

SECTION IV
FACTORS INFLUENCING AND
CONSTRAINING RESOURCE
DEVELOPMENT AND MANAGEMENT

SECTION IV - FACTORS INFLUENCING AND CONSTRAINING
RESOURCE DEVELOPMENT AND MANAGEMENT

4-01. GENERAL LAND AND WATER CONSTRAINTS

a. Topography and Soils.

The geological elements of the area around Carlyle Lake do not present any particular known constraining influences to resource development and management. However, the other associated elements, topography and soils, do present resource management problems such as erosion control.

The relatively flat topography around the perimeter of the lake coupled with a fluctuating pool level causes extensive mudflat areas to be exposed at various times. These areas are not aesthetic and are difficult to manage. It is difficult to establish any type of vegetative cover which will grow under these adverse conditions. Due to the flat topography, portions of public access areas are flooded during periods of high water. In addition to the temporary loss of recreational use of these sites, the high water severely limits the variety of plant species which can be used to control erosion on the mudflats.

The soils of the area present several problems. They are quite erosive particularly when the shoreline of the lake is subjected to periods of high water combined with windy conditions. The lake is also located in the center of a zone of solonetzic soils in Illinois. These are nitric soils, which have a high content of sodium, which present extremely difficult problems in establishing woody vegetation. Solonetzic soils are definitely a constraining influence in resource development and management.

b. Water Constraints. The lake level may rise or fall depending upon the natural factors of flood and drought. During flood control operations, the level of the lake is allowed to rise so that additional water storage can be achieved, thereby lessening the adverse effect of flooding to the downstream area. As the level of the lake rises, additional portions of land used for recreation are inundated, thereby restricting their use. The degree and length of restriction depends upon the severity of the flood. A pool elevation of 450 NGVD has detrimental effects upon recreational activities at the lake. Although most recreation areas will remain open at this elevation, some swimming, picnicking, camping, and most boat launching facilities are closed. Adverse side effects will include the destruction of grass turf, killing of trees, accumulation of driftwood in mowed areas, erosion of the shoreline, and loss of revenue to the businesses around the lake. Floods in excess of a 450 NGVD will cause proportionately greater damages, and at pool elevations in excess of 455 NGVD, most recreation areas are closed. The closure of recreation areas, if prolonged over a good portion of the season, can cause economic hardship for tourist associated businesses around the lake. Flooding, as described, is generally considered very beneficial to aquatic ecosystems and a requirement for their optimum development. Constraints on the optimum development of these resources would include such factors as elevated turbidity and poorly timed water level fluctuation or stabilized water levels. This subject is discussed more fully in SECTION 4-07 below.

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c. Area Development as a Result of the Project.

As a result of Carlyle Lake being constructed and operated, several pertinent situations have developed which to some extent affect the environment of the project areas. The land acquisition policy at Carlyle Lake was such that the great majority of fee land was only purchased to elevation 450 (programmed 5-year flood frequency); however, additional minor acquisition of real estate above this elevation has and is currently taking place due to extensive shoreline erosion in certain areas. This subject is discussed further in Section 10-08.

Rather than purchasing all the land outright for Carlyle Lake operations between 450 and 465.5 NGVD, the federal government only purchased the right to flood these lands. These lands are designated as flowage easement lands. The Corps currently owns flowage easement rights on 24,972 acres of land around Carlyle Lake. On tracts where flowage easements were acquired, residences can only be constructed on ground at or above 462.5 and must have a first floor elevation of 467.2. Any construction requires an approved flowage easement permit. Several subdivisions were developed on private ground adjacent to Corps community boat dock harbors during initial construction. Some developments are oriented to the overnight and vacation camper, however, they are more developed than the Corps and state facilities. Other developments include year-round homes and house trailers. The community boat docks are now grandfathered and no new harbors are permitted.

When easement tracts are developed for subdivisions purposes, an approved sewage system must be provided for all lots. The sewage treatment must meet State of Illinois, Department of Public Health standards. Outdoor toilets (open pits) are not permitted. Some developments are located entirely on private land. The Corps has no zoning control of these areas, but a county zoning ordinance was established in Clinton County in August 1992 to regulate future development.

4-02. DEMOGRAPHIC DATA

The following is a brief economic and demographic analysis of Bond, Fayette, Marion, and Clinton Counties, Illinois. The combined area is located northeast of the St. Louis, Missouri - Illinois Metropolitan Statistical Area (MSA). This investigation will focus on a statistical analysis of past, present, and future trends of the counties mentioned above. TABLE 3 and FIGURE 1 reveal a growth trend in the study area for the period of 1960 through 1980 with a slight decrease (3.5%) in the decades of the fifties and eighties. Overall in the last 30 years, the area has experienced an 9% increase of population from 99,384 in 1960 to 108,389 in 1990.

4-03 AREA OF INFLUENCE

General. A 100 mile radius of influence, centered on the dam site, has been adopted for purposes of this Master Plan. See PLATE 3, Population Density Map and Zone of Influence. This zone is preponderantly in southern Illinois, but includes the large metropolitan complex of greater St. Louis and a portion of east central and southern Missouri. The area is generally characteristic of the Midwest adjacent to the Mississippi Valley. The St. Louis Metropolitan Statistical Area (MSA) on both sides of the Mississippi River represents the significant concentration of both population and industry. The remainder of the zone is primarily agricultural in nature with numerous small cities, towns and villages offering commodities and services. The area is well served by freight rail service, road systems, and truck lines.

TABLE 3
COUNTY POPULATIONS

	1990 ¹	1980 ²	1970 ³	1960 ⁴
Bond	14,991	16,224	14,012	14,060
Clinton	33,944	32,617	28,315	24,029
Fayette	20,893	22,167	20,752	21,946
Marion	<u>41,561</u>	<u>43,523</u>	<u>38,986</u>	<u>39,349</u>
	108,389	114,531	102,065	99,384

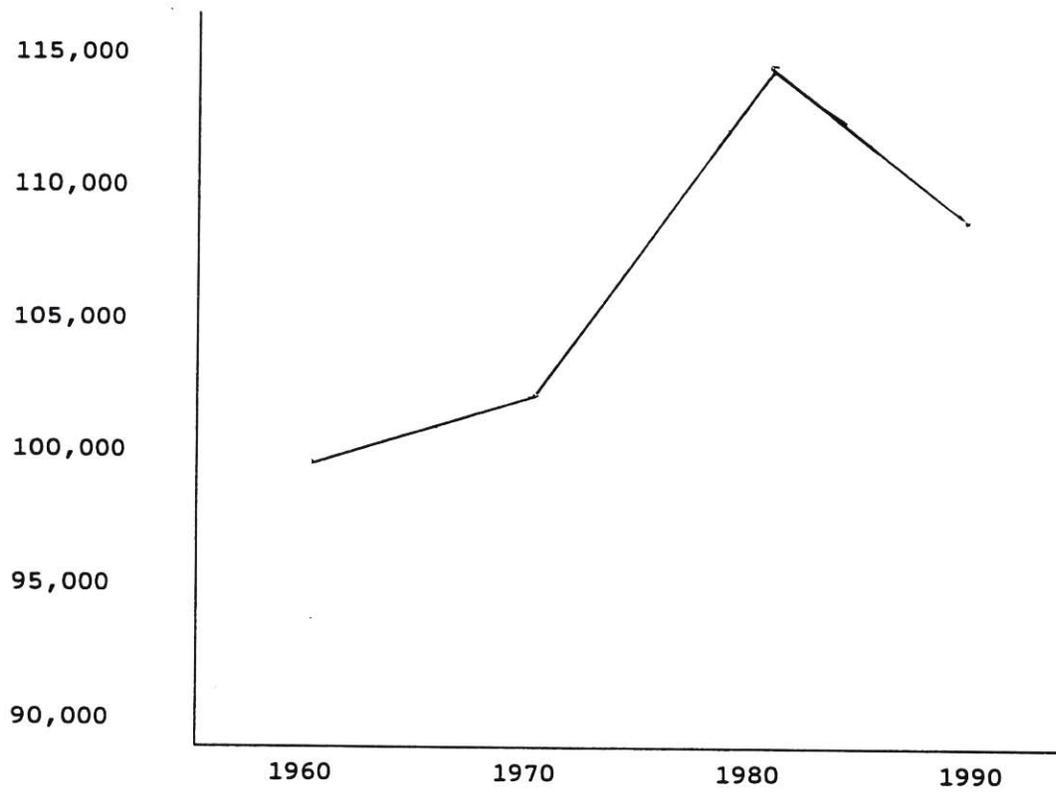
¹ U.S. Bureau of the Census, 1990 Census of Population, General Population Characteristics, Illinois. Pages 1 & 2.

² U.S. Bureau of the Census, 1980 Census of Population, General Social and Economic Characteristics, Illinois. Page 15-17.

³ U.S. Bureau of the Census, 1970 Census of Population, General Population Characteristics, Illinois. Pages 15-87 and 15-88.

⁴ U.S. Bureau of the Census, 1960 Census of Population, General Population Characteristics, Illinois. Pages 15-55 and 15-56.

FIGURE 1
COMBINED POPULATION TRENDS OF FAYETTE, CLINTON, BOND, AND
MARION COUNTIES, ILLINOIS
1990



Source: TABLE 3

b. Industries. The concentration of population and industry in the St. Louis MSA has shifted from the city of St. Louis to St. Louis and St. Charles Counties. Manufacturing employed the greatest percentage of workers in the study zone in the 1970's, with the manufacture of shoes, malt beverages and air and spacecraft dominating. Even though the three major automobile manufacturing corporations and several leading defense contractors and major chemical companies are located in the zone, the employment trend in the last two decades has been away from manufacturing and into the service sector which employs 38 percent of all workers in the study zone. The service sector comprises such occupations as health services, financial services, educational, legal, and personal services. A wide variety of light industries, wholesale and retail commercial establishments operate in the study zone.

c. Transportation and Road Network. The St. Louis MSA is a major railroad center of the United States. Adequate freight service is available throughout the area. Passenger rail and service has decreased at an accelerating rate over time. Many towns in the zone of influence, formerly served by passenger rail service now have none at all and the remainder consider this mode of transportation to be inadequate. Passenger rail service's obsolescence was brought about in large part by the use of private automobile transportation and the expansion of passenger bus. In recent years rural passenger bus service is virtually non-existent and is only available in the larger cities.

In 1994, a light rail commuter line was completed between East St. Louis and metro St. Louis. Monies for expansion of this line east to the new airport at Scott Air Force Base have been appropriated and this segment may be completed over the next few years.

A number of smaller cities have small airports capable of handling light executive type aircraft and a number of cities have scheduled service by feeder airlines. The Lambert International Airport located in St. Louis County adequately meets the air transportation needs of the majority of the study zone. A commercial/military airport is being constructed adjacent to Scott Air Force Base. This joint use airport will serve southwest Illinois and is only 30 miles from the dam.

A comprehensive network of interstate, intrastate, primary, secondary and farm-to-market roads adequately serve the study zone. However, heavy traffic conditions prevail on metro interstates during rush hours on weekdays in the St. Louis/St. Charles area. The development of express bus service and light rail between Lambert Airport and East St. Louis has provided some relief for commuter congestion. More branch routes may be added which would further relieve rush hour and special event traffic congestion.

d. Relationship to Other Agencies Programs. State, federal and local agencies are advised and given the opportunity for input on future plans or impacts that affect Carlyle Lake. Currently, primary coordination efforts are with the Illinois Department of Natural Resources because of their extensive participation in the development and management of Corps owned lands; their ability to establish and enforce State Fish and Wildlife regulations and laws; and their enforcement capability as it relates to the Illinois Boat Registration and Safety Act.

e. Market Area Delineation for Boating.

The Illinois market area consists of the following ten counties within approximately 50 miles of Carlyle Lake: Bond, Clinton, Fayette,

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Macoupin, Madison, Marion, Monroe, Montgomery, St. Clair and Washington. Metro-East communities such as Alton, Belleville, Collinsville, Edwardsville, Glen Carbon and Granite City, along with those closer to the lake such as Centralia and Salem, supply the majority of the Illinois market area boaters.

Carlyle Lake primarily serves weekend recreational boaters who prefer that their boats be located within an hour or less drive from their homes. Therefore, the primary service area for marina development at Carlyle Lake is based upon an approximate 50 mile radius of the lake. The shape of the market area is influenced by factors other than driving time, however, such as road patterns, population densities and competing facilities. Thus, some areas outside of the 50 mile radius may be included in the primary market while some areas within the 50 mile radius may be excluded. (See Plate 3)

The Carlyle Lake market is stronger to the west towards the St. Louis Metropolitan Area and weaker towards the sparsely populated areas east and southeast of the lake. The market area is also limited, to a minor degree, to the north and south by the market areas for Lake Shelbyville and Rend Lake, respectively.

A survey of zip codes conducted by West Access Marina on current and past marina patrons at West Access Marina and the 1994 members of the Carlyle Sailing Association revealed that 70.7 percent of customers and members come from Missouri locations. Twenty-six and two-tenths percent of customers and members come from Illinois locations and 3.1 percent are from other than 62xxx and 63xxx zip codes.

The Missouri market area consists of the city of St. Louis and the following counties from 40 to 70 miles west of the lake: St. Louis, Jefferson, and St. Charles. The numerous suburban communities within this area, such as Creve Coeur, Ferguson, Manchester, O'Fallon, and St. Charles, supply the majority of Missouri market area boaters.

4-04 ECONOMIC CHARACTERISTICS

There is a wide variety in the degree of economic health of the various areas that comprise the study zone. The total economy of the zone is considered to be highly stable. As indicated earlier, there is a wide variety of industry and commerce which tends towards general stability. Median family income has steadily increased, the percentage of families with income below the poverty level has steadily decreased and the unemployment rate for most counties of the study zone has remained below the national unemployment rate. Outside of the St. Louis MSA, east and west of the Mississippi River, the economy is predominantly agricultural, consisting of cash grain crop and dairy cattle farms. The major crops are corn, soybeans and wheat. Most of the smaller towns in the past depended largely upon business from the farm communities. Due to mechanization of farming, the on-the-farm population has steadily declined. This loss of farm population has precipitated loss of business opportunity to the small towns and rural areas. Insufficient new industry has moved in to offer additional employment opportunities, and as a consequence, the young people both from the farms and from the small towns have migrated to urban population centers to seek employment. However, because of improved road systems and public transportation, there seems to be an increased willingness to commute from further distances. The metro east portion of the St. Louis MSA has also experienced some difficulty with it's economy with an unemployment rate higher than most of the study zone. Industry is more dominant in the metro east general economy. Continued improvements in the efficiency of industrial production will affect the numbers of employed workers. However, it is believed that service sector

opportunities will increase due to riverboat gambling. East of the St. Louis MSA, the economy of much of the rural area and the smaller towns therein may be characterized as unsatisfactory. The coal mining industry shows a marked decline in the number of employees and, in fact, many mines have been closed. Some portions of southern Illinois are considered economically depressed areas.

4-05. ACCESSIBILITY

a. Major Highways. The Carlyle Lake project is bordered on the north by Interstate Highway 70, on the east by U.S. Highway 51, on the south by U.S. Highway 50 and Interstate Highway 64 and on the west by State Highway 127. These major highways provide adequate and safe public access to all areas of the project. Two lanes of a divided, four lane, limited access highway (New U.S. Highway 50, FA 409) running east and west between Lebanon, Illinois and Carlyle, Illinois has been completed. This highway terminates at Rt.. 127 1/4 mile south of the Dam West Recreation Area. Future plans call for the completion to four lanes, a bypass connection around Lebanon to I-64 and the extension of the highway to a point one and a half miles east of Carlyle on Route 50. This highway replaces existing U.S. Highway 50 (now referred to as Old Highway 50) and provides a means of quick, safe access to the lake complex from the St. Louis metropolitan area.

b. County Roads. The off project roads leading from the major highways to the recreation areas are maintained by the local county authorities. In general, the condition of these roads around the project is good. The following is a listing that gives the general location of all county roads considered to be the primary routes of access from the major highways to the recreation areas around the lake. These roads are indexed as numbered on PLATE 2.

- (1) Keyesport and Mulberry Grove Road north of Carlyle. Major access road to the Dam West Recreation Area, Eldon Hazlet State Park, Keyesport, Tamalco and subimpoundments. Clinton, Bond and Fayette Counties.
- (2) Eldon Hazlet State Park Road from Highway 127. Leads to Road No. 1 and Eldon Hazlet State Park.
- (3) Keyesport Road from Highway 127. Leads to Road No. 1 and Keyesport Recreation Area.
- (4) Huey Road. Leads to east end of South Shore State Park to Highway 50.
- (5) Boulder, Ferrin Road. Leads from Highway 50 to Coles Creek Road, Boulder and Patoka Recreation Areas. Clinton and Fayette Counties.
- (6) Coles Creek North and South Roads. Leads from Road No. 5 to Coles Creek Recreation Area.
- (7) Shobonier Road. Leads from Highway 51 to Highway 8-Subimpoundment Road.
- (8) Vandalia - Subimpoundment Road. Leads from Vandalia to Highway 40 to Subimpoundment to Road No. 1. To Subimpoundment; From Subimpoundment to Road No. 1.

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- (9) Patoka Road. Leads from High 51 (Patoka) to the Patoka Boat Access Area.
- (10) Tamalco Road. Leads from Highway 127 to Tamalco Boat Access Area.

4-06. RELATED RECREATIONAL AND HISTORICAL AREAS

a. The following table is a listing of the recreational and historical areas within 25 miles of Carlyle Lake. The available facilities, general direction, and mileage are also listed.

TABLE 4
RELATED RECREATIONAL AND HISTORICAL AREAS
WITHIN THE DELINEATED MARKET AREA

	RACCOON CREEK RESERVOIR	RAMSEY LAKE S. PARK	STEPHEN A. FORBES S. PARK	VANDALIA LAKE	VANDALIA STATE HOUSE	WASHINGTON COUNTY S. PARK
Tent or Trailer Camping	X	X	X	X		X
Fishing	X	X	X	X		X
Swimming	X			X		X
Picnicking	X	X	X	X		X
Boating	X	X	X	X		X
Launch Ramps	X	X	X	X		X
Toilets	X	X	X	X	X	X
Nature Trails						X
Group Camp	X	X				
Lake	X	X	X	X		X
Drinking Water	X	X	X	X	X	X
Electricity	X	X		X		X
Hiking	X	X	X			X
Hunting		X	X			X
Showers	X	X				
Restaurant						X
Saddle Horses	X					
Acreage	1235	1919	3103		2	1417
State of Illinois		X	X		X	X
City-owned	X			X		
Mileage	SE10	N25	E27	N20	NE17	S25

None of these public attractions are comparable in size to Carlyle Lake. They all have outdoor recreational facilities with the exception of the Vandalia State House, a state memorial that was Illinois' first state capitol building. The others listed are either city owned areas or state parks. These areas, while not in competition with Carlyle Lake, provide supplementary points of interest to the visitors at Carlyle Lake. None of these areas have cabin or hotel accommodations within their boundaries, however, these facilities are obtainable locally.

4-07. RESERVOIR PLAN OF REGULATION

The plan of regulation of Carlyle Lake features a seasonally adjusted top of conservation (joint use) pool. The plan selected for the long-term regulation of the project requires the water surface level of the lake to be lowered from elevation 445 feet NGVD to elevation 443 feet NGVD on December 1 and held at 443 until April when it is increased to 444. On 1 May the pool is then allowed to return to elevation 445 for the recreation season. This plan was selected from several studies because it minimizes total damages to the project, both pool and downstream, and balances the damages between those experienced in the pool (mainly recreational) with those downstream of the dam (mainly agricultural). The winter drawdown will reduce the volume of water that must be released downstream during spring runoff, thus improving agricultural conditions, and also shortens the duration of time that the lake is above elevation 445.

Flood damages prevented by the Carlyle Lake and Lake Shelbyville projects since impoundment total approximately \$557,147,000. Flood damages prevented during the 1993 and 1995 flooding totaled \$ 145,000,000 and \$359,000,000 respectively. Most of the flood damage benefits were derived from the Lower Mississippi River floodplain.

Lake Shelbyville is located on the Kaskaskia River upstream of Carlyle at river mile 221.8 from it's confluence with the Mississippi River. Lake Shelbyville is regulated in part to maintain an equilibrium of flood control storage between the two lakes. The drainage area for Lake Shelbyville is 1,030 square miles.

High pool elevations and extended durations of flood control operations adversely affect recreational activities in the lake area and may have a similar impact below the lake in the natural river valley. The effects of pool regulation on the two most popular sport species were studied by researchers of Southern Illinois University at Carbondale during 1988-1993. In their study entitled *Factors Determining Largemouth Bass and Crappie Recruitment in Reservoirs*, it was found that the two primary limiting factors affecting largemouth bass and white crappie populations at Carlyle Lake were rapid pool fluctuations (rises and falls) and availability of flooded terrestrial shoreline vegetation during the spring spawning period. Further discussion can be found under paragraph b.(3) below.

a. Lake Regulation and Flood Control Storage. In order to provide flood protection to downstream property, mainly agricultural crops, water must be stored in Carlyle Lake during periods of high river flow that would result in out of bank conditions. The segment of Carlyle Lake between elevations 445.0 and 462.5 feet NGVD is designated as Flood Control Storage Pool and is for the purpose of storing water during high river flow periods. From 1 May until the crops are harvested, maximum effort is made to protect crops. During the dormant crop season the flow rate into Carlyle Lake is matched by outflow (as near as possible to natural flow) up to 10,000 cfs. The water stored will be evacuated as rapidly as conditions permit so as to have maximum flood protection available when the next wet period occurs. For further details see APPENDIX B to Kaskaskia River Basin, Illinois, Master Reservoir Regulation Manual.

b. Impacts of Flood Control.

(1) Downstream. As stated above, flood control has reduced flood damages downstream by hundreds of millions of dollars. However, flood

waters stored in Carlyle Lake at the peak of a flood must be released at a later time. The releasing of stored waters prolongs the high water period in the river channel downstream, which can be detrimental to bottom land use.

(2) Upstream. Because of the requirement to maintain a minimum pool, opportunities for recreational development were available and subsequent development has exceeded projections. However, as the level of the lake rises, much of the lands used for recreation are inundated, thereby restricting their use. The degree and length of restriction depend upon the severity of the flood. A pool elevation of 450 NGVD has detrimental effects upon recreational activities at the lake. Although most recreation areas will remain open at this elevation, some swimming, picnicking, camping, and most boat launching facilities are closed. Adverse side effects will include the destruction of grass turf, killing of trees, accumulation of driftwood in mowed areas, erosion of the shoreline, and loss of revenue to the businesses around the lake. Floods in excess of a 450 NGVD will cause proportionately greater damages, and at pool elevations in excess of 455 NGVD, most recreation areas are closed. The closure of recreation areas, if prolonged over a good portion of the season, can cause economic hardship for tourist associated businesses around the lake. The inundated areas are unsightly once the water recedes. Swimming beaches are developed so that they may be used with a fluctuating water level of plus or minus 3 feet with little affect upon the visitor. Greater fluctuations render them unusable due to the limits of spread sand. The extent to which picnic and camping areas at Carlyle Lake are affected by flood waters is dependent on their elevation. Coles Creek, Dam West and Eldon Hazlet State Park areas are impacted the most but are able to operate at least partially during high water levels below 455 NGVD. Boat dock facilities become unusable around 450 NGVD except for high water ramps at Dam East and Keyesport, thus limiting boater access. Marinas, are operable up to 455 NGVD. This plan proposes making several boat ramps useable during times of high water (See Section 10-04).

Management practices undertaken to reduce the effect of flooding on the recreation activities include the planting of water tolerant trees and shrub species to preserve vegetative cover on low lying recreation land, raising low portions of access roads to assure access to campgrounds and picnic areas during times of moderate flooding, riprap protection of key recreation areas which are subject to erosion at high pool stages, protecting lift stations from flooding so that toilet facilities can be used during moderate flooding, and drawing the pool elevation down to winter level after waterfowl season each fall so that additional flood storage capacity is achieved. The drawdown has the adverse effect of exposing mud flats in shallow reaches, thereby restricting access to portions of the lake by water. Since recreation activities are at a low intensity during the programmed drawdown between December and May, there is little adverse effect on recreation. Most years, however, seasonal pool cannot be reached by the first of May. This low water does affect recreation in that beaches are not fully usable, the bare strip around the lake is unsightly, and the desire for boating is much less. Steps taken to counteract for low water include the construction of boat channels from the launching ramps to deep water, excavation of marina boat harbors, and sufficient underwater portions of launching ramps to accommodate boats during a moderate drawdown.

(3) During Spring Spawning. One of the limiting factors of fish populations, particularly black bass and sunfish, is pool fluctuation during the spring spawning period. Spring water levels in Carlyle Lake fluctuate frequently, and often abruptly, as a result of normal flood control uses. This is generally detrimental to bass and sunfish which typically spawn in shallow water along the shore. Rapidly falling water strands nests, and

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rapidly rising water often causes nest abandonment. The fish population could be adversely affected if spawning coincides with receding high water or improved if high water is maintained during the spawn.

A water control strategy to maintain a constant to slightly rising pool during the spring fish spawn has been followed the last few years. The goal of the water control strategy is to enhance the fish spawn when hydrologically feasible within the parameters of the Pool Regulation Plan. The fish spawn requires a two step process. First, the water level is held steady or slightly rising for the eggs to hatch. Then once the fry are hatched the water should be raised enough to provide cover in grassy or vegetated areas. The time frame for this activity is limited because of weather conditions. Usually only one fish species can be helped each year. If there is high water, implementation of the water management strategy may not be possible due to the need to release water to keep recreation facilities from being closed during the summer.

The process is initiated when the IDNR informs the Corps water control staff of an impending fish spawn. This is coordinated with the lake staff and Corps Environmental Quality Section. The pool level is then manipulated to bring about the proper sequencing of water levels. The Corps also coordinates with downstream landowners prior to holding the pool slightly higher if necessary.

4-08. RELOCATIONS OF ROADS, CEMETERIES, RAILROADS AND UTILITIES

a. Highways. Elevation 462.5 was used as the guide elevation at which existing county and township road alterations and relocations were made. Where alternate routes were reasonably available at elevation 462.5 or above, road raises were reduced to less than 462.5. The general policy used in the plan of relocation was to maintain the continuity of the existing road network on each side of the reservoir and to provide access to remaining properties and residences adjacent to the reservoir substantially equivalent to that which they had previously.

Most all county and township roads (PLATE 2) are below 462.5 in one or more locations. PLATE 1 shows the flowage easement ground which is 465.5 or below.

b. Railroads. The operations of the Carlyle Reservoir affected that portion of the old CB&Q Railroad system (presently Burlington-Northern Railroad) from a point northwest of Keyesport, Illinois, to a point southeast of Boulder, Illinois. The affected section of track was relocated in the immediate vicinity and constructed with base of rail at minimum elevation 467.6. The relocation involved reconstruction of the main bridge over the Kaskaskia River to a low steel elevation of 463.8 feet NGVD, three overflow bridges in the Kaskaskia River bottom, and one over Brewster Creek immediately south of Boulder, with a low steel elevation of 463.8.

c. Utility Lines.

(1) There is one 138 Kv power line crossing within the limit of the joint use pool. All remaining power and telephone facilities within project limits have either been relocated or removed.

(2) In general, clearances are not less than those outlined in the National Electrical Safety Code, even for reservoirs or areas without boating.

d. Cemeteries. Eighteen cemeteries or burial grounds in the Carlyle Reservoir area were studied with respect to burial sites affected by the Carlyle Reservoir. Approximately 600 burials from 7 cemeteries and private burial sites required relocation. In addition, protective fills were placed in 3 major cemeteries to protect approximately 240 burials. The existing cemeteries in the vicinity of the project are not in the immediate vicinity of any public use areas, with the exception of family cemeteries located in the Eldon Hazlet and South Shore State Parks. The cemeteries do not create any problems and are interesting historical features.

4-09. EARTH BORROW AND SPOIL AREAS

The project has two minor borrow areas within its boundaries. The two areas have been revegetated and do not hamper the scenic qualities of the project. There are no spoil or major borrow areas on adjacent properties.

4-10. WATER QUALITY

a. A water quality investigation program is conducted on a continuing basis by St. Louis District, Corps of Engineers. The water of Carlyle Lake and the downstream river channel is generally good. The lake is a very shallow reservoir susceptible to high winds. These conditions prevent the lake from stratifying permanently during the summer months. During extended periods of very calm winds and high air temperatures the population of algae greatly increases. Upon subsequent die off, the dissolved oxygen is severely depressed. When this condition exists, along with minimum downstream discharge, minor fish kills have occurred in the lake and below the dam. Operational changes are then implemented to improve downstream water quality by changing the release source from the sluice gate to the spillway. This change also increases the minimum release from 50 cfs to 100 cfs. The lake appears to be a suitable source for drinking water both presently and in the future with the exception of possible taste and odor problems associated with algae.

b. All sampling sites - lake, tributary and tailwater - met their appropriate state standards except on a small number of occasions. The lake water met the state standards applying to primary and secondary contact recreation for the main purposes of swimming, boating, fishing and water skiing. Phosphorous levels have exceeded the state standards on a routine basis. Generally, the discharge from the pool has had lower phosphorous concentration than the incoming tributary flows. On a few occasions, the tailwater has not met the minimum dissolved oxygen standard established by the State of Illinois. The project area has several pollution potentials, but at present time, no major form of degradation to the lake or streams is apparent. Constant water quality monitoring will continue to help check future degradation of the area.

4-11. PUBLIC USE OF THE SPILLWAY

Recreational facilities are located adjacent to the Spillway immediately downstream of the dam. This area presently receives the heaviest fishing concentration of any area on the lake. The facilities are included as part of a day use area on each side of the spillway channel with picnicking facilities, waterborne comfort stations, picnic shelters, playground equipment, and adequate parking.

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4-12. FOREST AND MINERAL RESOURCES

The exploitation of mineral resources on project lands has increased in recent years. Oil development has occurred in the Coles Creek Recreation Area and further mineral exploitation may occur. A District oil and gas development policy was developed and implemented in 1995 to manage mineral exploitation and to prevent conflict among user groups at Carlyle Lake. There is no ongoing or proposed exploitation of timber resources.

a. Timber Resources. With the exception of the Eldon Hazlet and South Shore State Parks, most of the timber was located below elevation 448 feet NGVD (3 feet above normal pool). Clearing of the reservoir area consisted of removal of all timber, fences, structures, etc., except in designated areas below that elevation. A total of approximately 16,500 acres were cleared, consisting of approximately 80 percent moderate to heavy timberland and 20 percent cultivated land.

b. Mineral Resources. The mineral resources of the Kaskaskia Basin consist of coal, petroleum, gas, limestone, sand, gravel, and clay. Coal and oil are considered the most important. Mineral resources of the project area, however, are chiefly oil, sand, and gravel. All structures or machinery formerly used for the extraction of these minerals have been removed. Prior to lake impoundment a total of 69 oil wells located in the pool area were plugged.

Mineral activity at the project has been reinitiated and there is scattered oil production in the vicinity of Carlyle Lake. Oil and gas reserves were purchased at the Boulder and West Patoka oil fields. The Bureau of Land Management is the government mineral rights manager and is responsible for leasing rights for oil and gas exploitation at those areas. Privately owned mineral interests were not purchased, but rather subordinated to the right of the United States to construct, operate, and maintain Carlyle Lake. Private mineral exploitation on or under public land is handled through the real estate division office at St. Louis. Exploration and exploitation are permitted but with Corps concurrence. No lake drilling is permitted. All oil wells must be above 450 NGVD and spill containment berms are required around oil operations for environmental protection.

4-13 WATER SUPPLY

The Illinois Department of Transportation negotiated the revision of the water supply contract and a modified contract was signed in 1986. This relieved the State of Illinois from the obligation to pay for water storage operations and maintenance costs until that storage was actually utilized.

4-14. RECREATION ATTENDANCE AND FACILITY REQUIREMENTS

a. Existing User Demand. Existing user demand is reflected using 1996 visitation as a basis for computations. Existing facility requirements are based on current visitation, design criteria, and guidelines detailed in the Institute for Water Resources' Research Report 74-R1. (Estimating Recreational Facility Requirements, Volume IV of V). Facility requirements are oriented toward key facilities which include camp sites, picnic units, boat launching lanes and beach area. This planning methodology estimates the number of facilities necessary to satisfy recreation use on an average weekend day during the peak month of visitation.

(1) Facility Design Day Load. This determination represents the anticipated number of users visiting the project on an average weekend day during the peak month of use. Based on 1996 visitation, the present facility design day load is estimated at 53,278. (See FIGURE 2, ACTUAL AND PROJECTED ANNUAL VISITATION).

FIGURE 2.

ACTUAL AND PROJECTED ANNUAL VISITATION
CARLYLE LAKE, ILLINOIS

ACTUAL RECREATION USE DAYS VISITATION

1970 - 2,022,246	1979 - 2,752,486	1988 - 3,530,773
1971 - 2,330,468	1980 - 2,628,067	1989 - 3,546,272
1972 - 2,262,449	1981 - 2,575,763	1990 - 3,880,531
1973 - 2,534,267	1982 - 3,424,750	1991 - 4,198,436
1974 - 2,658,564	1983 - 3,776,272	1992 - 4,345,954
1975 - 2,360,534	1984 - 3,599,551	1993 - 4,511,261
1976 - 2,310,186	1985 - 3,606,873	1994 - 4,394,159
1977 - 2,815,527	1986 - 3,931,039	1995 - 4,480,439
1978 - 3,116,788	1987 - 4,045,611	1996 - 4,566,719

PROJECTED RECREATION USE DAYS VISITATION

2000 - 4,911,839	2005 - 5,343,239	2010 - 5,774,639
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(2) Summary of Existing User Demand. Utilizing the facility design day load, participation rates for each activity requiring facilities, and the appropriate activity turnover rates, the principal recreation facility requirements were estimated. The existing facility user demand estimate is presented in TABLE 5.

(3) Summary of Existing Facility Supply. The existing supply of key park and recreation facilities is presented in TABLE 5. The principal agencies developing facilities at Carlyle Lake are the Corps of Engineers and the Illinois Department of Conservation. The state contributes to the supply of campsites, picnic sites, and boat launching ramps.

(4) Evaluation of Existing Supply and Demand. Comparison of existing supply and demand, as presented in TABLE 5 indicates a shortage of campsites, and swimming beach to meet demand. Picnic units are slightly in excess of demand.

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TABLE 5

PRINCIPAL RECREATION FACILITIES:
EXISTING SUPPLY AND DEMAND SUMMARY

Facility	Existing Supply			Demand	Existing Excess(+)/Shortage(-)
	Corps	State	Total		
Camp Units	422	397	819	887	-68
Picnic Units	345	372	715	697	+18
Boat Launch Lanes	32	8	40	32	+8
Swimming Beach (sq. ft. sand area)	200,000	0	200,000	260,000	-60,000

b. Projected User Demand. Utilizing projected visitation, current planning and design criteria, and the procedures and guidelines outlined in the Institute for Water Resources' Research Report 74-R1 (Estimating Recreational Facility Requirements, Volume IV), the projected recreation facility requirements through the year 2010 were computed and are presented in TABLE 6. Based on these estimates for existing and projected recreation facility requirements, additional campsites, picnic units, and swimming beach area are needed and there will be an increasing need through the year 2010. Further detailed evaluations will be required to substantiate the key facility demand levels identified by this planning methodology.

TABLE 6

SUMMARY: PROJECTED RECREATION FACILITY REQUIREMENTS

	2000	2005	2010
Camp Units	980	1,067	1153
Picnic Units	771	838	906
Boat Launch Lanes	35	38	41
Swimming Beach Area (sq. ft. sand area only)	285,000	310,000	335,000

4-15. ENVIRONMENTAL AND ECOLOGIC CONCERNS

The Carlyle Lake project and vicinity provides potential habitat for two federally endangered and threatened wildlife species. One federally threatened species, the bald eagle, has nested at the lake over the last few years and eagles are observed during the winter months. Bald eagles will be managed in accordance with the objectives of the Northern States Bald Eagle Recovery Plan and the Bald Eagle Management Plan for Carlyle Lake. Summer roosts of Indiana bats have been found in Bond County. It is likely that this species uses the forested habitat surrounding Carlyle Lake. The bald eagle is the only federally threatened wildlife species noted for the area. No federally threatened or endangered plant species are noted for the Carlyle Lake area as well.

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In addition to the above, the list below shows Species of Concern (formerly Category 2 candidate species) recognized by the Fish and Wildlife service. Efforts should be taken to minimize potential impacts to these species and their habitats.

Several state threatened or endangered wildlife and plant species have been sighted at Carlyle Lake or the surrounding area. The Eastern Massasauga rattlesnake is listed as state endangered. The protection plan for the bald eagle and eastern massasauga include establishment of a protective zone and restricting management practices to appropriate times of the year.

The loss of forest cover is one of the most crucial habitat concerns in the Carlyle Lake Area. Forest interior bird species such as the Scarlet Tanager, Acadian Flycatcher, Red-eyed Vireo and Kentucky Warbler appear to be in need of special attention due to declining woodland habitats. Efforts will be made to preserve large undissected forest tracts, and to design habitats so that existing forests will be enhanced.

Additional observations and field study are needed to determine the presence or absence of any or all Federal and State endangered or threatened plants and animals on project lands and waters since much of this information is incomplete. Any operation and maintenance plans or actions will consider any possible effects on all species documented in the area. A list of federal and state plant and wildlife species located or potentially located on project lands and waters is provided in TABLES 7 and 8 below.

The following Tables were developed with assistance from lake personnel, Ms. Joyce Collins of the U.S. Fish and Wildlife office in Marion, Illinois, and Ms. Deanna Glosser, Illinois Department of Natural Resources, Natural Heritage Biologist, Region IV headquarters in Alton, Illinois.

FEDERAL AND/OR STATE THREATENED AND ENDANGERED ANIMAL
SPECIES SITED OR POTENTIALLY SITED IN THE
CARLYLE LAKE AREA

TABLE 7

Federal Wildlife List	Status	Scientific Name
Bald Eagle	T	<i>Haliaeetus leucocephalus</i>
Indiana Bat	E	<i>Myotis sodalis</i>
Kirtland's snake	P	<i>Clonophis kirtlandii</i>
Loggerhead shrike	P	<i>Lanius ludovicianus</i>
Double-Crested Cormorant	T	<i>Phalacrocorax auritus</i>
Greater Prairie Chicken	E	<i>Tympanuchus cupido</i>
Short Eared Owl	E	<i>Asio flammeus</i>
Northern Harrier	E	<i>Circus cyaneus</i>
Upland Sandpiper	E	<i>Bartramia longicauda</i>
Black Crowned Night Heron	E	<i>Nycticorax nycticorax</i>
Barn Owl	E	<i>Tyto alba</i>
Eastern Massasauga	E	<i>Sistrurus catenatus</i>
Cooper's Hawk	E	<i>Accipiter cooperii</i>
River otter	E	<i>Lutra canadensis</i>
Little Spectaclecase Mussel	E	<i>Villosa lienosa</i>
Spike Mussel	T	<i>Elliptio dilatata</i>

Table continued below

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Unique Species at Carlyle Lake **Scientific Name**

Eastern Massasauga P Sistrurus catenatus

- E - endangered
- T - threatened
- P - species of concern (Fish and Wildlife Service)

There are no federal endangered or threatened plant species listed for the Carlyle Lake area.

The following table lists some state endangered or threatened plants noted for the Carlyle Lake area.

TABLE 8
STATE THREATENED OR ENDANGERED PLANT SPECIES
NOTED OR POTENTIALLY NOTED IN THE CARLYLE LAKE AREA

State Plant List	Status	Scientific Name
Prairie Rose Gentian	E	Sabatia campestris
Water Pennywort	E	Hydrocotyle ranunculoides
Fibrous-rooted sedge	E	Carex communis
False Hellebore	T	Veratrum woodii
Drooping Sedge	E	Carex prasina
Ear-leafed Foxglove	T	Tomanthera auriculata
Blazing Star	T	Liatris scariosa var. nieuwlandii

- E - endangered
- T - threatened
- P - species of concern (Fish and Wildlife Service)

Additional Source: Checklist of Endangered and Threatened Animals and Plants of Illinois. Illinois Endangered Species Protection Board Illinois, Illinois Department of Conservation, 1994.