823,595
Total I-III	2,145,307	176,067	50,725	76,887	2,448,986
IV	101,676	23,743	6,357	1,005	132,781
Total I-IV	2,246,983	199,810	57,082	77,892	2,581,767
V	7,857	19,136	33,221	-	60,214
VI	92,820	32,740	15,800	1,407	142,767
VII	42,900	28,614	35,067	1,411	107,992
VIII	-	-	-	-	-
Total V-VIII	143,577	80,490	84,088	2,818	310,973
TOTAL	2,390,560	280,300	141,170	80,710	2,892,740

Total geographic area 3,083,520 acres; total land area 3,076,340 acres; total water area 7,200 acres.

1/ USDA Conservation Needs Inventory, 1967.

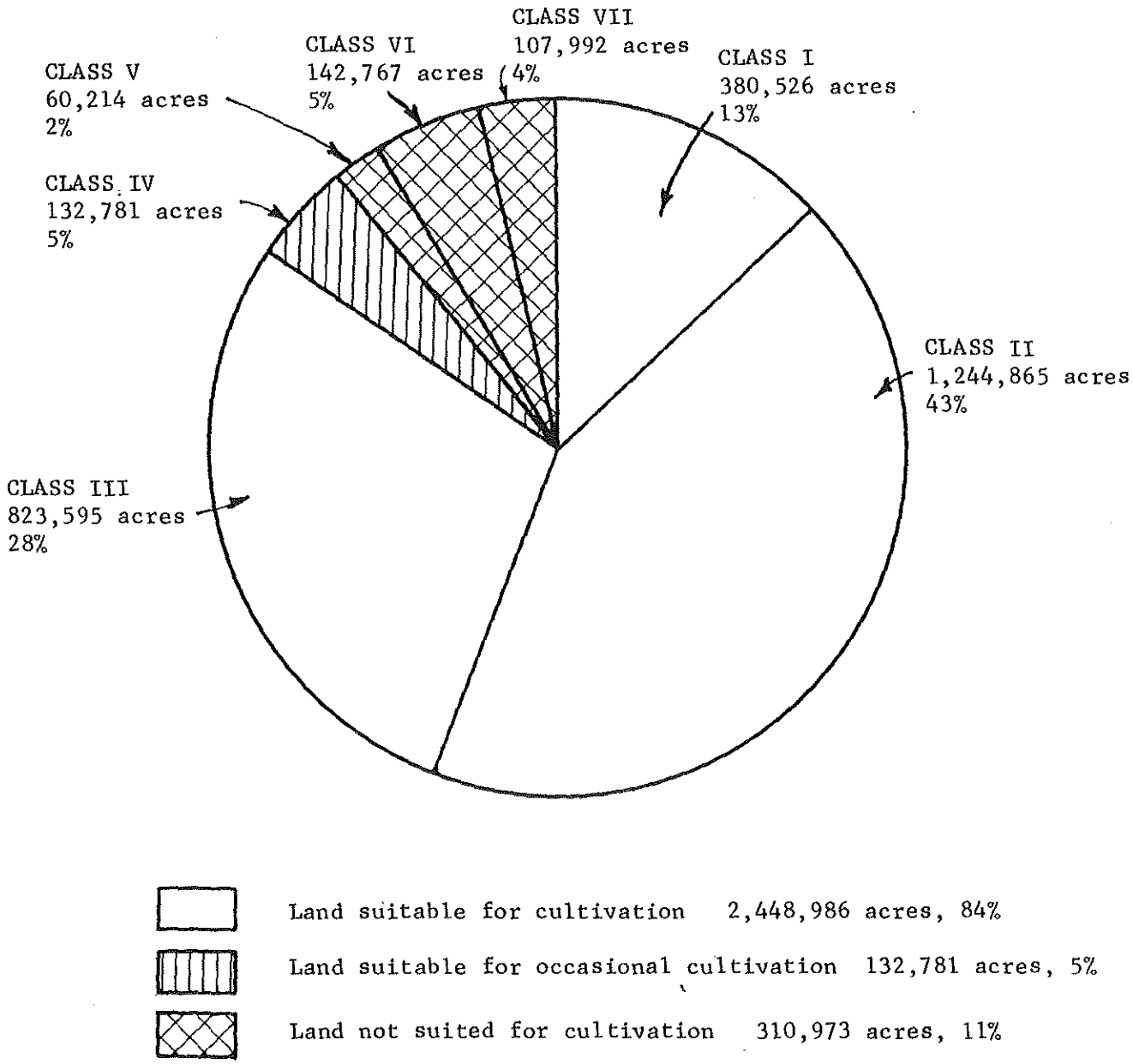


Figure 2
LAND CAPABILITY CLASSES

IOWA RIVER SUBBASIN

Almost nine percent is in Classes VI and VII. About 144,000 acres in these classes being used as cropland are unsuited for cultivation. There are 310,973 acres in Classes V, VI, and VII.

Comprising 5 percent of the total Iowa River Subbasin area, forest land encompasses 141,170 acres. A variety of native hardwood species occur within the bottomland and upland areas of the Subbasin. Most of the forest area bears mixtures of oak and hickory or elm, ash, and cottonwood. Eastern red cedar, growing primarily on drier sites in association with several of the oaks and hickories, is an occasional tree within the forest area.

Over 95 percent of the forest land is in private holdings--primarily small individual woodlots. The remainder is essentially state and local government tracts.

F. Water Resources

Surface Water

The average annual runoff varies from 5.5 inches in the north to 7.9 inches near the outlet, with an overall average for the Iowa-Cedar Basin of 6.8 inches.

One major reservoir has been installed on the Iowa River near Coralville. The normal summer conservation pool of the Coralville reservois is 4,900 acres. There are an additional 2,280 acres of surface water scattered throughout the Subbasin. The largest natural lake is the Eagle Lake wildlife area in Hancock County with over 900 acres surface area.

The Iowa River, from Alden to Eldora, is one of the more scenic canoeing streams of the Subbasin. In this reach the river is bordered by steep, timber covered bluffs. This scenic corridor is in sharp contrast to the adjacent, nearly level cropland.

Table 5 describes the availability of the surface water resource at various gaging stations within the basin.

Ground Water

Precipitation falling on the surface and percolating into the soil and bedrock formations is the source of groundwater in the Iowa River Subbasin. Most of the water falling on the surface runs off in streams or is evaporated into the atmosphere. Part of the water that soaks into the ground is withdrawn later by evaporation and by transpiration of plants. Only a relatively small portion of the precipitation seeps down to the water table and recharges the groundwater reservoir. Some water moves into and out of the Subbasin area by underflow through deep bedrock formations.

TABLE 5

WATER RESOURCE AVAILABILITY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

Average Discharge 2/		Station Description	Drainage Area	Flow Availability 1/ Cfs Percentage of Time Equaled or Exceeded					
				50% Chance		95% Chance		99% Chance	
cfs	inch		sq. mi.	cfs	csm	cfs	csm	cfs	csm
185	5.85	Iowa River near Rowan	429	59	0.138	9.7	0.023	5.0	0.012
726	6.30	Iowa River at Marshalltown	1564	330	0.211	46	0.029	24	0.015
57.7	6.64	Timber Creek near Marshalltown	118	18	0.153	0.8	0.007	0.36	0.003
29.3	7.09	Richland Creek near Haven	56.1	8	0.143	0.3	0.005	0.18	0.003
115	7.76	Salt Creek near Elberon	201	40	0.199	5.3	0.026	3.4	0.017
36.5	6.99	Walnut Creek near Hartwick	70.9	9.2	0.130	0.14	0.002	-	-
1159	6.41	Iowa River near Belle Plaine	2455	520	0.212	70	0.029	38	0.016
107	7.68	Big Bear Creek at Ladora	189	32	0.169	1.4	0.007	0.32	0.002
13.6	7.29	Rapid Creek near Iowa City	25.3	3.8	0.150	-	-	-	-
51.8	7.17	Clear Creek near Coralville	98.1	13	0.133	0.74	0.008	0.37	0.004
1.53	6.90	Ralston Creek at Iowa City	3.01	0.29	0.096	-	-	-	-
333	7.89	English River at Kalona	573	83	0.145	3.9	0.007	2.2	0.004
45	5.45	West Branch near Klemme	112	8.3	0.074	0.84	0.008	0.43	0.004
55.5	5.66	East Branch near Klemme	133	14	0.105	1.9	0.014	0.55	0.004
6253	6.79	Iowa River at Wapello	12,499	3520	0.282	840	0.067	565	0.045

1/ From Iowa Natural Resources Council Bulletin No. 10

2/ From current Water Resources Data for Iowa, U. S. Geological Survey

Recharge is determined by several factors including the amount of precipitation, the topography of the land surface, the amount and type of vegetation, the season, and the permeability of the surficial materials and bedrock. Most of the recharge occurs during the periods of heaviest precipitation in the spring and fall. Recharge seldom occurs during the growing season when plants take up most of the moisture, or during the winter when the ground is frozen.

The surficial units of the Iowa River Subbasin are unconsolidated soil (loess, glacial drift clay, and sand and gravel) while the bedrock units are indurated limestones, dolomites, shales, sandstones, and siltstones. These materials have varying abilities to store and transmit water. Clays and shales are relatively impermeable and have low water-yielding capacities. However, the more permeable alluvial, glacial, and bedrock formations make good water-yielding strata.

The principal aquifers from which water can be recovered by wells in the Iowa River Subbasin are: (1) Shallow water-course deposits underlying the bottomlands and terrace levels of the Iowa River and its tributaries, (2) sand and gravel deposits within and at the base of the glacial drift including sand and gravel filling deep bedrock channels that occur mostly in the lower reaches of the Subbasin from Marshalltown downstream, (3) Limestones and dolomites of Mississipian age, and (4) limestones and dolomites of Devonian and Silurian age. The deeper-lying Galena-Platteville, St. Peter, Prairie du Chien, Jordan and St. Lawrence Formations of Ordovician and Cambrian age that are largely dolomites and sandstones, are additional sources of water supply.

Where the shallow alluvial sand and gravel deposits are thick and extensive enough and have a good hydraulic connection with the river, may be one of the best sources for moderately large to large capacity wells as at Marshalltown, Tama, Chelsea, Marengo, Lone Tree, Kalona and Wapello. Upwards of several hundred gallons a minute of water of good mineral quality can be developed from this source. In this discussion shallow wells are arbitrarily limited to a maximum depth of 100 feet.

Shallow glacial sands located beneath the uplands generally yield only small quantities of water adequate for farm and domestic use. These supplies may fail completely during droughts when the water table level declines. More dependable yields might be obtained from sand and gravel layers in the deeper levels of the glacial drift or in buried bedrock channels. Some of these channel-fill deposits may be quite productive. Industrial wells at Marshalltown and municipal wells at Victor, Williamsburg, and Lone Tree produce from these deep sands. The water from the deep levels of the drift commonly is highly mineralized and very hard compared to the water from the shallow sands.

The bedrock formations underlying the glacial drift in the Iowa River Subbasin range from Cretaceous to Silurian age as shown on the accompanying geologic map (Figure 3) and stratigraphic column (Figure 4). However, the Cretaceous and Pennsylvanian rocks are extremely limited over the Iowa River Subbasin and these have little value as aquifers. The most productive strata in the upper part of the Subbasin are the Kinderhook Series at the

BEDROCK MAP OF IOWA-CEDAR RIVERS BASIN (To be added later)

Figure 3

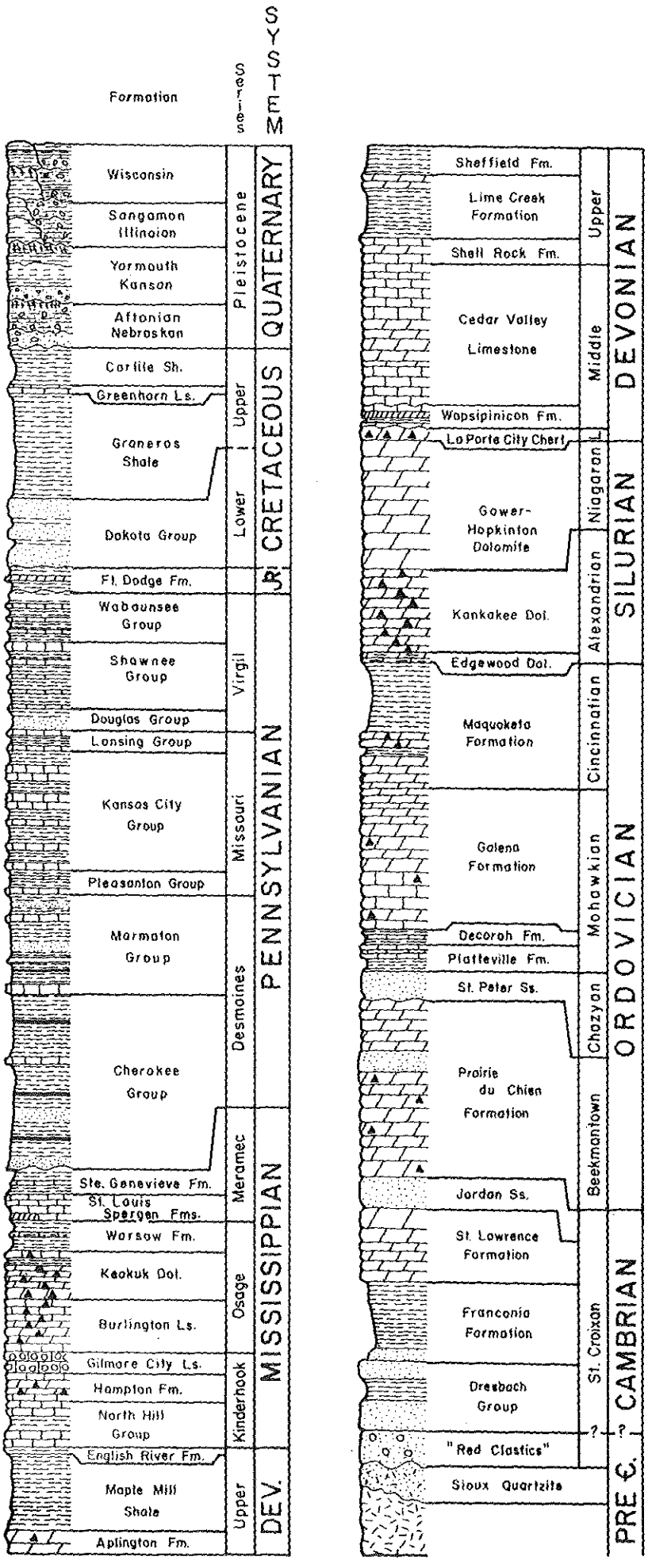


Figure 4

IOWA GEOLOGICAL SURVEY
1971

base of the Mississipian System of rocks and the Cedar Valley Formation in the middle of the Devonian System. In the lower part of the Subbasin the most productive units are the Cedar Valley-Wapsipinicon limestone and dolomite formations of Devonian age and the dolomites of Silurian age.

Yields of a few hundred gallons a minute or more can be developed from the Kinderhook Series in Hancock, Wright, and Hardin Counties, while only small yields generally are obtainable from the Mississipian in the lower part of the Subbasin because the strata are cemented so tightly and have fewer secondary openings. The water from the Mississipian rocks generally is of good quality and acceptable for drinking and other domestic uses.

The Cedar Valley-Wapsipinicon sequence together with the underlying Silurian rocks are capable of yielding 200-400 gpm in places in the lower part of the Subbasin particularly in Johnson and Iowa Counties. The water from the Devonian-Silurian interval in the middle part of the Subbasin generally is so highly mineralized in sulfate as to be unsuitable for drinking.

Although several water-yielding zones probably will occur in the Galena-Platteville, St. Peter, and upper Prairie du Chien Formations in all parts of the Subbasin, the next promising source for large supplies of acceptable quality water is the Jordan Sandstone and associated dolomites at depths of about 1500 feet at Klemme, 2050 feet at Iowa Falls, and 1950 feet at North English. Wells penetrating the Jordan aquifer are practically certain to yield at least several hundred gallons a minute and if developed extensively may produce as much as 1000 gpm.

A number of mineral analyses of the water from the various aquifers discussed here are summarized in Table 6.

The Iowa Geological Survey in cooperation with the U. S. Geological Survey maintains a file of well logs which provides much valuable information on the geologic units underlying the Subbasin and their water-yielding characteristics. Computer printouts of this information are available at a cost. Research on the hydrology of the aquifers underlying the Subbasin is an integral part of this cooperative program.

G. Recreation and Fish and Wildlife Resources

The listing of all known public and private recreation facilities within the Subbasin is based upon a general statewide inventory maintained by the State Conservation Commission. The outdoor recreation area classification system developed by the Outdoor Recreation Resources Review Commission of 1962 is utilized where applicable.

General Outdoor Recreation Area Classification System

Class I. High-Density Recreation Areas

Generally located within or near urban centers, and "user-oriented" in design. Diverse and varied recreation opportunities appropriate to the

TABLE 6

TABULATION OF GROUND WATER ANALYSIS 1/

Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Dissolved constituents in parts per million)

Town - Well No. Owner	DATE OF COLL.	Depth (ft.)	Geol. Source	°F	Diss. Solids	Fe	Mn	Ca	Mg	K	Na	CO_3	HCO_3	SO_4	Cl	F	NO_3	Hardness cal as $CaCO_3$ tot.	carb.	non carb	pH	Cond
Garner town No. 2	5-13-69	325	Cedar Valley		389	.32	<.05	85	36	4.0	8.3	0	449	21	2	.55	0.5	360	360	0	7.1	580
Rowan town No. 1 (1947)	9-9-69	225	Kinderhook) Aplington)		394	2.4	.10	98	28	2.0	17	0	465	25	<0.5	0.4	0.2	360	360	0	7.2	700
Iowa Falls town No. 4 (1957)	4-2-68	221	Kinderhook		326	1.2	.25	91	34	1.4	6.8	0	405	36	5.5	.25	3.0	368	332	36	7.3	680
Radcliffe town No. 3 (1957)	8-11-71	365	Kinderhook	50	381	.36	.33	83	27	0.6	18	0	432	16	2	.45	0.2	320	320	0	7.1	690
Marshalltown IEL & P. Co. No. 5	3-2-61	248	Pleistocene	51	473	2.0	<.05	104	29	3.3	14	0	375	107	<0.5	.15	<0.1	381	307	74	7.5	730
LeGrand town No. 2 (1955)	4-3-71	100	Kinderhook		532	<0.2	<.05	102	30	1.0	22	0	298	110	31	0.2	40	380	244	136	7.3	800
Tama town No. 5 (1967	1-17-69	44	Alluvium		360	.04	<.05	78	19	2.2	10	0	220	110	4	.25	12	276	180	96	7.5	500
Elberon town No. 1 (1953)	11-1-70	635	Devonian-) Silurian)		1690	.96	<.05	128	44	18	310	0	317	910	17	2.0	1.1	500	260	240	7.3	2300
Malcolm -Iowa Highway Comm. (1964)	9-3-64	337	Osage) Kinderhook)	55	2283	3.1	.10	285	157	10	147	0	437	1180	69	0.8	1.6	1360	358	1002	7.0	2730
Amana town (1950)	9-26-66	550	Devonian-) Silurian)		415	.42	<.05	74	28	6.0	31	0	364	84	1	.45	0.1	300	298	2	7.5	690
Williamsburg town No. 4 (1963)	1-23-67	160	Pleistocene	55	419	2.0	.11	54	15	2.7	94	0	515	8.0	<0.5	0.8	0.5	196	196	0	8.0	730
Solon town No. 2 (1960)	8-26-68	485	Silurian	53	256	.04	<.05	62	23	1.3	5.0	0	300	8.8	<0.5	0.2	0.4	250	246	4	7.2	460

TABLE 6 (Cont'd)

TABULATION OF GROUND WATER ANALYSIS 1/

Iowa River Subbasin
Iowa-Cedar Rivers Basin
(Dissolved constituents in part per million)

Town - Well No. Owner	DATE OF COLL.	Depth (ft.)	Geol. Source	°F	Diss. Solids	Fe	Mn	Ca	Mg	K	Na	CO_3	HCO_3	SO_4	Cl	F	NO_3	Hardness cal as $CaCC_3$ tot.	carb.	non carb.	pH	Cond
Lone Tree town (1958)	9-19-68	155	Pleistocene	54	376	1.9	.09	82	23	2.2	29	0	432	23	<0.5	0.2	0.5	296	296	0	7.1	650
Kalona town No. 2	1-25-71	70	Alluvium		478	4.1	.20	70	30	1.0	15	0	239	110	20	0.2	0.5	280	196	84	6.9	600
Wapello town No. 2 (1955)	1-19-67	77	Alluvium	54	222	1.2	.18	53	11	1.2	6	0	189	38	4	.15	0.5	176	155	21	7.5	370
Oakville - private owner (1966)	9-6-67	427	Devonian) Silurian)	58	1990	2.1	<0.5	68	25	15	560	0	431	900	170	1.0	1.2	276	276	0	7.5	
Iowa Falls Farmbest Inc. #3 (1963)	8-3-66	2067	Jordan		902	3.2	<.05	103	41	26	110	0	370	360	20	1.1	0.1	425	303	122	7.6	1300
Toledo town No. 1 (1961)	3-22-65	2016	Jordan	66	705	1.7	<.05	104	37	17	77	0	388	257	8	1.3	0.1	410	318	92	7.5	1090
Brooklyn town No. 5 (1961)	12-5-69	2040	Jordan	70	896	3.6	<.05	102	47	22	120	0	361	400	18	1.3	<0.1	450	296	154	7.1	1300
Wellman town (1955)	6-17-69	1715	Jordan	77	1200	3.3	<.05	104	46	22	190	0	296	570	49	1.2	1.9	450	243	207	7.4	1600
Iowa City municipal (1962)	10-4-71	1570	Jordan		1160	.18	<.01	100	43	19	220	0	290	570	50	1.4	0.5	426	238	88	7.3	1600
Columbus Jct. Rath Pkg. Co. (1964)	10-25-65	1530	Jordan		1107	.12	<.05	86	38	13	212	0	288	489	70	1.5	<0.1	372	236	136	7.6	1650

1/ From Iowa Geological Survey

terrain and location and "mass" accommodations are provided. Intensive day or weekend type of activities.

Class II. General Outdoor Recreation Areas

The natural resource is utilized for the recreation opportunity it provides, irrespective of location. These areas are readily accessible, equipped with a wide variety of man-made facilities, and vary from the simple to the elaborate. Activities are generally of a localized nature and "mass" use is not generally a feature as in Class I.

Class III. Natural Environment Areas

Generally large areas which provide traditional outdoor recreation activities. The user is encouraged to use the area in its natural state with a minimum of man-made developments necessary for access and sanitation. Scattered use is more likely than concentrated use. The area may be used in conjunction with other resource uses.

Class IV. Unique-Natural Areas

These areas are unique in scenic splendor, natural wonder, and/or scientific importance. Recreation activities are strictly limited to those which will not affect the unique value of the natural features.

Class V. Primitive Areas

The essential characteristics of these areas are that the natural environment has not been disturbed by commercial utilization, and that mechanized transportation is non-existent. The natural, wild, and undeveloped characteristics are the distinguishing factors. The area must be sufficiently large to remove the user from the sights, sounds, and smells of civilization and provide the recreationist with a "feeling" of true wilderness experience.

Class VI. Historic and Cultural Sites

Sites associated with history, tradition, or cultural heritage and are of sufficient significance to merit preservation or restoration. Management is directed to restoration, preservation and interpretation for sightseeing, enjoyment, and study of the historic and cultural features. Limited day-use facilities may be provided when such facilities do not detract from nor interfere with the primary purpose and value of the site.

Class VII. Reserved Open Spaces and Undeveloped Lands

Lands and waters in the classification are those desirable recreation sites which are acquired, pending eventual development, to preserve them from loss to conflicting or undesirable uses. They may be located anywhere such areas are found and acquired through several methods from easement agreement to fee simple title. When finally developed, such areas would be reclassified under the appropriate category.

Wildlife Areas

Includes lands and waters specifically developed and managed for wildlife purposes. Areas in this class may be open to hunting or closed as in the case of refuges. In either situation the intent is for wildlife management. Other recreational facilities may be available, however, they are essentially provided to serve and facilitate the hunter.

Water Access

This category includes those relatively small areas developed to essentially provide boating or fishing access to the waters of the State. Other recreational facilities may be available, but similar to wildlife areas their original intent is specific, in this situation boating or fishing access.

Rest Areas

Highway oriented areas specifically developed to provide the highway traveller with a place for rest, relief, and relaxation from driving. They are relatively small and generally not intended for overnight use, or for use as destination recreation areas. They are incidental and serve to facilitate travel to other larger destination type recreation areas.

Other

A general classification encompassing a variety of specific or specialized recreation endeavors. Areas in this category tend to be organization program or facility oriented rather than being dependent on any particular natural resource attribute. These include club areas, organizational areas, resorts, vacation farms, miniature golf, sports areas, race tracks, etc. This grouping includes any areas that can't be classed in the other categories.

General Recreation Area Listing

The General Recreation Area listing is based upon a recent (1968-1970) updating the the inventory of every known category of park and recreation land in the State. Details concerning the facilities available is summarized in Table 7, Recreation Inventory. This list provides general information as to the type of area, size, management, ownership, and services provided. Municipal recreation areas have not been listed. This listing is provided as a specific aid to local and regional planning efforts.

Figure 5 shows the general location of recreation facilities in the Subbasin as well as the location of river reaches well suited for fishing and fishing and boating.

TABLE 7
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Modern Comfort Stations	Showers	Shelters	Trails	Boat Access	Boating	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un-dev.		Dev.	Un-dev.							Cold Water	Warm Water			
Benton Co.	Hannen Pk.	4 mi. SW Blairstown			⊠			II	130	50	180																
	Go Kart Track	Dysart					⊠	Go Kart	4		4																
	Kozta Store	Belle Plaine					⊠	Service Unknown																			
Franklin Co.	Oakland-Access	3 Mi. SW Popejoy			⊠			River Access	74		74													*	*		Outdoor Classroom
	Oakland Valley Game Mgt. Area	1 1/2 Mi. SW Popejoy			⊠			Wild-life Area	2		2														*		Outdoor Classroom
	Popejoy Park	Popejoy			⊠			II	63	4	67	*				*						*	*	*	*		Outdoor Classroom
	Alexander Park	Alexander			⊠			I	1		1		*			*											
	Toft Park	Dows			⊠			II	8	5	13		*			*								*		*	
Hancock Co.	Crystal Lake	Crystal Lake		⊠				Sover-eign L.		283	283												*	*			
	Ellsworth Park	Crystal Lake		O	X			II	130		130		*			*						*	*	*			
	Eagle Lake Area	4 Mi. NE Britt		O	X			III	21		21		*			*					*						
	East Twin Lake	2 1/2 Mi. E. Kanawha		⊠	X		O	VII	300	193	493													*			
	West Twin Lake	4 Mi. E. Kanawha		⊠				Sover-eign L.		109	109													*	*		
	Concord Park	Garner			⊠			VI	2		2	*				*											

O - Ownership
X - Management
⊠ - Ownership and Management

TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Golfing	Swimming	Boating	Fishing		Hunting	Skeeting	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un-dev.		Dev.	Un-dev.				Cold Water	Warm Water			
Hancock Co. (Continued)	Eagle Lake Woodland	4 Mi. NE Britt			⊠			III	46		46												*		
	East Twin Lake For.	4 Mi. E. Kanawha			⊠			III	9		9												*		
	Eldred-Sherwood Rec. Area	4 Mi. NE Goodell			⊠			II	78	22	100	*				*						*		*	
	Ell Town Wayside	2½ Mi. S. Garner		O	X			Rest Area	2		2		*			*									
	Thiemann Farm	Klemme					⊠	Vac. Farm																	
	Klemme Rec. Club	Crystal Lake					⊠	Service Unknown																	
	Sportsmen Park	Britt					⊠	Service Unknown																	
	Eagle Lake	4½ Mi. NE Britt		⊠				Sover-eign L.	5	915	920										*		*	*	
	Goodell Area	3 Mi. NE Goodell		⊠				Wild-life Area	71		71													*	
Hardin Co.	Iowa Falls Rifle Club	Iowa Falls					⊠	Service Unknown																	
	Fitz Land-ing	Iowa Falls					⊠	Service Unknown																	
	Iowa Falls Boat Club	Iowa Falls					⊠	Service Unknown																	
	Alden Boat Club	Alden					⊠	Service Unknown																	
	Gehrke's Lake	Iowa Falls					⊠	Service Unknown																	
	Hubbard Rec. Club	Hubbard					⊠	Service Unknown																	

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TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Wilderness Environ Station	Showers	Shelters	Trails	Boat Access	Fishing			Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un. dev.		Dev.	Un-dev.						Cold Water	Warm Water			
Hardin Co.. (Continued)	Tonto Leo	Steamboat Rock					⊠	Service Unknown																			
	Pine Lake Saddle Club	Steamboat Rock					⊠	Service Unknown																			
	Scenic City Saddle Club	Iowa Falls					⊠	Service Unknown																			
	Quaker Heights Camp	Eldora					⊠	Service Unknown																			
	Pine Lake Baptist Camp	Eldora					⊠	Service Unknown																			
	Church of the Brethren Camp	Eldora					⊠	Service Unknown																			
	Long Mem. Park	1 Mi. E. Union			⊠			II	7		7	*				*						*	*		*		
	Nichols Wildlife Area	Iowa Falls			⊠			Wildlife Area	16		16					*											Outdoor Class room
	Reece Mem. Park	2½ Mi. SE New Providence			⊠			II	75		75	*				*					*			*			Handicapped Fac.
	Twin Elms Park	1½ Mi. N Buckeye			⊠			Wildlife Area	4		4													*	*		
	Steinberg Wildlife Area	2 Mi. SE Alden			⊠			Wildlife Area	3		3														*		
	Utech Wildlife Area	5½ Mi. SW Iowa Falls			⊠			VII	2		2																

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TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Golf	Shooting	Skating	Trails	Boat Access	Beaches	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Undev.		Dev.	Undev.								Warm Water			
Hardin Co. (Continued)	Ziesman Wildlife Area	7 Mi. W. Eldora			⊠			Wildlife Area	10		10														*	*		
	Hwy. 65 Wayside	9 Mi. S. Iowa Falls		⊠				Rest Area								*				*							Playground Equip.
	Pine Lake Wildlife Club	Eldora					⊠	Service Unknown																			
	Steamboat Rock Rifle Club	Steamboat Rock					⊠	Service Unknown																			
	Iowa Cons. & Improvement Assoc.	Steamboat Rock					⊠	Service Unknown																			
	Gehrke Wildlife Area	4 Mi. SE Buckeye			⊠			Wildlife Area	6		6														*	*		
	Hartman Wildlife Area	2½ Mi. NE Steamboat Rock			⊠			Wildlife Area	10		10															*		
	Hwy. 20 Wayside	Iowa Falls		O	X			Rest Area	4		4					*											
	Lepley Mem. Park	1½ Mi. N. Union			⊠			II	9		9	*				*											
	Corwin Hadley Ski-lift	Eldora					⊠	Ski Area																			
	Earl Thomas Ski-Life	Steamboat Rock					⊠	Ski Area																			
	Hardin City Access	5 Mi. NW Steamboat Rock		O	X			River Access	25		25											*	*		*	*		

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TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Visitor Center Exhibit Station	Shelters	Shelters	Trails	Boat Access	Boating	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un. dev.		Dev.	Un-dev.							Cold Water	Warm Water			
Hardin Co. (Continued)	Pine Lake	Eldora		⊠				II	382	160	542	*			*	*		*	*	*	*	*	*		*		*	Golf & Concession
	Steamboat Rock Access	Steamboat Rock		⊠				River Access	5		5					*						*	*		*			
	Iowa River Greenbelt	Iowa River			⊠			III	771		771		*			*					*	*	*		*	*		Outdoor Classroom
	Alden R. Access	Alden			⊠			River Access	1		1					*									*			
	Bessman-Kemp Park	½ Mi. W. Alden			⊠			II	10		10		*			*						*	*		*			
	Bigelow Park	3 Mi. NW Alden			⊠			III	10		10					*						*	*		*			Outdoor Classroom
	Boddy-Hunt Rec. Area	10 Mi. S. Iowa Falls			⊠			VII	46		46																	
	Flowing Well Park	4½ Mi. S. Alden			⊠			III	6		6					*									*			
Iowa Co.	Hwy. 6 Wayside	1½ Mi. W. Ladora		O			X	Rest Area								*												
	Star Inn Campground	Victor					⊠	Camping Area	57		57	*																
	Victor Go-Kart	Victor					⊠	Service Unknown																				
	American Legion Area	Marengo					⊠	Service Unknown																				
	Izaak Walton League	Marengo					⊠	Service Unknown																				
	Kozia Access	8 Mi. NW Marengo		⊠				Wildlife Area	57	4	61															*		River Access

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TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Indoor Conference Facilities	Showers	Shelters	Trails	Boat Access	Boating	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Undev.		Dev.	Undev.							Cold Water	Warm Water		
Iowa Co. (Continued)	Randolph Access	5½ Mi. SE Belle Plaine		Ø				Wildlife Area	371	28	399		*									*	*		*	*	
	Iowa Co. Park	5 Mi. N. Millersburg			Ø			II	207	92	299					*		*							*	*	
	Hwy. 212 Wayside	7 Mi. NE Marengo		O			X	Rest Area								*				*							
	Micheal Becker's Area	Marengo					Ø	Service Unknown																			
Johnson Co.	Hawkeye Wildlife Area	Coralville Reservoir	O	X				Wildlife Area	10,195	2,000	12,195											*	*		*	*	
	Lake Mac-Bride State Park	Coralville Reservoir	O	Ø				III	1,020	950	1,970	*				*		*	*	*	*	*	*		*		*	Concession
	Stainbrook Geological Preserves	4 Mi. NE N. Liberty			Ø			VII	23		23																
	Camp Cardinal	Coralville					Ø	Girl Scout Camp	14		14		*								*							Riding Trails
	Fire Dept. Park	Tiffin					Ø	I	Service	Unknown																	
	Izaak Walton League Wayside	Oxford					Ø	Rest Area								*											
	Coral Village	Solon					Ø	II	5		5	*															
	Pleasant View Lodge	N. Liberty					Ø	II	10		10	*				*										*	Riding Facilities

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Ø - Ownership and Management

TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Modern Comfort Station	Showers	Shelters	Trails	Boat Access	Boating	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un-dev.		Dev.	Un-dev.							Cold Water	Warm Water			
Johnson Co. (Continued)	Sugar Bottom Stables	Solon					☒	Riding Stable	124		124																	
	Purple Cow	Coralville Reservoir					☒	Marina					*			*						*	*					
	Marina 218	Coralville Reservoir					☒	Marina					*			*						*	*					
	Coral Marina	Coralville Reservoir					☒	Marina					*			*						*	*					
	Hwy. 218 Wayside	6 Mi. N. N. Liberty		O			X	RestArea								*												
	Jct. 6 & 109 Wayside	1 Mi. NE of Jct.		O			X									*				*								
	Ten Corps Area	Coralville Reservoir	☒					III	100		100		*			*		*				*	*		*		*	
	Uncommitted	Coralville Reservoir	☒					VII	2,640	2,400	5,040												*		*	*		
	Swan Lake	6 Mi. NW N. Liberty		☒				Sovereign Lake		44	44														*	*		
	Plum Grove	Iowa City		☒				VI	4		4																	Residence of First Governor
	F.W. Kent Park	2½ Mi. W. Tiffin			☒			III	187	30	217		*			*										*		
	Old State Quarry	3 Mi. NE N.Liberty			☒			VII	8		8																	
	River Jct. Access	6 Mi. W. Lone Tree			☒			VII	11		11																	
Keokuk Co.	S. English Wayside	S. English		O			X	Rest Area				*				*				*								
Linn Co.	Ski Pal	Ely					☒	Service Unknown																				

TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Lodge or Concession Stations	Showers	Shelters	Trails	Boat Access	Swimming	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un. dev.		Dev.	Un-dev.								Cold Water	Warm Water			
Linn Co. (Continued)	Upmeier Stables	Ely					⊠	Riding Stable																				
Louisa Co.	Indian Hills Rec. Area	3 Mi. N. Morning Sun					⊠	II	250		250		*					*		*								Golf
	Pitch Inn Farm	Columbus Jct.					⊠	Service Unknown																				
	Boat Livery	Wapello					⊠	Service Unknown																				
	Iowa River	Wapello					⊠	II	29	25	54		*								*							
	Lake Odessa	6 Mi. E. Wapello	O	X				Wildlife Area	1,207	2,000	3,207		*			*						*	*		*	*	*	
	Toolesboro Access	Toolesboro	O	X				River Access	4		4											*	*		*			
	Sand Run Access	5 Mi. E. Wapello	O	X				Fishing Area	3		3											*	*		*			
	Cone Marsh	2 Mi. W. Conesville		⊠				Wildlife Area	180	421	701															*		
Marshall Co.	Nicholson Ford	Marshalltown		⊠				River Access																	*	*		
	Bangor Public Square	Bangor			⊠			I	2		2					*												
	C.D. Coppock Park	3 Mi. W. Le Grand			⊠			RestArea	9		9	*				*				*								Handicapped Facilities
	Fairground Co. Park	Marshalltown			⊠			VII	2		2																	
	French Grove	4 Mi. SW Clemens			⊠			Wildlife Area	28		28															*		
	Grammer Grove W.A.	3 Mi. SW Liscomb			⊠			Wildlife Area	120		120		*			*										*		Handicapped Facilities

O - Ownership
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TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Shelter, Comfort Stations	Showers	Shelters	Trails	Golf	Access	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Undev.		Dev.	Undev.							Cold Water	Warm Water			
Marshall Co. (Continued)	Marshall Co. Wildlife Club	Marshall-town					⊠	Service Unknown																			
	Holland Access	1½ Mi. N. Le Grand			⊠			River Access	75	5	80														*	*	
	Marshall Co. For. Res.	4 Mi. SW Liscomb			⊠			Wildlife Area	80		80														*	*	
	Three Bridges Park	1½ Mi. NW Le Grand			⊠			II	12		12	*				*					*				*	*	Handicapped Facilities
	Timmons Grove Park	1 Mi. SW Albion			⊠			II	191	7	198	*				*					*				*	*	Handicapped Facilities
	Van Cleve Park	Van Cleve			⊠			I	4		4					*											Playfields
	State Center Wayside	State Center		O			X	Rest Area								*											
	Hwy. 330 Wayside	7 Mi. W. Marshall-town		O			X	Rest Area								*											
	Marshall-town Little League	Marshall-town					⊠	Service Unknown																			
	Izaak Walton League	Marshall-town					⊠	Service Unknown																			
	Lion Roadside Park	Marshall-town					⊠	Service Unknown																			
	Ruth Fish Hatcheries	Marshall-town					⊠	Fish Hatchery																			
	Central Iowa Coon Hunters Assoc.	Marshall-town					⊠	Service Unknown																			

O - Ownership
X - Management
⊠ - Ownership and Management

TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Modern Comfort Station	Showers	Shelters	Trails	Boat Access	Boating	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un-dev.		Dev.	Un-dev.							Cold Water	Warm Water			
Poweshiek Co.	Deedrick Area	Malcom					⊠																					
	I-80 Area	2 Mi. N. Guernsey					⊠	Rest Area	Service Unknown																			
	Guernsey Park	Guernsey			⊠			VII	5		5															*		
	Holiday Lake	5 Mi. N. Brooklyn					⊠	II		87	87	Service Unknown																
	Brooklyn Rec. Area	Brooklyn			⊠			I	7		7					*												Playfield
	Deep River Rec. Area	Deep River			⊠			VII	9		9																	
	Star Inn Camp	Victor					⊠	Service Unknown																				
Story Co.	Dakins Lake	1 Mi. NE Zearing			⊠			II	12	5	17	*				*									*	*		
Tama Co.	Trap Shoot Fac.	Richland Twp.					⊠	Service Unknown																				
	Robert Humpy	Montour					⊠	Service Unknown																				
	Staker Min. Golf	Toledo					⊠	Min. Golf																				
	Howard Stump	Tama					⊠	II	93	7	100	*																
	Hickory HillLake	Montour					⊠	Lake Access	10	10	20	Service Unknown																
	Howard Stump Camping	Tama					⊠	Service Unknown																				

O - Ownership
X - Management
⊠ - Ownership and Management

TABLE 7 (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management					Recreation Classification or Specialization	Acreage			Camping			Vacation Cabins	Picnicking		Visitor Center Station	Showers	Shelters	Trails	Boat Access	Fishing		Hunting	Swimming	Other
			Fed.	St.	Co.	Munic.	Priv.		Land	Water	Total	Mod.	Non-Mod.	Un. dev.		Dev.	Un-dev.						Cold Water	Warm Water			
Tama Co. (Continued)	Pilgrim's Heights Campground	Montour					⊠	Service Unknown																			
	Rainbow Lake	Chelsea					⊠	Service Unknown																			
	Otter Creek Marsh	2 Mi. NW Chelsea		⊠				Wildlife Area	2,435	574	3,009														*		
	UnionGrove	3 ½ Mi. SW Gladbrook		⊠				II	172	110	282	*				*				*		*	*	*		*	Concession
	Iowa R. Boat Access	2 Mi. N. Chelsea			⊠			River Access	1		1											*	*	*			
	Manatt's Iowa R. Access	Tama			⊠			River Access	6		6					*						*	*	*			
	Otter Cr. Park	3 Mi. NE Toledo			⊠			VII	208	69	277																
	T.F. Clark Park	4½ Mi. NE Toledo			⊠			VII	23	1	24																
	Tama Wayside	Tama		O			X	Rest Area								*											
	Shady Hills	Tama					⊠	II	77	10	87	*															
	Circle L Riding Stables	Tama					⊠	Service Unknown																			
	Tama-Toledo Izaak Walton League	Toledo					⊠	Service Unknown																			
	Arlo Windgardner	Montour					⊠	Shooting Preserve																			

O - Ownership
X - Management
⊠ - Ownership and Management

TABLE & (Cont'd)
RECREATION INVENTORY
Iowa River Subbasin
Iowa-Cedar Rivers Basin

County	Name	Location	Ownership and Management: Fed.	St.	Co.	Munic.	Priv.	Recreation Classification or Specialization	Acreage: Land	Water	Total	Camping: Mod.	Prim.	Undev.	Picnicking	[illegible]	[illegible]	[illegible]	[illegible]	Other
Washington Co.	Iowa Twp. Park	N. Riverside			⊠			II	26	1	27				*					Playfield
	Marr Park	5 Mi. E. Washington			⊠			II	38	2	40		*		*					Playfield
	Ainsworth Wayside	1 Mi. W. Ainsworth			⊠			Rest Area							*	*				
	Amvets Trap Shoot	Riverside					⊠	Trapshoot												
	Foster Woods	1½ Mi. SW Wellman			⊠			III	16	1	17				*		*	*	*	Outdoor Class-room
	Corbin Crawford Pond	Ainsworth					⊠	Service Unknown												
Wright Co.	Ann & Shorty's	Belmond					⊠	II	4		4	*								
	Flutzwald Game Farm	Belmond					⊠	Shooting Preserve												
	Pikes Timber	2 Mi. E. Lake Cornelia			⊠			II	46		46	*			*			*		
	Solberg Wayside	6 Mi. E. Clarion		O	X			Rest Area	2		2				*	*				
	Bingham Park	2 Mi. SE Rowan			⊠			II	11	1	12				*				*	Outdoor Class-room
	Dows Park	1½ Mi. N. Dows			⊠			II	3		3				*				*	
	Charles Mikesh BoatLivery	Belmond					⊠	Service Unknown												
	Elm Lake	4 Mi. NE Clarion		⊠				Sovereign Lake	3	463	466								*	

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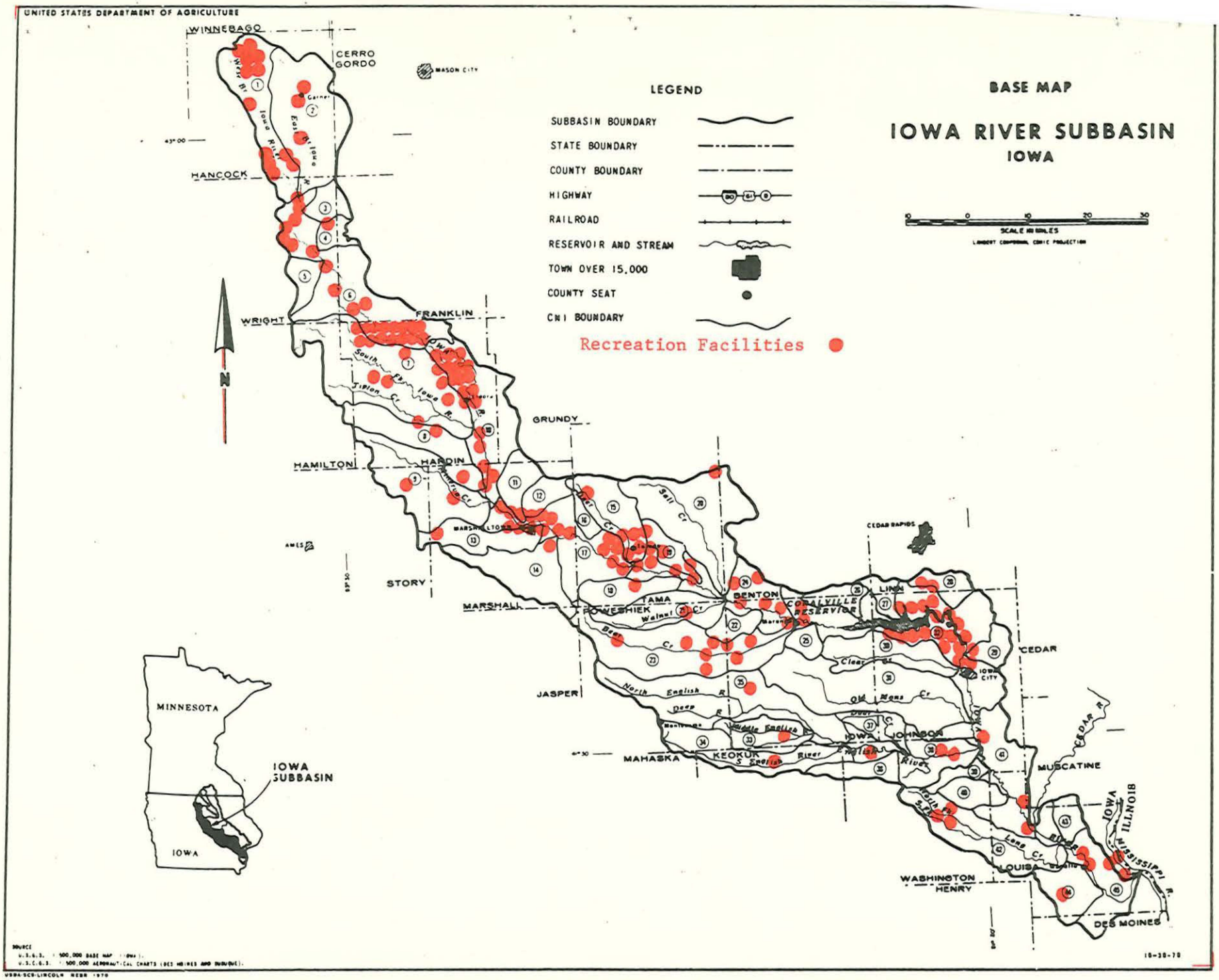
UNITED STATES DEPARTMENT OF AGRICULTURE
BASE MAP
IOWA RIVER SUBBASIN
IOWA
LEGEND
SUBBASIN BOUNDARY
STATE BOUNDARY
COUNTY BOUNDARY
HIGHWAY
RAILROAD
RESERVOIR AND STREAM
TOWN OVER 15,000
COUNTY SEAT
CNI BOUNDARY
Recreation Facilities
SCALE IN MILES
LAMBERT CONFORMAL CONIC PROJECTION
WINNEBAGO
CERRO GORDO
MASON CITY
HANCOCK
WRIGHT
FRANKLIN
GRUNDY
HAMILTON
HARDIN
STORY
MARSHALL
TAMA
BENTON
JASPER
MAHASKA
KEOKUK
WASHINGTON
HENRY
JOHNSON
CEDAR
MUSCATINE
LOUISA
LINN
CEDAR RAPIDS
IOWA CITY
CORALVILLE RESERVOIR
DES MOINES
AMES
MINNESOTA
IOWA
IOWA SUBBASIN
ILLINOIS
MISSISSIPPI R.
CEDAR R.
IOWA R.
N
10-30-78

Figure 5

H. Mineral Resources

The important known mineral resources within the Iowa River Subbasin consist of sand and gravel, and limestone and dolomite. Portions of the Subbasin are underlain by rocks known to contain gypsum and coal.

The sand and gravel occurs mostly as alluvial (stream-deposited) deposits along the river and the larger tributaries. These materials are utilized almost entirely as construction aggregate, although they also serve as sources of water for a number of municipal and many domestic supplies. The sand and gravel resource is rather evenly distributed throughout the Subbasin but it appears that the supplies in the western portion of the central part are not as widely exploited.

Limestone and dolomite for use in highway construction and maintenance, agricultural limestone, and mineral feeds are available throughout the Iowa River Subbasin.

Although gypsum is known to occur under a large portion of the area, deposits in sufficient thickness to warrant mining at this time have not been found.

Coal reserve estimates have been made for Hamilton, Hardin, and Marshall Counties in the northern part of the Subbasin. The reserves are small and are not considered to be economically significant.

The storage of liquid petroleum gas (LPG) and natural gas within the Subbasin has become of some economic significance. This cannot be considered a mineral resource but local geologic conditions do play a part in making such storage feasible in these particular areas. In Johnson County, LPG is being stored in large underground caverns excavated in thick shales that underlie the area. In Louisa County natural gas is being stored in aquifers under domal geologic structures.

I. Archeological and Historic Sites

Only one area listed in the National Register of Historic Places is found in the Subbasin. This area includes all of the Amana Colonies and is located in northeast Iowa County. It is a privately developed community made up of persons of German ancestry. The colonies were founded in 1843. (See "Early History").

Table 8 identifies state historical areas, markers and points of interest.

J. Early History

The first permanent settlement of the Subbasin began in 1834 and extended to 1854. The southern part of the Subbasin was settled first since this was a stop-over area after crossing the Mississippi. Marquette and Joliet are credited as being the first white men to land in Iowa and it is claimed that their first landing place was in what is now Louisa County.

TABLE 8
STATE HISTORIC AREAS, MARKERS, AND POINTS OF INTEREST

Iowa River Subbasin
Iowa-Cedar Rivers Basin

Item	County	Location	Ownership	Comment
Amana Colonies	Iowa	Located on & N. of U.S. Hwy. 6	Private	Seven "Old World" villages founded in 1855 by Inspirationalists.
Amana Heim (Home)	Iowa	Homestead, Ia.	Private	100 year old home on south bluffs of Iowa River.
Gritter School	Iowa	3 mi. N.W. of North English, Ia.		Red brick schoolhouse established in 1872.
Marengo City Park	Iowa	City Park	City	Last remaining log cabin.
Brigade Camp	Johnson			Tablet marker.
Chauncey Swan Circle	Johnson	Oakland cemetery Iowa City, Iowa		Boulder with tablet placed by D.A.R.*
Grave of Cordelia Swan	Johnson	Iowa City, Iowa		Small stone placed by D.A.R.*
Indian Ford	Johnson	5 mi. E. of Solon		Marker
Indian Villages	Johnson	Along Iowa R.	Private	Village sites and burial mounds.
Iowa City Community School District: School	Johnson	Coralville, Ia.	Iowa City Community School District	Brick schoolhouse built in 1876.
Iowa City Stage Stop	Johnson	Iowa City, Ia.		Tablet placed by D.A.R.*
Museum of Natural History	Johnson	McBride Hall University of Iowa	University of Iowa	Natural History Collections.
Old Capitol	Johnson	Clinton St. at Iowa Avenue	University of Iowa	Iowa's first permanent Capitol.
Portrait of Sr. William Blackstone	Johnson	Iowa City, Iowa		D.A.R.*
Plum Grove	Johnson	727 Switzer Ave. Iowa City, Iowa	State	Home of Robert Lucas, first Governor of Territory of Iowa.
Site of Camp Pope	Johnson	Iowa City, Iowa		Boulder with tablet placed by Civil War Soldiers.
Site of Mormon Handcart Brigade Camp	Johnson	Coralville, Iowa		Boulder with bronze tablet placed by D.A.R.*

*Daughters of the American Revolution

TABLE 8 (continued)
STATE HISTORIC AREAS, MARKERS, AND POINTS OF INTEREST

Iowa River Subbasin
Iowa-Cedar Rivers Basin

Item	County	Location	Ownership	Comment
State Historical Society	Johnson	Centennial Bldg. Iowa City, Iowa		Historical Library.
Amish Settlement	Washington	Near Kalona, Ia.	Amish	Strict "Old Order" settlement.
Iowa Mennonite Museum	Washington	Kalona, Iowa	Iowa Mennonite Hist. Soc.	Mennonite historical collections.
Kalona Historical Society	Washington	Kalona, Iowa	Kalona Hist. Soc.	Restored historic village - depot and log cabin.
Swinging Bridge	Louisa	Columbus Junction just off Iowa 92		Built over 100 years ago and restored in 1967.
Toolesboro Indian Mounds	Louisa	N. of Toolesboro, Iowa	State	Location of 100 Hopewell Indian mounds. County Historical Society built a museum on five acres near the site.
Memorial Tribute	Hardin	Eldora, Iowa		Bronze tablet placed by D.A.R.*
Memorial to Founder of Iowa Falls	Hardin	Iowa Falls, Iowa		Stone tablet placed by D.A.R.*
Site of First State Normal School	Hardin	Iowa Falls, Iowa		Tablet placed by D.A.R.*
Site of First Log Cabin	Marshall	Marshalltown, Iowa		Bronze tablet placed by D.A.R.*
Memorial Log Cabin	Marshall	Riverview Park Marshalltown, Iowa	City	Built in 1937 to honor settlers prior to 1885.
Susie Sower Historical House	Marshall	Marshalltown, Iowa	Court App'ted Trustees	Built in 1860 (frame house). Exhibits include Civil War relics.
Wetherbee Rural School House	Marshall	Sower Historical House Site Marshalltown, Iowa	Historical Society of Marshall Co.	Restored country school.

TABLE 8 (continued)
STATE HISTORIC AREAS, MARKERS, AND POINTS OF INTEREST

Iowa River Subbasin
Iowa-Cedar Rivers Basin

Item		County	Location	Ownership	Comment
Dysart Historical Museum		Tama	315½ Main St. Dysart, Iowa	Private	Pioneer exhibits.
Old Stone House		Tama	Montour, Iowa		
Tama Indian Settlement		Tama	West of Tama, Iowa	Private	Mesquakie Indian settlement.
Tama County Court House		Tama	Toledo, Iowa	County	Pioneer exhibits, maintained by Tama County Historical Society.
Merrill A. Stainbrook	Corps of Eng.*	Johnson	2½ mi. N.E. of North Liberty at E. end of Mahaffey Bridge.		Forest and brushland with exposed geological formations consisting of State Quarry Limestone overlying Cedar Valley Limestone. Fossils abound.
Old State Quarry	Corps of Eng.*	Johnson	1½ mi. N.E. of North Liberty off private road		Wooded tract containing remains of limestone quarry where stone was taken for building Old State Capitol and other structures.

Sites of State or Local Significance

Grinnell College, Grinnell, Poweshiek County
Robert Lucas Home, Iowa City, Johnson County
Old Capitol, University of Iowa, Iowa City, Johnson County

*Leased to County Conservation Board

The first permanent settlement of European immigrants near Iowa City took place in 1836. Iowa City was Iowa's first capitol with the capitol building completed in 1842. In 1857, the capitol was moved to Des Moines. The State University of Iowa, founded in 1847, is located in Iowa City.

The first white settlers came to Iowa County in 1840. The Amana Society played a unique part in the history of Iowa County and the State of Iowa. Its members were among the early immigrants when settlements were first being made along the Iowa River. They organized seven villages in the area which still exist today.

The central part of the Subbasin was first settled in 1849. The eastern part of Tama County was settled mostly by Bohemians. Their churches and cemeteries are much in evidence today.

The first settlements in Wright County were along the Boone River and the Iowa River, starting in 1854. The area between these two rivers was known to early settlers as "the Great Frog Pond". In 1875, only one acre in fifteen was cultivated.

The northern most part of the Subbasin was also settled in 1854. These pioneers were predominantly of Scandinavian, German, Irish, and Bohemian descent. Hancock County is located in what had been a neutral zone in which the warring Sioux Indians on the north and Winnebago Indians on the south might fish and hunt. They had agreed not to establish homes or wage battles in this area.

II. WATER AND RELATED LAND RESOURCE PROBLEMS

A. Land Resource Problems

Of the 2,670,860 acres of crop and pasture land in the Iowa River Subbasin, 958,600 acres, or 36 percent, is considered to be adequately treated to meet the conservation problems.

Erosion is a problem on about 1.5 million acres of crop and pasture land. Of this, only 273,000 acres, or 18 percent, are considered adequately treated to meet the erosion problem. The remaining 1.2 million acres, or 82 percent, are in need of conservation treatment. Erosion is by far the most critical land and water problem in the Subbasin. Eighty-four percent of the erosion hazard area is in the southern part of the Subbasin which has 72 percent of the land.

There are 762,900 acres of crop and pasture land with a wetness hazard. A total of 251,000 acres, or 33 percent, are adequately treated. This leaves 512,000 acres, or 67 percent of the area with a wetness problem still requiring treatment. It is interesting to note that half of the area with a wetness problem is located in the northern one-thrid of the Subbasin and that seventy percent of the wetness problem has been treated.

There are 154,000 acres of upstream floodplain with a floodwater and sediment damage problem. These areas will require project action for solving the floodwater and sediment problems. This does not mean, however, that these projects could be economically justified, but rather that group action is required for problem solution.

In addition, there are 76,000 acres of floodplain along the main or downstream rivers which also have floodwater and sediment damage problems. There are 28,000 acres of upstream and 16,600 acres of downstream floodplain in the northern part of the Subbasin subject to damage.

The following cities have been identified as having some floodwater and sediment damage problems: Belmond, Iowa Falls, Union, Marshalltown, Montour, Garwin, Tama, Chelsea, Koszta, Marengo, Ely, Coralville, Iowa City, Brooklyn, and Williamsburg.

The 1967 Conservation Needs Inventory for Watersheds identified 45 watersheds in the Iowa Subbasin. Table 9 lists the watersheds and identifies the flooding and drainage problems in each.

There is an area in the Subbasin which is receiving attention in this study which has a serious sediment deposition problem. Sediment is accumulating in the Coralville Reservoir at the average rate of about 1,200 acre-feet per year. Sediment storage was provided in the design of the reservoir but sites available for a body of water this size are extremely limited. A plan utilizing land treatment and structural measures is being developed to extend the life of this very valuable water resource.

TABLE 9

WATERSHED INFORMATION

Iowa River Subbasin
Iowa-Cedar Rivers Basin Study

Watershed			Agric. FW and Sediment Damage		Drainage	
Name	No.	Drainage Area (acres)	Acres with Problems	Acres Needing Project Action	Acres with Problems	Acres Needing Project Action
West Branch, Iowa R.	1	95,360	15,800	15,800	40,800	38,400
East Branch, Iowa R.	2	126,720	3,030	3,030	77,200	74,400
Luicks Creek	3	28,420	120	120	21,400	16,500
Joint D.D. 146, 7	4	18,820	50	50	12,850	7,800
Wheeler Creek	5	23,810	80	80	17,600	13,300
Main & Small Tribs. R.1	6	153,600	3,810	3,810	91,930	55,220
So.Fork, Iowa R.	7	197,760	2,700	2,700	99,030	53,800
Honey Creek	8	70,400	1,850	1,850	24,260	8,970
Minerva Creek	9	104,960	4,680	4,680	25,040	11,310
Main & Small Tribs. R.2	10	113,920	12,780	12,780	21,870	9,170
Asher Creek	11	29,570	1,900	1,900	4,200	1,040
Burnett Creek	12	20,740	1,700	1,700	2,640	510
Linn Creek	13	42,750	2,000	2,000	4,100	1,200
Timber Creek	14	79,360	4,950	4,950	9,140	1,800
Deer Creek	15	54,780	5,250	5,250	9,140	30
Sugar Creek	16	13,820	2,500	2,500	1,380	0
Main & Small Tribs. R.3	17	94,980	5,590	5,590	11,950	1,410
Richland Creek	18	38,590	7,580	7,580	10,300	0
Otter Creek	19	26,370	8,340	8,340	10,210	7,000
Salt Creek	20	142,720	11,910	11,910	31,480	3,100
Walnut Creek	21	58,430	3,700	3,700	22,800	0
Honey Creek	22	19,140	1,000	1,000	5,420	0
Bear Creek	23	142,080	4,950	4,950	59,760	2,010
Main & Small Tribs. R.4	24	82,110	11,020	11,020	21,300	7,420
Hilton Creek	25	13,760	300	300	2,400	0
Price Creek	26	19,780	130	130	2,900	700
Knapp Creek	27	19,580	60	60	3,240	300
Hoosier Creek	28	31,230	140	140	3,930	0

TABLE 9

Watershed Information (continued)

Iowa River Subbasin
Iowa-Cedar Rivers Basin Study

Watershed Name	No.	Drainage Area (acres)	Agric. FW and Sediment Damage: Acres with Problems	Agric. FW and Sediment Damage: Acres Needing Project Action	Drainage: Acres with Problems	Drainage: Acres Needing Project Action
Rapid Creek	29	21,120	1000	1,000	2,900	0
Clear Creek	30	67,200	4,640	4,640	8,900	0
Old Man Creek	31	158,720	11,600	11,600	41,870	0
Main & Small Tribs. R.5	32	176,770	11,250	11,250	34,530	300
Middle Fork English River	33	44,290	880	880	12,700	360
So.Fork, English R.	34	81,920	11,110	11,110	33,300	4,800
No.Fork, English R.	35	156,670	9,290	9,290	45,590	630
Smith Creek	36	26,180	2,520	2,520	3,000	600
Deer Creek	37	25,860	1,200	1,200	5,650	200
Lower English River	38	73,410	16,250	16,250	19,900	11,600
Davis Creek	39	18,620	1,200	1,200	2,600	2,000
Goose Creek	40	27,580	1,460	1,460	6,300	4,000
Main & Small Tribs. R.6	41	101,000	11,030	11,030	51,570	6,200
Long Creek	42	98,550	8,120	8,120	42,700	19,100
Indian Creek	43	20,290	890	890	8,000	0
Otter Creek	44	41,860	1,260	1,190	13,700	300
Main & Small Tribs. R.7	45	79,940	20,900	20,900	25,230	260

B. Forest Resource Problems

Numerous uses are made of the forest resource including recreation, wildlife, livestock grazing, timber harvesting, and watershed protection. In many instances, several of these land uses can and do occur on the same piece of land simultaneously. However, in other cases, because of land use intensities and other factors, some uses are not compatible. For instance, excessive grazing of forest land can damage the forest resource to the extent that recreation, water quality, long-term timber harvesting, and wildlife values deteriorate. New subdivisions within a forested setting, while quite desirable from the owners standpoint, can effectively modify or eliminate other uses including various recreational activities, wildlife, timber harvesting, and watershed protection.

Other uses occur which unalterably eliminate the forest resource. Conversion to cropland or pasture, municipal-industrial development, transportation and utility rights-of-way, and water developments are probably the most significant uses contributing to a decline in forest acreage.

Reduction of grazing of woodlands is needed on some 32,000 acres of woodland areas. Reforestation is needed on about 44,000 acres. Timber stand improvement should be carried out on about 52,000 acres. And forage improvement should be done on some 31,000 acres of woodland.

Any change in land use from woodland to some other use reduces the areas of useful multiple purpose wooded areas. Changes in use are: Cropland, pasture, urban areas, recreational developments, and the like. Each of these land use conversions either eliminate the wooded areas or reduces its effectiveness for multiple-use purposes.

C. Water Problems--Quantity and Quality (Groundwater)

Agricultural, rural domestic and livestock

There is no groundwater quantity and quality problem that is definable for the entire basin. In general adequate supplies of acceptable quality are available. However, there are areas where it is difficult to develop a suitable supply at depths generally considered economical for the average domestic or agricultural user.

In the middle part of the basin those localities away from the stream valleys often find it necessary to utilize highly mineralized water from the sands within the deep levels of the glacial drift. In the absence of those sands the next alternative at a reasonable shallow depth is the Devonian-Silurian interval, but the water in this interval is generally so highly mineralized in sulfate as to be undesirable for drinking.

Along the western portions of the southern part of the basin there is difficulty in obtaining adequate yield from the Mississippian bedrock. The strata are tightly cemented and have few secondary openings and thus the yield from these rocks may be marginal even for domestic or agricultural usage.

Municipal and Industrial

The municipalities and industries located along the Iowa River and the major tributaries generally have little difficulty in developing satisfactory water supplies. However, the smaller municipalities and industries in comparable parts of the basin are confronted with the same problems as those described for the rural users.

Although there are localized water supply problems within the basin, there are alternate sources that can be utilized. Generally to utilize these sources requires considerable financing for drilling to deeper aquifers or for pipeline construction to alluvial supplies.

All towns in the Subbasin that have recognized sewer systems are providing adequate treatment for their waste. The City of Burlington is scheduled to install secondary treatment facilities by 1975.

III. SUBBASIN RESERVOIR SITE INVENTORY

An inventory of potential reservoir sites was made in the upstream area of the Iowa River Subbasin. The information developed for 128 sites was based upon information gathered by the Soil Conservation Service. There are a few other potential reservoir sites that were not inventoried that could provide water impoundments with surface areas of from 10 to 100 acres in size. It is felt that those that were inventoried are some of the most desirable sites. Location map, Figure 6, shows in general, sites are available throughout the Subbasin except the upper reaches that include Wright, Franklin and Hancock Counties.

These sites present opportunities for water storage in the Iowa River Subbasin for floodwater storage; sediment control; recreation; and fish and wildlife development; water supply for rural domestic, livestock, municipal and industrial uses, and other beneficial uses. The inventory reflects only physical potential for storage in the Subbasin and economic justification of sites is not implied. More intensive on-site investigations should be made to substantiate topographic and geologic data before sites are selected for detailed planning and development.

In general, sites were limited to drainage areas of under 50 square miles. Sites having significant adverse effects on railroads, Federal and State highways and county roads, towns, and concentration of buildings were avoided.

A Soil Conservation Service inventory of farm ponds that have fishing potential shows that 897 exist in the Iowa Subbasin with surface areas of 1 to 5 acres, 23 with surface area of 5 to 10 acres, and 11 with surface area of over 10 acres. This inventory indicates that sites for small ponds are relatively plentiful in the southern three-quarters of the Subbasin.

A representative group of reservoir sites in the Iowa-Cedar Rivers Basin were studied in detail to establish reservoir storage requirements for floodwater detention. In general maximum storage available for beneficial uses was based on anticipated annual water yield from the contributing drainage area. Reservoir storage includes sediment, beneficial use, and temporary floodwater. Beneficial storage includes all permanent storage, except for sediment, for any desired purpose. Structure data appears on Table 10.

Sediment volume needed was estimated for a 50-year period. Temporary flood storage required in this area is normally about four to five inches of runoff from the contributing watershed.

No reservoir costs have been developed for these sites.

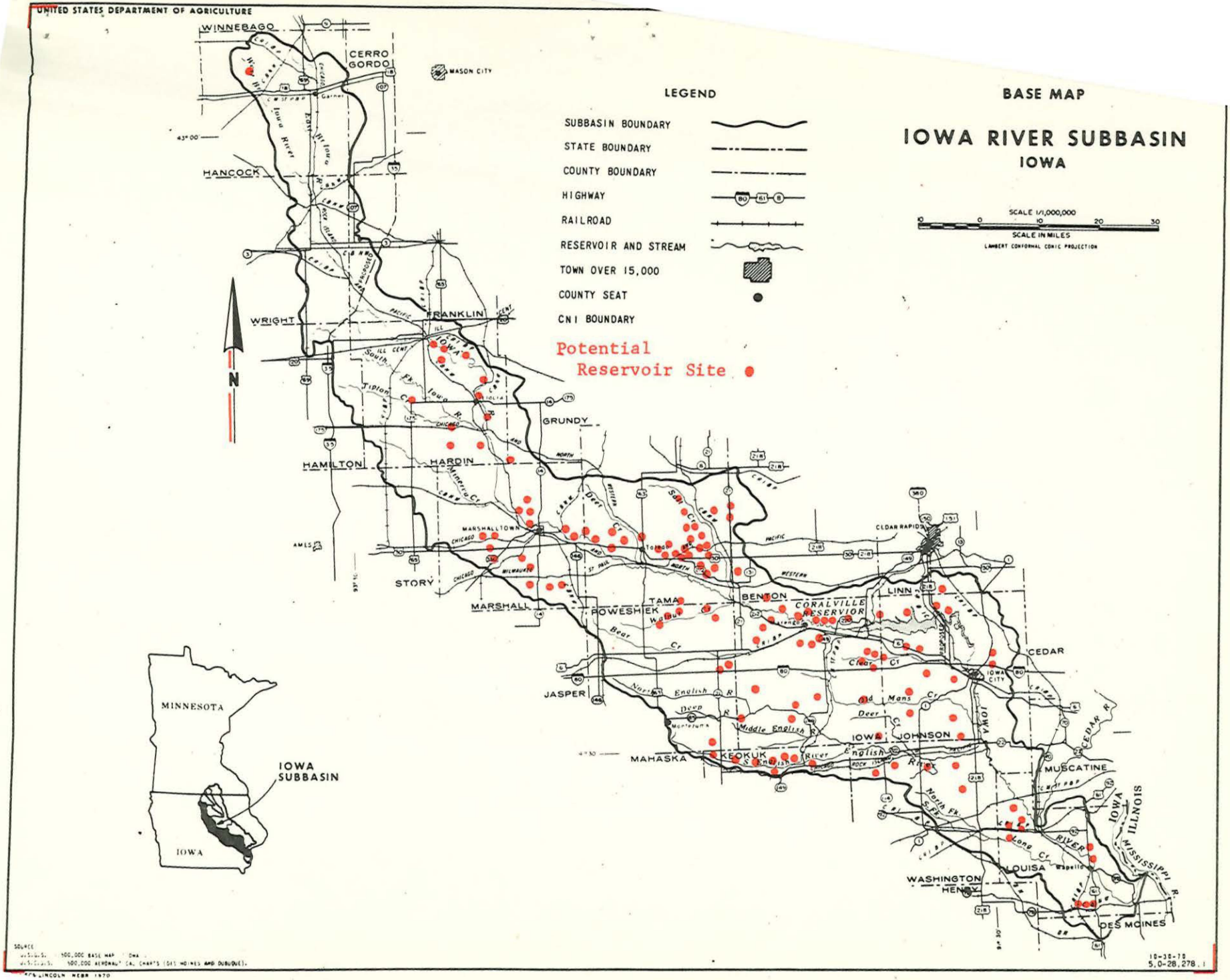
UNITED STATES DEPARTMENT OF AGRICULTURE
BASE MAP
IOWA RIVER SUBBASIN
IOWA
LEGEND
SUBBASIN BOUNDARY
STATE BOUNDARY
COUNTY BOUNDARY
HIGHWAY
RAILROAD
RESERVOIR AND STREAM
TOWN OVER 15,000
COUNTY SEAT
CNI BOUNDARY
Potential Reservoir Site
SCALE 1/1,000,000
SCALE IN MILES
LAMBERT CONFORMAL CONIC PROJECTION
WINNEBAGO
CERRO GORDO
MASON CITY
HANCOCK
WRIGHT
FRANKLIN
GRUNDY
HAMILTON
HARDIN
STORY
MARSHALL
TAMA
POWESHIEK
BENTON
LINN
CEDAR
JASPER
MAHASKA
KEOKUK
JOHNSON
IOWA
MUSCATINE
LOUISA
WASHINGTON
HENRY
DES MOINES
AMES
CEDAR RAPIDS
IOWA CITY
CORALVILLE RESERVOIR
MINNESOTA
IOWA
IOWA SUBBASIN
N

Figure 6

TABLE 10

POTENTIAL RESERVOIR SITE INVENTORY DATA
Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr.)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool		Temporary Flood-water	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Minimum Acres	Max. Acres	Acres	
Benton Co.													
6-11	18	84N	12W	23.2	45	1240	--	5560	6800	390 1/	--	790	X
6-12	19	84N	12W	15.4	40	830	--	3700	4530	270 1/	--	590	X
6-21	9	82N	12W	8.2	45	440	2780	1980	5200	140	285	375	X
6-26	32	82N	11W	4.0	40	220	1390	960	2570	90	170	215	X
6-28	27	82N	11W	1.2	35	80	420	270	770	40	45	70	X
Grundy Co.													
38-8	31	86N	18W	1.4	35	90	450	340	880	32	50	68	X
Hardin Co.													
42-14 2/	27	89N	20W	2.2	40	120	650	500	1270	60	90	130	
42-15 2/	4	88N	20W	1.1	40	60	320	250	630	30	40	70	
42-16 2/	32	89N	19W	2.4	40	130	700	550	1380	70	100	140	
42-17 2/	12	88N	20W	4.1	40	220	1200	920	2340	100	170	230	

1/ Sediment pool.
2/ Data estimated as USGS topographic coverage is not available.

TABLE 10

POTENTIAL RESERVOIR SITE INVENTORY DATA
Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool Minimum	Multi-purpose Pool Max.	Temporary Flood-water	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Hardin Co. (cont'd)													
42-19 2/	22	88N	19W	1.0	40	60	300	240	600	30	45	60	
42-20 2/	5	88N	19W	2.3	40	120	670	520	1310	65	100	130	
42-21 2/	3	87N	21W	1.7	40	90	500	400	990	50	75	100	
42-24 2/	27	87N	20W	1.6	45	90	470	370	930	45	70	90	
42-25 2/	21	87N	19W	9.0	45	500	2640	2060	5200	200	360	460	
42-27 2/	16	86N	19W	1.1	45	60	320	260	640	35	50	65	
Iowa Co.													
48-5	24	81N	12W	1.4	45	150	530	330	980	40	60	76	X
48-8	11	81N	11W	2.6	40	260	970	630	1860	80	110	140	X
48-9	12	81N	11W	2.1	45	230	790	500	1520	70	90	115	X

2/ Data estimated as USGS topographic coverage is not available.

TABLE 10

POTENTIAL RESERVOIR SITE INVENTORY DATA
Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-Water	Total	Multi-purpose Pool		Temporary Flood-water	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Minimum Acres	Max. Acres	Acres	
Iowa Co. (cont'd)													
48-10	17	81N	10W	1.2	40	140	450	290	880	40	46	60	X
48-11	16	81N	10W	1.8	40	190	680	440	1310	50	75	95	X
48-12	23	81N	10W	2.9	45	280	1090	700	2070	80	112	150	X
48-13	19	81N	9W	2.8	40	280	1050	680	2010	90	120	160	X
48-16	1	80N	11W	2.3	45	225	860	550	1635	50	95	125	X
48-17	5	80N	10W	11.0	45	880	4110	2640	7630	280	455	580	X
48-18	29	80N	9W	9.3	35	600	--	5160	5760	114 1/	--	310	X
48-19	16	80N	9W	9.7	35	600	--	5400	6000	100 1/	--	315	X
48-20	35	80N	9W	9.2	40	690	--	4290	4980	110 1/	--	270	X
48-21	25	80N	9W	5.0	35	410	--	2740	3150	50 1/	--	170	X

1/ Sediment pool.

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Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Floodwater	Total	Multi-Purpose Pool Minimum	Multi-Purpose Pool Max.	Temporary Floodwater	
	Sec.	Twp	Range	Sq.Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Iowa Co. (cont'd)													
48-22	25	79N	12W	7.1	40	550	2660	1710	4920	210	280	350	X
48-26	22	79N	9W	12.4	45	820	4630	2980	8430	260	470	600	X
48-31	24	78N	9W	4.3	40	380	1610	970	2960	140	180	220	X
48-32	4	81N	11W	1.0	45	120	375	240	735	30	45	70	X
48-33	25	81N	12W	0.9	40	110	340	220	670	40	45	60	X
48-34	3	80N	12W	1.9	40	200	710	460	1370	70	85	105	X
48-35	4	80N	10W	0.3	40	45	115	75	235	10	10	15	X
48-36	5	78N	12W	40.6	50	2170	14500	9750	26420	1100	1200	1530	X
48-37	35	79N	11W	2.8	40	270	830	700	1700	80	95	135	X
48-38	2	78N	11W	1.7	40	180	640	410	1230	60	75	95	X
48-39	33	79N	10W	3.7	35	330	1390	890	2610	120	145	190	X

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Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool		Temporary Flood-water	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Minimum Acres	Max. Acres	Acres	
Johnson Co.													
52-1	19	81N	8W	1.6	50	160	640	360	1160	45	65	85	X
52-2	18	81N	6W	6.9	60	490	2760	1550	4800	115	180	250	X
52-6	19	80N	8W	3.5	35	350	--	730	1080	56 1/	--	115	X
52-7	22	80N	8W	1.7	40	170	680	390	1240	55	80	105	X
52-8	29	80N	7W	8.1	40	520	--	1760	2280	70 1/	--	205	X
52-9	30	80N	5W	20.1	65	1080	8040	4510	13630	200	600	815	X
52-10	4	80N	7W	3.2	30	280	1290	770	2340	120	200	265	X
52-11	31	80N	5W	3.0	40	260	1200	680	1140	75	115	170	X
52-13	23	79N	8W	23.5	45	1260	9400	5270	15930	400	880	1100	X
52-16	7	79N	6W	1.6	40	170	640	440	1250	75	80	100	X
52-19	1	78N	8W	3.6	40	300	1440	810	2550	90	140	190	X
52-25	13	81N	8W	9.5	45	610	3800	2130	6540	100	350	450	X

1/ Sediment Pool.

TABLE 10

POTENTIAL RESERVOIR SITE INVENTORY DATA
Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Floodwater	Total	Multi-purpose Pool		Temporary Floodwater	
	Sec	Twp	Range	Sq Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac. Ft.	Minimum Acres	Max. Acres	Acres	
Johnson Co. (cont'd)													
52-26	22	79N	9W	4.8	55	370	1920	1080	3370	90	150	200	X
52-28	9	78N	9W	3.1	35	270	1240	750	2260	95	135	180	X
52-29	32	78N	9W	14.6	45	830	5840	3510	10180	285	550	705	X
Keokuk Co.													
54-1	5	77N	13W	27.6	45	1800	4800	6050	12650	460	630	920	X
54-3	13	77N	12W	7.3	45	700	2500	1700	4900	200	260	350	X
54-6	16	77N	12W	2.5	40	240	900	780	1920	80	110	150	X
54-8	13	77N	12W	3.3	40	310	1160	910	2380	80	120	170	X
54-9	19	77N	11W	2.6	40	250	920	700	1870	80	100	140	X
54-11	14	77N	11W	2.3	40	210	860	560	1630	80	110	135	X
54-12	13	77N	11W	1.8	40	180	680	440	1300	50	65	85	X

TABLE 10

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Iowa River Subbasin
Iowa-Cedar Rivers Basin

Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool Minimum	Multi-purpose Pool Max.	Temporary Flood-water	
	Sec	Twp	Range	Sq.Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Linn Co.													
57-17	25	82N	7W	15.0	45	800	5600	3360	9760	240	545	730	X
Louisa Co.													
58-5	32	76N	5W	2.2	50	130	880	530	1540	40	60	85	X
58-6	11	75N	5W	1.3	45	80	520	320	920	30	50	65	X
58-7	10	75N	5W	13.7	45	730	5470	3300	9500	290	535	710	X
58-8	22	75N	5W	1.2	45	80	480	290	850	30	45	60	X
58-9	29	75N	5W	1.5	45	90	600	360	1050	35	55	70	X
58-10	34	75N	3W	1.5	45	90	600	360	1050	45	65	90	X
58-11	15	74N	3W	4.9	50	270	1960	1180	3410	75	170	255	X
58-12	21	73N	3W	2.9	55	160	600	700	1460	40	50	85	X
58-13	21	73N	3W	9.2	70	500	2600	2200	5300	100	145	205	X
58-14	22	73N	3W	1.4	50	90	560	340	990	25	40	55	X

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Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool		Temporary Flood-water	
	Sec.	Twp	Range	Sq.Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Minimum Acres	Max. Acres	Acres	
Marshall Co.													
64-1	21&22	18N	85W	17.0	50	930	4900	3370	9200	250	435	625	X
64-2	28	18N	85W	7.7	40	520	--	1630	2150	85 1/	--	215	X
64-3	31&32	18N	85W	6.2	35	470	--	1280	1750	80 1/	--	190	X
64-10	27	17N	84W	8.3	40	450	2700	2150	5300	150	250	340	X
64-13	36	17N	84W	3.9	70	210	1240	930	2400	40	85	145	X
64-14 2/	31	19N	84W	23.0	40	1230	7360	5520	14110	400	860	1100	
64-15 2/	33	19N	84W	3.5	40	240	1120	840	2200	85	150	195	
64-16 2/	4&5	19N	84W	4.2	40	270	1350	1000	2620	100	175	235	
64-19 2/	21	19N	83W	14.4	40	770	--	3460	4230	270 1/	--	550	
64-20 2/	26	19N	83W	3.5	40	240	--	840	1080	85 1/	--	150	
64-21 2/	27&34	18N	83W	8.4	40	450	2700	2020	5170	175	335	440	

1/ Sediment pool.
2/ Data estimated as USGS topographic coverage is not available.

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Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50 yr)	Beneficial Use	Temporary Flood-water	Total	Multi-purpose Pool Minimum	Multi-purpose Pool Max.	Temporary Flood-water	
	Sec.	Twp	Range	Sq.Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Marshall Co. (cont'd)													
64-22 2/	3&10	18N	82W	14.1	40	750	4500	3400	8650	265	545	705	
64-23 2/	18	17N	82W	14.6	40	780	4680	3500	8960	275	550	725	
64-24 2/	16	17N	82W	14.8	40	790	4740	3560	9090	280	570	740	
Poweshiek Co.													
79-1	3	81N	14W	3.7	40	300	1160	800	2260	140	140	200	X
79-5	16	81N	13W	3.9	45	370	1390	940	2700	90	140	200	X
79-6	9	81N	13W	2.6	45	250	940	610	1800	70	90	140	X
79-11	28	78N	13W	10.6	45	750	3650	2550	6950	210	320	445	X
79-12 2/	18 & 19	81N	14W	24.5	60	1300	6650	5000	13000	350	550	790	
79-13 2/	17	81N	14W	3.5	40	300	1000	800	2200	80	120	160	
79-14	27	80N	13W	1.9	40	200	660	460	1320	55	80	110	X

2/ Data estimated as USGS topographic coverage is not available.

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	Sec.	Twp	Range	Sq.Mile	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Poweshiek Co. (cont'd)													
79-15	26	80N	13W	1.9	40	200	660	460	1320	55	80	110	X
79-16 2/	7	79N	15W	18.8	45	1000	6000	4500	11500	300	520	900	
Tama Co.													
86-25	29	84N	16W	3.1	40	200	1000	720	1920	80	110	140	X
86-28	31	84N	15W	3.1	50	200	1000	740	1940	80	105	145	X
86-34	10	84N	14W	3.3	45	200	1050	750	2000	80	100	140	X
86-35	24	84N	14W	3.5	45	200	1100	800	2100	100	120	165	X
86-36	35	84N	14W	1.5	45	110	390	480	980	50	55	75	X
86-37	15	84N	13W	21.5	45	1200	--	5200	6400	175 1/	--	560	X
86-38	4	83N	16W	2.5	55	160	760	580	1500	40	65	85	X
86-39	13	83N	16W	4.0	45	220	1320	1000	2540	130	130	190	X

1/ Sediment pool.
2/ Data estimated as USGS topographic coverage is not available.

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						Sediment (50 yr)	Beneficial Use	Temporary Floodwater	Total	Multi-purpose Pool Minimum	Multi-purpose Pool Max.	Temporary Floodwater	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Ac.Ft.	Acres	Acres	Acres	
Tama Co. (cont'd)													
86-41	9	83N	15W	1.7	40	110	380	530	1020	60	60	80	X
86-42	18	83N	13W	6.0	45	350	2080	1670	4100	250	250	350	X
86-43	9	83N	13W	2.5	40	160	800	580	1540	60	90	120	X
86-44	22	83N	13W	1.6	40	110	510	400	1020	50	60	80	X
86-45	31	83N	13W	2.0	40	130	620	450	1200	80	80	100	X
86-49	34	82N	14W	12.4	45	830	3870	3200	7900	400	450	650	X
86-51	2	82N	13W	3.5	45	200	1080	860	2140	80	115	165	X
86-40	17	83N	14W	3.8	35	300	1230	880	2400	150	150	200	X
86-55	35	84N	15W	1.4	35	100	450	350	900	45	55	85	X
86-56	21	83N	14W	0.8	35	50	260	210	470	25	30	40	X
86-57	22	83N	14W	0.7	40	40	225	195	460	30	32	45	X
86-58	23	83N	14W	0.5	30	30	160	140	300	20	20	25	X

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Site No.	Location			Drainage Area	Est. Dam Height	Storage Capacity				Water Surface			Map Available in Report
						Sediment (50yr.)	Beneficial Use	Temporary Floodwater	Total	Multi-purpose Pool		Temporary Floodwater	
	Sec.	Twp	Range	Sq. Miles	Ft.	Ac.Ft.	Ac.Ft.	Ac. Ft.	Ac.Ft.	Minimum Acres	Max. Acres	Acres	
Tama Co. (cont'd)													
86-59	23	83N	14W	0.8	35	50	250	190	490	25	28	40	X
86-60	26	83N	14W	0.6	40	40	180	150	330	20	20	30	X
86-61	25	83N	14W	0.7	45	40	220	190	450	20	25	35	X
86-62 2/	20	83N	14W	18.8	50	1000	6100	4700	11800	500	600	820	
86-64	7	82N	13W	6.5	50	400	2100	1600	4100	175	195	270	X
86-65	27&34	85N	14W	22.2	50	1200	6770	6030	14000	500	630	900	X
86-66	35	84N	14W	19.6	45	1050	5700	4750	11500	500	570	740	X
Washington Co.													
92-1	25	77N	9W	2.6	40	200	1040	600	1840	70	105	135	X
92-3	20	77N	7W	20.2	55	1100	8100	4800	14000	600	680	910	X
92-5	19	77N	6W	1.8	45	150	700	500	1350	60	80	110	X
92-7	16	76N	6W	11.5	50	600	4600	2800	8000	300	400	540	X
92-9	21	77N	8W	9.2	45	520	3600	2560	6700	360	360	500	X

2/ Data estimated as USGS topographic coverage is not available.

IV. SUBBASIN ENVIRONMENTAL QUALITY PROBLEMS

Severe sheet erosion resulting in much pollution and sediment damages throughout the lower three-fourths of the Subbasin. Sediment damages include siltation of drainage ditches, floodways, road and highway ditches and culverts. Otter Creek wildlife refuge in Tama County, and rapid loss of recreation pools of Union Grove State Park and the Coralville Reservoir. Sediment also reduces water quality of streams and lakes by being a carrier of such pollutants as insecticides and phosphates.

Farm income is reduced in the upper reaches of the Subbasin by inadequate drainage of cropland.

Inadequate wildlife cover in the upper reaches of the Subbasin. Pheasants sustain heavy losses many years due to inadequate winter cover to protect them from severe weather. Over-grazing of forested areas is creating poor quality timber, reducing wildlife habitat and lowering recreational values. Over-grazing also causes soil erosion which contributes to downstream sedimentation and deposition problems.

Many abandoned automobiles scattered throughout the basin with many discarded in what could be scenic woodland areas. Specific problem areas were noted in the area north of the Coralville Reservoir. Some were noted to be pushed into gullies and minor tributaries of streams that were creating additional erosion rather than preventing erosion along with sight pollution.

Feedlot problems resulting in pollution of water and air and erosion of soil that results in sedimentation of roads, ponds and lakes. One example is a large lot one half mile west of Owasa in Hardin County where 8,000 to 10,000 head of cattle are on feed.

Recreation demands of Coralville Reservoir and Lake MacBride are exceeding the facilities. Quality of facilities for recreation about the Coralville Reservoir for hikers, picnickers, and campers could be improved. Encroachment of streams by landowners in urban areas such as Ralston Creek in Iowa City.