~~ENVIRONTOLOGY COUNCIL~~
~~IOWA STATE UNIVERSITY~~
~~AMES, IOWA 50010~~
~~JULY 1973~~

REPORT OF THE TECHNICAL TASK FORCE-SAYLORVILLE RESERVOIR ENVIRONMENTAL IMPACT STUDY

A review conducted for the
Inter-Agency Resource Council
Office of the Governor

ENVIRONMENTAL STUDIES REPORT NO. 1

Report
of the
Technical Task Force
Saylorville Reservoir Environmental Impact Study

A review conducted for the

Inter-Agency Resource Council
Office of The Governor

State of Iowa

June 1973

Prepared by
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July 2, 1973

Mr. William H. Greiner
Chairman
Governor's Inter-Agency Resource Council
Grimes State Office Building
Des Moines, IA 50319

Dear Mr. Greiner:

We are pleased to submit to the Council and its respective state agencies this review report of the Technical Task Force concerning the Saylorville Reservoir Environmental Impact Study. The study group, composed of technical staff members of the several state, county and local agencies concerned with the reservoir development and of invited observers from environmental organizations, has made a thorough review of four major problem areas. These include: (1) study of the environmental impact of reservoir operation and its flood control fluctuations in the reservoir reach of the Des Moines River with specific emphasis on timber clearing, vegetative management, and the lower Ledges State Park; (2) review of alternative protection plans for the lower Ledges, including the barrier dam concept, with some attention given to problems associated with future land use, open space and outdoor recreation uses; (3) evaluation of the proposed and alternative operation plans for the reservoir as they relate to flood damage reduction; and (4) review of the status of future availability of the river valley's sand and gravel materials for construction programs in the region and of miscellaneous remedial, mitigation, and relocation measures.

A second Task Force entitled the Land Use and Flood Plain Management Task Force was also established, and its work should continue. The efforts of this group are directed to the land use planning and flood plain management of the valley reach lying between the dam site and the levee system in Des Moines. A green belt plan and a positive flood plain management program are needed in this reach if realistic control over urban encroachment is to be achieved. An initial status report of this group is included herein.

The summary, findings and recommendations contained in this report are intended to serve as a factual basis for decision making. There are several local, county and state agencies directly involved in the project, and each must make certain decisions regarding the reservoir project in the completion phase. In conducting the review, care has been taken to avoid infringing on the responsibilities of any single agency. Rather, the study was conducted within the spirit of group review of a broad and complex state problem. As with all projects involving the allocation of resources and having an impact on the environment, many complex issues arise and solutions are not obtained easily. Technical, economic, social and legal aspects are involved in each and every alternative, and all must be weighed in making decisions. A solution acceptable to one segment of the public may not be preferred by another. The office of the Governor, the affected local and state agencies, and the federal government will all be involved in making final decisions directed to solving the remaining environmental problems associated with the Saylorville Reservoir project.

The Task Force concept has provided an excellent forum for discussion and review. Participants from the state and federal agencies and observers from the Boone citizens group have worked together to review all aspects of the problem. The sub-groups assigned specific study topics for review have been particularly effective, and their reports are contained in the appendices. The findings, conclusions, and recommendations contained herein should assist all agencies and other groups in arriving at a decision that will be of maximum benefit to the people of Iowa. The metropolitan area at Des Moines will receive the direct benefits of the flood control and water quality phases of the project, with downstream communities benefitting from operation of both Saylorville and Red Rock Reservoirs. With Saylorville Reservoir located near the major metropolitan area within the state, its open-space, park and water areas should assist in meeting regional needs in outdoor recreation if proper development is fostered and adequate facilities are provided.

Respectfully submitted,

Merwin D. Dougal

Merwin D. Dougal
Chairman
Technical Task Force

MDD:jc

Governor's Inter-Agency Resource Council
Technical Task Force
Saylorville Reservoir Environmental Impact Study

Synopsis

Saylorville Reservoir is a federal multipurpose reservoir being constructed on the Des Moines River immediately upstream of the City of Des Moines. Its primary purpose is flood control, and secondary purposes include water-oriented outdoor recreation and related park uses, water quality enhancement through downstream low-flow augmentation and incidental fish and wildlife propagation. Its environmental impact is currently being assessed by the Corps of Engineers and considered by the courts through the provisions of the National Environmental Policy Act (NEPA) of 1969. Environmental organizations who have been instrumental in the court suit and out-of-court agreement have been particularly concerned about the flooding impact of the reservoir on the lower Ledges State Park. This report has been prepared at the request of the Governor's Inter-Agency Resource Council, to provide a factual basis for decision making by the State of Iowa through the Office of the Governor and affected state agencies.

Many Iowans have observed the environmental impact experienced at Coralville and Red Rock Reservoirs. Changes in the visual aesthetics are the most frequently discussed topics, but more detailed studies of other changes, including both

losses and gains, are also being made. Several types of management programs are being planned or proposed at Saylorville Reservoir to mitigate such adverse effects in advance of completion and operation, or which would become part of the operation and maintenance phase. Long term losses at Saylorville include: (a) the valley lands currently used for agriculture crop production; (b) the pasture, timber, other vegetation and associated wildlife habitat; (c) change in scenic values and loss of recreational use of the natural river channel in the reservoir area, through permanent or temporary flooding; and (d) loss of mineral resources which cannot be reclaimed following construction. The project provided for: (a) flood damage reduction at Des Moines and other downstream points, (b) the addition of 5,400 acres of recreational waters in the conservation pool, (c) the 885 acre Big Creek Lake as a stable-level recreation lake, (d) 12,000 additional acres of public land in the flood control pool which will be subject to periodic inundation by the flood control operation, and (e) low flow augmentation and expected water quality improvement during drought periods.

Several specific environmental areas of concern were reviewed by the Technical Task Force study group. If solutions can be found for these problem areas, there is opportunity to make Saylorville Reservoir more useful to the citizens of central Iowa. First, the task force supports the proposed change by the Corps of Engineers in timber clearing at Saylorville Reservoir. Of three alternative plans, a combination of at least two is recommended.

The three alternatives are: (1) complete clearing of trees in the conservation pool (elevation 833 feet, mean sea level datum) and to some designated level in the flood pool, with the 5-year frequency flood pool elevation of 869 feet being considered; (2) selective clearing initially of the least-tolerant species in the flood pool to this designated level, along with complete clearing of the conservation pool, and introduction of an annual debris and dead tree removal and maintenance program; and (3) initially clearing only the conservation pool accompanied by an annual removal and maintenance program thereafter. Experience at Coralville and Red Rock Reservoirs, where only the conservation pool was cleared, would suggest that one of the first two, or some combination for various reaches of the reservoir, should be considered for funding and implementation. In order that these choices can be made, the Technical Task Force recommends further the development of a comprehensive vegetative management plan for the entire reservoir. This plan should include the desired timber clearing alternative at specific locations and in addition include provisions for controlling and combating weed growth, mudflat problems, floating debris, and reestablishing water-tolerant vegetative species. A much more comprehensive program should be developed as a trial, ideal management scope.

As a second study area of concern, the environmental impact of the reservoir flooding on the lower Ledges State Park has been reviewed and alternatives studied. The Technical Task Force has found that future park use is of equal concern

to certain environmental organizations as is the impact of reservoir flooding; however, the Technical Task Force has concentrated on the latter in conducting the environmental review. There is a total of 1,275 acres contained in the park and wildlife areas at the Ledges State Park. The reservoir flooding potential will not affect the 1,000 or more acres of existing park and wildlife lands situated on high ground above the proposed flood pool. The reservoir impact area consists of approximately 230 acres of flood plain land in the lower Ledges. Some 15 acres of the most sensitive ecological habitat in the downstream section of the Pease Creek valley will be affected, including the smaller Davis Creek tributary at their confluence. Of this total, 9 acres were inundated in the 1954 flood. These tributary streams contain the unique sandstone ledges from which the park derives its name. The remainder of the flood plain land along the Des Moines River affected by the reservoir includes 115 acres on the east side currently used for intensive recreation purposes, and some 100 acres on the west side which serve as a wildlife habitat and buffer zone for the park. The land area contained in the existing river channel is not included in these flood plain acreages.

Much of this lower area is subject naturally to flooding by the river and the local streams, and has been flooded periodically in the past. Maximum experienced depths of flooding have been as great as 16-18 feet, with intermittent overbank flooding occurring as many as 60 days or more during those years when the greatest floods of record occurred. With

the proposed operation schedule, the maximum flooding effect could be increased to a total depth of 28-30 feet, with the length of overbank flooding period increased to as much as 100-120 days, as and when similar flood magnitudes occur in the future. Existing vegetation--trees, shrubs, flowers and ground cover--will be particularly sensitive to the increased duration of flooding in terms of consecutive days of submergence, as much as or more so than may be caused by the increased depths of flooding. Interruption of park use, especially for nature studies, will also extend for longer periods.

The Ledges State Park exists in an area of the state where exposed bedrock features are rare. The sandstone formations have a variety of prominent features which have been exposed through differential erosion. This presents a picturesque, mural-like valley wall in the park, forms a unique object of interest and outstanding opportunity for a nature interpretative program. Similar exposures in Iowa are found only in three other locations, in Webster, Marion and Muscatine Counties.

The effect of reservoir flooding in the sandstone gorge section of Pease Creek has been reviewed for geological, vegetative, archaeological and recreational impact. Interruption of access for studies, some additional staining of the formations, groundwater changes and additional sediment accumulation in the gorge section are potential losses in the geological area, which might be offset by potential mineralization and case-hardening of the surface of the sandstone formations during flood storage periods. Vegetative or ecological losses

depend on the additional depths and durations of flooding, with greatest impact on the less water-tolerant species of vegetation at the higher flood pool elevations and on all species at the mouth of Pease Creek and along the Des Moines River flood plain. Two archaeological sites also were identified in the lower Ledges area, and would be affected by natural or reservoir flooding, or by various alternative protection plans. Additional effects will occur also on fisheries, wildlife, songbird habitat, scenic views and other park uses, which have been identified and evaluated by the Technical Task Force and its study sub-groups.

Reservoir flooding under the proposed operating schedule also will result in substantial changes and periodic alterations of the wildlife habitat located on the west side of the river, and would require relocation of most existing park and recreation facilities situated in the flood plain area of the lower Ledges State Park.

Future use patterns at the Ledges State Park are closely related to the reservoir project, but the overuse by the public as currently experienced is also of concern. All parties involved in the Task Force study agree on the change in emphasis to a more preservation and ecological interpretative study area concept. Within this objective, various ideas and proposals have been offered. Further review of this problem may be needed to provide additional opportunity for all interested parties to discuss the various alternatives for park use. Emphasis on a total regional system for the Saylorville Reservoir area is paramount in this phase.

Three major alternatives exist for mitigating the reservoir flooding problem at the lower Ledges State Park. These alternatives are summarized in this synopsis and explained in detail in the main report. The first alternative is to construct the proposed barrier dam with its attendant high costs, and adjust the future park use and related facilities to meet the stated use objectives. The second alternative is to introduce an enlarged-scope management and mitigation program for coping with the reservoir flooding impact within the proposed reservoir operating schedule. The third alternative involves making changes in the flood control storage allocation or in the proposed reservoir operating schedule and associated release rates.

The barrier dam proposal as alternative 1 for protecting the lower Ledges State Park has been studied and reviewed in detail. It would be similar to the Polk City-Big Creek barrier dam project now under construction. It is a construction project of large scope, and would cost at least $5,400,000. It would require a dam 7,000 feet long and with an average height of 32 feet, and contain over 1.3 million cubic yards of fill. It would include also an outflow structure and pumping plant to accommodate interior drainage from Pease and Davis Creeks. Its construction requires 55 acres of foundation area, and a channel change of the Des Moines River. It also would affect lands and well facilities at Camp Hantesa, the Camp Fire Girl's camp. The addition of subimpoundments in the upper reaches of Pease and Davis Creeks for sediment

storage, reduction of peak flood flows, and miscellaneous recreation uses, if found necessary or desirable, would increase the construction cost by an additional $1,000,000.

The barrier dam project would physically separate the lower Ledges State Park from the flood control pool and reduce the impact of flooding. The protected area would contain the most-sensitive 15-acre Pease Creek impact area, about 100 acres of Des Moines River floodplain and the oxbow lake created by cutting off the existing bend of the river. However, intensive use facilities in the lower flood plain areas would still need to be relocated since the oxbow and adjacent flat areas would intermittently be needed as temporary ponding areas for the interior drainage system. As stated previously, the relocation of park facilities also is a part of the master plan to reduce overuse and stress on the lower Ledges State Park now being experienced from large numbers of park visitors. Federal funding for construction, operation and maintenance would be required. Construction of the barrier dam would further delay the completion of the Saylorville Reservoir at least one year, which is adverse to the concept of achieving additional flood protection at Des Moines as soon as possible. To date, this alternative does not add significantly to the long-term goals and objectives of future park use, as expressed in the master plan for redevelopment.

An enlarged-scope management and mitigation program is included as alternative 2. The proposed flood pool and associated reservoir flood operation schedule would remain unchanged.

Under the general concepts of this program, the state would obtain as mitigation measures (a) the required additional lands in the Pease Creek and Davis Creek valleys to supplant the lower flooded area, (b) replacement and relocation of the existing recreation facilities, and (c) a negotiated settlement to offset initial costs of clearing, renovation and replanting, and including an equivalent sum for the estimated additional annual maintenance required to clean up, rehabilitate and control weed growth in the lower areas once floodwaters subside. Implementation of this alternative would require an inventory of the ecological, geological and recreation features existing in the upstream reaches of each stream. This inventory would assist in determining precisely which additional areas should be acquired, the type and extent of trail system needed, and the most advantageous development pattern required for nature interpretative study area emphasis. The cost of this alternative cannot be estimated in detail until the required inventory and other analyses are performed; however, it most likely would be less costly than the barrier dam proposal.

Reduction of the flood control effectiveness of the reservoir is alternative 3. However, if the flood control storage allocation is reduced to an elevation that would eliminate reservoir flooding of the lower Ledges State Park (from elevation 890 to elevation 860), over two-thirds of the storage allocation would be lost. There would be little opportunity remaining to reduce the estimated annual flood

damages of $4,000,000 which can be reduced to a level of about $234,000 with the full flood control pool. Study of the most-recent increase in the operating level of the reservoir, from elevation 884 to 890 feet, shows that eliminating this incremental storage volume would result in an increase of the annual flood damages in downstream rural reaches and urban areas by $1,000,000 or more, to a level of $1,260,000. Additional reductions of the storage volume would cause further increases in resultant downstream flood damages, and an inability to maintain a favorable benefit-cost ratio for the project. Introduction of increases in reservoir release rates within the allocated storage volume would decrease the duration of adverse flooding at the lower Ledges, but this would also be detrimental to the estimated economic returns from annual reduction of flood losses. The loss in economic benefits incurred with either change of operation within this alternative indicates that the other two alternatives would be preferred in an economic sense.

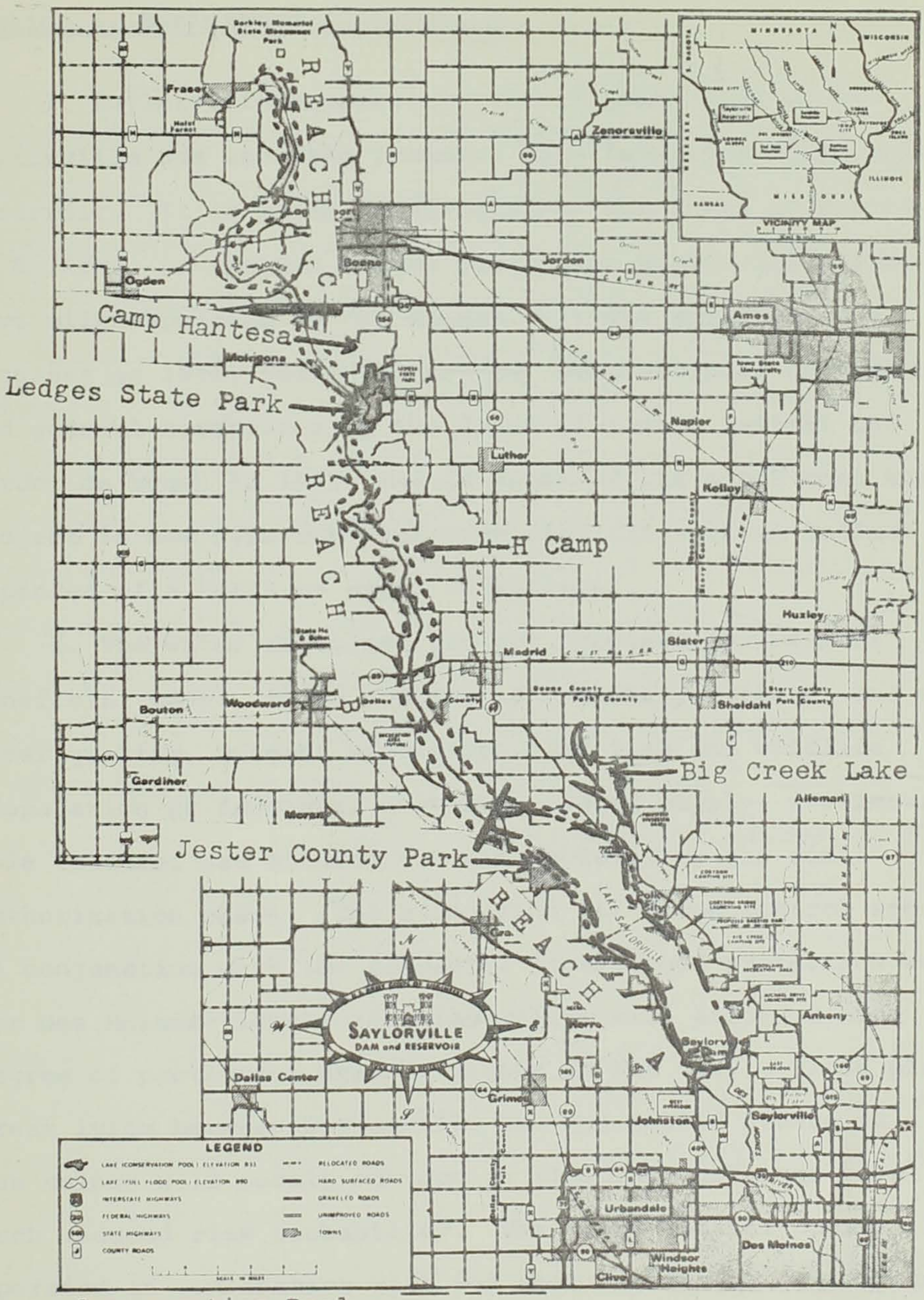
The Technical Task Force recommends that all factors, gains and losses, be considered in selecting among these three alternatives. The total impact and final decision must be evaluated in terms of (a) the entire Saylorville Reservoir project, (b) other state plans and programs for water resources, recreation, water quality, flood control and related uses, and (c) the needs and sensitivity of residents of central Iowa for the Ledges State Park.

A third major area of emphasis is the need for evaluating and implementing a long-range land use and flood plain management program for the valley reach between Saylorville Dam and the City of Des Moines levee system. The reservoir reduces the flood risk but does not eliminate the flood potential. A comprehensive flood plain management program is needed to control urban encroachment into the existing flood plain. In addition, a greenbelt program as initially envisioned in this area by planning groups and the federal government would add to the regional open space and recreation needs. Support of this program is encouraged.

Other problem areas were briefly reviewed; however, negotiations for mitigation of the environmental impact of the project on these areas of concern appear to be proceeding satisfactorily. These include: (a) flooding effects and remedial measures, including land acquisition and control at the Iowa 4-H Camping Center; (b) continuation of materials extraction and processing of the sand and gravel resource in the upper flood pool reaches; and (c) effects on other facilities, including group camps, county and state highways, municipal well fields, etc. No additional problems were brought to the attention of the Technical Task Force study group.

Part I

MAIN REPORT



Conservation Pool - _ _ _ _

Flood Pool - _ _ _ _

Fig. 1. Location Map, Saylorville Reservoir
(Source: Army Corps of Engineers)

Section I, Background Information

1. Saylorville Reservoir, further identified as the Saylorville Dam and Lake project, is a federal multipurpose reservoir. It is being constructed by the Corps of Engineers, U. S. Army, on the Des Moines River near Saylorville, about five miles upstream of Des Moines. It was authorized by Congress in 1958, following review, submission of comments, and general acceptance by the State of Iowa. Initial construction began in 1965, and in terms of its total cost the project is now over one-half completed (35 million dollars expended of a total of about 70 million).

2. The water resources project provides for several beneficial uses: flood control as a primary purpose, and with water quality, outdoor recreation, and fish and wildlife propagation as secondary purposes. Water supply, a reimbursable feature, was studied but not included in the final authorization phase. The allocation for flood control storage, in conjunction with the completed local flood protection works for Des Moines--levees and floodwalls--will afford a high degree of protection against floods in the city. Flood plain areas lying between Saylorville Dam and Euclid Avenue in Des Moines will remain subject to flooding, although at a much reduced risk probability. The flood control pool will be operated in combination with Red Rock Reservoir, downstream of Des Moines, to provide additional flood protection for Iowa communities and rural areas between Knoxville and Keokuk,

and for additional control of flooding along the Mississippi River downstream of Keokuk.

3. The size and volume of the basic conservation pool, for initial sediment allocation, recreation and water quality, low-flow augmentation uses, has remained essentially unchanged in final design and construction phases. Established at elevation 833 feet (mean sea level datum), it has a water surface area of 5,400 acres, a width of about one mile between the valley bluffs, and extends 17 miles up the river valley to a point southwest of Madrid (Iowa #17 highway bridge). The initial capacity of the conservation pool is 74,000 acre feet, which will provide a minimum of 200 cfs to the downstream valley during drought periods, compared to practically no flow during the driest months of the 1955-56 drought period.

4. Several project changes have taken place during the detailed design and construction phase:

a. The State of Iowa in November 1965 concurred with the Big Creek barrier dam concept which was introduced to protect Polk City from inundation and avoid relocation of the lower parts of the community and one or more cemeteries. This action represented a strong element of environmental enhancement at this point, which is in the main conservation pool reach near the dam. This also required construction of the Big Creek diversion dam and subimpoundment upstream (north) of Polk City (drainage area of 80 square miles) and a diversion channel and separate spillway to the west. A stable-elevation recreation lake, Big Creek Lake, was thus created which has a water surface

area of 885 acres. This lake project, completed and placed in operation last year, will become part of the state park system of Iowa. The Saylorville-Big Creek combination compares in concept with the existing Coralville Reservoir-Lake McBride combination on the Iowa River near Iowa City.

The protected area (interior drainage area of 16 square miles) at Polk City which lies between the barrier dam and the diversion dam must be further protected from stormwater runoff by a gravity outlet and pumping system at the barrier dam. A temporary ponding area varying from 85 to 400 acres (elevation 833 to 848 feet) is required for temporary retention of local runoff, and the pumping plant capacity is 125 cfs. The barrier dam at Polk City illustrates the methodology and facilities required to protect low-lying areas from reservoir inundation if they are not to be evacuated and relocated. The barrier dam has a maximum height of 80 feet, a length of 4,550 feet and requires 1.5 million cubic yards of earth fill for its construction.

b. The maximum normal-operating level of the flood control pool was increased vertically 6 feet from elevation 884 feet to 890 feet. This compensated in part for the loss of flood control storage incurred through the construction of the Polk City-Big Creek barrier dam complex, which would have required an increase of about 3 feet. Additional storage (an increase of 77,000 acre-feet) also was included to provide a higher degree of protection at Des Moines, after several large-volume floods occurred in the 1960's. The elevation of the flood control pool was therefore reestablished at 890 feet, mean sea level datum. It contains 602,000 acre feet of storage

above the conservation pool elevation of 833. At this proposed full flood pool, the lake would extend upstream about 54 miles, to Fraser northwest of Boone, and would cover 16,700 acres.

c. No further changes in the Saylorville dam, outlet works, and spillway were necessary. The outlet works, which consists of a three-gated inlet structure and a 22 feet diameter conduit with associated stilling basin, is used for normal low-flow and flood-control releases. Its maximum discharge capacity is 21,000 cfs at full flood pool. The overflow spillway has an ungated, uncontrolled concrete crest section at elevation 884. The increase in flood pool levels, from elevation 884 to 890 feet, would place a 6-foot hydraulic head or surcharge on the spillway crest at the maximum flood pool level, and uncontrolled overflow would occur. The uncontrolled discharge for this levelwould be 21,000 cfs, at the 6-foot head of water. Because the spillway, downstream of the crest section, has an unlined chute on bedrock with no stilling basin, some damage could occur during such infrequent use.

To accommodate this increase in flood pool elevation and subsequent uncontrolled spillway discharge without causing detrimental flood damages downstream, the reservoir operating schedule is being altered to maintain a maximum outflow of 21,000 cfs in the downstream channel. This is to be accomplished by closing the outlet works gates as a flow-compensating measure, when the flood pool elevation of 884 is exceeded. The spillway is also designed to protect the dam embankment from ever being overtopped. The top of the dam is elevation 915.5,

a 100-foot height above the flood plain. Rare-occurrence floods synthesized and used as a test for stringent spillway and dam safety requirements could conceivably cause a rise in the flood pool to elevation 908, without failure or appreciable damage to the dam and appurtenant works.

5. The increase from elevation 884 to 890 in the maximum operating elevation of the normal flood control pool was made after two key highway relocations had been completed. One, Iowa No. 17 south of Madrid, was constructed in the late 1950's by the Iowa Highway Commission as a high crossing. The bridge is located at the upstream head of the conservation pool, about 50 to 60 feet above the flood plain. No further alterations are required at this point, except for rip-rap protection. The second highway relocation already completed was primary route U.S. No. 30, west of Boone, in the upper reaches of the flood control pool. The relocation project was completed in the mid-1960's. The 6-foot vertical increase in flood pool affects this project, requiring remedial measures which have been provided for in a consumated relocation agreement with the Iowa Highway Commission.

6. Additional changes due to the 6-foot increase in flood pool elevation are incorporated into current design and construction programs. Land acquisition, easements, and rights-of way, further county and state highway relocations, and other remedial measures have been adjusted to the 890 pool elevation. A "take-line" of 892 has been used to guide land

acquisitions. Several group camps are located in the flood pool reach, and several camp and municipal well fields and pump houses also are affected. The additional loss of access to materials sources (sand and gravel) was also a potential problem in the flood pool area. County and state agencies and other organizations having park, camp, or open-space areas affected by Saylorville Reservoir include the Jester Park of Polk County, the Ledges State Park of the Iowa Conservation Commission, and the Iowa 4-H Camping Center owned by the Iowa State 4-H Foundation and operated by Iowa State University. There are probably more group camps of various organizations located in this reach of the Des Moines River than any other single place in Iowa.

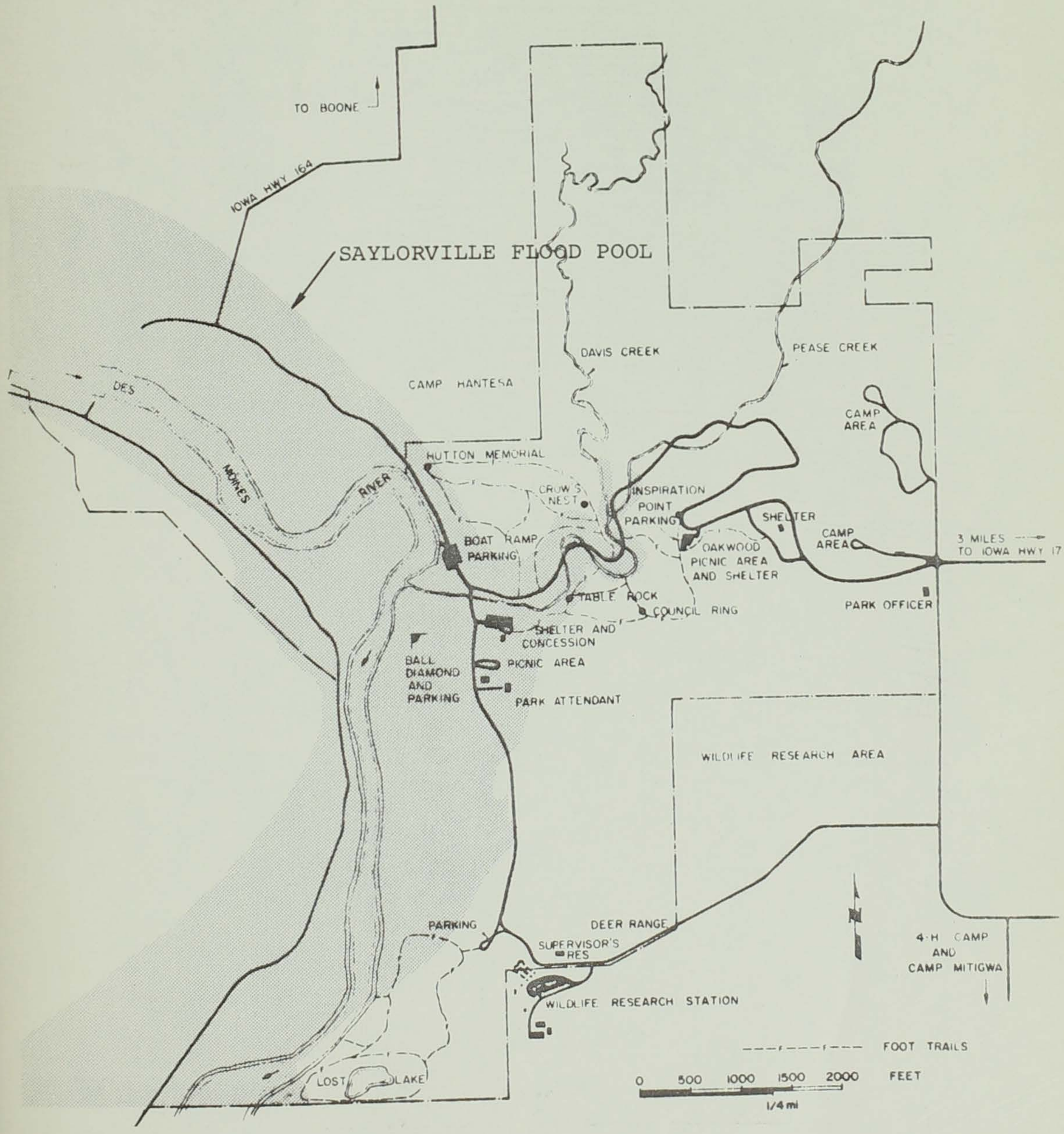


Fig. 2. Existing park facilities and land use at the Ledges State Park (Source: Conservation Commission, Redevelopment Master Plan)

Section II, Major Environmental Problems and Actions

7. Long range comprehensive planning of the resources remaining in the entire reservoir area have been the subject of intensive study by the Iowa Conservation Commission and the U.S. Army Corps of Engineers. A separate study of the additional alterations needed by each specific park or camp area affected by the Saylorville project also has been made by the Corps. Initial development of a master plan was followed by coordination meetings among affected and interested local and state government agencies, and one or more public meetings.

a. The Ledges State Park is located in the Des Moines River valley in Boone County (See Fig. 2). It is approximately 35 miles north of Des Moines, and 4 miles south of Boone. State Highway 17 and Boone County road K serve as the main hard-surfaced access roads from the east. State Route 164, from U.S. Highway #30 south of Boone, provides a gravel-surfaced secondary access.

b. The park and wildlife area cover approximately 1,275 acres of land. This area consists of heavily wooded and/or grassed ridgelines, ravines, river channel and flood plain areas. The park land varies in elevation from the Des Moines River flood plain at 860 feet to the flat prairie upland at 1,080 feet. This provides unique land forms and a diversity of ecological habitat. The lowest park areas are 27 feet in elevation above the Saylorville Reservoir conservation pool elevation, and are thus unaffected by the "permanent" or conservation pool. The Des Moines River flows along the

western boundary of the park. Pease Creek (also spelled as Peas and Peese in various publications and/or maps), with Davis Creek as a tributary, bisects the northern half of the park before joining the Des Moines River. Along these two creeks are found the unique sandstone ledges or formations from which the park is named.

c. Figures from the Engineering Section of the Conservation Commission show that 247 acres, including land and water, will be affected by Saylorville Reservoir. This figure includes: 66 acres on the west side of the river between elevation 860 (river bank) and 890 (top of flood pool); and 117 acres on the east side of the river between elevation 860 and 890. Approximately 9 acres of the 117 on the east side lie in the Pease Creek area above the bottom elevation of 860.

This total area of 247 acres compares with a total of 231 acres obtained by the Corps of Engineers, as shown in paragraph (d) below.

d. An analysis by the Corps of Engineers excludes the surface area of the Des Moines River, and includes the following breakdown:

Location	Flood Plain Acres Affected at Elev. 890	Flood Plain Acres Affected at Elev. 892
(1) Right (west) flood plain area of Des Moines River	101	102
(2) Left (east) flood plain area of Des Moines River	115	118
(3) Pease and Davis Creek flood plains, east of D.M. River bluffline	15	18
	231	238

The right (west) area also includes 26 acres situated above elevation 892, which will be acquired by the Corps during land acquisition for the project as proposed. Because the Corps data will be used in final land acquisition and negotiations, their land acreages will be used in the remainder of this report.

e. Of major concern to the Iowa Conservation Commission are future plans for the Ledges State Park, located in the central reaches of the flood control pool. Overuse and overstress by more than 485,000 visitors per year were considered detrimental to the unique sandstone formations, steep bluff areas, forest and understory vegetation, and other environmental attributes and interpretative study areas. The preliminary master plan would involve abandonment and closure of the lower road network (no through traffic), added development of picnic areas along Davis and Pease Creeks, relocation and expansion of intensive use areas to high ground in the east part of the present park, and acquisition of additional land in this relocation area. A preliminary long range plan prepared for the Iowa Conservation Commission by a planning group of the Department of Landscape Architecture, Iowa State University, would provide for: (1) relieving the present concentrated overuse of the park, (2) adequately accommodating the projected increase in number of visitors, (3) replacing the periodic loss of use of land due to flood control operations, and (4) providing adequate buffer space for protection of the park from adjacent landowners. The current master plan provides for immediate acquisition of 93 acres to accomplish these purposes.

An early alternative plan to place a barrier dam immediately at the mouth of Pease Creek was reviewed by the Iowa Conservation Commission, but was not accepted. The revision of use, relocation of the lower lodge and intensive recreation use facilities, and permitting periodic flooding was accepted in the final development of a park master plan.

8. The barrier dam alternative proposed for the lower area of the Ledges State Park will affect the Camp Hantesa area owned by the Camp Fire Girls (Heart of the Hawkeye Council). This camp is located immediately north and west of Ledges Park, and consists of 132 acres of land. The majority of the land and all buildings are above elevation 890, but the camp has land west of the entrance road to the park which includes flood plain land located in the area immediately upstream from the Ledges Park. This land is owned by the Heart of the Hawkeye Council of Camp Fire Girls with a flowage easement granted to the Corps of Engineers for the Saylorville Dam flooding.

a. The Ledges State Park is used by campers at Camp Hantesa. Many changes in physical facilities at the camp were done by the Corps of Engineers as a result of the building of Saylorville Dam.

b. The beach adjoining Camp Hantesa land is used by the campers all during the summer and both the flooding and the barrier dam concept will affect the access to the beach.

c. The camp uses Iowa Highway #164 as a connecting link to its entrance from U.S. Highway #30. A new entrance located

above the flood pool and other remedial works have been constructed as part of the Saylorville project.

d. Two water supply wells are located on the flood plain of the Des Moines River. These have been altered and renovated as part of the camp's remedial works, and would be affected by the proposed barrier dam.

9. Another public or semipublic use area is the Iowa 4-H Camping Center located southwest of Luther in the area between Richardson Branch (creek) and the Des Moines River. The tributary has a drainage area of 11.7 square miles, has a deeply incised valley in the lower reaches with bedrock outcropping but having no unique or unusual sandstone formations. The Iowa 4-H Camping Center is owned by the Iowa State 4-H Foundation and managed through Iowa State University. It is located several miles downstream of the Ledges State Park.

a. The flood plain lands along the Des Moines River are at elevation 850±. Therefore, the valley and immediate tributary areas will be flooded to a depth of about 40 feet by maximum flood control pool operation. The Richardson Branch valley would be affected for a one-mile reach extending from the main camp area to the confluence with the Des Moines River.

b. All main buildings are located on the uplands and are far above the flood pool. The facilities affected by the reservoir include the canoe storage shed and canoe program on the Des Moines River, trail facilities for hiking and for vegetation and forest interpretation, and the camp's water

supply well which is located on the floodplain of the Des Moines River.

c. At a reservoir elevation of 890 there are about 84 acres of land on the Des Moines River flood plain (east or left bank) and about 100 acres on Richardson Branch affected by the reservoir.

10. Environmental studies conducted to date in Iowa have shown that specific impact evaluation requires careful designation of not only what will be the impact but more precisely where will it occur. General, overall expressions of impact are not as meaningful and complete as a more detailed and descriptive listing, as they can easily be misinterpreted. Therefore, the environmental impact of Saylorville Reservoir will be expressed in terms of three impact reaches and of six impact zones (within the three reaches). Effects on use patterns, aesthetic evaluation and other considerations can be better described using this system (See Fig. 3).

a. Reach A, the conservation pool reach. This reach extends from the dam site upstream to the Iowa Route No. 17 high bridge south of Madrid. Impact zones 1, 2 and 3 are included in this reach. Zone 1 represents the ground surface area and water area contained below elevation 833 feet, in the conservation pool. Zone 2 is the "active" flood pool area most-frequently inundated and Zone 3 is the "less-active" or the fringe of the flood pool, and is flooded rather infrequently. This horizontal demarcation line (which divides impact zones 4 and 5 also) presumably separates the flood

pool into two categories, with almost complete loss of vegetation and timber expected in the active flood pool category (zones 2 and 4). The 5-year frequency level (elevation 869-870) is selected at this time as this demarcation line; however, experience may indicate eventually that it could be higher--perhaps as high as the 10-year flood pool or higher. Zone 3 extends to the maximum operating elevation (890 feet) of the flood control pool, plus perhaps 2-3 feet additionally for submergence of tree roots in the fringe area when it is completely flooded. Side slopes are fairly steep in zones 2 and 3,and the lateral extent of flooding is less than in flat flood plain areas.

b. Reach B, the additional active flood pool reach. For the Saylorville Reservoir, this impact reach extends from the Iowa Route No. 17 high bridge upstream essentially to the primary U.S. 30 Route west of Boone. Impact zones 4 and 5 are in this reach, zone 4 extending upward to elevation 869± and zone 5 to elevation 890±. Impact zone 4 will include the flood plain areas in this reach where the most rapid tree loss can be experienced, unless past timber clearing practices are altered. Zone 5 is the fringe area, comparable to zone 3 in many regards, but being lower on the valley slopes.

c. Reach C, the less-active upstream portion of the pool. This impact reach extends from the primary U.S. 30 Route west of Boone northward to Fraser where the maximum flood pool elevation of 890 is within the banks of the river. This reach includes impact zone 6, principally a flood plain land area,

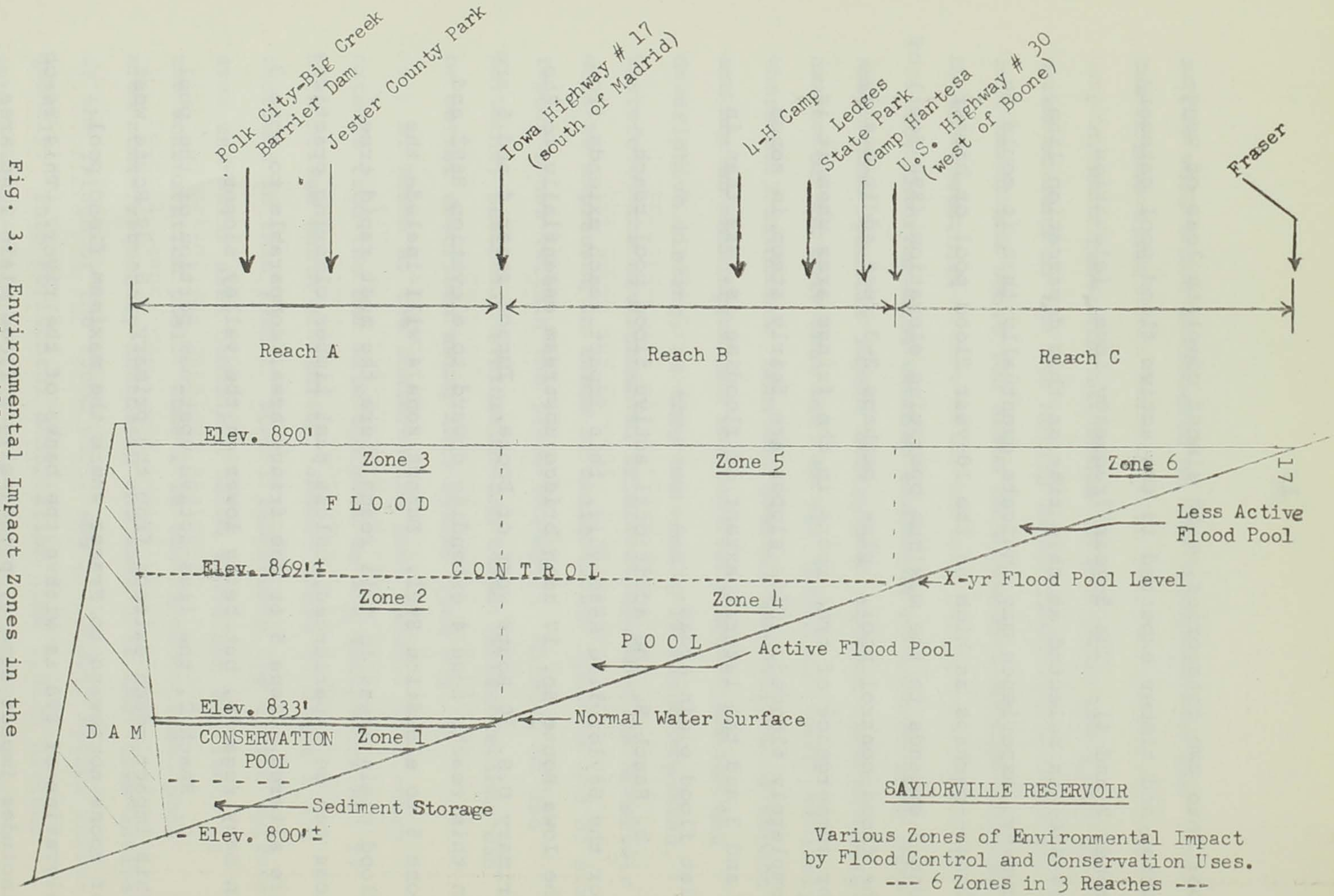


Fig. 3. Environmental Impact Zones in the Saylorville Multipurpose Reservoir (Source: ISU Environtology Council)

with only the lowest portions of the valley side slopes included. The more water tolerant species of timber have a fair chance of survival in this reach, because it is flooded less frequently and the effects and characteristics of natural flooding may not be altered appreciably. This zone represents a maximum of 21 feet (890-869) in vertical elevation at the downstream end. The tree survival in impact zones 3, 5 and 6 at Coralville and Red Rock should be reviewed during 1973 and again throughout 1974 for verification purposes, since they were essentially filled this year (within 2 to 3 feet of full flood pool in each reservoir).

11. Major existing facilities are located as follows as related to the environmental impact reaches.

a. Impact Reach A. The Jester County Park is located west of Polk City on the west side of the valley. The Polk City barrier dam, and Big Creek diversion dam, lake and ridge area lying between are also in this reach.

Because the valley walls or slopes are steep in this reach, a minimum of lateral flooding occurs and this reach represents the most aesthetically pleasing reach of the reservoir. All primary water-oriented recreation areas identified by the Corps of Engineers are located in this reach.

b. Impact Reach B. This is the least desirable reach from an aesthetically pleasing viewpoint, and a maximum environmental impact is expected. The Iowa 4-H Camping Center, Camp Hantesa and the lower Ledges State Park are in Reach B

in the active flood pool. The impact on the existing facilities--parks and camps--within this reach will be greatest of any location, and careful evaluation of mitigation measures is necessary.

c. Impact Reach C. There are several other group camps located west and northwest of Boone. The Boone waterworks is also located in this reach. The largest deposits of sand and gravel may also occur here. Less adverse environmental impact is forecast in this reach.

12. Congress in late 1969 passed the National Environmental Policy Act (PL 91-190). Section 102C further specifies:

> (C) "include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on...
>
> (i) the environmental impact of the proposed action,
>
> (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
>
> (iii) alternatives to the proposed action,
>
> (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of a long-term productivity, and
>
> (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.
>
> Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved.
>
> Copies of such statement and the comments and view of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by Section 552 of Title 5, United States Code, and shall accompany the proposal through the existing agency review processes;"

Sections D-H elaborate upon the coordination measures required in planning and developing resource-oriented projects:

(D) "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(E) recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and presenting a decline in the quality of mankind's world environment;

(F) make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(G) initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(H) assist the Council on Environmental Quality established by Title II of this Act."

13. Three environmental organizations, the local Iowa Citizens to Save the Ledges State Park, the Iowa Citizens for Environmental Quality and the National Sierra Club, in December 1972 initiated court action to enjoin the U.S. Army Corps of Engineers from letting of the last major dam-construction contract and completion of the project pending the preparation of an environmental impact statement. A reduction of the potential damage to the lower Ledges State Park has been the objective of this action, including the means of preventing or limiting that damage. An out-of-court agreement subsequently was reached in mid-December prior to court hearings in the U.S. District Court at Des Moines. The stipulations of this agreement permitted the Corps of Engineers to let contracts

and complete construction of the dam, in exchange for allowing the environmental groups to participate and assist in preparing an environmental impact statement on the project, a study of alternative protection measures at the lower Ledges State Park, and seeking necessary approvals and funds for those alternatives considered to be the best.

14. The environmental organizations have solicited public support for additional studies of various technical alternatives. The primary alternative proposed is a barrier dam concept similar to the Polk City-Big Creek project. Assistance of the state agencies involved with the project and support of the Office of the Governor were also requested. Coordination of interdisciplinary and multi-agency resource problems among the state agencies concerned with natural resources is currently being conducted through the Governor's Inter-Agency Resource Council of the State of Iowa. This council appointed two technical task forces to conduct the necessary review studies: (1) a Technical Task Force on the Saylorville Reservoir Environmental Impact Study, and (2) a Technical Task Force for Land Use Planning and Flood Plain Management for the reach between the Saylorville Dam and Des Moines.

Seven principal environmental resources study categories were outlined, six being assigned to the first short-term Task Force and one to the latter as a continuing long-range function. The seven categories were: (1) the lower Ledges State Park--impact, flooding problems, barrier dam, park use; (2) Iowa 4-H Camping Center--environmental impact, education

and recreation programs; (3) evaluation of additional timber clearing in the reservoir area; (4) need for a long range, funded vegetative management program; (5) need for a continuing program for extraction and materials processing of sand and gravel deposits in the flood control reach; (6) study of the proposed reservoir operation schedule and alternatives thereto; and (7) evaluate the status, need and establish an on-going program for land use planning, control and flood plain management in the valley reach between the dam and Des Moines.

15. Staff representatives were appointed for each state agency included in the Inter-Agency Resource Council and additional representatives were solicited from other county and state agencies and university environmental groups. Representatives of the environmental organizations were invited to participate also, either through members having technical or professional expertise or as observers. The District Engineer of the Rock Island District, U.S. Army Corps of Engineers, appointed a liaison group to work with the two Task Force groups. These included representatives of the planning, engineering, environmental resources, economics, construction, and relocations branches or sections within the Corps administrative structure.

The task force groups have conducted the necessary studies and reviews through sub-group assignments and periodic joint meetings. The findings and conclusions are based on these studies. Agencies participating in the review included:

State Agencies

Conservation Commission
Department of Soil Conservation
Department of Environmental Quality
Geological Survey
Natural Resources Council
Office of State Archaeologist
State Historic Preservation Officer
Iowa State University
  Environtology Council
  Engineering College and Engineering Research Institute
  Iowa State 4-H Office
Iowa Highway Commission (brief review of results and report)

County Agencies

Boone County Board of Supervisors and County Engineers Office
Boone County Soil Conservation District

Federal Agencies

Corps of Engineers, U.S. Army
Soil Conservation Service, U.S. Department of Agriculture (advisory on request of state agencies and task force groups)

Environmental Organizations

Iowa Citizens to Save the Ledges
ISU Special Student Study Groups
Iowa Chapter, Sierra Club
Iowa Citizens for Environmental Quality

Local Organizations

Camp Fire Girls, Camp Hantesa
Others

Section III, Specific Findings

16. The environmental impact of multipurpose reservoirs having a large allocation of flood-control storage volume is appreciable, as evidenced by study and observations at Coralville and Red Rock Reservoirs. Projected long term losses of greatest magnitude resulting from the Saylorville Reservoir include: (1) the valley lands currently used for agricultural crop production; (2) the pasture, timber and other vegetation lost as a producing unit, harvest potential or as wildlife habitat; (3) loss of use of the natural river system as portions are submerged permanently and others periodically inundated; (4) loss of mineral resources if access or extraction is no longer possible; (5) loss of existing park lands and areas used by group camps as a specific problem encountered at Saylorville; and (6) changes in aesthetic values which are suffered to varying degrees in the flood control reservoir as uncleared timber or regrowth is periodically submerged and killed through long-duration flooding.

As proposed, the Saylorville project would provide for the following: (1) flood damage reduction to and within the City of Des Moines and downstream in the Des Moines River valley and upper Mississippi River valley, as used in combination with Red Rock Reservoir; (2) the addition of 5,400 acres of recreational waters of the conservation pool; (3) the 885 acre Big Creek Lake as a stable level subimpoundment for outdoor recreation purposes; (4) more than 12,000 acres of

additional land placed in public ownership subsequently available for wildlife propagation and for public access and use, but limited by permitted use plans and periodic fluctuations of the flood control pool; and (5) low flow augmentation for water quality enhancement.

17. The State of Iowa, through the Governor's Office and the water resources agency, the Iowa Natural Resources Council, favorably reviewed and accepted the Saylorville Reservoir project during its authorization stages in the late 1950's. However, the State requested a restudy of several problem areas, as unfavorable comments were expressed by one or more state agencies regarding the intangible losses foreseen for the reservoir area. Although the original study indicated that the project's tangible economic benefits exceeded the associated direct costs of construction and operation as measured by the benefit-cost ratio, a study of additional remedial construction needs and mitigation measures was requested to decrease the impact of the project on key developments, including the Polk City area and other resource areas.

During the detailed design and construction stages, additional coordination and more in-depth studies have been taken by the Corps of Engineers and the affected local, county and state agencies. Solutions acceptable to the groups primarily affected have been the result of such negotiations. These solutions have increased substantially the time for completion of the project, with inflation and additions also

increasing its cost (70+ million compared to a 1958 estimate of 44 million dollars).

In addition, compliance with the National Environmental Policy Act of 1969 has now been directed by the courts. Therefore, the environmental impact studies now being conducted will permit a final review of all aspects of the Saylorville Reservoir Project. This offers the State of Iowa an additional opportunity also to review the project and determine those additional features or mitigating measures which should be adopted. Optimal environmental enhancement of the total project is the objective of these final studies, based on the seven environmental topics listed in Section II, Paragraph 14.

18. Timber clearing and vegetative management problems are associated with the Saylorville Reservoir project. The problems of soil disturbance, tree and vegetation mortality, and observations of plant succession in flood control pools is currently of interest as a research topic at Iowa State University. Preliminary studies have been conducted at Coralville Reservoir on the Iowa River near Iowa City, at Red Rock Reservoir on the Des Moines River and at Rathbun Reservoir on the Chariton River. The studies included as appendix material and used in formulating findings are based on these field observations.

a. In the three reservoirs listed above, timber clearing was limited essentially to the conservation pool. Stumps left along the shoreline have posed some hazard to boats,

although floating debris has been a greater hazard to speedboats. In some ravines and small tributaries along Reach A (See Fig. 3, page 17), in the conservation pool, trees have not been cleared but serve as dense habitat for fisheries, waterfowl and wildlife. Experience has shown a severe, almost complete loss of trees, shrubs and native herbaceous growth in environmental impact zones 2 and 4, in the active flood pool. The debris problem from dead and fallen trees has posed a serious management problem during and following flood periods.

There is more opportunity for tree and other vegetation survival in the less-active flood pool, impact zones 3, 5 and 6. However, the species of trees will vary according to the aspect and location of valley slopes, and less water-tolerant trees and shrubs will be lost before the more water-tolerant species succumb. Willows, boxelders, soft maples and cottonwood would have the best chance for survival. The upland trees such as the oak-hickory timber would have the least chance.

b. Six plant associations, as identified specifically at the Ledges State Park, may be recognized in the reservoir area. These are the drainage way association, the streamside association, the maple-linden association, the oak-hickory association, the forest fringe association and the prairie association. These are described as follows, as extracted from the ISU-ICC preliminary master plan report:

(i) "the drainage way association occurs in the ravines and is basically a damp to moderately wet situation. The major species are elms, ash, walnut, hackberry, and silky dogwood.

(ii) the streamside association is found along the Des Moines River and in the floodplains of Davis and Pease creek. The soil is moderately wet to wet and the water table is near the ground surface. Species found in this association are eastern poplar, silver maple, black willow, elm, mulberry, boxelder, american hornbeam, hawthorn and segment grass.

(iii) maple, linden, ash, red oak and ironwood grow on the moist, well-drained, north facing slopes. Wild flowers and the forest carpet plants are most numerous in this association and the Ledges State Park is noted for the large variety of species which occur there. The maple-linden association is a climax vegetation although due to the dry Iowa climate it will not reach this dominant stage.

(iv) the prairie and forest fringe associations are situated on the dry ridge lines. The prairie occurs in the open field areas and the fringe line is an ecotone between the prairie and oak-hickory forest. The prairie at the park entrance was re-established in 1950. However, there are smaller areas throughout the park that still remain as native prairie. Big blue stem and Indian grass are dominants in the prairie and red cedar, honeylocust, prickly ash and sumac are associated with the fringe area.

(v) the oak-hickory association, although truly a subclimax group, is the dominant association in central Iowa and predominates at the Ledges. The major portion of the existing forest cover is oak-hickory and their associates. The association is found on ridgelines and south facing slopes, both of which have dry soils. The major species occurring in this group are white oak, burr oak, black oak, shagbark hickory, bitternut hickory, ironwood, gooseberry, and bladdernut.

c. Soil disturbance of the steeper slopes will occur upon submergence and loss of vegetative cover. Saturated slopes, upon evacuation of the flood pool following a flood, can slump from a loss of shear stability. The Corps of Engineers proposes to maintain release rates within reason, to limit the lowering rate to one or two feet a day. This

will permit slow drainage of excess moisture, and minimize the bank slumping or sluffing problem. However, the reduced lowering rates imply a longer duration of flooding to the detriment of vegetation.

19. (a) The Corps of Engineers is proposing three alternatives for the timber clearing problem. The three alternatives are: (1) complete clearing of trees in the conservation pool and to some designated level in the flood pool, with the 5-year frequency flood pool elevation of 869 feet being considered, but presumably some minimum debris clearance and vegetation management plan would still be required; (2) selective clearing initially of the least-tolerant species in the flood pool to this designated level, along with complete clearing of the conservation pool, and introduction of an annual debris and dead tree removal and maintenance program; and (3) initially clearing only the conservation pool accompanied by the annual removal and maintenance program thereafter. Experience at Coralville and Red Rock Reservoirs would suggest that one of the first two, or some combination for various reaches of the reservoir, should be considered for funding and implementation.

(b) In areas where the state or its agencies maintain fee title but give only a flood easement, the Corps of Engineers desires to negotiate a lump-sum settlement. This would include the discounted present value of estimated annual maintenance, vegetative management, etc. Other alternatives including an annual payment system may need to be studied.

(c) A comprehensive and detailed vegetative management program for future implementation and operation, beyond the tree removal phase, has not been prepared to date, but only suggested as a general proposal.

20. The environmental uniqueness of the Ledges State Park has been evaluated in detail by the study group.

a. The uniqueness of the natural features of the ledges as described in general terms are: the sandstone formations forming the "canyon" walls of the park, in the Pease and Davis Creek valleys; the covering of lichens, mosses and other plants; the trees and shrubs; the fords used as stream crossings and the sandy stream bed with its flowing water; and the woodland habitat for bird species unusual to Iowa.

The lower floodplain area along the Des Moines River serves as an intensive use area for day-use recreation. Activities and facilities include fishing, wading, athletic fields, lodge and concession stand, picnic areas, well and waterlines and storage buildings. The flood plain area west of the river serves as a natural wildlife habitat and as a buffer for the park.

b. A preliminary inventory of vegetative and timber species was made in March (See Appendices B and C for the detailed report). The potential flooded area (by the reservoir) at the junction of Pease and Davis Creeks (a part of the 15 acres total affected area) contains over 160 trees greater in size than a 3-inch diameter. The four dominant species are black walnut (43), hackberry (35), elm (29) and boxelder (10).

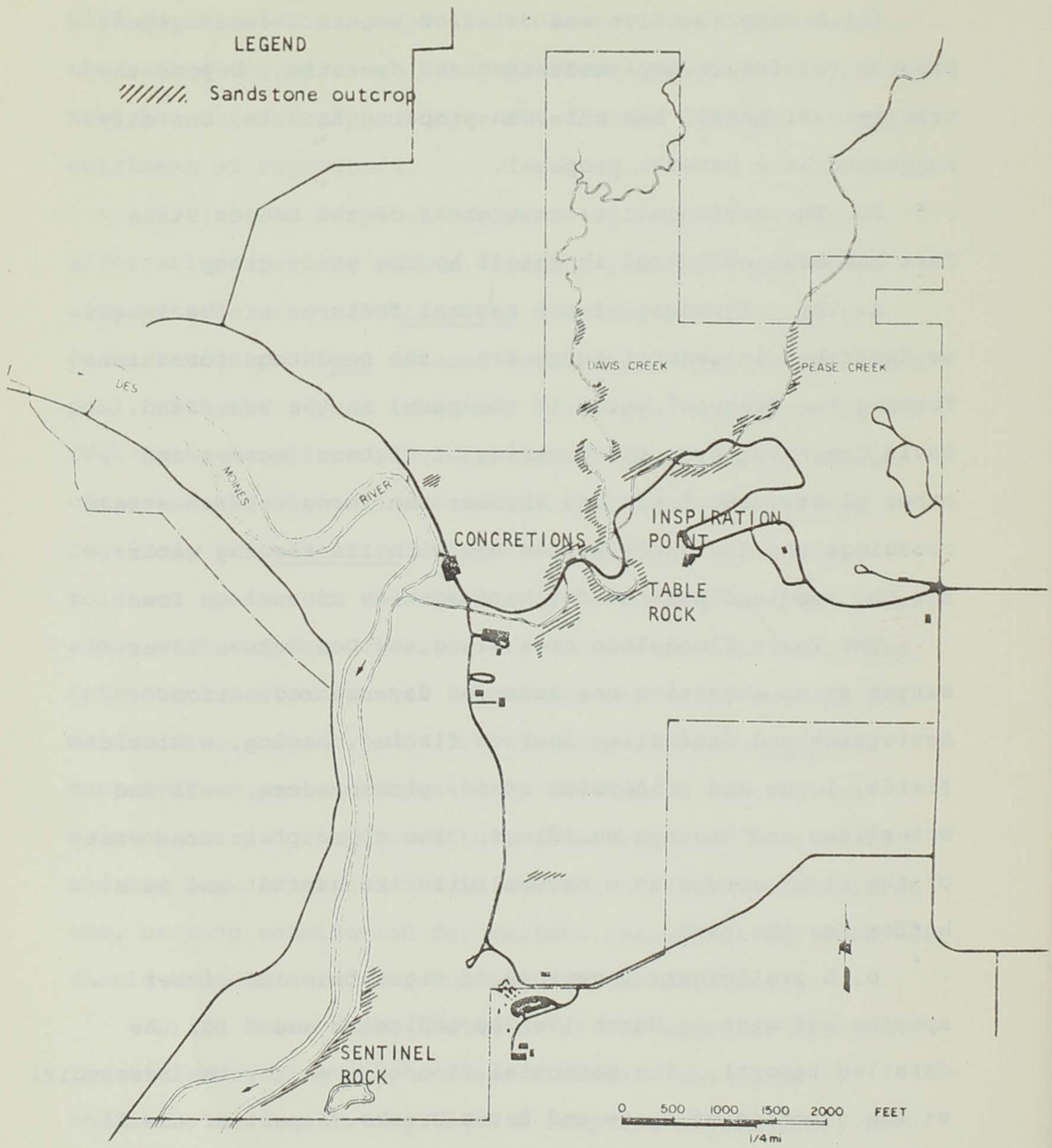


Fig. 4. Geologic features
(Source: ISU L.A. Dept.
preliminary master plan report)

Others include black maple, bitternut hickory, hawthorn, ash, honey locust, butternut, cottonwood, sycamore, black cherry, bur oak, red oak, black locust, and basswood. Shrubs include the rare leatherwood, bluebeech and many species of native herbaceous growth continue to flourish despite heavy park use.

From this junction to the mouth of the stream at the park entrance the number of trees were not counted, but would approximate at least twice the number listed above (300-400). Upland species include white oak, hop hornbean, and shagback hickory. The larger number of trees would be the flood plain species of willow, cottonwood and soft maple.

c. The geologic report states that the lower portions of the Ledges State Park are characterized by the level flood-plain and terrace sediments of the Des Moines River valley and the narrow intersecting alluvial valley of Pease and Davis Creeks. These smaller valleys are deeply incised into the landscape, cutting through the overlying glacial deposits and into a massive sandstone bedrock formation. This exposed sandstone forms the picturesque, mural-like valley walls within the lower Ledges State Park. In addition, differential cementation within the sandstone, a variety of prominent concretionary forms, and the accentuation of cavities and convexities by differential weathering and erosion has resulted in the protuberant "ledges" and overhangs, characteristic of the sandstone escarpments. The channel sandstone at the Ledges is a unique geological disturbance in the Pennsylvanian

geologic section in this region. It is quite local in its occurrence, with its identity being lost within two miles of the rock exposures at the Ledges Park.

The bedrock geology is rarely exposed in the central part of Iowa where glacial deposits blanket the area. The greatest exposure is in northeast Iowa; in east central, southeast, and south-central Iowa the exposures are confined to the deeper river valleys. Sandstone exposures of this type and magnitude exist only in Dolliver State Park in Webster County (south of Fort Dodge), along portions of the Red Rock Reservoir in Marion County (Knoxville-Pella area), and in Wildcat Den State Park in Muscatine County (near Muscatine).

d. Ledges State Park serves also as a preserve and sanctuary for many animals native to the central Iowa region. The park provides a permanent and seasonal habitat for a very wide variety of species of birds. It is noted especially to the ornithologists for its warbler habitat.

The deer population has increased and frequent observations are possible by the public. Other common mammals include the cottontail rabbit, jackrabbit, squirrels (gray, red, ground and fox squirrels), striped chipmunk, ground hog, striped and spotted skunk, opossum, raccoon, redfox, muskrat, mink, pocket gopher, weasel, prairie mole, bat and field mice. Toads and frogs abound in pond and bog locations, and reptiles and snakes are found throughout the park. The Wildlife Exhibit Station southeast of the park provides a close look at Iowa's native animals.

21. Flooding at the lower Ledges State Park does interfere with public use of the facility. The adverse effect of reservoir flooding needs to be expressed in terms of areas flooded as well as in terms of depths, duration of these depths and the frequency of their occurrence. In addition, the natural flood characteristics must be evaluated and compared with reservoir effects, since the Des Moines River flood plain and the lower Ledges State Park have been inundated periodically in the past by the Des Moines River. The bottom of the river channel is at elevation 853 feet, the top of bank is 860, and the average flood plain elevation is in the lower Ledges State Park 862 feet.

a. Areas flooded. The flood plain area in the lower Ledges State Park, as previously noted, is divided into three areas. The most sensitive ecologic areas are the Pease and Davis Creek valleys, with their sandstone formations and other biota. The Des Moines River flood plain area on the right (west) bank of the river is largely inaccessible to park users and serves primarily as a wildlife habitat. The Des Moines River flood plain area on the left (east) bank is used for more intensive outdoor recreation pursuits. These include a fishing access near the entrance, a ball park, lodge and concession center, picnic area and maintenance buildings.

Division of the flood plain area of the park into three categories provides the following results, as listed previously in the data section:

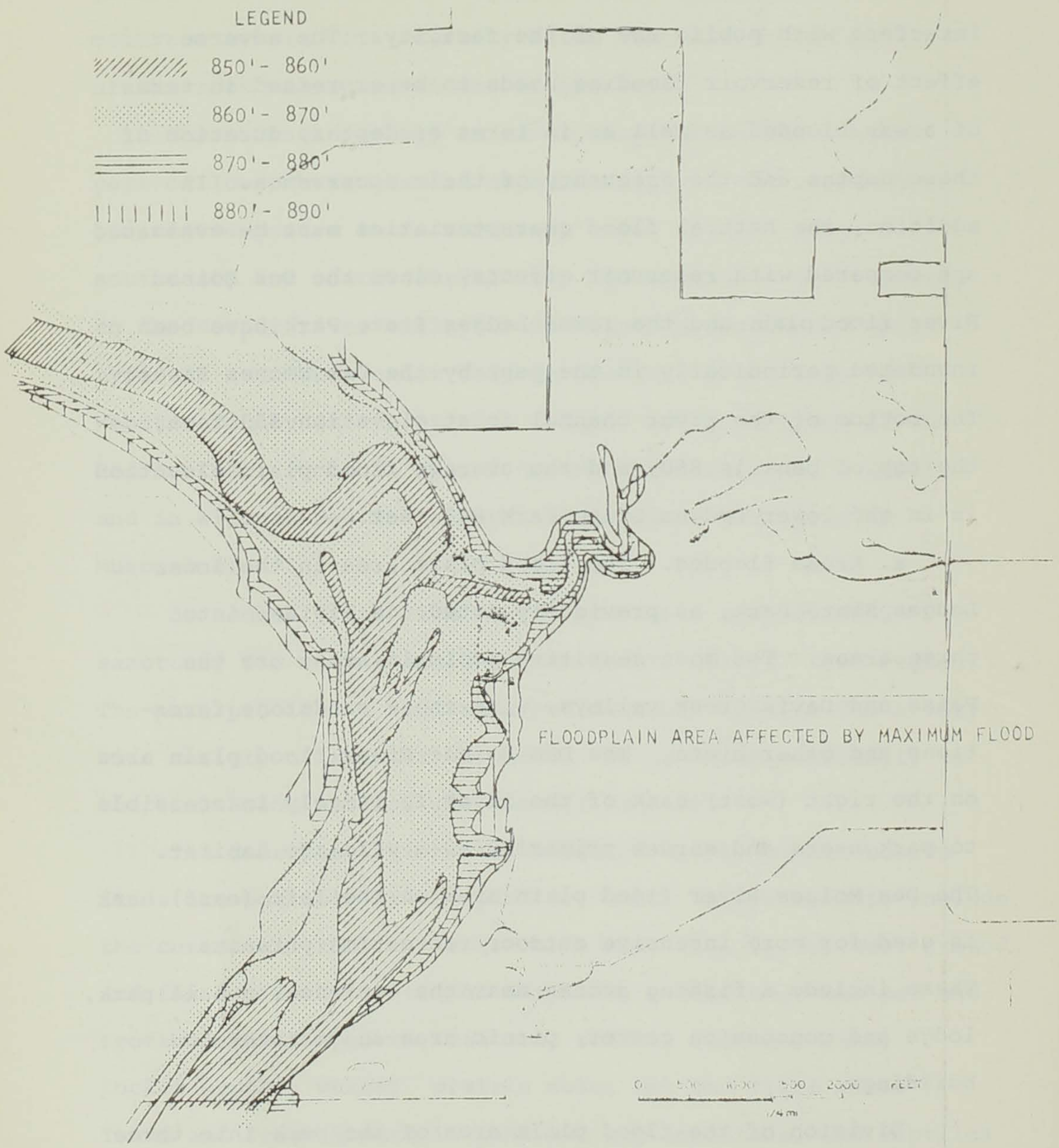


Fig. 5. Flood plain areas in the Ledges State Park (Source: ISU L.A. Dept. preliminary master plan report)

Elevation, Feet	Acres of park flood plain inundated		
	Pease Creek	East DM River FlPl.	West DM River FlPl.
860-862	0	0	0
878 (1954 flood)	9	98	97
890 (top of flood control pool)	15	115	101
892 (project "take line" for easements)	18	118	102

There are an additional 26 acres on the west side located above elevation 892.

Therefore, 15 acres of the most sensitive ecological area would be affected by the flood pool operation. Of this, 9 acres were flooded in the 1954 flood. An additional 115 acres of the flood plain east of the river affected by the project are developed for intensive-use recreation pursuits--ball field, lodge, picnicking, fishing, etc. West of the river, about 100 acres are contained in the flood pool area, and an additional 26 acres located above the flood pool elevation would be acquired by the federal government.

b. Frequency of flooding. Floods have occurred naturally in the lower Ledges State Park in the past. The flood of record (maximum stage) occurred in 1954. The reservoir will not change conditions for floods having a frequency (volume frequency) of some four years or less (greater than 25 percent chance occurrence or probability in any one year). Reservoir operation studies for the period of streamflow record provide the following elevation-frequency data:

Frequency in years	Percent chance occurrence in any one year	Elevation the flood pool would reach, ft MSL.
1.5	67	835
2	50	843
3	33	856
4	25	864
5	20	869
10	10	881
20	5	885.5
50	2	889
76	1.32	890

Therefore, the average 4-year frequency flood would naturally flood the lower park area (elevation 862±) in passing through this reach, and subsequently would fill the reservoir to the point where it would again cover the bank areas to a shallow depth. The park would be unaffected by reservoir operation for floods having a greater frequency of occurrence than this. Greater floods, a greater frequency in years, would flood the park areas both naturally during inflow and subsequently an additional amount as a storage phenomenon. It is estimated that once every 76 years, on the average, the full flood pool will be utilized (elevation 890). Once every 10 years, on the average, the reservoir will fill to an elevation slightly higher (881 versus 878) than occurred naturally during the 1954 flood.

c. Duration and depth of flooding. At the Ledges, the bottom of the river channel is at elevation 853, the top of low bank is 860 and the average flood plain is 862. Three major floods of record were studied, using the reservoir operation data for historical floods. These three years of flooding were studied to compare what would have resulted

under reservoir conditions with what occurred under natural conditions. These particular years are important for the following reasons: 1954, the peak discharge of record; 1965, the maximum volume of floodwater; and 1969, a recent major flood of less volume and peak discharge.

The results, at the south boundary of the park, are as follows:

			Number of days that indicated elevation is exceeded, at mile 246.1		
Year	Natural Peak Elev.	Reservoir Peak Elev.	Elev.	Natural Conditions	Reservoir Conditions
1954	878	879.5	860	16	38
			864	7	29
			870	3	21
1965	874.3	889.1	860	48	102
			864	16	88
			870	7	79
1969	867.0	882.8	860	60	123
			864	24	105
			870	0	72

In a general sense, the duration (period of time) of flooding above the lowest flood plain elevation of 860 feet, is approximately doubled with the reservoir in operation as proposed. The longest increase in flooding, during any year of hydrologic record studied, would have occurred with a flood equal in magnitude and volume to the 1969 flood. Overbank flooding (above bankfull) would have occurred 123 days with the reservoir compared to 60 days which occurred under natural conditions. These are not necessarily consecutive days. Using both the 1965 and 1969 floods as examples, under the proposed reservoir operating conditions flooding of the lower park above elevation 870 (which causes an increasingly severe effect in the Pease Creek valley) could occur for a

period of 70-80 days, compared to a week or less under natural conditions. Some of this additional period of flooding could occur in the early spring from snowmelt, when trees are still dormant. However, the added duration may extend into the growing season. The 1954 flood occurred in June, during the early summer. It had the peak stage and discharge, but the 1965 and 1969 floods had greater volumes, hence the highest reservoir levels in operation studies are reached using the latter two floods.

A review of reservoir operation reports for the period 1920-1970 shows that stage rises in the river or the reservoir can be expected to occur at least every other year:

Decade	Number of years that floods occurred	Number of separate rises of river (and reservoir)
1920-30	3	5
1930-40	8	12
1940-50	7	15
1950-60	7	12
1960-70	8	14

Some insight can be gained concerning the percent of time the reservoir would be above specified elevations over a long period of time. Review of proposed reservoir operation plans provides the following comparative data between natural and reservoir conditions.

Elevation Feet	Percent of time given elevation is exceeded: Under natural conditions	Percent of time given elevation is exceeded: Conditions with the reservoir
860	3.6	5.4
862	2.0	4.0
864	1.1	3.2
870	0.1	2.1
876	0.02	1.2

Therefore, compared to natural conditions, the reservoir will increase the percent of time the lower Ledges is inundated, from a range of 0-3.6% for the elevations shown to 1.2-5.4%. This indicates that the net increase that could be expected is 1 - 2% in total inundation time, or an average of 3 to 7 days additional per year over a long period of time. As indicated above, however, most of the additional period of flooding will be experienced during years when major floods occur. These inundation periods do not include for park use analysis the time required for cleanup and rehabilitation.

22. The environmental impact of flooding by the proposed reservoir, as presently planned, has been evaluated by the planning sub-group. Two major problems have been identified. These are (1) the immediate and long-term effect of additional flooding by the Saylorville Reservoir as it relates to park use and its unique features and (2) the problem of stress and over-use by large numbers of the public congregating in one relatively small park area and a desire by some to shift away from intensive-use recreation programs to a more preservation-interpretative study area concept.

a. All of the intensive-use features in the east flood plain areas of the Des Moines River (lodge, concession stand, picnic area, athletic fields, storage building) must be removed and relocated. The frequency, duration and depths of flooding would be too severe an interruption of park activities and use at this point, and in addition the time and cost of cleanup and rehabilitation would be excessive. A six-month's

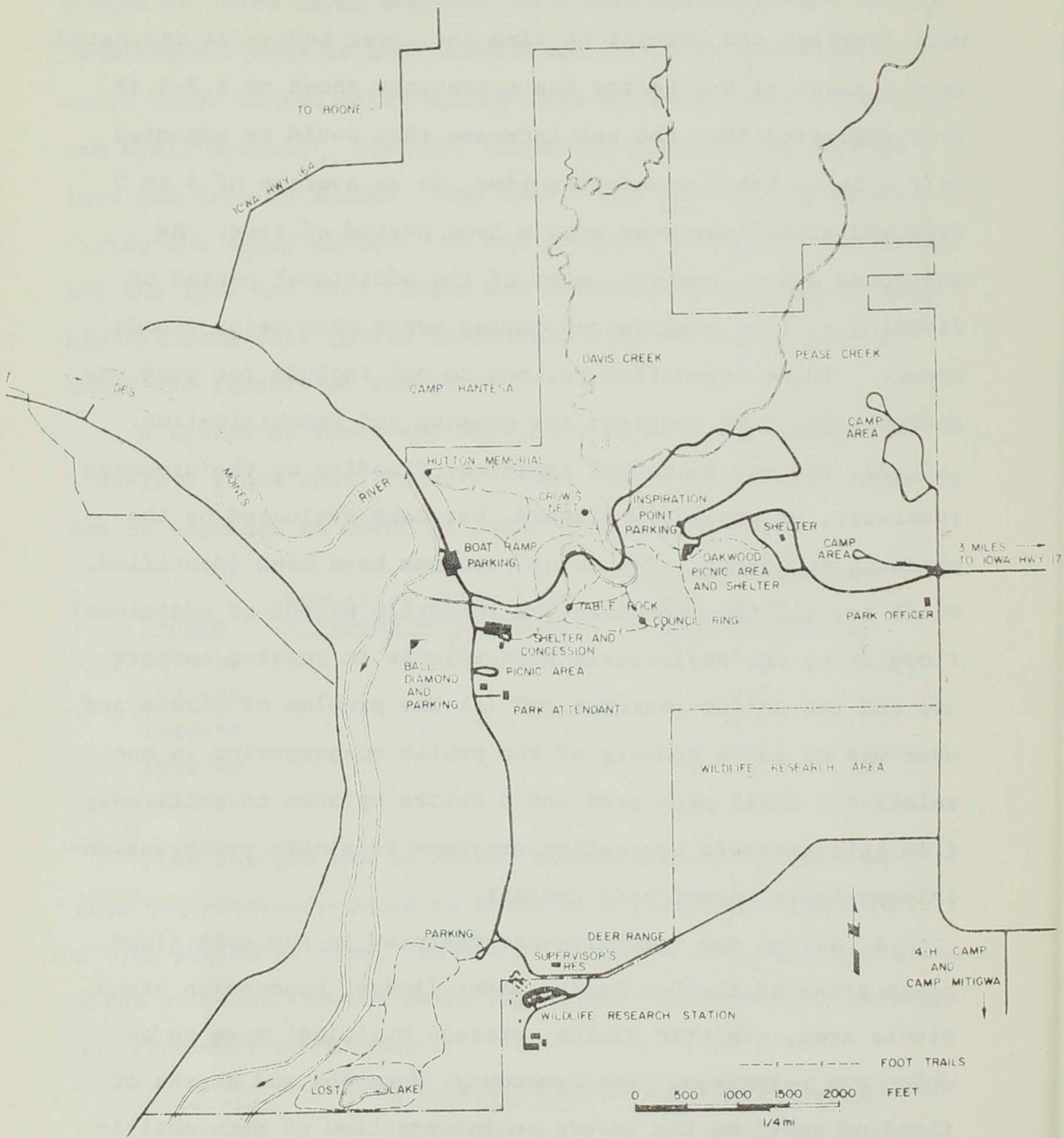


Fig. 6. Existing park facilities and land use at the Ledges State Park (Source: Conservation Commission, Redevelopment Master Plan)

loss of use was experienced in 1954 following the record-stage flood, although lack of funds for rehabilitation was purportedly a contributing factor.

b. The additional depths and duration of flooding will have an adverse effect on trees, shrubs and other vegetation. In the two flood plain areas of the Des Moines River, east and west, substantial loss of the flood plain timber will occur. The 5-year frequency flood pool level is elevation 869, which is 7-9 feet above top of bank and low flood plain. Duration of flooding will exceed 100-120 days during major floods. Most of the lower flood plain will receive a substantial vegetation kill, although some of the most water tolerant trees--willows, sycamores, soft maples, boxelders and cottonwoods--may survive. Thin deposits of sediment will occur during this additional slackwater storage period, as well as sedimentation from the natural more frequent floods moving into the downstream portions of the flood pool. Nuisance conditions including mud and debris, and somewhat later, dust and pollen from invading ragweed and other vegetation, will prevail after these flood periods. A vegetative management program should be considered to combat the natural succession of weed species in the flood plain areas.

c. Shrubs are less apparent and less abundant in the valley floor because of past management for picnicking, other recreational uses, and due to a general increase in the park visitors. The proposed master plan for the park with more emphasis on interpretive facilities and reduction in use in

the bottom creek area, in conjunction with a suitable planting program will aid in restoring the vanishing vegetation cover.

The overall impact of backwater flooding on the existing vegetation in the floodplain area as well as in the creek area, will be detrimental to the growth of a variety of plant material. In the long run, this impact might kill the naturally diverse vegetation which provides an attractive aspect to the present sandstone walls. It will be necessary to plant water tolerant species in the flood prone areas to maintain scenic interest and avoid drabness that might result from the inundation effect in the lower Ledges. Plants colonizing recently inundated areas tend to be weedy species of considerably less attractiveness than present species.

Along the valley bluff perimeter and in the Pease and Davis Creek potential flood area (15 acres), maximum flooding would damage, if not kill, almost all of the trees to the base of valley walls in these locations. Most trees are growing in soils that are above the lowest flood plain and in well-drained areas. Inundation longer than 10 days would probably result in severe damage to all species except cottonwood, hackberry, boxelder and sycamore. Damage to these may occur because of potential changes in the groundwater regime. Saturation by flooding may affect the groundwater levels along the valley bluffs and in the outer flood plain fringes. Shrubs and other native herbaceous growth, grasses, etc. will also suffer adversely from long durations of flooding. Floating debris and dead trees will pose a removal problem.

The amount of timber clearing scheduled during the construction phase may affect the visual qualities of the park, and the type and amount permitted needs to be evaluated.

d. Backwater flooding, from the geological framework, will have minimal effect on the exposed sandstone ledges. The most serious effect of the periodic flooding will be denial of access to the area where the sandstone formations are best exposed and offer the most picturesque scenery and educational value. The percent of time loss, as listed previously, would be increased from 2% to a 4% amount, above elevation 862, the flood plain elevation at the mouth of Pease Creek. There is little potential for undermining and erosion since the reservoir floodwaters are essentially a slackwater phenomenon with low current velocities. Any potential erosion might be offset elsewhere by the hardening of weakly-cemented sandstone formations through contact with mineral-bearing floodwaters. Some staining of the rock surface may occur under long-duration storage, especially if the flood pool is held at one elevation for a long period; however, water seeping down the rock faces from above has already resulted in extensive natural staining of the sandstone walls and ledges.

Deposition of silt and sand from floodwaters of Pease and Davis Creeks may be altered during reservoir flood storage periods, and may result in additional detrimental effects. The exact location and extent cannot be forecast; this depends on the reservoir level when floods occur in the tributary valleys.

e. Among the positive results of the Saylorville Reservoir noted in a park planning report is the opportunity to lessen the over-use of the park by the public. The reservoir will require curtailment or termination of the road system in the lower Ledges as it now exists. This action alone would tend to reduce the number of persons now using the area. These high concentrations result in damage to the sandstone ledges, hillsides and trail systems. In time, this overuse can be as damaging as the reservoir. If a reduction is achieved in the number of persons gaining access to the lower ledges, for more-intensive recreational uses, the hillsides and formations will have a chance to begin to heal and return to a more stable, natural condition.

23. Future-use planning for the Ledges State Park. The objective of both the Iowa Conservation Commission and certain environmental organizations (including the Boone citizens' group) is a change of emphasis to a preservation and ecological-interpretative study area. As stated in the master plan report of the Iowa Conservation Commission:

> "The master plan for Ledges State Park hinges on the basic concepts of preservation of its resource features with a principal recreational emphasis on its educational values. Other recreational uses become secondary to the principle and concept of preservation. Main features will be: Nature interpretative center, natural trail system for natural study, wildlife exhibit areas as a part of interpretative program, camping and picnicking facilities, scenic views, and to restore the natural qualities of the park through management techniques."

a. Some significant aspects of the redevelopment plan (long range) for the Ledges State Park are:

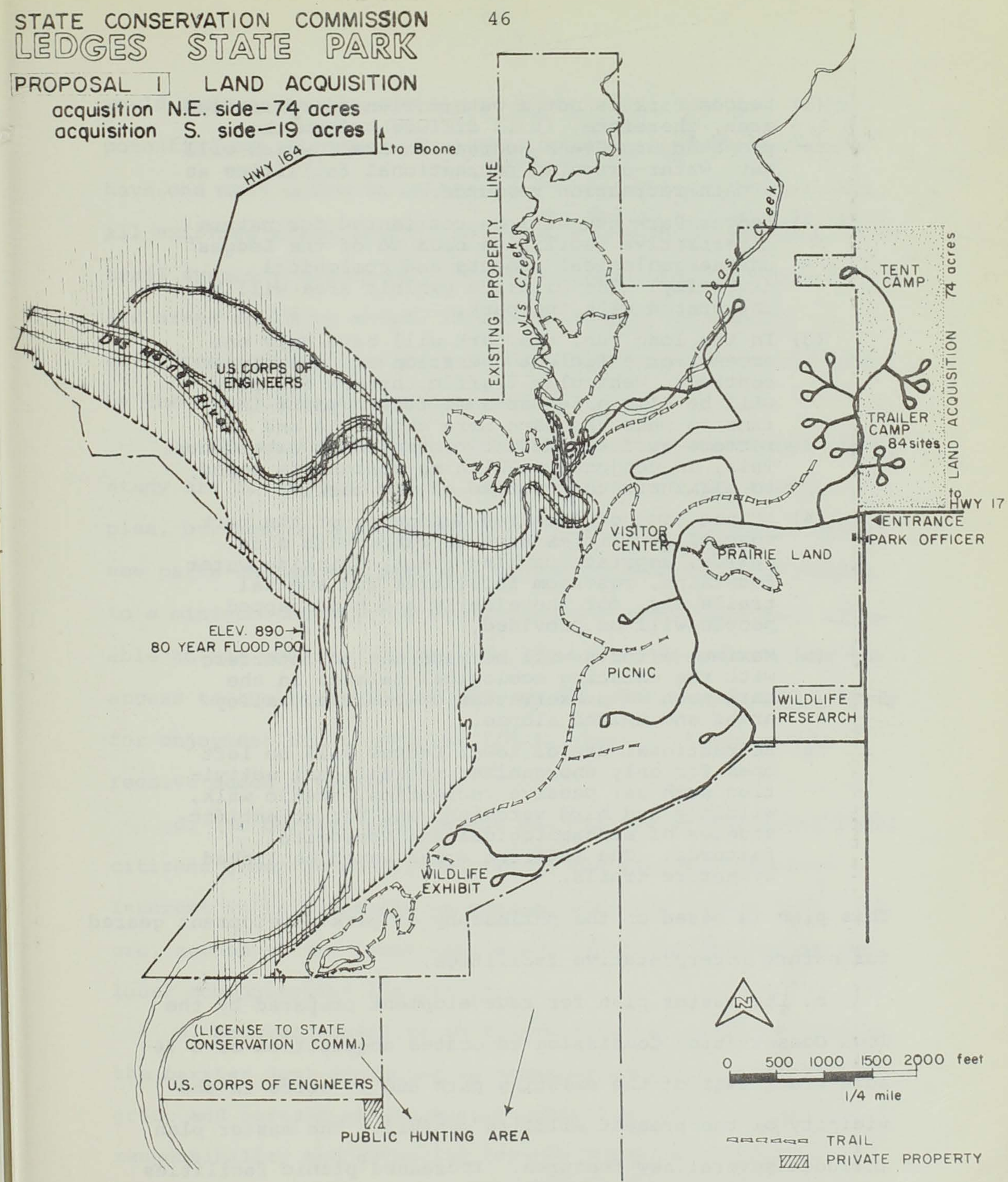


Fig. 7. Proposed future park use plan for the Ledges State Park
(Source: Conservation Commission, Redevelopment Master Plan)

(1) Ledges Park is not a water-oriented recreation area, therefore, it is different from the proposed Big Creek Recreation Area, which will have water-oriented recreational facilities as a main recreation resource.

(2) Ledges Park use will be reoriented for nature interpretive facilities because of the Ledges' unique geological aspects and ecological diversity. The wildlife exhibit area will be integrated with the park.

(3) In the long run, the park will have only one access for efficient operation and management control. Vehicular traffic through the park will be eliminated at some future point in time to make the park more enjoyable and restore quality outdoor recreational experience. This, in conjunction with re-design, is hoped to eliminate the overuse of the park.

(4) At the time of detailed designing of the park, special facilities such as ramps with side guards, separate parking areas, drinking water fountains, restroom facilities and special trails etc. for the elderly and handicapped people will be provided.

(5) Maximum efforts will be made not to interfere with the existing ecological balance in the park such as preservation of prairie, valley areas and upland slopes.

(6) Recreational use of lower Ledges will be left open for only unorganized recreational activities such as: passive recreation, scenic walk, wildlife and bird watching, and for scientific studies of archaeological and ecological features. The interest areas would be linked by nature trails.

This plan is based on the philosophy of park development geared for nature interpretative facilities.

b. The master plan for redevelopment prepared by the Iowa Conservation Commission advocates acquisition of a 74-acre tract east of the existing park and 19 acres in the vicinity of the present wildlife exhibit. The master plan includes several new features. Increased picnic facilities

would replace the losses in the lower Ledges and add to the potential use concept. The road system would be altered to have one main entrance at the east side, and would close off all existing roads (north, south and Pease Creek roads). The trail system would be revised and nature interpretative center and areas would be added. A public hunting area would be developed south of the park in reservoir areas to be managed by the Iowa Conservation Commission.

c. The environmental organizations involved in the review study are in agreement with the objectives of the master plan, but desire to relocate intensive-use features to other new parks and access points in the reservoir area and reduce to a minimum the mass recreational uses previously made available to the public. In the development of detailed plans the access to the lower Ledges park by the handicapped and elderly for enjoyment of its natural scenic characteristics is to receive added attention.

d. The barrier dam concept was evolved by the local Boone citizens group as an alternative to the flooding problem. Inherent in this concept is concern over the future park use, access to the lower ledges and needs and desires of the local community and its citizens.

e. Several conflicts in future park use (with or without the barrier dam) are noted to exist between the park planning group and certain environmental organizations. The primary responsibility and authority for the State of Iowa remains with the Iowa Conservation Commission. Additional public

meetings are being considered in the detailed development phases for the Saylorville project. The park planning group has well noted the present traffic load and safety hazards in the lower Ledges State Park with two way traffic and large numbers of autos. The park road system in the lower Ledges is an "attractive nuisance" to a certain degree, as related to safety, since the drive-through fords with flowing water attract numerous drivers who make several passes through the park before departing.

The future park plan and use of the Ledges State Park will be developed within the regional context of the entire reservoir area, including the new Big Creek Lake area. Within this objective, various ideas and proposals have been offered and considered. The Iowa Conservation Commission plans a public hearing for the Ledges Master Plan, which will include aspects of the lower Ledges. With the Des Moines area representing the largest metropolitan area within the state, its citizens and those of the central Iowa region can be expected to make heavy use of the reservoir area as a public access and open space area. An additional regional need which will deserve additional study is the future highway transportation needs of the reservoir area. Additional generation of traffic and increased population growth in the area will bring about many changes.

24. The barrier dam is one alternative for reducing the reservoir flooding impact on the lower Ledges State Park. The Iowa Citizens to Save the Ledges State Park has proposed

the concept of an extensive barrier dam which would be an alternative to flooding the lower Ledges State Park. This concept, as illustrated previously, was first used at Polk City as part of the Saylorville Reservoir project. The barrier dam concept for the lower Ledges State Park has been studied in substantial detail by the Corps of Engineers and given a general review by the Task Force group.

a. Location and features. The proposed barrier dam would have a length of about 7,000 feet, extending from Iowa 164 southward to the terrace below the wildlife exhibit. It would require a channel change of about 2,000 feet of the Des Moines River to place the river and flood control reservoir to the west side of the valley. The barrier dam would have an average height of 32 feet above the general flood plain (from elevation 861 to 893 feet) and a base width of over 300 feet. In general, it would protect the east one-half of the valley from reservoir inundation and from natural flood flows on the Des Moines River.

b. The barrier dam would be an engineering project of large scope. Approximately 1.3 million cubic yards of earth fill material would be required, which must be protected by rip-rap, etc. A foundation area of 55 acres is needed, which would be cleared through the existing valley timber. An interior drainage structure, combining gravity drainage during low reservoir levels with a pumping plant for use in high reservoir periods, is included. An 8 feet wide by 6 feet high conduit, gated, with a 111 cubic feet per second (50,000

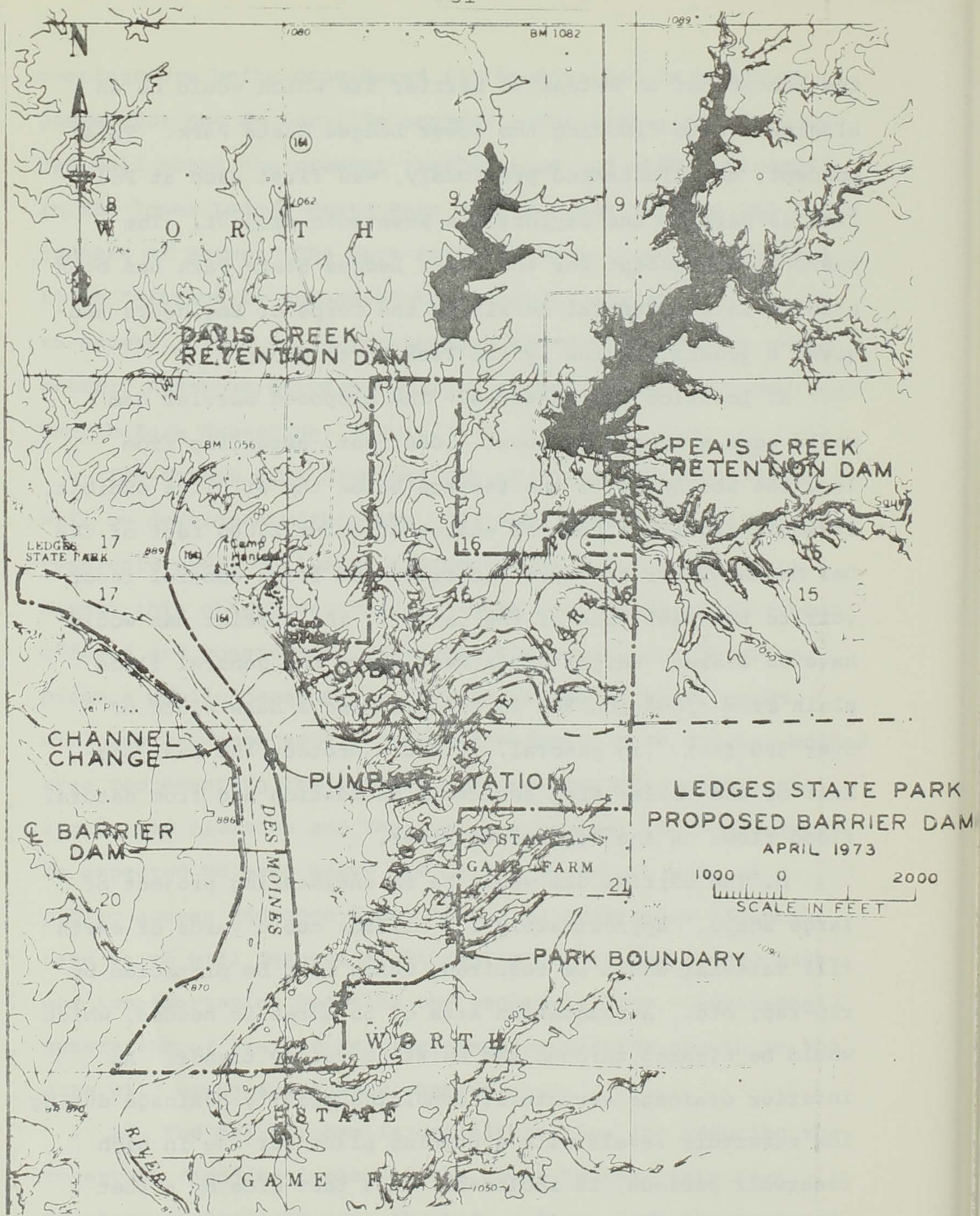


Fig. 8. The proposed barrier dam location and area features at Ledges State Park (Source: Corps of Engineers map)

gallons per minute) pumping plant, is proposed to accomplish this purpose. The abandoned oxbow would become a recreation pond and a temporary storage area for local storm runoff. Some temporary ponding in the oxbow area would be permitted behind the barrier dam during local flood periods on Pease and Davis Creeks, to obtain a reasonable conduit size and minimum pumping requirements. The water would be discharged within a few days (gravity outflow during low reservoir stages and pumping during high stages of flood storage), with minimal damage to the vegetation and trees. However, the lower park facilities would still need to be relocated since they would be in the temporary ponding area. The 1.3 million cubic yards of impervious earth fill would have to be obtained from an upland source, requiring a 100-130 acre borrow area for removal of 6-8 feet of borrow and a haul of about 4 miles.

c. Sediment problems in the Pease Creek valley might be accentuated by the barrier dam. The sediment production is estimated by the engineering sub-group to be about 500 tons per square mile per year. About 2,800 acres of the 9 square mile watershed are in tilled crop land;the remainder is in pasture and woodland. About one-third of the crop land has natural drainage to the ravines extending towards the upland from the Pease Creek and Davis Creek valleys. This accelerates the movement of sediment compared to flat uplands having poor drainage. Inspection of several branches of the valley indicates that bank sloughing is a relatively minor problem. Some slides have occurred, but not in a location where they

would be scoured and transported downstream.

If the invert of the outlet works of the proposed barrier dam is placed at elevation 860 or above, most of the sediment accompanying the Pease Creek flood flows will be deposited in the oxbow lake. Some sediment will be distributed above elevation 860 and some material will go through the gated outlet works when gravity outflow occurs. As the oxbow lake fills with sediment, trap efficiency will decrease somewhat and more sediment will move through the outlet works. During high reservoir stages when the gate is closed, nearly all the sediment will be deposited in the lake.

Sediment will also be deposited on flood plain lands located above elevation 860 with the barrier dam in place. The pattern of deposition will be controlled by the range of water level elevations and flow frequencies occurring as a result of runoff from the Pease Creek watershed. Thus, the barrier dam would reduce sediment deposition from the Des Moines River but will increase sediment deposition from Pease Creek. Sediment amounts delivered to the oxbow lake could be reduced considerably by installation of small sedimentation ponds near the upper reaches of the valley. Several potential locations were identified by the planning sub-group during field inspection of the watershed and park areas.

d. Two additional dams and subimpoundments, of a larger scope than small sediment impoundments, were studied by the Corps of Engineers, one on Pease Creek and one on Davis Creek. These would trap sediment from at least one-half the watershed

and also reduce peak flood flows. These subimpoundments could have small conservation pools for recreation purposes. Considerable disturbance of the environment might occur during their construction unless due care was exercised. These two subimpoundments do not aid appreciably in reducing the hydraulic structure capacities at the barrier dam (size of conduit and pump capacity), but would assist in sediment control once they were constructed and the vegetative cover reestablished.

25. The estimated cost of construction of the Ledges State Park barrier dam project is appreciable. The estimated cost is $5,400,000 for the basic project (lands, materials, construction) and $6,400,000 if the two subimpoundments were included. The length of haul (3-4 miles) for earth fill increases earth materials cost by a factor of three. Because of this, and increases in construction costs, the Ledges State Park barrier dam would be more expensive than the barrier dam at Polk City, which is being constructed at a cost of about $3,000,000.

a. The lower Ledges State Park would be physically separated from the flood control pool and partially protected from adverse reservoir flooding with the barrier dam alternative. As stated above, this includes 15 acres of the most sensitive ecological areas of Pease Creek, and about 105 acres of flood plain land that is situated east of the barrier dam outside the foundation area required for its construction. The existing channel would become an oxbow lake of about 20

acres in size. It would offer a quiescent pool for recreation use, although intensive uses would not be allowed according to the master plan for redevelopment. Intermittent flooding from Pease and Davis Creeks will also occur.

b. Several losses are associated with the barrier dam. These include loss of the natural stream fisheries access point and use at this bend. Another loss exists in the interference with the Camp Hantesa area, since some of their land and well facilities are involved. The visual impact of the barrier dam must also be considered within the overall impact analysis. Loss of vegetation in and along the foundation area must be evaluated against the reservoir loss without the barrier dam. Sediment problems in the oxbow area are also noted, as Pease and Davis Creeks discharge to this area.

c. The average annual costs of operation and maintenance of the barrier dam and pumping facilities must be included in its total evaluation. This annual cost is estimated to be $11,300 per year. The cost estimate is based on a project life of 100 years and reflects maintenance of 1.3 miles of barrier dam, operation and maintenance of the pumping plant including electrical energy costs. The Iowa Conservation Commission staff has noted that this should be a federal cost, either as operation or as an amortized or discounted equivalent present-worth value for negotiation and settlement purposes.

26. A second alternative to the impact of reservoir flooding is introduction of an enlarged-scope area management and mitigation program. This extended-scope program could be incorporated

into the proposed project operation schedule. Review of its potential indicates that the following items would have to be studied and evaluated in substantial detail before such a program could be implemented.

a. Additional inventory of the natural resources--ecological, geological and other features--of the Pease Creek and Davis Creek valleys upstream of the current park use areas. The inventory would serve as a basis for evaluating the amount of additional lands needed to supplant the downstream areas temporarily flooded and impacted by the reservoir.

b. Development of a comprehensive vegetative management program for the lower Ledges State Park. Each of the three principal areas (west, east and Pease Creek) would need to be placed in a specific category for cleanup, debris removal, washing down of trails and access roads, rehabilitation and other periodic mitigation measures. Initial timber clearing and replanting of water-tolerant vegetation would need to be studied and implementation plans formulated.

c. Extension of present redevelopment plans to encompass the facilities required for an enlarged scope management plan also would be required.

d. This alternative would not place the lower Ledges State Park in the same operational level and environmental context as the existing park development, but a change in park emphasis is being recommended regardless of alternatives. Also, its economic costs have not been evaluated.

It remains principally a physical alternative until studied in additional detail. Presumably it might be expected to cost less than the barrier dam proposal. Reduction or elimination of construction costs would be partially offset by additional land acquisition, development and mitigation costs.

27. A third alternative for reducing the impact on the lower Ledges State Park is to reduce the flood control effectiveness of the Saylorville Reservoir project. A review was made of the proposed and alternative reservoir operation plans. Several types of alternative plans are being evaluated by the Corps of Engineers as part of the environmental impact study.

a. The non-damaging bankfull capacity (or slightly less) of the Des Moines River is 8,000 cfs, from Saylorville to Des Moines. For greater discharges, flooded areas increase rapidly, during reservoir pool rises.

b. The design release rates of the proposed operation schedule would provide for the following for operation of the flood pool (elevation 833 to elevation 890).

Reservoir level	Release rate, cubic feet per second
833 to 875	equal or less than 8,000 cfs
875 to 879	10,000
879	12,000
880	14,000
882	18,000
884	21,000
884 to 889	21,000 maintained by gradual gate closure and overflow over concrete spillway crest
889 to 890	Increase release rate to 42,000 cfs by reopening conduit gates

c. The maximum attainable release rate through the outlet works conduit (11,800 cfs at elevation 833 to 21,000 cfs at elevation 884) equals or exceeds the release rate provided for in the proposed operation schedule.

d. The proposed lower limit on flood release rates, 8,000 cfs, would limit flood stages to less than bankfull (by some 2 feet) with 10,000 cfs being slightly above bankfull discharge capacity.

e. In the reach from the dam to Des Moines, at a river stage corresponding to 10,000 cfs, the flood plain area flooded is 619 acres. This increases to 1,300 acres at 12,000 cfs and to about 2,500 acres at 20,000 cfs. More than 5,000 acres would be flooded at a discharge of 60,000 cfs, approximately the magnitude of the 1954 flood.

f. Construction of the Polk City-Big Creek barrier dam concept eliminated approximately 38,000 acre-feet of storage; by increasing the flood pool to elevation 890, the total flood control storage was increased from 525,000 acre-feet to 602,000 acre-feet. The flood control project at this revised level of development reduces the average annual flood damages in downstream reaches from $4,000,000 to a level of $234,000, principally achieved in the Des Moines area.

g. The review has shown that the alternative methods of operating the reservoir (except for those alternatives which eliminate the conservation pool) will result in increased frequency of flooding in downstream reaches of the Des Moines River, when compared to the presently proposed

operating schedule. Eliminating the highest increment of flood control storage, the elevation 884 to 890 increment, would result in annual flood damages of $1,260,000. This increase in damages represents an annual loss of $1,000,000+ in flood control benefits. This annual loss of benefits in a 100-year economic period, represents a present worth of $18,000,000 at a 5 1/2 percent discount rate, or more than $27,000,000 at 3 1/2 percent. This indicates that the benefits gained through reduction of flood losses downstream of the dam are relatively sensitive to both the volume of flood control storage and the proposed release rates.

h. Changes in the proposed operating procedure which would increase the frequency of flooding in downstream reaches might require renegotiation of flooding easements which were acquired in the Red Rock Reservoir area.

Flowage easements obtained by the Corps of Engineers at Red Rock were based on the operational plans of both reservoirs. Alteration of the operating schedule at Saylorville Reservoir would adversely affect these easements and could possibly require re-negotiations with the landowners in the Red Rock Reservoir area.

The actual test that should be applied is whether the change in any operation plan places an additional servitude on the flowage easement land to the extent that it constitutes an additional taking. Changes in operating plans, therefore, do not necessarily require renegotiations.

i. Evaluation of any changes and needed supplementary programs in flood control and flood plain management remains within the responsibility and authority of the Iowa Natural Resources Council for the State of Iowa. Additional detailed, in-depth studies of all alternatives would be required prior to any consideration of changes.

28. Development of an on-going program for the implementation of a sound land-use and flood plain management plan has been initiated, for the 5,000 acres of flood plain in the reach of the valley lying between the Saylorville Dam and the City of Des Moines (Euclid Avenue). Restudy of the greenbelt program, flood damage potential, land use alternatives, zoning and other regulations are specific items of restudy. The initial efforts of this task force and an initial report on use of the 5,000 acres of flood plain area and other bluff and timber lands are included in the Appendices.

29. The sand and gravel resources used as road and materials aggregate will continue to be available to Boone County, in the upper flood pool area. Those materials resources in the conservation pool and downstream flood pool areas will be lost due to permanent or too-frequent temporary inundation. The Corps of Engineers has permitted Boone County to continue extraction of gravel deposits. The county has leased or purchased five separate sites containing an estimated 4 to 5 million tons. Private gravel pits are negotiating with the Corps of Engineers to continue their operations in areas where intermittent flooding has a

potential. There is fair assurance that satisfactory arrangements will be completed.

30. The archaeology study team and the officer of the state historic preservation program have provided brief comments regarding archaeological salvage work. Two archaeological sites have been identified but not salvaged in the lower Ledges State Park. There is a possibility of finding other sites within the area which would be affected by the barrier dam construction, if the barrier dam is constructed. The dam will encroach on the prehistoric area and the sites will be destroyed. It will have the same impact if there is ponding behind the barrier dam.

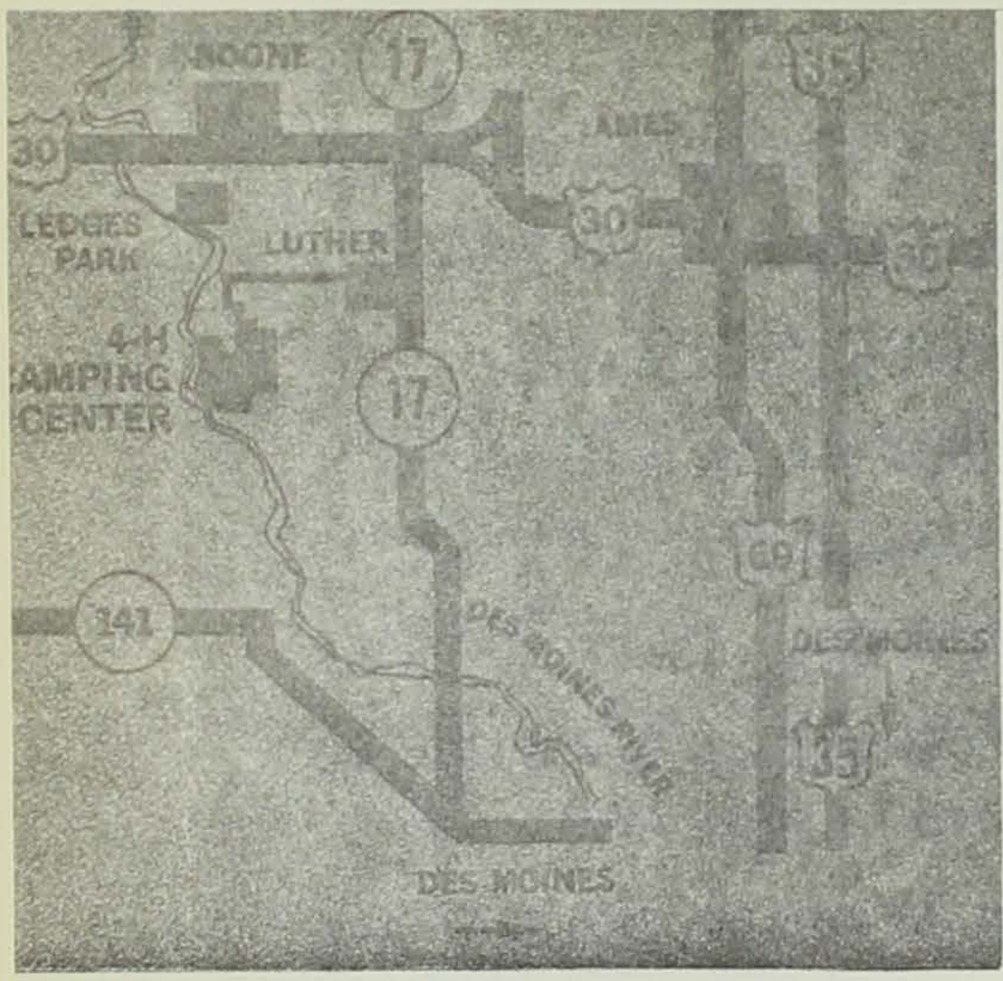
Under natural flooding conditions the sites will be submerged for some duration, but will not be destroyed. Still there is a need to identify the sites, determine their significance and salvage them. Backwater flooding in the creek area and the low area at the mouth of the Pease Creek will eventually fill the areas with sand and silt burying potential sites. The reservoir water storage level changes may cause some bank-slumping which would tend to destroy the sites.

31. The Camp Hantesa area, with a total of 132 acres, is affected also by the barrier dam. The Heart of Hawkeye Council is concerned about the impact of the dam on their lands and camp programs if the barrier dam alternative is selected. Other remedial measures have now been constructed as part of the Saylorville Reservoir project. Additional details are included in Appendix G.

32. Environmental considerations at the Iowa 4-H Camping Center have been included as part of the study. Iowa State University, through its 4-H Office and the Environtology Council, is assisting the State 4-H Foundation in evaluating the environmental impact of Saylorville Reservoir on these two facilities. The student study reports are presently being compiled, as is a consulting report on additional developments at the camp.

a. The camping center complex consists of more than 1,000 acres on the Des Moines River in Boone County, with facilities for over 400 campers. Almost one-million dollars have been contributed to its development, facilities and program since its beginning in 1952. It has been used by some 150,000 persons since that time. The camp is owned by the 4-H Foundation and operated by Iowa State University, through a memorandum of understanding. The Iowa Arboretum, an adjacent and adjunct facility, is being developed in conjunction with the Iowa Horticulture Society, on lands both north and east of the 4-H camping center. However, these lands are not affected by the reservoir.

b. The 4-H Camping Center is located southwest of Luther on upland lands lying between Richardson Branch and the Des Moines River. The stream has a drainage area of 11.6 square miles (7,400 acres) at its confluence with the Des Moines River. Lands owned by the camping center extend from the left (east) bank of the Des Moines River eastward across the ridge between the two streams and to the east bluff of



IOWA 4-H CAMPING CENTER

Located near Ledges State Park in Boone County, the Iowa 4-H Camping Center is not more than a 5-hour drive from the most distant county. All-weather gravel roads lead to the camp, which is within 4 miles of a paved highway.

Location of Facilities

A. Entrance
B. Custodians Home
C. Elm Village
D. Hickory Village
E. Butternut Cabin
F. Log Cabin Museum
G. Cedar Cottage
H. Oak Village
I. Linden Lodge
J. Swimming Pool
K. Birch Village
L. Maple Village
M. Clover Bowl (proposed)
N. Dam (proposed)
O. Lake (proposed)
P. Richardson's Creek
Q. Des Moines River
R. Headquarters, Iowa Aboretum, Inc.
S. Iowa Aboretum (proposed)

Fig. 9. The Iowa 4-H Camping Center located near Luther (Source: State 4-H Office)

Richardson Branch. The latter stream flows southward through the camp property, then westward to the Des Moines River. The river flows about due south in this reach.

c. The camp buildings are located on the flat uplands at elevations exceeding 1,020 feet. This places the main camp area at a height of some 130 feet above the maximum flood pool elevation of 890. The Des Moines River flood plain is 850± feet in the camp area. The camp's well is located on the Des Moines River flood plain west of the camp. A canoe storage shed is located near the river northeast of the camp. An extensive nature trail system and access trails for maintenance are located along the Des Moines River and in the lower downstream parts of Richardson Branch. The flood plain areas along the Des Moines River are at elevation 846-851. Areas in the lower, downstream part of Richardson Branch are above elevation 850.

d. The impact of Saylorville Reservoir will be greatest on the timber, shrubs, and native herbaceous vegetation, presently used in nature study and environmental education programs. Visual impact will be great, since this camp is in the middle of the active flood pool (Reach B and Impact Zone 4. See Fig. 3, page 17). Because of prospective severe loss of timber below the 5-year flood pool (elevation 869±), all of the Des Moines River flood plain and much of the lower Richardson Branch valley will be affected. Although full evaluation is not completed, it is estimated that about 100 acres of land in the valley of Richardson Branch is affected,

and about 84 acres along the Des Moines River. In Richardson Branch, about 20 acres of the 100 would be above the 5-year flood pool level, (Impact Zone 5), and would be affected to a lesser extent than those areas within the active flood pool (Impact Zone 4).

e. The bluff along the Des Moines River west of the 4-H Camp is unusually straight and steep in alignment (trending slightly northwest). Therefore, lateral flooding will be a minimum on the valley sideslopes. The greatest loss would appear to be in the Richardson Branch valley, insofar as lateral flooding, mudflat potential, slope effects, etc., are concerned. The other unusual flooding impact is that the flood pool, in backing into Richardson Branch, will place floodwaters on both sides (east and west) of the southerly part of the camp. Poor visual perspectives will result at several overlooks located in this area.

f. The 4-H Foundation, 4-H leaders and camp staff have been most concerned about land acquisition, encroachment of public access and facilities of the greenbelt program of the Corps of Engineers, and intrusion by the public into camp areas from the adjacent reservoir area. Proposed development of a recreational trail system on the east side of the valley in this reach is of special concern. To counterbalance the loss of use of the Des Moines River and adjacent areas, and to improve its program in water-oriented outdoor recreation, the 4-H Foundation has been studying the alternative of constructing a recreation lake on Richardson Branch. It would

be located at a site east of the camp at the point where the flood pool ends. However, engineering studies have indicated that the site can be developed only at considerable expense. Therefore, additional alternatives are being considered.

g. The 4-H Foundation, through its executive committee, is negotiating with the Corps of Engineers to obtain an acceptable plan of action for future land use and for final settlement for land acquisition. Key elements are: (1) maintaining full control and/or ownership of all lands in the Richardson Branch valley; (2) maintaining a measure of control over the Des Moines River flood plain which the Corps desires to purchase in fee title as part of the reservoir resources plan for recreation, fish and wildlife, and open-space use by the public; (3) development of access control between the Des Moines River flood plain and the camp property, above elevation 892, perhaps by barrier vegetation or acceptable fencing; (4) retaining access rights to maintain a well field on the Des Moines River flood plain, at the location of the existing well; and (5) determining what type of timber clearing and future vegetative management program would be best for the valley areas in this reach of the reservoir.

h. The 4-H Camping Center will need to relocate its nature trails and vegetative interpretative study areas to the Richardson Branch valley upstream of the reservoir flood pool limits and to the ravine area west of the camp. The Richardson Branch valley offers much promise as a compensating trade-off, and negotiations with the Corps need to include the cost of shifting these environmental study programs.

Section IV, Conclusions and Recommendations

Conclusions Regarding Existing Status

32. Saylorville Reservoir is a federal multipurpose reservoir being constructed on the Des Moines River immediately upstream of the City of Des Moines. Its primary purpose is flood control, and secondary purposes include water-oriented outdoor recreation and related park uses, water quality enhancement through downstream low-flow augmentation and incidental fish and wildlife propagation.

Many Iowans have observed the environmental impact experienced at Coralville and Red Rock Reservoirs. Changes in the visual aesthetics are the most frequently discussed topics, but more detailed studies of other changes, including both losses and gains, are also being made. Several types of management programs are being planned or proposed at Saylorville Reservoir to mitigate such adverse effects in advance of completion and operation, or which would become part of the operation and maintenance phase. Long term losses at Saylorville include: (a) the valley lands currently used for agriculture crop production; (b) the pasture, timber, other vegetation and associated wildlife habitat; (c) change in scenic values and loss of recreational use of the natural river channel in the reservoir area, through permanent or temporary flooding; and (d) loss of mineral resources which cannot be reclaimed following construction. The primary gains include: (a) flood damage reduction at Des Moines and

other downstream points, (b) the addition of 5,400 acres of recreational waters in the conservation pool, (c) the 885 acre Big Creek Lake as a stable-level recreation lake, (d) 12,000 additional acres of public land in the flood control pool which will be subject to periodic inundation by the flood control operation, and (e) water quality improvement during drought periods.

Several specific environmental areas of concern were reviewed by the Technical Task Force study group. Impact analysis has been made in terms of (1) the conservation pool, (2) the active flood pool and (3) the less-active flood pool. The greatest degradation of the environment will occur in the active flood pool, in the specific impact zones identified in the review study and listed in a previous section. Additional attention to environmental considerations during the final construction phase will do much in providing Iowans with a more acceptable multipurpose water resources facility.

33. The proposed environmental resources plan of the U.S. Army Corps of Engineers now provides for alternative timber clearing methods and introduces a measure of a vegetative management program. The three options are: (1) complete clearing of trees in the conservation pool and to some desired level in the flood pool, such as the 5-year frequency (869 feet flood pool elevation); (2) selective clearing of the least-tolerant species to some desired elevation (again using the 5-year or 869 feet elevation frequency criterion), and annual maintenance thereafter; and (3) clearing only the

conservation pool with annual removal and maintenance programs being used thereafter in the reservoir area.

34. The environmental review study has shown that certain environmental organizations and the local citizens group have two concerns at the Ledges State Park. The first is the effect of reservoir flooding on the lower Ledges State Park area, and the second is the long-range park plan for future use.

Future use patterns at the Ledges State Park are closely related to the reservoir project, but the overuse by the public as currently experienced is also of concern. All parties involved in the Task Force study agree on the change in emphasis to a more preservation and ecological interpretative study area concept. Within this objective, various ideas and proposals have been offered. Further review of this problem may be needed to provide additional opportunity for all interested parties to discuss the various alternatives for park use. The Iowa Conservation Commission plans a public meeting to present the Master Plan for the Ledges State Park. This will include aspects of the lower Ledges State Park. The environmental organizations and individuals will have an opportunity to comment at that time. Emphasis on a total regional system for the Saylorville Reservoir area is paramount in this phase.

35. The Ledges State Park exists in an area of the state where exposed bedrock features are rare. The sandstone formations have a variety of prominent features which have

been exposed through differential erosion. This presents a picturesque, mural-like valley wall in the park, forms a unique object of interest and outstanding opportunity for a nature interpretative program. Similar exposures in Iowa are found only in three other locations, in Webster, Marion and Muscatine Counties.

There are 1,275 acres contained in the park and wildlife areas at the Ledges State Park. The reservoir flooding potential will not affect the 1,000 or more acres of existing park and wildlife lands situated on high ground above the proposed flood pool. The reservoir impact area consists of approximately 230 acres of flood plain land in the lower Ledges. This acreage has been divided into three impact areas for evaluation purposes. The three areas include, at the maximum flood pool elevation of 890 feet: (1) 15 acres in the Pease and Davis Creek valleys, the most sensitive ecological area; (2) 115 acres east of the river on the Des Moines River flood plain (elevation 860-862 feet), now used as an intensive-use recreation area; and (3) over 100 acres west of the river, mostly used as wildlife habitat and as a buffer zone for the park.

36. The effect of flooding at the Ledges State Park has been studied for the three land areas influenced by the reservoir. Some 15 acres of the most sensitive ecological habitat in the downstream section of the Pease Creek valley will be affected, including the smaller Davis Creek tributary at their confluence. Of this total, 9 acres were inundated

in the 1954 flood. These tributary streams contain the unique sandstone ledges from which the park derives its name. The remainder of the flood plain land along the Des Moines River affected by the reservoir includes 115 acres on the east side currently used for intensive recreation purposes, and some 100 acres on the west side which serve as a wildlife habitat and buffer zone for the park. The land area contained in the existing river channel is not included in these flood plain acreages.

Much of this lower area is subject naturally to flooding by the river and the local streams, and has been flooded periodically in the past. Maximum experienced depths of flooding have been as great as 16-18 feet, with intermittent overbank flooding occurring as many as 60 days or more during those years when the greatest floods of record occurred. With the proposed reservoir operation schedule, the flooding effect could be increased to a total depth of 28-30 feet, with the length of overbank flooding period increased to as much as 100-120 days, as and when similar flood magnitudes occur in the future. Existing vegetation--trees, shrubs, flowers and ground cover--will be particularly sensitive to the increased duration of flooding in terms of consecutive days of submergence, as much as or more so than may be caused by the increased depths of flooding. Interruption of park use, especially for nature studies, will also extend for longer periods.

The effect of reservoir flooding in the sandstone gorge sections of Pease and Davis Creeks has been reviewed for geological, vegetative, archaeological and recreational impact. Interruption of access for studies, some additional staining of the formations, groundwater changes and additional sediment accumulation in the gorge section are potential losses in the geological area, which might be offset by potential mineralization and case-hardening of the surface of the sandstone formations during flood storage periods. Vegetative and other ecological losses depend on the additional depths and durations of flooding, with greatest impact on the less water-tolerant species of vegetation at the higher flood pool elevations and on all species at the mouth of Pease Creek and along the Des Moines River flood plain. Two archaeological sites also were identified in the lower Ledges area, and would be affected by natural or reservoir flooding, or by various alternative protection plans. Additional effects will occur also on fisheries, wildlife, songbird habitat, scenic views and other park uses, which have been identified and evaluated by the Technical Task Force and its study subgroups.

Reservoir flooding under the proposed operating schedule also will result in substantial changes and periodic alterations of the wildlife habitat located on the west side of the river, and would require relocation of most existing park and recreation facilities situated in the flood plain area of the lower Ledges State Park.

37. Several miscellaneous areas of concern are being negotiated satisfactorily with the Corps of Engineers.

a. A solution is being reached regarding the problem of maintaining the access rights to sand and gravel in the Des Moines River valley deposits. Those located in the upper flood pool will be flooded infrequently. Boone County has the necessary agreements to use several sites for long-term sources of supply. Private sand and gravel operators presumably will have a similar opportunity.

b. The land acquisition and access control problems at the State 4-H Camping Center are proceeding slowly but satisfactorily. Remedial measures and access rights for well relocation and redevelopment are being planned and construction proposed. The greatest problem is control over public access into the camp area from the adjacent reservoir recreation areas, as currently proposed for additional greenbelt development and recreation use.

c. If a proposed barrier dam is to be constructed to protect the lower Ledges State Park, additional problems would occur at Camp Hantesa, adjacent to the Park. It would involve their property, well supply, and use of the existing river. Coordination with this camp is needed with any plan of development at the Ledges State Park, particularly with the plans which may involve entrance road changes.

d. Other miscellaneous problems may exist, but have not been brought to the attention of the Task Force. It is considered, however, that the major problems have been considered

and studied. Specific highway relocations have been negotiated separately with the Iowa Highway Commission, and the counties involved, and have not been considered further in this environmental study. Erosion control problems at new valley crossings have been noted in field studies as being a specific problem area to which additional attention could be given.

One additional area of transportation needs has been identified, which is the future access and general highway requirements if large amounts of traffic are generated because of the reservoir. The policy of the Iowa State Highway Commission is to continue to monitor the population and traffic generation patterns of the area and to plan for future highway improvements accordingly.

This policy will ensure that an adequate and orderly system of primary and secondary roads will be available to serve the traffic which is anticipated to be generated within the Saylorville Reservoir project area. All such planning and development will be coordinated with other appropriate agencies as necessary.

General Recommendations for Alternative or Additional Programs

38. The Task Force supports the proposed change by the Corps of Engineers in timber clearing at Saylorville Reservoir. Of three alternative plans, a combination of at least two is recommended.

The three alternatives are: (1) complete clearing of trees in the conservation pool (elevation 833 feet, mean sea

level datum) and to some designated level in the flood pool, with the 5-year frequency flood pool elevation of 869 feet being considered; (2) selective clearing initially of the least-tolerant species in the flood pool to this designated level, along with complete clearing of the conservation pool, and introduction of an annual debris and dead tree removal and maintenance program; and (3) initially clearing only the conservation pool accompanied by an annual removal and maintenance program thereafter. Experience at Coralville and Red Rock Reservoirs, where only the conservation pool was cleared, would suggest that one of the first two, or some combination for various reaches of the reservoir, should be considered for funding and implementation.

The Technical Task Force recommends further the development of a comprehensive vegetative management plan for the entire reservoir. This plan should include the desired timber clearing alternative at specific locations and in addition include provisions for controlling and combating weed growth, mudflat problems, floating debris, and reestablishing water-tolerant vegetative species. A much more comprehensive program should be developed as a trial, ideal management scope.

39. Three major alternatives exist for mitigating the reservoir flooding problem at the lower Ledges State Park. The first alternative is to construct the proposed barrier dam with its attendant high costs, and adjust the future park use and related facilities to meet the stated use objectives.

The second alternative is to introduce an enlarged-scope management and mitigation program for coping with the reservoir flooding impact within the proposed reservoir operating schedule. The third alternative involves making changes in the flood control storage allocation or in the proposed reservoir operating schedule and associated release rates.

The barrier dam proposal as alternative 1 for protecting the lower Ledges State Park has been studied and reviewed in detail. It would be similar to the Polk City-Big Creek barrier dam project now under construction. It is a construction project of large scope, and would cost at least $5,400,000. It would require a dam 7,000 feet long and with an average height of 32 feet, and contain over 1.3 million cubic yards of fill. It would include also an outflow structure and pumping plant to accommodate interior drainage from Pease and Davis Creeks. Its construction requires 55 acres of foundation area, and a channel change of the Des Moines River. It also would affect lands and well facilities at Camp Hantesa, the Camp Fire Girl's camp. The addition of subimpoundments in the upper reaches of Pease and Davis Creeks for sediment storage, reduction of peak flood flows, and miscellaneous recreation uses, if found necessary or desirable, would increase the construction cost by an additional $1,000,000.

The barrier dam project would physically separate the lower Ledges State Park from the flood control pool and reduce the impact of flooding. The protected area would contain the most-sensitive 15-acre Pease Creek impact area, about 100

acres of Des Moines River flood plain and the oxbow lake created by cutting off the existing bend of the river. However, intensive use facilities in the lower flood plain areas would still need to be relocated since the oxbow and adjacent flat areas would intermittently be needed as temporary ponding areas for the interior drainage system. As stated previously, the relocation of park facilities also is a part of the master plan to reduce overuse and stress on the lower Ledges State Park now being experienced from large numbers of park visitors. Federal funding for construction, operation and maintenance would be required. Construction of the barrier dam would further delay the completion of the Saylorville Reservoir at least one year, which is adverse to the concept of achieving additional flood protection at Des Moines as soon as possible. Implementation of this alternative, if selected, may require reconsideration of the present master plan for redevelopment.

An enlarged-scope management and mitigation program is included in alternative 2. The proposed flood pool and associated reservoir flood operation schedule would remain unchanged.

Based upon the review studies, the use of the lower Ledges (the 115 acres of flood plain east of the Des Moines River and the 15 acres of the Pease Creek valley) would be reduced two percent, from 98 to 96 percent of the time, based on historical floods and the reservoir operation studies.

This would mean that the existing fishing access point on Iowa Highway 164 at the horseshoe bend could be used most of the time. The flood plain east of the river and the lower Pease Creek valley could also be used most of the time. The exact uses would depend upon the final master plan developed by the Iowa State Conservation Commission. The absence of the barrier dam would maintain one aspect of the scenic beauty of the lower Ledges--the river front views would still be available, although affected by timber clearing and vegetative management programs.

Under this alternative, the lower Ledges area would not be protected from periodic inundation. When the inundation did occur, many of the trees and shrubs in the area would be killed, depending upon the depth and duration of the flooding. Specific plans would need to be developed for planting water-tolerant tree and shrub species in the lower Ledges to replace those lost due to high reservoir levels. A tree barrier should also be maintained at the mouth of Pease Creek to reduce the influx of floating debris in the lower Ledges from the river channel at high water stages. Plans and procedures would need to be developed for the removal of these trees and those that would be killed by inundation. Under the general concepts of the management and mitigation program, the state would obtain as mitigation measures (a) the required additional lands in the Pease Creek and Davis Creek valleys to supplant the lower flooded area, (b) replacement and relocation of the existing recreation facilities, and (c) a negotiated settlement to

offset initial costs of clearing, renovation and replanting, and including an equivalent sum for the estimated additional annual maintenance required to clean up, rehabilitate and control weed growth in the lower areas once floodwaters subside. Implementation of this alternative would require an inventory of the ecological, geological and recreation features existing in the upstream reaches of each stream. This inventory would assist in determining precisely which additional areas should be acquired, the type and extent of trail system needed, and the most advantageous development pattern required for nature interpretative study area emphasis. The cost of this alternative cannot be estimated in detail until the required inventory and other analyses are performed; however, it most likely would be less costly than the barrier dam proposal.

Reduction of the flood control effectiveness of the reservoir is alternative 3. However, if the flood control storage allocation is reduced to an elevation that would eliminate reservoir flooding of the lower Ledges State Park (from elevation 890 to elevation 860), over two-thirds of the storage allocation would be lost. There would be little opportunity remaining to reduce the estimated annual flood damages of $4,000,000 which can be reduced to a level of about $234,000 annually with the full flood control pool. A review was made of the most-recent increase in the operating level of the reservoir, from elevation 884 to 890 feet, caused by the Big Creek project. The study showed that eliminating this incremental storage volume would result in increased

release rates and an associated increase of the annual flood damages in downstream rural reaches and urban areas of $1,000,000 or more, or to a total annual level of $1,260,000. Additional reductions of the storage volume would cause further increases in release rates and in resultant downstream flood damages, and an inability to maintain a favorable benefit-cost ratio for the project. Introduction of increases in reservoir release rates within the allocated storage volume would decrease the duration of adverse flooding at the lower Ledges. Practically all adverse effect could be avoided by utilizing the full outflow capacity of the outlet works conduit and of the overflow spillway. However, this would also be detrimental to the estimated economic returns from annual reduction of flood losses. The loss in economic benefits incurred with either change of operation within this alternative, has indicated to date that the other two alternatives would be preferred in an economic sense.

The Technical Task Force recommends that all factors, gains and losses, be considered in selecting among these three alternatives. The total impact and final decision must be evaluated in terms of (a) the entire Saylorville Reservoir project, (b) other state plans and programs for water resources, recreation, water quality, flood control and related uses, and (c) the needs and sensitivity of residents of central Iowa for the Ledges State Park.

40. A third major area of emphasis is the need for evaluating and implementing a long-range land use and flood

plain management program for the valley reach between Saylorville Dam and the City of Des Moines levee system. The reservoir reduces the flood risk but does not eliminate the flood potential. A comprehensive flood plain management program is needed to control urban encroachment into the existing flood plain. In addition, a greenbelt program as initially envisioned in this area by planning groups and the federal government would add to the regional open space and recreation needs. Support of this program is encouraged.

41. Other problem areas were briefly reviewed; however, negotiations for mitigation of the environmental impact of the project on these areas of concern appear to be proceeding satisfactorily. It is recommended that these negotiations be followed closely and coordinated as necessary by the appropriate state agency or agencies involved, to assure that equitable and satisfactory settlements are obtained for the benefit of the citizens of Iowa. The problem of determining general highway needs in the reservoir area may need additional attention in the future. Other problem areas include: (a) flooding effects and remedial measures, including land acquisition and control, at the Iowa 4-H Camping Center; (b) continuation of materials extraction and processing of the sand and gravel resource in the upper flood pool reaches; and (c) effects on other facilities, including group camps, county and state highways, municipal well fields, etc. No additional problems were brought to the attention of the Technical Task Force study group.

Section V, Acknowledgements

42. The Task Force study group has completed a review of the Saylorville Reservoir environmental resources, impact and effects on local and state facilities. The report is directed to the Governor's Inter-Agency Resource Council, a coordinating group of natural resource agencies for the State of Iowa. The information contained in this report can serve to guide the individual agencies and the Office of the Governor in their decision-making roles.

Appendix material is also attached as a part of the report to amplify the many details which cannot be briefly summarized effectively.

43. The following individuals participated in the Task Force Study Group.

(a) Chairman:
Merwin D. Dougal
Iowa State University (Environtology Council member) and member, Iowa Natural Resources Council

(b) Iowa Natural Resources Council
James F. Cooper
Chris Carrier
Dale Tekippe

(c) Iowa Conservation Commission
Thomas Albright
Vasant Nerikar
Steve Brenton

(d) Iowa Geological Survey
Jean C. Prior

(e) Department of Soil Conservation
Richard Wilcox
Fred Higginbottom
Advisor: Dewey T. Bondurant
Soil Conservation Service

(f) Department of Environmental Quality
Dan Brindley

(g) Office of State Archaeologist and State Preservation Program
Adrian D. Anderson

(h) Iowa State University
Roger Q. Landers
Wendell Beardsley
Howard P. Johnson
James J. O'Toole
Ronald L. Rossmiller

(i) Iowa State Highway Commission
Dave Drake

(j) Boone County
Carl F. Schnoor
M. C. Cole

(k) Federal Agency Coordination
Corps of Engineers, Rock Island District
Thomas J. Rodhouse
George E. Johnson
Frank Collins
John F. Merritt
S. K. Nanda
R. J. Fleischman

(l) Observers
Citizens to Save the Ledges State Park, Inc.
Hans H. Goeppinger
Christina Cowles

Iowa Chapter, Sierra Club
Clark C. Bowen

Iowa Citizens for Environmental Quality
James J. O'Toole

(m) Group Camps
Camp Hantesa, Camp Fire Girls Camp
Susan Welch

Iowa State 4-H Camping Center
Gerald Lineweaver

Credit is given also to the Environtology Council office, Iowa State University, for office and stenographic assistance, and to Mrs. Judy Cruzen for typing and assisting in the preparation of the report. Mr. Kenneth Choquette, water resources graduate student, assisted in the final editing and printing phase.

Part II

APPENDICES

Appendix A

Project Description and Planning Information

Saylorville Reservoir Project

Des Moines River,

Iowa

Data provided by

Rock Island District
Corps of Engineers
U.S. Army

January 1973

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING
ROCK ISLAND, ILLINOIS 61201

IN REPLY REFER TO

NCRED-RL

7 February 1973

Dr. Merwin D. Dougal
Associate Professor
Department of Civil Engineering
Iowa State University
Ames, Iowa 50010

Dear Dr. Dougal:

Thank you for your letter of 16 January 1973 in which you informed me of the meeting on 12 January 1973 with members of the Governor's Interagency Resources Council and representatives of the environmental groups involved in the recent court action.

I welcome the opportunity to work with the Council. We are most anxious to see early completion of the project not only in fulfillment of the flood control concept as authorized by the Congress, but also in full compliance with the National Environmental Policy Act.

We are concerned that the Council consider all feasible alternative solutions to the problem of protecting and enhancing the environment, particularly with reference to Ledges State Park. I am sure that all concerned will press forward in their considerations as rapidly as they can. Even so, time will be rapidly consumed and our prospect of completion of the project for beneficial use by the end of next year is far from being good. This prospect raises an important subject for concurrent consideration.

One of the primary purposes of Saylorville Lake is to protect Des Moines from flood damage. The City's present protection is limited. Our knowledge of probabilities is far from prophetic with respect to any given year; we do not know whether 1975 will bring flood flows on the Des Moines River in any degree between insignificant and catastrophic. The experience with Red Rock Dam emphasizes the importance of completing this type project in a timely fashion. Within a few months of completion in 1969, the project yielded some $4.6 million in prevention of flood

NCRED-RL 7 February 1973
Dr. Merwin D. Dougal

damage. Prudent planning dictates that Saylorville Lake should not be prevented by undue delays from performing likewise, should the circumstances require in 1975.

The occasions foreseen for our communication with the Governor's Council appear to be favorable for taking up another important aspect of flood damage prevention. I have in mind the avoidance of flood damage, that can be achieved without the expensive construction required by reservoirs and local protective works. The Corps of Engineers is charged with assisting states to implement flood plain management through regulation based on flood plain information studies, flood hazard evaluation, flood-proofing, and flood plain delineations. I should like to expand the scope of our talks with the Council to include these means of reducing the effects of future floods, wherever applicable in Iowa.

Our relationship to the Council will be governed by its desires. The key areas you outlined fit the structure of the district organization without necessity for modification. It follows, then, that these men will assist me:

Mr. T. F. Crane, District Counsel; on legal matters.

Mr. T. J. Rodhouse, Chief of Relocations Branch; on negotiations, past and future, with the Iowa State Conservation Commission about Ledges State Park.

Mr. R. G. Stearns, Chief of Planning and Reports Branch; on past planning and project development, including economics.

Mr. G. E. Johnson, Chief of Water Control Section; on the subject of reservoir operation.

Mr. H. E. Kendall, Chief of Real Estate Division; on acquisition of lands and rights-of-way, and management of said lands, including leases, licenses, concessions, and permits.

Mr. F. W. Collins, Chief of Environmental Resources Section; on assessment of environmental impacts and mitigation thereof, on preparation of the environmental impact statement, and on development of our master plan for the reservoir's recreational usage.

Mr. D. C. Davis, Chief of Flood Plain Management Services; on flood plain information, hazards, delineations, and insurance.

I am not delegating my responsibility for personal liaison with the Council, for ultimate decision on significant issues, or for other matters of policy affecting the Corps of Engineers and the State of Iowa. However, to facilitate the free flow of information, discourse,

NCRED-RL
Dr. Merwin D. Dougal

7 February 1973

and arrangements for meetings, agenda, and the like, I designate Mr. Rodhouse as the coordinator of my staff with the Council. Further, please feel free to communicate informally with any of those named for specifics within their areas. We shall be glad to assist Mr. Greiner in the work of the two proposed task forces as needed.

The inclosed packet of material is identical to those furnished to the plaintiffs and the Iowa State Conservation Commission in mid-January to assist them in providing initial input for the EIS. We shall be glad to receive any comments you deem appropriate for the EIS.

I look forward to a constructive and agreeable outcome with respect to the timely completion of Saylorville Lake.

Sincerely yours,

WALTER H. JOHNSON
Colonel, Corps of Engineers
District Engineer

Incl
Packet

Copy furnished: w/o incl

Honorable Robert D. Ray
Governor of Iowa
Des Moines, Iowa 50319

Mr. Othie R. McMurry, Director
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Allen L. Donielson, Esq. w/cy ltr fm Dr. Dougal
United States Attorney
Southern District of Iowa
113 U. S. Courthouse
Des Moines, Iowa 50309

1. Project Description.

a. Authorization. The project for the Saylorville Lake on the Des Moines River, Iowa, was authorized by the Flood Control Act of 1958, substantially in accordance with the recommendations of the Chief of Engineers in Senate Document Number 9, Eighty-Fifth Congress, provided that if the reservoir [illegible] conservation, such use shall be in accordance with the Water Supply Act of 1958. The authorization provides that if the project includes storage for domestic, municipal, or industrial water supply, such use shall be in accordance with Title III of the authorizing act.

b. Background.

(1) The Saylorville Lake is located in central Iowa on the Des Moines River. The dam is located 213.7 miles above the mouth of the Des Moines River approximately five miles upstream from the northern city limits of Des Moines, Iowa, and about 2.5 miles upstream from the town of Saylorville. The lake lies in Polk, Dallas, and Boone Counties. The lake at full flood control pool elevation will extend about 54 miles, and will cover about 16,700 acrea.

(2) The Saylorville Lake, with the completed local flood protection works for Des Moines, will afford almost complete protection against floods in that city. Operated in conjunction with Red Rock Lake downstream from Des Moines, it will also provide a high degree of protection for cities and rural areas along the Des Moines River downstream from the Red Rock Dam and effect significant reductions in flood heights along the upper Mississippi River.

c. Major Features of Project. The major features of the project include: (1) the Saylorville Dam; (2) Big Creek Remedial Works; (3) Relocation of the C.M.St.P.& P. Railroad; (4) Polk County Roads Remedial Works (S&V Bridge); (5) Hubby Bridge, Boone County; (6) Iowa State Highway 89 Bridge; (7) Boone County Roads; (8) Clearing; (9) Recreation Facilities; and (10) Administration Building and Appurtenances. Construction dates for these items are given in the table below:

Description	Starting or Scheduled Starting Date	Completion or Scheduled Completion Date
Saylorville Dam:		
Stage I	May 1965	December 1967
Stage II	April 1967	September 1971
Slurry Trench	July 1972	January 1973
Stage III	February 1973	June 1975
Big Creek Remedial Works:		
Stage I	May 1970	June 1972
Stage II	October 1970	June 1972
Stage III	May 1972	June 1974
C.M.St.P.& P. RR Bridge	August 1971	December 1974
Hubby Bridge	March 1972	November 1972
S&V Bridge	April 1972	December 1974
Highway 89 Bridge	November 1972	November 1974
Boone County Roads	September 1973	December 1974
Lake Clearing	October 1973	December 1974
Recreation Facilities	September 1974	June 1976
Admin. Bldg. & Appurtenances	February 1974	June 1975

2. Detailed Description of Features.

a. Dam.

(1) The flood plain at the dam site has an average elevation of about 812. The crest of the dam is at elevation 915.5. The height of the dam will range from about 105 feet above the flood plain to about 120 feet above the river bed. The crest length will be about 6,750 feet. The width of the flood plain at the site is about 4,080 feet.

(2) The crest of the embankment is 44 feet wide, surfaced with six inches of granular surfacing to serve as a road for maintenance and access between bluffs. The upstream slope is 1V on 2.5H from the crest to elevation 885, and 1V on 3.5H to elevation 846. Those parts of the slope will be protected with two feet of riprap on six inches of bedding material. Between elevation 846 and the upstream toe there will be an upstream berm approximately 300 feet wide. The downstream slope will be 1V on 3H from the crest to elevation 856.5, thence 1V on 3.5H to elevation 826. From elevation 826 to elevation 825.5 a 20-foot wide roadway will be provided, surfaced with six inches of granular surfacing. From elevation 825.5 to the toe, the slope will be 1V on 3.5H covered with two feet of riprap on six inches of bedding material. The downstream slope from the crest to elevation 826 will be seeded.

(3) The embankment is constructed of compacted impervious materials obtained from spillway excavation and from borrow areas on the right overbank and on the left bluff. Underseepage is controlled by a slurry trench located 487 feet upstream from the center line of the dam. An inclined sand drain in the embankment will control thru seepage. The completed embankment will contain approximately 7,750,000 cubic yards of earthen materials.

b. Outlet Works.

(1) The outlet works structure consists of an intake structure housing three gates, a single reinforced concrete circular conduit 22 feet in diameter and 509.25 feet long, a chute 138.25 feet long, a stilling basin 96 feet long, and appurtenant walls and slope protection. The overall length of the concrete structure exclusive of the approach

walls and the walls downstream from the end sill of the stilling basin is 949.17 feet. The approach channel is approximately 2,800 feet long and the discharge channel is 3,200 feet long. Access to the control tower is by a bridge from the crest of the dam.

(2) The approach walls and control tower contain approximately 8,800 cubic yards of reinforced concrete, the conduit 13,200 cubic yards, and the stilling basin and downstream retaining walls 9,900 cubic yards.

c. Spillway.

(1) The spillway consists of an uncontrolled concrete ogee weir flanked with gravity bulkhead sections, 200 feet of paved chute, and approximately 5,000 feet of unlined trapezoidal chute. The overflow section consists of a straight, uncontrolled gravity weir, 430 feet long, with the crest elevation at 884.0. It has a standard ogee shape and the upstream face slopes 3V on 2H.

(2) The spillway construction included 725,000 cubic yards of excavation and approximately 20,000 cubic yards of reinforced concrete.

d. Conservation Pool and Flood Pool. The conservation pool elevation is 833, the spillway crest at elevation 884, and the flood control pool at elevation 890 for Saylorville Lake. The Big Creek sub-impoundment has a permanent conservation pool elevation of 920.

e. Diversion Dam and Sub-impoundment.

(1) The Big Creek Remedial Works feature of the Saylorville Lake project is located entirely in Polk County, Iowa, approximately nine miles upstream from Des Moines, Iowa. Big Creek is a tributary of the Des Moines River, entering the left bank about 5.3 river miles

upstream from the Saylorville Dam. It has a drainage area of about 96 square miles. The drainage area upstream from the diversion dam is about 80 square miles.

(2) The major features of Big Creek Remedial Works include: (1) Diversion dam; (2) Terminal dam and diversion channel; (3) Big Creek Lake; (4) Barrier dam; and (5) Relocations. The diversion dam is approximately 75 feet high, has a crest length of 1,650 feet and contains 920,000 cubic yards of earth fill. There is a 3'6" x 3'6" outlet conduit for low flow or for draining the lake. Work at the terminal dam and diversion channel include a maximum cut of 70 feet, 1,050,000 cubic yards of excavation, with the length of cut of one-half mile. The concrete chute spillway is located at the downstream end of the channel on a 60-foot high terminal embankment. The Big Creek Lake, which is established by the diversion dam and channel, has a depth of 60 feet, a surface area of 885 acres, and a length of 3.5 miles. The permanent pool elevation is 920 and is unaffected by the Saylorville Lake stage. The barrier dam, located near the mouth of Big Creek has a maximum height of 80 feet, a length of 4,550 feet, and contains 1,500,000 cubic yards of earth fill. It contains a gravity outlet eight feet in diameter and a pumping plant with a capacity of 125 c.f.s. The ponding area at elevation 833 is 85 acres; at elevation 848 (100-year frequency) the ponding area is 400 acres. Relocations include 2.3 miles of state highway, two miles of other road, 8.4 miles of power and telephone lines, and protection for the sewage lagoon.

f. Borrow Areas. The borrow areas for the major contracts of this project are given in the table below. As noted below, the borrow area locations are currently illustrated on several drawings. The Rock Island District is presently attempting to consolidate the drawings. The drawings listed below may be viewed at the Rock Island District Office.

Contract	Drawing Nos.
Saylorville Dam:	
Stage I	SR-2 20/1, 40/1, 80/1
Stage II	SR-6 10/1
Slurry Trench	SR-7 10/1
Stage III	SR-18 10/1, 16/14
Big Creek Remedial Works:	
Stage I	SR-9 16/4, 40/1
Stage II	None
Stage III	SR-15 10/1, 16/1, 16/7, 16/8
C.M.St.P.& P. RR Bridge	SR-13 20/4
Hubby Bridge	None
S&V Bridge	SR-8 20/5, 20/10
Highway 89 Bridge	SR-12 10/1

g. Other Structures

(1) Major structures in the Saylorville Lake project, other than the Saylorville Dam and Big Creek Remedial Works, include three highway bridges and one railroad bridge. Pertinent data for these structures are given below.

(2) C.M.St.P.& P. Railroad Bridge. The Chicago, Milwaukee, St. Paul and Pacific Railroad main line between Chicago and Omaha crosses the Des Moines River on a viaduct about 130 feet above the river bank, some 15 miles above the Saylorville Dam. Due to the effects of the lake, the existing crossing had to be replaced. The relocated bridge is a

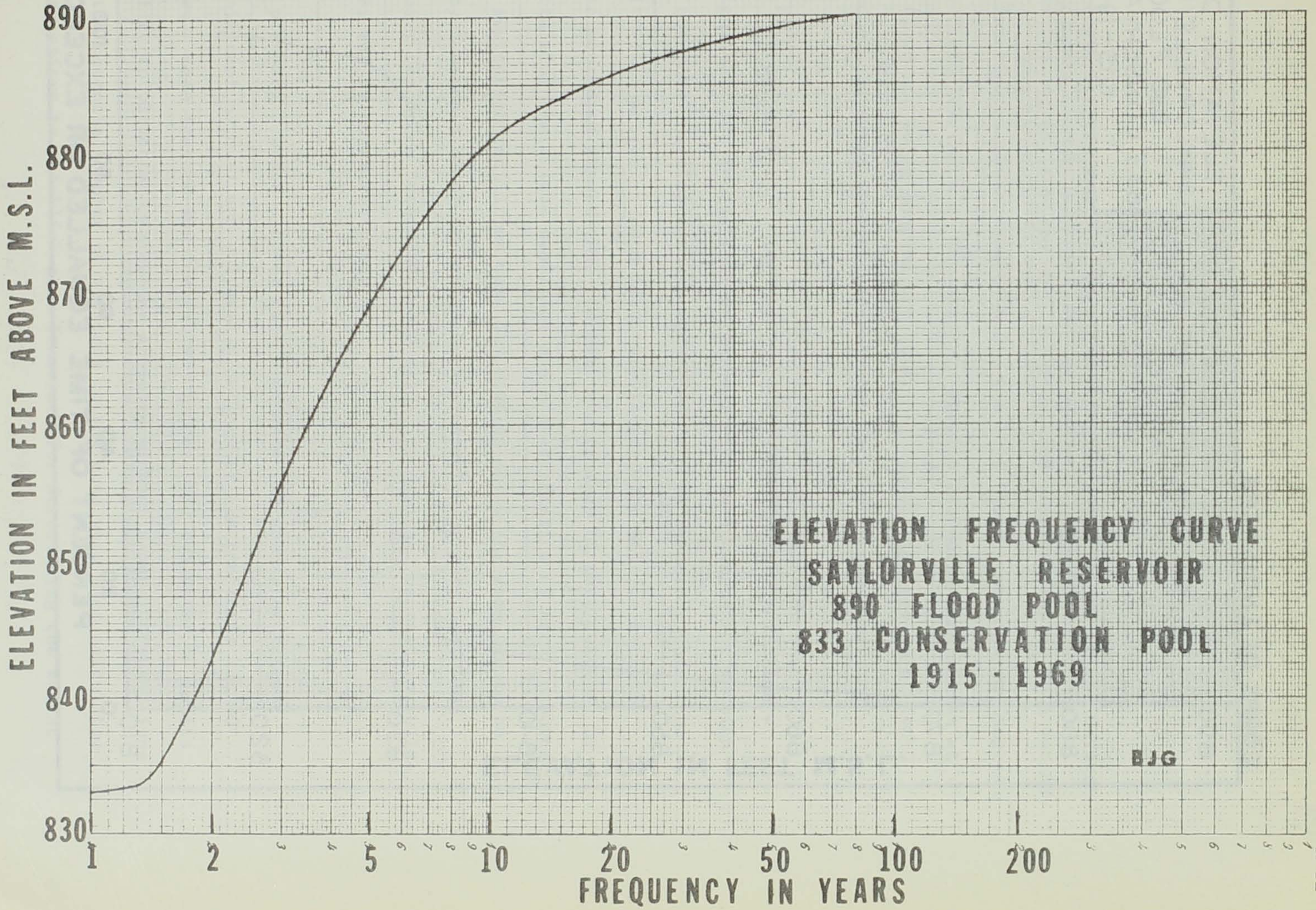
single track structure with 23 110-foot deck girders supported on concrete piers and concrete abutments. The relocated crossing is located 70 feet downstream from the existing crossing. Total length of the new bridge from abutment bearing to abutment bearing is 2526'-6". The new embankment has a 24-foot top width and utilizes much of the existing embankment.

(3) Hubby Bridge. This Boone County road relocation crosses the Saylorville Lake approximately one mile south of Ledges State Park and about four miles west of Luther, Iowa. This new bridge replaces the existing low-level Hubby Bridge that will be vacated by the County. The new bridge is a continuous steel girder bridge with four reinforced concrete piers and a concrete roadway deck about 50 feet above the floor of the Des Moines River Valley. The bridge will be 682 feet long and 30 feet wide. Low steel for the bridge will be at elevation 892, which is two feet above the full flood control pool of Saylorville Lake.

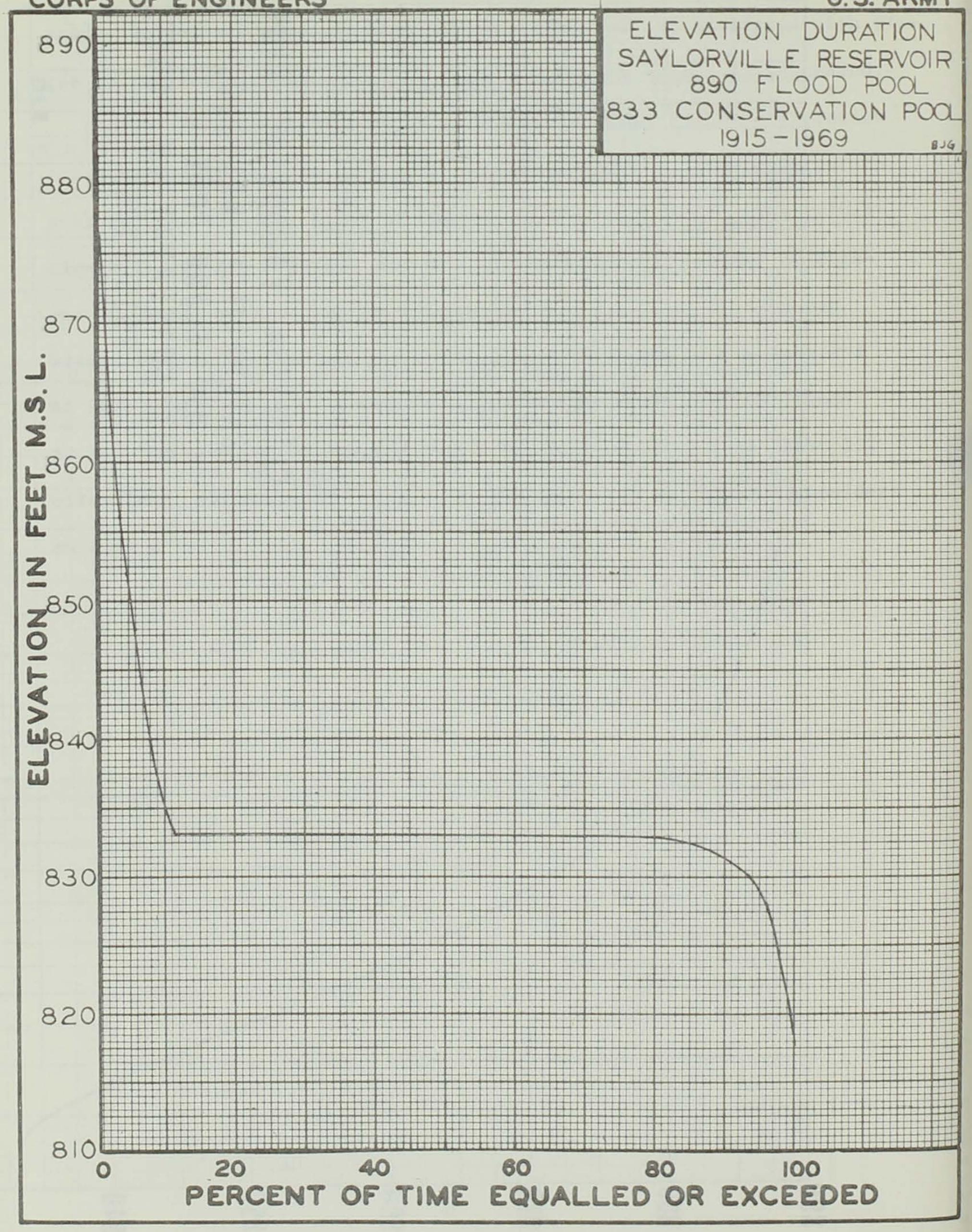
(4) S&V Bridge (Polk County Remedial Works, Item 2). This high-level Polk County road relocation crosses the Saylorville Lake approximately 2.2 miles in length, replaces three existing low-level Des Moines River crossings which will be vacated by the County. The new bridge is a continuous steel girder bridge with 24 reinforced concrete piers and a concrete roadway deck. The new bridge will be 4,934 feet long and 30 feet wide and will be constructed two feet above the full flood pool. Roadway embankments on both side of the new bridge will be constructed with a 44-foot finished top width and a maximum of 60 feet high fills, and will be at a minimum elevation of 892. The road will be paved with 8-inch thick concrete, 24 feet wide with 10-foot shoulders on each side of the

road. Embankment slopes on the lake crossing will be protected with riprap up to elevation 892 with all other embankment slopes to be seeded.

(5) Iowa State Highway 89. This major State highway relocation crosses the Saylorville Lake near the upper limits of the conservation pool and connects the towns of Madrid and Woodward, Iowa. The relocation will replace a bridge and an existing low-level section of Highway 89 which are about 35 feet below the full flood pool. The new bridge is a continous welded plate girder bridge 1,012 feet long and 44 feet wide, and will be constructed two feet above the full flood pool. The new high-level portion of the embankment will be about 1.2 miles long, 44 feet wide, with a 24-foot pavement and 10-foot shoulders on each side.


ELEVATION FREQUENCY CURVE
SAYLORVILLE RESERVOIR
890 FLOOD POOL
833 CONSERVATION POOL
1915 - 1969
BJG
ELEVATION IN FEET ABOVE M.S.L.
890
880
870
860
850
840
830
1
2
5
10
20
50
100
200
FREQUENCY IN YEARS

CORPS OF ENGINEERS U.S. ARMY



PLATE

SAYLORVILLE MASTER PLAN FOR RECREATION

The basic Congressional document authorizing construction of the Saylorville Dam and Saylorville Lake has provisions for recreation as a secondary function of the project. Under the 1944 Flood Control Act, Congress authorized the Corps of Engineers to provide recreation facilities at its flood and water control projects. The facilities are to be constructed and maintained entirely by the Corps of Engineers.

The "Recreation Master Plan" consequently developed is more than a design guide for recreation development - it is a comprehensive plan for the total development and management of the resources under the Saylorville project. Each identifiable resource will be strictly administered to insure that the best use is made of that feature. By recognizing the unique qualities and characteristics of each resource, the recreation facilities were designed to allow the resource to be enjoyed without being destroyed by exploitation or over use. The primary resources identified were soils, topography, vegetation, wildlife, and cultural features.

The planning process started with a detailed inventory of these significant natural and cultural resources of the project's 23,000 acres. Each feature was identified, mapped, and evaluated as to its ability to withstand recreation activity without damage. Projections of the potential number of visitors to the area were also calculated in an effort to establish some framework for determining the extent

of recreation facilities required. The anticipated user demand (visitors) of 1,500,000 visitor days/year was then matched to the available resources. In some cases, very little access or development of a site was recommended due to its susceptibility to damage from people. Areas able to withstand development without damage were designated "recreation areas" and slated for extensive development, such as campgrounds, picnic grounds, buildings and roads. The resultant design is one that safeguards critical areas and resources, while encouraging development at other sites more suitable for recreation facilities.

In all approximately 800 acres of land above the flood pool level have been designated for intensive recreation development and 200 acres planned for dispersed recreation areas. Much of the remaining land will serve as buffer between various activities and as wildlife habitat areas. Although the developed acreage is only 15% of the total land under federal administration, it represents sufficient capacity to meet the expected visitor demand. Once construction is completed, the visitor will be able to select from a variety of active and passive activities to consume his leisure time.

Throughout this planning process, coordination with State, and County recreation agencies was conducted to insure compatibility with their long range goals and plans. The Iowa State Conservation Commission has asked to lease over 10,000 acres of land for management as wildlife habitat. Other governmental agencies have also requested to lease

lands for development as parks and public recreation areas. Such leases will be encouraged by the Corps.

The recreation facilities to be constructed and administered by the Corps of Engineers are classified as either major areas or minor areas. Four major areas have been designated. All of these are located adjacent to the conservation pool south of Polk City. They will include camping facilities, picnic areas, boat launch facilities, a beach, and all necessary support facilities such as roads, buildings, flush toilets and water.

There are five minor sites, all located upstream of Highway 89. These will have less sophisticated development and be designed for use more by local citizens who wish to continue use of the river without using the regional oriented major areas. Some special features such as boat launching ramps, pit toilets, water, and nature and cultural displays will be included but the extent of development will be less than at the major areas.

Landscaping of unsightly areas will be part of the development. Areas presently deteriorated or subject to erosion will be reforested and managed to prevent further loss of soil. The master plan outlines detailed management practices of all forest and wildlife areas.

Finally, all of the developments both major and minor will be linked by various trail systems, accommodating hikers, bicyclists, horse-

back riders and motorized vehicle users. The total plan will offer any individual or group a diverse selection of activities to choose from, while at the same time conserving the region's resources for future generations.

SUMMARY OF FACILITIES
(Under Corps Administration)

Camp Units	550
Picnic Units	1300
Boat Launch Lanes	11
Swimming Beaches	1
Trails (in Miles)	50

SPECIFIC DATA SHEET

Listed below are a few questions concerning specific data, in addition to general information, that would be of value in the preparation of the Environmental Impact Statement. These questions are not considered to be all-inclusive and any additional information would also be valuable.

1. Have any rare, unique, or endangered species of plants or animals been observed or are known to exist within the project area?

2. Are there any known significant historical or archaeological area or sites within the project area?

3. Are there any known significant cultural or ethnic developments existing within the area?

4. Are there any known existing recreational opportunities or activities that are unique to the project area?

5. Are there any existing outstanding or unique geological features within the project area in addition to the Ledges?

Appendix B

Planning Sub-Group Report on Ledges State Park Area and Redevelopment Master Plan

Data provided

by

Planning Sub-Group
Saylorville Reservoir Environmental Impact Study

April 1973

GOVERNOR'S INTER-AGENCY RESOURCE COUNCIL

TECHNICAL TASK FORCE, SAYLORVILLE ENVIRONMENTAL IMPACT STUDY

PLANNING SUBCOMMITTEE REPORT

The Planning Subcommittee was assigned the following persons by Dr. Merwin Dougal, Chairman of the Technical Task Force on Saylorville Environmental Impact Study, at the organizational meeting of the Task Force held on March 15, 1973.

Vasant N. Nerikar (for G. F. Schnepf), Chairman, Iowa Conservation Commission

Roger Q. Landers, Dept. of Botany and Plant Pathology, Iowa State University

Wendell Beardsley, Dept. of Forestry, Iowa State University

Jean C. Prior, Iowa Geological Survey

Adrian D. Anderson, Office of State Archaeologist

Steve Brenton (on call basis), Iowa Conservation Commission

Dr. Dougal informed the subcommittee that representatives from other private groups interested in the environment of the Ledges State Park may be invited to participate as observers, if necessary.

The purpose of this subcommittee was to examine the environmental impact from flooding due to the Saylorville Reservoir on recreational, geological, vegetational, and archaeological aspects of the lower portion of the Ledges State Park under various suggested protective measures. The subcommittee was to prepare a report of their findings for the information of the Technical Task Force and the Corps of Engineers for their Saylorville environmental impact study.

The Planning Subcommittee took a field tour of the lower Ledges State Park on March 21, 1973. The members participating in the field trip were; Vasant N. Nerikar (for G. F. Schnepf), Chairman, Roger Q. Landers, Wendell Beardsley, Jean C. Prior, and Adrian D. Anderson.

Participating in the field trip as invited observers were Ed Lawrence, Ledges State Park Officer; Hans Goeppinger, Iowa Citizens to Save Ledges State Park; and C. C. Bowen, Citizens Alliance, Iowa State University Botany Department. Mr. Bowen did not participate in the field trip due to other commitments. A group of students from Iowa State University with James O'Toole, Instructor, were included on the field trip of the Ledges to study ecological and environmental problems of the lower Ledges.

The Ledges contour map (scale 1 in. = 300 ft.) and the existing facilities location maps were used for determining the probable flood prone areas in assessing the flood impact on the significant archaeological and geological aspects and on the existing vegetation and recreational facilities. Nerikar and Lawrence interpreted the contour maps to designate the flooding levels in the Pease and Davis Creek Valley that would be caused by various flood pool elevations of the Saylorville Reservoir. The proposed park use pattern in the lower Ledges was explained by Vasant Nerikar (Refer Appendix - E, Ledges State Park Area Master Plan).

The field trip was useful and productive in assessing the environmental problems in the lower Ledges. It was felt that <u>for further in-depth flooding impact evaluation, lower Ledges areas should be marked with fixed permanent elevation markers</u>. This will also clear any doubts concerning the contour elevations.

The Planning Subcommittee members also met on April 12, 1973, in the conference room of the Iowa Conservation Commission in which Nerikar, Landers, Beardsley, Prior and Anderson participated. This meeting was devoted to individual flooding impact evaluation and discussions on the archaeological, ecological, geological and recreational aspects of the lower Ledges State Park. The synopsis of these reports follows herewith and the respective reports are enclosed to this subcommittee's report as appendix for reference.

In a report on the archaeological sites in the Ledges State Park, Anderson has emphasized the need to conduct more elaborate archaeological survey and salvage operations in the project area. On the basis of the information of the earlier archaeological resources survey carried out in Saylorville Reservoir area, it was pointed out that two sites were identified and tested in the Ledges State Park -- one near the park attendant's residence and the other adjacent to the proposed barrier dam site. It was pointed out that there is a possibility of other sites within the area of the proposed barrier dam. Due to the inadequate nature of the earlier surveys and salvage works (and because barrier dam site problems were not known at that time), it will be necessary to conduct detailed survey of the lower Ledges Park area to pin-point archaeological sites, (Appendix - F). The project impacts upon archaeological sites in Ledges State Park are summarized in the Project Impact Assessment, (Page 7).

Landers and Beardsley have prepared a report on the flooding impact on vegetation at the confluence of Pease and Davis Creek, after visiting the area again on March 24, 1973. Their preliminary report emphasized flooding

impact on vegetation (Appendix - C), but their modified report of April 27 "consideration of flooding effects on natural features of Ledges State Park," (Appendix - C) has raised some issues about the planning concept of the Ledges State Park. (Some of the issues raised in this report do not fall within the scope of the work of this subcommittee and the Task Force. This was clarified by Dr. Dougal and subsequently by Mr. Nerikar in all our meetings.)

On the initial tree count (below elevation 890) done by Landers and Beardsley in upper floodplain and valley floor near the junction of Pease and Davis Creek for trees greater than three inches DBH (diameter at breast height), they identified 164 trees consisting of 10 boxelder (Acer negundo), 35 hackberry (Celtis occidentalis), 8 ash (Fraxinus sp.), 43 black walnut (Juglans nigra), 7 basswood (Tilia americana), 29 elm (Ulmus sp.), and 32 miscellaneous species.

It was pointed out that shrubs are less apparent and less abundant in the valley floor because of past management for picnicking, other recreational uses, and due to a general increase in the park visitors. (The proposed Master Plan for the park with more emphasis on interpretive facilities and reduction in use in the bottom creek area, in conjunction with a suitable planting program will aid in restoring the vanishing vegetation cover.)

The overall impact of backwater flooding on the existing vegetation in the floodplain area as well as in the creek area, will be detrimental to the growth of a variety of plant material. In the long run, this impact might be terminal to the naturally diverse vegetation which provides an attractive aspect to the present sandstone walls. It will be necessary to plant water tolerant plant species in the flood prone areas to maintain scenic interest and avoid drabness that might result from the inundation effect in the lower Ledges. Plants colonizing recently inundated areas tend to be weedy species of considerably less attractiveness than present species.

Some important issues raised about the flooding impact were discussed by the subcommittee on April 12, which are summarized in the Project Impact Assessment.

Jean Prior has provided a geological report on the sandstone ledges occurrence in the Ledges State Park (Appendix - D). The sandstone outcrops have been excavated from beneath (appearing through) glacially deposited materials in the lower valley. This exposed sandstone forms the picturesque, mural-like valley wall in the park. Differential cementation, a variety of prominent concretionary forms, and the accentuation of cavities and convexities within the sandstone by differential erosion have made the Ledges the unique object of interest in the overall landscape. This sandstone is quite local in its occurrence and its identity is lost within two miles of the exposure at the Ledges Park. The exposed bedrock geology offers unique opportunities for a nature interpretive program in the park. Such areas are relatively rare in Iowa as glacial deposits cover the bedrock surface; the exception being in extreme northeast Iowa where bedrock provides dominating topographic configuration due to the absence of glacial deposits. Exposed bedrock is commonly found in east-central, southeast, and south-central Iowa, but generally is confined to the deeper river valleys where dissection through the glacial sediments has exposed the bedrock. Exposed bedrock becomes increasingly rare toward the northwest part of the State. Thus, the Ledges exists in an area where exposed bedrock features are rare. Sandstone exposures of this type and magnitude exist only in Dolliver State Park in Webster County, along portions of the Red Rock Reservoir in Marion County and in Wildcat Den State Park in Muscatine County. The project impact upon geological aspects of the lower Ledges is summarized in the Project Impact Assessment, (Page 9).

Vasant N. Nerikar explained in detail the proposed Ledges Master Plan concept (approved in principle by the Conservation Commission) to the Planning Subcommittee and the Task Force in their meetings. A synopsis of the plan can be found attached to this report.

Some significant aspects of the Ledges Redevelopment Plan (long range) are - -

(a) Ledges Park is not a water-oriented recreation area, therefore, it is different from the proposed Big Creek Recreation Area, which will have water-oriented recreational facilities as a main recreation resource.

(b) Ledges Park use will be reoriented for nature interpretive facilities because of the Ledges unique geological aspects and ecological diversity. The wildlife exhibit area will be integrated with the park.

(c) In the long run, the park will have only one access for efficient operation and management control. Vehicular traffic through the park will be eliminated at some future point in time to make the park more enjoyable and restore quality outdoor recreational experience. This, in conjunction with re-design, is hoped to eliminate the overuse of the park.

(d) At the time of detailed designing of the park, special facilities such as ramps with side guards, separate parking areas, drinking water fountains, restroom facilities and special trails etc. for the elderly and handicapped people will be provided.

(e) Maximum efforts will be made not to interfere with the existing ecological balance in the park such as preservation of prairie, valley areas and upland slopes.

(f) Recreational use of lower Ledges will be left open for only unorganized recreational activities such as: passive recreation, scenic walk, wildlife and bird watching, and for scientific studies of archaeological and ecological features. The interest areas would be linked by nature trails.

PROJECT IMPACT ASSESSMENT

ARCHAEOLOGICAL

(1) Two archaeological sites have been identified but not salvaged in the Lower Ledges. There is a possibility of finding other sites within the area which would be affected by the barrier dam construction, if the barrier dam is constructed. The dam will encroach on the prehistoric area and the sites will be destroyed. It will have the same impact if there is ponding behind the barrier dam.

(2) Under natural flooding conditions the sites will be submerged for some duration, but will not be destroyed. Still there is a need to identify the sites, determine their significance and salvage them.

(3) Backwater flooding in the creek area and the low area at the mouth of the Pease Creek will eventually fill the areas with sand and silt burying potential sites.

(4) The reservoir water storage level changes will cause bank-slump and will tend to destroy the sites.

ECOLOGICAL

(1) In the upper floodplain and valley floor near the junction of Pease and Davis Creeks, inundation longer than ten days would probably result in severe damage to all tree species except willow, cottonwood, hackberry, boxelder and sycamore.

(2) Rare specimens of leatherwood (Dirca palustris) and blue beech (Carpinus caroliniana) found at the base of the north - facing valley walls would be the only loss of shrubs of any consequence, except as others provide habitat for wildlife.

(3) The spring flowers such as snow trillium (Trillium nivale), dog tooth violet (Erythronium albidum) and many others which bloom each spring in the valley floor, would probably not survive inundation if it occurred during the early spring during their peak growing time.

(4) The effects of inundation would gradually increase higher on the valley walls from the junction of Pease and Davis Creeks to the mouth of Pease Creek.

(5) White oak (Quercus alba), hop hornbeam (Ostrya virginiana) and shagbark hickory (Carya ovata) would be adversely affected on high ground near the mouth of Pease Creek. The largest number of trees affected in this area, however, would be floodplain species of willow (Salix Spp.), cottonwood (Populus deltoides) and soft maple (Acer saccharinum).

(6) Floating trees and other debris would likely be dumped by the action of river currents in the reservoir at the mouth of Pease Creek if the large floodplain trees now blocking the entrance to Pease Creek were removed either by inundation or mechanical means.

GEOLOGICAL

(1) The backwater flooding in the lower Ledges due to periodic rises in the flood pool of the Saylorville Reservoir will temporarily cover the lower portion of the Ledges State Park, thus it will temporarily deny access to the sandstone Ledges. This is also the case at present for very brief periods of time under natural flooding situations in the Pease and Davis Creek area.

(2) The water currents in the valley will be slow moving, hence there will be little danger of sandstone erosion. However, wave action for extended periods of time at one elevation may cause cavities in the Ledges.

(3) The surface of sandstone Ledges may become "case-hardened" because of the chemical action of the mineral-bearing drainage water on the sandstone.

(4) The case-hardened sandstone Ledges will be more resistant to natural weathering agencies. Thus, it may add to the stability and longevity of the Ledges out-crops.

(5) Some staining of the rock surface may occur if flood waters remain at a single elevation for a long time. The rocks have already been stained due to natural seepage.

(6) Rapid siltation will occur in the valley floor due to backwater flooding.

(7) Regional rise in the water table will occur due to backwater flooding and due to the very existence of the reservoir, which will slow infiltration rates. However, this condition will be invariably present under all man-made reservoir conditions.

Geologically speaking the effects of floodwater on the exposed sandstone Ledges themselves will be minimal.

RECREATIONAL

(1) Flooding will occur under reservoir conditions periodically depending on the operational reservoir level which will deposit sediments in the lower Ledges Park, thus rendering the lower park facilities unusable until such time these are restored. This has already happened due to natural flooding in 1954.

(2) Scenic and aesthetic quality of the lower park will be adversely affected due to the mud-flat, mud-flat vegetation, increase in weedy species and the debris left over after the flooding duration.

(3) Flooding will deny access to the lower Ledges temporarily even for passive recreation.

(4) The reservoir flooding impact on wildlife in the Ledges cannot be measured on any single tract of the total impact area, because of mobility and habitat requirement of the wildlife. The wildlife seen in the park may not have its habitat in the park. Thus, the flooding and subsequent mud-flat conditions will affect mobility of its visiting wildlife appreciably.

(5) The flooding of Pease Creek and Davis Creek at flood-pool elevations of 890, 884 and 878 may inhibit or destroy reproduction of many stream fishes. Any significant fish habitat in these creeks is a valuable natural resource for nature study and the park interpretive programs.

(6) Because of the diversity of birds found in the Ledges State Park, it is popular for bird watching. Unique birds to Iowa such as Louisiana Waterthrush, Blue-Winged Warbler, Kentucky Warbler, Hooded Warbler, etc., are found nesting in the Upper Pease Creek area. Because of the flooding of Pease Creek area at flood-pool elevations of 890, 884 and 878, these unique birds may not nest in the creek and the Iowans would lose the chance of watching and studying the birdlife. Adaptability of the birds to the changed environment is not known.

The proposed change in the existing recreational use of the lower Ledges inclusive of the creek area (for interpretive facilities), and relocation of the existing recreational facilities on the upper ridges within the park will not adversely affect the recreational value and interest of the park. On the other hand, it will enhance the outdoor recreational experience, if overuse of the lower Ledges can be effectively controlled. Access to the lower floodplain and the scenic sandstone ledges will be maintained - but only by foot-trails with due consideration to the needs of elderly and handicapped visitors.

The proposed change in recreational use of lower Ledges would have occurred in the immediate near future irrespective of the Saylorville Reservoir flooding impact in order to impart quality outdoor recreational experience and conserve the recreational resources (avoid overuse caused by various recreational activities). The Saylorville flooding impact issue merely coincided and hastened the recreational replanning process in the Ledges State Park.

POSSIBLE ALTERNATIVES TO PROTECT THE LOWER LEDGES AND THEIR IMPACT EVALUATION

The subcommittee members are of the opinion that the lower Ledges State Park area should be protected as far as possible without causing additional environmental problems in the park itself as well as in other adjoining areas.

From discussions in the Task Force meetings, four protective alternatives became evident either to eliminate or minimize adverse impact due to flooding on the lower Ledges and the Pease and Davis Creek areas. These alternatives are:

(1) Barrier dam at mouth of Pease Creek.

(2) Des Moines River channel change and barrier dam located on west bank of the river in lower Ledges floodplain with an oxbow lake.

(3) Ponding area behind the barrier dam and subimpoundments on Pease and Davis Creek outside the park boundary on the north side.

(4) Lowered operational level of the reservoir.

Assuming that these alternatives are feasible, the subcommittee members discussed pros and cons of the first three alternatives in relation to the uniqueness of the sandstone Ledges and the environmental quality of the lower portion of the park. The fourth alternative was not discussed as it was beyond the scope of work of this subcommittee. However, it is necessary to determine the relevance of lowered operational level of the reservoir in minimizing environmental damage to the lower Ledges. The impacts of the various alternatives are as follows:

(1) Barrier dam at mouth of Pease Creek. The construction of a barrier dam at mouth of Pease Creek will protect backwater flood-prone area above the mouth of Pease Creek.

An earthen embankment of 30 to 32 feet high would have to be constructed to avoid backwater flooding in the Pease Creek Valley to protect the sandstone

Ledges. Some additional construction will be needed to release drainage flows from Pease and Davis Creeks. Moreover, this alternative will not be effective in protecting the lower Ledges - the natural flood plain from backwater flooding. Extended flooding (more than 10 days) in this zone will adversely affect the natural vegetation.

It has been observed by the Iowa Conservation Commission over the years that Pease and Davis Creeks have extensive watershed in which soil conservation practices are minimal. Both of these streams are of a high gradient and are quickly flooded after little precipitation. Davis Creek has a watershed of approximately 1,400 acres, 700 acres of which are in cropland with an average slope of 4%. Pease Creek has a drainage area of about 3,000 acres including a total cropland of about 900 acres with an average slope of 4%.

The remaining area in both of the watersheds is in pasture and woodlands providing good wildlife habitat.

To control siltation problems downstream in the creek areas, ten small soil conservation structures in the upper reaches of Davis Creek and thirty such structures in the Pease Creek would be required. Without incorporating soil conservation practices in the watershed management of Davis and Pease Creek, construction of a barrier dam at mouth of Pease Creek will simply aggrevate the problem of siltation in the creek area within the park. Such a situation will adversely affect fish habitat (carpsuckers, suckers, some minnows and darters). These fish presently contribute heavily as forage for many game fish in the river. Thus, the most vital ecological balance in the Pease and Davis Creek and the river will be offset by the barrier dam. In this perspective, this alternative needs to be further investigated.

It has been noted that backwater flooding will have minimal impact on the sandstone Ledges, therefore, the construction of this barrier dam to protect the unique Ledges is questionable.

The impact of a barrier dam on the vegetation needs to be further studied. The barrier dam, even with provisions for upland water drainage will act as a ponding area in the creek for extended period of time. This situation may adversely affect the native vegetation because of gradual rise in the water table.

No archaeological sites are known in the creek area; the barrier dam will have little impact from an archaeological point of view. However, the dam will not offer any protection to potential sites in the lower floodplain.

From a recreational point of view, the barrier dam will be an eyesore. The barrier dam will not change recreational planning in the lower Ledges. In the proposed Master Plan, all vehicular traffic will be stopped at the junction of the Pease and Davis Creek to eliminate thru traffic and accident hazards, avoid overuse of the area and restore environmental quality. However, the lower Ledges will have access by nature trails and will be used for minimal recreational activity. Significant archaeological sites in the lower Ledges will be used for minimal recreational activity. Significant archaeological sites in the lower Ledges will be integrated in the proposed park interpretive program by linking them with the proposed nature-foot-trails.

Though the construction of the barrier dam at the mouth of Pease Creek is feasible, its usefulness to eliminate or minimize adverse backwater flooding impact on the creek's environment is not obvious. This alternative will cause additional environmental problems in the lower Ledges. Moreover this

alternative fails to provide any protection to the rest of the lower Ledges. Therefore, it will afford only partial solution to the overall flooding problem in the lower Ledges, hence this alternative is not recommended by the subcommittee.

(2) Des Moines River Channel change and barrier dam on west bank with an oxbow lake.

This alternative is physically feasible. The alternative will have certain positive impacts in protecting the lower Ledges, but at the same time it will create new environmental problems (negative impact) in the lower Ledges as well as in the immediate vicinity. Therefore, acceptance of this alternative really depends upon the relative environmental merits over its demerits, which are merely value judgments with no standard scale for measurement.

Moreover, this value for environmental good will vary greatly from person to person depending on his/her environmental interest (subjective variation).

It will be also necessary to justify cost/benefit relationship of this alternative in relation to its maintenance and management problems.

From the information available from the various Task Force Subcommittees, it is certain now that:

- The barrier dam will be approximately 7,000 feet long.
- The dam will have an average height of 32 feet, and a width of 320 feet at base.
- The dam itself will occupy 55 acres of the lower Ledges.
- To obtain suitable soil for the dam, which is not available in the lower floodplain, approximately 130 acres will have to be excavated to a depth of 6 to 8 feet and will have to be transported from a distance of about 4 miles.

The barrier dam will protect the lower Ledges from backwater flooding at elevation 890, which will occur once in 76 years. But, in doing so the park will lose approximately 25 acres of land from the total 115 acres of lower Ledges on the west side and only 90 acres will be protected partially for its scenic and ecological values. Also, approximately 15 acres will be protected in the Pease Creek. Supposing this alternative is accepted, it will not help to restore all existing recreational uses in the lower park. These facilities will have to be relocated at some other suitable place in the park, which the Conservation Commission has proposed in its redevelopment Master Plan for the area. It has been agreed that the Ledges Park is over-used particularly in the creek and lower portions. The Master Plan implementation will help correct this situation.

The barrier dam will certainly help to protect forest vegetation on the remaining 90 acres of lower flood plain. Additional extensive tree planting programs will have to be undertaken to partially hide the dam structure.

The dam structure will be visually uncongenial in the overall river-floodplain-creek environment. The dam structure itself may render the lower Ledges less scenic because of good river front views would no longer be available. River front views will be drastically changed anyway whether a barrier dam is built or not.

For upland drainage, temporary ponding areas will be necessary to store run-off water from the Pease Creek and Davis Creek, preferably behind the dam during the construction phase and as well during the times of high reservoir levels. It is, therefore, questionable whether the remaining 90 acres of lower Ledges land would be totally protected. Due to the ponding area, the water table of the adjoining areas will be affected.

Siltation of the ponding area will occur in the long run, and will cause maintenance problems in the lower Ledges Park involving extra time and money. The funds to maintain the lower Ledges will have to come from the Corps of Engineers in the form of mitigative losses - throughout the life span of the Ledges State Park.

The barrier dam and ponding area will inundate potential archaeological sites and these will have to be salvaged, and funding provision will have to be made for this work in the capital estimates for the barrier dam construction.

As already stated, the flooding of Pease Creek and Davis Creek will have minimal impact on the sandstone Ledges - their existence is not endangered.

The channel change of the Des Moines River will be necessary to make the barrier dam more effective. In the experience of the Iowa Conservation Commission, the channel changes invariably affect fish habitats and drastically reduce fishing potential of the water bodies. Increasing water velocity due to the reduction of channel length will increase debris carrying capacity of the river and debris accumulation might occur on the river-ward side of the barrier dam. The timber debris will have to be removed from time to time.

The channel change will create an oxbow lake in the old river bend. It has been suggested by some groups that the water flow from Pease Creek will feed the oxbow lake which then can be used for canoeing. The Ledges Park is not a water-oriented recreation area, therefore, the value of the oxbow lake for canoeing is not important. Moreover, there will be no public

vehicular access to the proposed lake as per the proposed Master Plan. This would encourage an inconsistent recreational activity that can occur or be provided for in other areas of the region and is not dependent solely upon the Ledges area.

Pease and Davis Creeks are high-gradient streams, capable of moving large volumes of water over short distances and do have abundant silt material which will be deposited in the oxbow lake. This gradual but progressive siltation process will silt up the lake in the near future, unless dredging operations are carried out. This will be an additional expense in the management of the park, and should be included in the long-range maintenance schedule of the barrier dam. Similarly, tree planting programs should be included in the long-range improvement and maintenance plans for this area.

The barrier dam, ponding areas, river channelization and the creation of an oxbow lake will create additional maintenance requirements. The Iowa Conservation Commission is of the opinion that the Corps of Engineers should accept full long-term responsibility along with its financial implications, in case this alternative is accepted as a protective measure for the lower Ledges State Park. It is not necessarily endorsed by the subcommittee as the most appropriate alternative.

(3) Ponding area behind the barrier dam and subimpoundments on Pease and Davis Creeks outside the park boundary (north side).

This alternative suggests the possibility of putting two subimpoundments on Pease and Davis Creeks outside the park boundary to the north. It will help control silt load coming from the watersheds of these creeks in the valley floor of the Pease Creek.

This alternative coupled with a barrier dam on the west bank of the river or at mouth of Pease Creek will certainly help to reduce silt deposition in the valley from backwater flooding under reservoir condition.

In case the barrier dam concept on the west side is accepted, the subimpoundments in the Pease and Davis Creeks will greatly reduce the siltation problem in the oxbow lake. Approximately 600 acres of land will have to be acquired to have an effective control on these impoundments.

This area has good timber cover which is a habitat for a variety of wildlife. Therefore, subimpoundments and subsequent recreation development in the area, if any, for picnicking, camping and nature study, etc., will adversely affect the wildlife habitat. The subimpoundments will be relatively small for any water-oriented recreational development. However, the subimpoundment could be used for stocking fish. Any recreational development in the area will have to be very minimal. Some additional recreational facilities can be located in this area. However, this alternative will not change the proposed recreational use of the lower Ledges.

This alternative will greatly relieve the danger of inundating the vegetation in Pease Creek Valley. The main barrier dam impacts as discussed earlier would remain the same under this modified alternative. However, the environmental success of this alternative will be accomplished only if the barrier dam concept is accepted.

CONCLUSIONS

The examination of the three alternatives to protect the lower Ledges do have some merits but at the same time they tend to create additional

environmental and management problems which need to be completely resolved by the various agencies involved in the construction and management of the Saylorville Reservoir and such other agencies which are affected by this project. The main thrust of whatever decision is made to adopt the protective measures will be felt by the Corps of Engineers and the Conservation Commission. It is, therefore, necessary to evaluate the alternatives for Ledges protection, their financial, operational and management implications in their best perspective. It should not be based wholly on the emotional and sentimental attachment for the lower Ledges State Park, but should be based on the facts of the project's overall public benefit and its welfare impact. The only sure way of "saving the Ledges" is by stopping the Saylorville impoundment project. This alternative, however, was not in the purview of this subcommittee.

Submitted on Behalf of the
Planning Subcommittee

Vasant N. Nerikar
Chairman

STATE CONSERVATION COMMISSION

LEDGES STATE PARK AREA

REDEVELOPMENT MASTER PLAN

ADDRESS YOUR INQUIRIES TO

Mr. G. F. Schnepf, Chief
Planning and Coordination
STATE CONSERVATION COMMISSION
300 4th Street
Des Moines, Iowa 50319

L E D G E S S T A T E P A R K A R E A

MASTER PLAN FOR DEVELOPMENT

The master plan study for the development of the Ledges State Park was carried out by a team of graduate students from the Department of Landscape Architecture, Iowa State University under the guidance from two faculty members of the Department of Landscape Architecture, the Chief of Planning and Coordination and the Superintendent of State Parks for the State Conservation Commission. Special technical assistance was provided from staff members of the Army Corps of Engineers, Rock Island District and the University.

The aim of the Ledges study was to aid the Conservation Commission staff in developing the formal master plan for the park. The purpose of the master plan is to phase the future uses in the park for the protection of its resources in relation to its orderly development and to enhance the experience imparted to the concerned park user. The recreation experience imparted to the user under the present conditions is far less than desirable due to overcrowding and related potential hazards.

The overuse of the park and the current thru-vehicular traffic (often repetitious for non-park oriented purpose) has created a high accident potential in the park. It is, therefore, necessary to regulate the traffic flow in the park for the safety and well being of the park users, and to enhance environmental quality of the park by having the vehicle serve a minor part in the visitors' total experience rather than a major role of concern.

Park use needs to be reduced in the bottom creek area in order to provide for greater protection of the sandstone ledges. In addition the use of the area adjacent to Pease Creek where it enters the Des Moines River must be reduced to avoid the water accident hazard. There has been (over the years) a loss of life associated with this situation, which tends to be an attractive hazard.

The Commission has instituted a program of master planning for all major state areas. The plan developed by the Commission (based in part on the University Report) was developed to alleviate the problems previously mentioned. The development of the Saylorville Reservoir has merely served to hasten the implementation schedule.

The master plan for Ledges State Park hinges on the basic concepts of preservation of its resource features with a principal recreational emphasis on its educational values. Other recreational uses become secondary to the principal of preservation and the concept of preservation. Main features will be:

-Nature interpretive center.

-Natural trail system for nature study.

-Wildlife exhibit areas as a part of interpretive program.

-Camping and picnicking facilities.

-Scenic views.

-And to restore the natural qualities of the park through management techniques.

The master plan report put forward by the consultants has been accepted in principle by the Conservation Commission. However, the Commission has modified the plan proposal to suit its needs and reduce the public expenditure involved with additional land acquisition.

Some salient features of the master plan are:

1. Closing thru-vehicular traffic within the park.
2. Relocation of the camping facilities to a more suitable environment.
3. Integration of the wildlife exhibit area as a part of the total interpretive program for the park.
4. Visitor orientation center.
5. Development of upland park areas for picnicking.
6. Single entrance to the park for efficient management control - both for possible fee collection and park security.
7. Encouragement of foot trail use to explore natural qualities of the park.

The proposed master plan is based on the philosophy of park development geared for nature interpretive facilities. The interpretive program will be based on detailed and extensive studies of the existing resources such as natural prairie land, geologic features, ecological plant associations, topographic interest, soils capability for development, etc. In general, the

proposed master plan provides the recreational facilities such as nature interpretive center, trail system for nature study, camping and picnicking facilities, scenic areas, and wildlife exhibit area with good buffer to protect the park quality from any conflicting land uses that might occur in the future.

The flood prone area at lower portion of the park due to the maximum flood pool (at elevation 890) is -

East side of Des Moines River	207 acres
West side of Des Moines River	117 acres
	324 acres

The main recreational facilities located on this flood plain consist of picnic and open play field areas. In order to maintain these functions of the park it is necessary to relocate these facilities on more feasible sites in the park. These have been relocated as shown in the proposed master plan.

The present location of the park campground near to the main park entrance, without buffer area, is undesirable both from the point of view of campers convenience and from an aesthetic viewpoint. To provide a quality outdoor camping experience, it is necessary to relocate the camping facility to a more congenial environment.

The site development feasibility study indicates that the area immediately to the east of the park is the most desirable site for providing a quality camping experience. The current

park land is not sufficient to locate all camping needs in terms of trailer camping, tent camping and primitive camping. To accommodate these camping facilities it is necessary to acquire private land.

The proposed master plan encompasses 74 acres of land acquisition on the east side in order to provide 84 modern camping sites and a tent camping area. At present, the park provides 52 camping sites. The current camping area is inadequate due to the small size of the campsites (1,000 sq. ft.) and the over-crowding of the sites (16 campsites to an acre). This proposed land acquisition of 74 acres will also provide adequate buffer for the camping area and will create very congenial environment for outdoor living and recreational experience. This change will provide for an improved campsite area, better spacing and generally an improved environment for an outdoor recreational experience.

The wildlife exhibit area already owned by the Conservation Commission will be integrated with the park area.

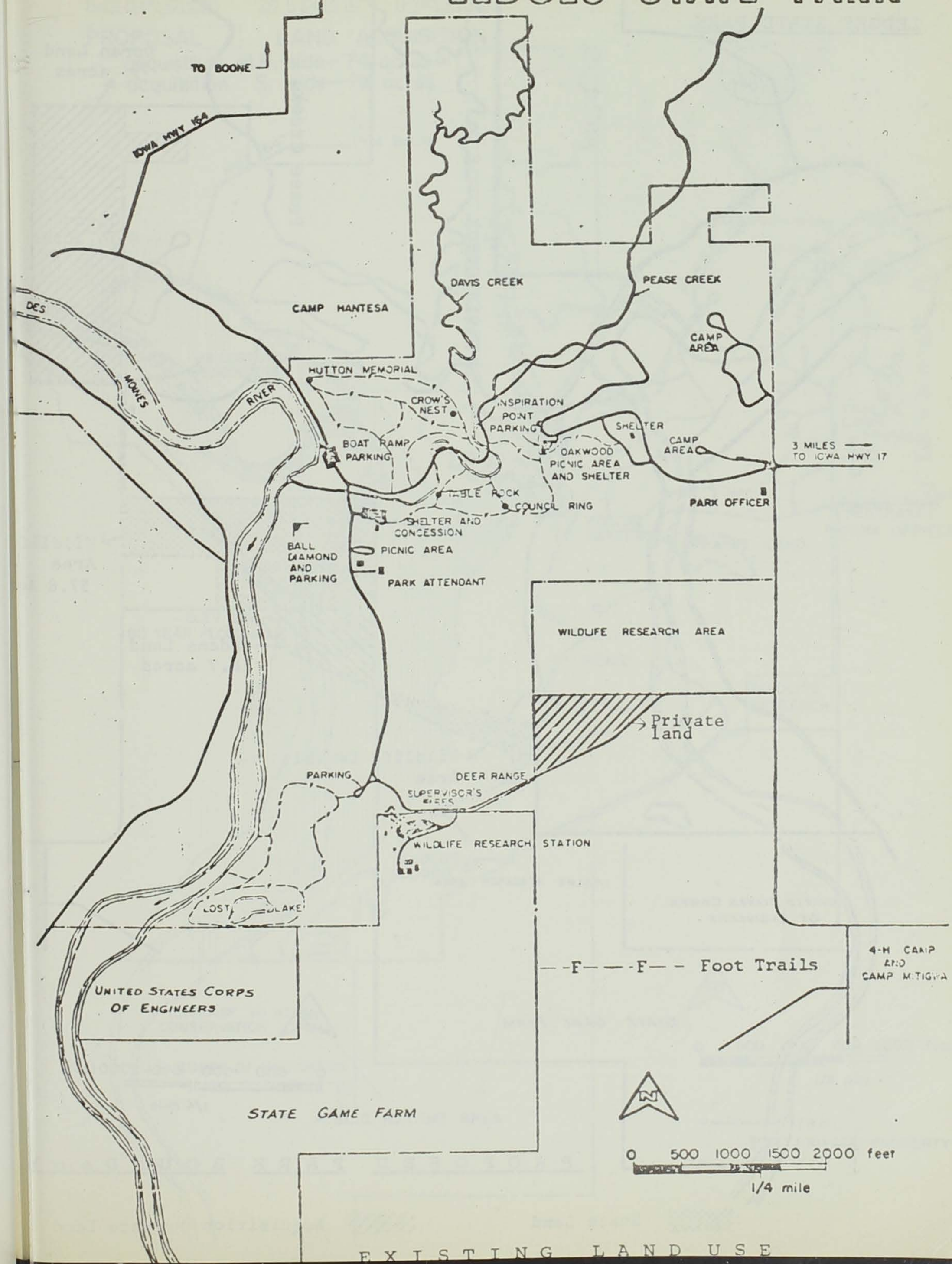
A quick glance at the total annual attendance figure of this park for the past six years reveals that the outdoor recreational activities in this region have increased. This trend will continue to occur in the future. The attendance figures are as below:

Attendance in 1967 - - - - 392,990
Attendance in 1968 - - - - 444,400
Attendance in 1969 - - - - 392,909
Attendance in 1970 - - - - 426,694
Attendance in 1971 - - - - 447,432
Attendance in 1972 - - - - 484,961

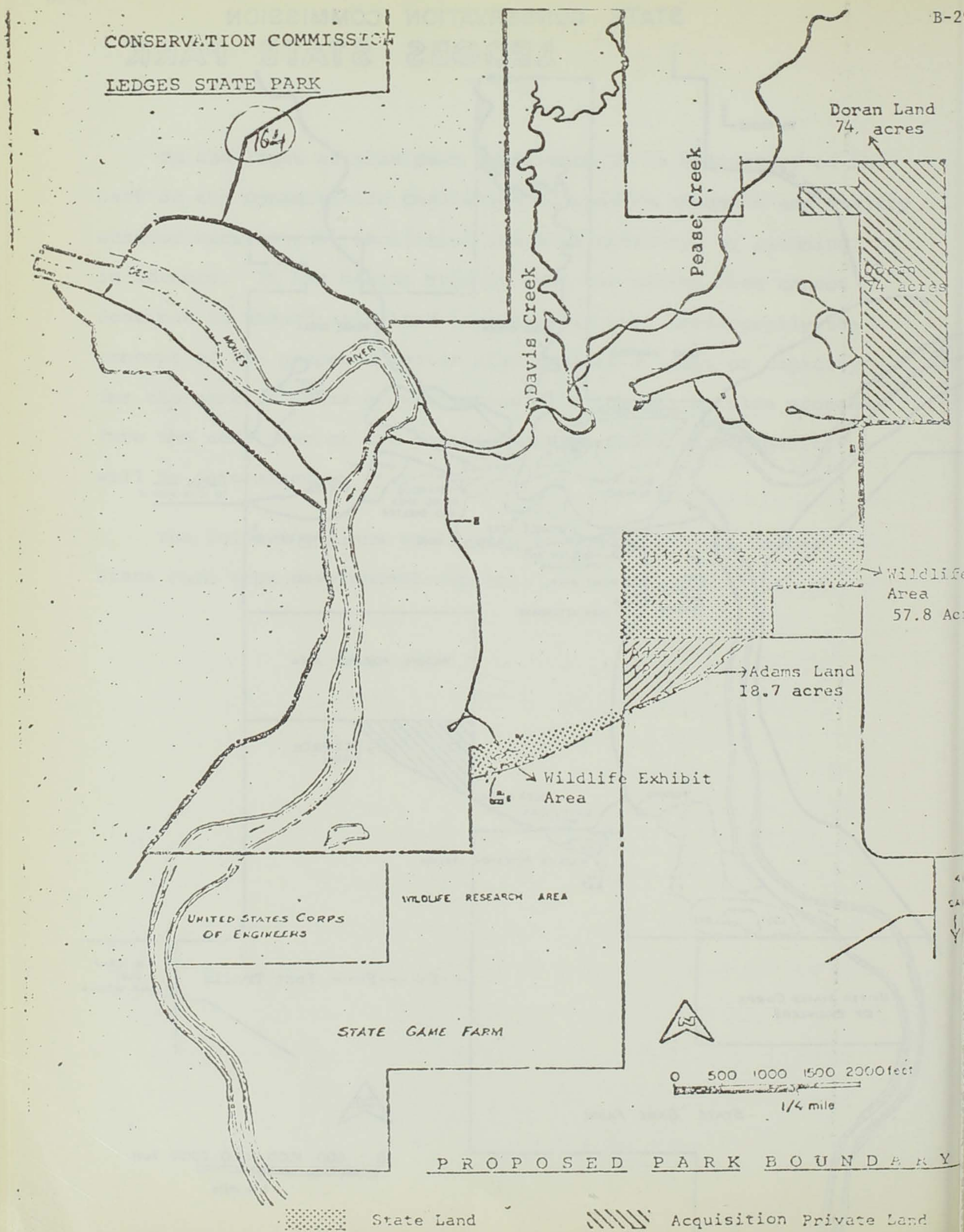
In the light of this past experience it is obligatory on the part of the Conservation Commission to provide adequate and quality outdoor recreational facilities and the experience by planning in advance. It has become evident that the Ledges Area cannot continue to absorb unlimited increases in use, consequently the concept of the proposed master plan implies a limit or capacity for the park in terms of visitation. As the master plan proceeds into the next step or the detailed design phase this capacity will be determined.

The following plans would help to understand the Ledges State Park area development concept.

STATE CONSERVATION COMMISSION
LEDGES STATE PARK



EXISTING LAND USE

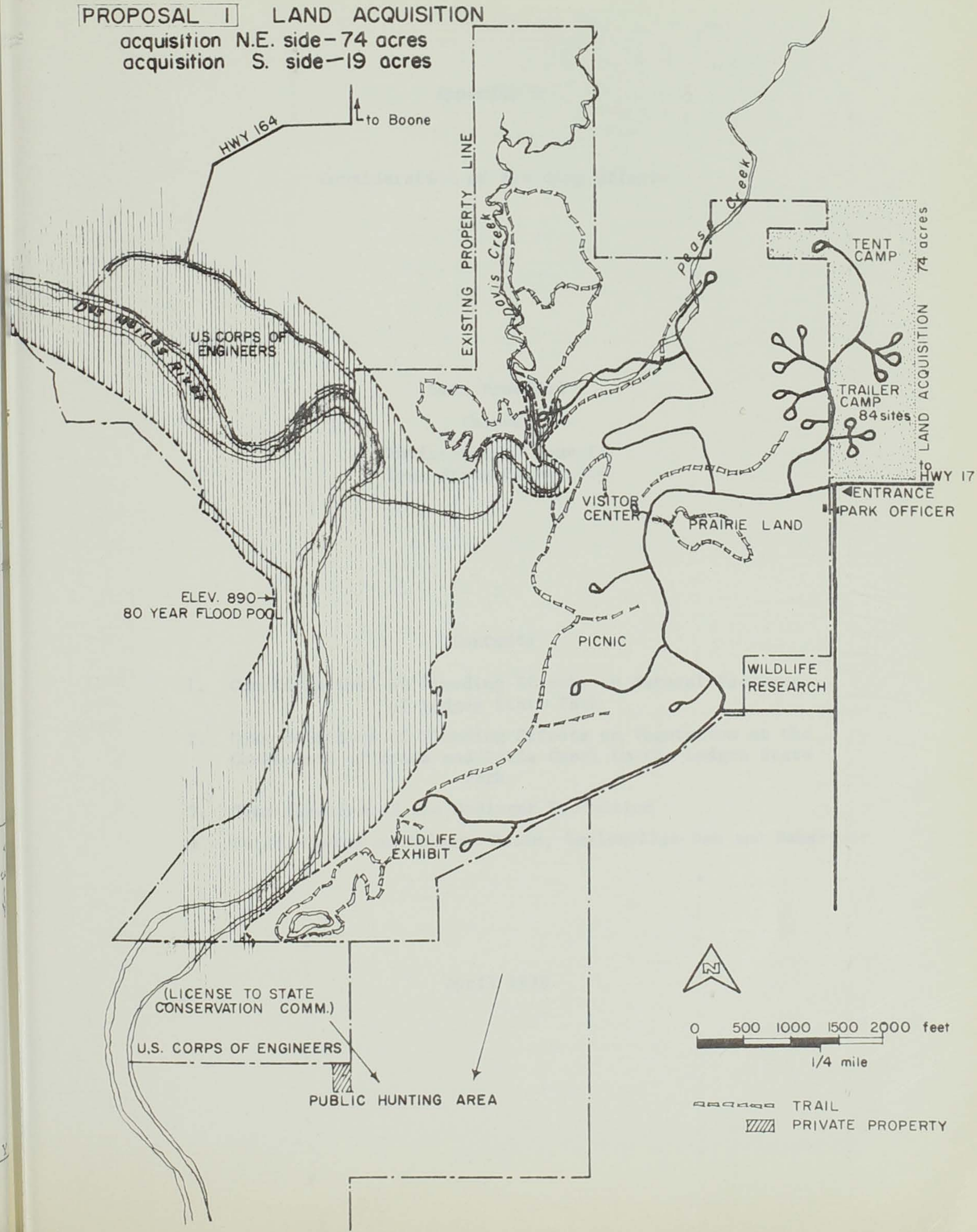

CONSERVATION COMMISSION
LEDGES STATE PARK
164
Doran Land
74 acres
Pease Creek
Davis Creek
Doran
74 acres
MOHIES
RIVER
Wildlife
Area
57.8 Ac
Adams Land
18.7 acres
Wildlife Exhibit
Area
WILDLIFE RESEARCH AREA
UNITED STATES CORPS
OF ENGINEERS
STATE GAME FARM
0 500 1000 1500 2000 feet
1/4 mile
PROPOSED PARK BOUNDARY
State Land
Acquisition Private Land

STATE CONSERVATION COMMISSION

LEDGES STATE PARK

PROPOSAL I LAND ACQUISITION

acquisition N.E. side – 74 acres
acquisition S. side – 19 acres



Appendix C

Consideration of Flooding Effects

Data Provided

through

Environtology Council
Iowa State University

Contents

April 1973

Iowa State University
Environtology Council

April 27, 1973

Considerations of Flooding Effects on Natural Features of Ledges State Park

by

Roger Q. Landers
Wendell Beardsley

The impending impact on lower Ledges State Park by the flood waters of Saylorville Reservoir permits a unique opportunity for re-examination of the primary, long-range purposes of Ledges.

We feel the purpose should shift from the massive recreational uses of the past, which contributed to severe degradation of the natural features of the Park, to low-impact uses, emphasizing enjoyment of scenic values and other natural features.

The overriding uniqueness of the natural features of Ledges: the sandstone walls; the covering of lichens, mosses and other plants; the trees; the stream crossings; and the woodland habitats for bird species unusual to Iowa; all require an emphasis on preservation instead of developed use.

A long-range plan based on preservation and protection of the natural features of Ledges must be adopted.

The impact of flooding on the lower Ledges to the 890 level cannot be accurately quantified, but it is expected to have a substantial effect.

Questions which the EIS should cover are:

What alternatives to the present plan offer protection to the lower valleys of Peas and Davis Creeks?

What alternatives provide for the continuation of a scenic road through the lower Ledges?

What alternatives would protect the area from flooding greater than under natural conditions?

A barrier dam structure to protect the lower Peas and Davis Creek valleys should be studied in detail together with the impact of the barrier dam itself on the Ledges and surrounding area.

What impact would a barrier dam have on scenic and recreational uses of Ledges?

What impact would a barrier dam have on borrow areas adjacent to the park?

What effect would there be on wildlife access?

Concerning the plans for the Ledges:

We predict a substantial public dissatisfaction with any plan that would close off the road through the lower Ledges. We oppose denial of access to handicapped and elderly people who have become accustomed to the scenic drive through the lower Ledges.

We question the value of moving displaced picnic facilities to upland sites, retaining team sports areas, and encouraging other-than-primitive camping when favorable mass recreation facilities can or will be available at the Big Creek area and along Saylorville reservoir further downstream. Recent research at Holst State Forest, not far upstream from Ledges, found the upland ridge areas to be underlain by a shallow clay "pan". These sites are highly sensitive to disturbance and likely to exhibit excessive tree mortality and soil erosion if subjected to development and heavy use. Prior to any development of the ridges or upland areas in Ledges, extensive soil surveys are needed to ascertain potential problems of this nature.

We oppose the expansion of roads in the valley of Peas Creek, thereby endangering the habitat of bird species unusual to Iowa.

Specific impacts on Park vegetation must be considered. A survey of the lower valleys of Peas and Davis Creeks in the Ledges State Park was conducted on March 21 and 24, 1973, to consider the impact of maximum flooding levels on local vegetation. The precise location of the 890' elevation contour was not apparent. Based on topographic maps from the Conservation Commission and position of flagging markers, the position of the 890' contour was approximated within 2-1/2 to 5 feet. Until a more accurate determination of the elevation is made the specific values in Table 1 are tentative.

It appears that the 890' elevation contour extends several feet above the upper floodplain level at the junction of Peas and Davis Creeks. Maximum flooding would damage, if not kill, almost all of the trees to

Table 1

Trees greater than three inches DBH in upper floodplain and valley floor near the junction of Peas and Davis Creeks.

Boxelder *Acer negundo*	10
Black maple *Acer nigrum*	7
Bitternut hickory *Carya cordiformis*	5
Hackberry *Celtis occidentalis*	35
Hawthorn *Crataegus mollis*	1
Ash *Fraxinus* sp.	8
Honey locust *Gleditsia triacanthos*	2
Butternut *Juglans cinerea*	3
Black walnut *Juglans nigra*	43
Cottonwood *Populus deltoides*	5
Sycamore *Platanus occidentalis*	1
Black cherry *Prunus serotina*	2
Bur oak *Quercus macrocarpa*	1
Red oak *Quercus rubra*	2
Black locust *Robinia pseudoacacia*	3
Basswood *Tilia americana*	7
Elm *Ulmus* spp.	29
Total	164

base of the valley walls in this vicinity and possibly upstream from the rock footbridge. Table 1 shows the composition of tree species in the upper floodplain and valley floor near the junction of Peas and Davis Creeks. Trees greater than 3 inches DBH were counted below the 890' contour from the first water crossing downstream from the junction of Peas and Davis Creeks to the rock footbridge. The mixture of species suggests that this site is reasonably well drained. Inundation longer than ten days would probably result in severe damage to all species except cottonwood, hackberry, boxelder and sycamore and perhaps even to some of these because their root systems developed under a different moisture regime. Trees such as black cherry have been reported killed with only one day of inundation. Little is known of the effects of changes in ground water levels on tree species growing on sandstone-derived soils, such as in the lower Ledges.

Shrubs are less apparent and less abundant in the valley floor because of past management for picnicking and other recreational uses. Specimens of the rare leatherwood (Dirca palustris) and blue beech (Carpinus caroliniana) found at the base of the north-facing valley walls would be the only loss of shrubs of any consequence.

Native herbaceous growth has largely been replaced by bluegrass and other species more resistant to mowing and trampling. Numerous early spring ephemeral species, such as snow trillium (Trillium nivale), dog tooth violet (Erythronium albidum) and many others, continue to bloom in the valley floor each spring, mature, and become dormant in underground parts before mowing and late spring trampling destroy them. It is doubtful

that these spring flowers could survive inundation, particularly if it occurred during the early spring during their peak growing time.

From the junction of Peas and Davis Creeks to the mouth of Peas Creek, the effects of inundation would gradually increase higher on the valley walls. Upland species, such as white oak (Quercus alba), hop hornbeam (Ostrya virginiana), and shagbark hickory (Carya ovata) would be adversely affected; however, the largest number of trees affected would be the floodplain species of willow (Salix spp.), cottonwood and soft maple (Acer saccharinum). Neither the number of trees nor the species composition was determined for this portion of the Ledges; however it appears that the amount would easily double the number counted at the junction of Peas and Davis Creeks. If the large trees at the mouth of Peas Creek were removed by the effects of inundation or mechanical means, it is expected that large amounts of floating trees and other debris would be dumped by the river at this site because of the present position of the river channel.

Specific plans should be developed for planting water-tolerant tree and shrub species in the lower Ledges. Plans are needed for removal of trees that would be killed by inundation.

If a barrier dam is not built we encourage retaining a tree barrier at the mouth of Peas Creek to reduce the influx of floating debris in the lower Ledges from the river channel at high water stages.

Procedures and plans for removal of mud and silt following flooding are needed.

What maintenance procedures are planned to remove woody debris?

What maintenance procedures are planned for the removal of silt in the lower valley of Peas Creek as it is dropped where creek waters enter the slower moving reservoir waters?

We perceive that trail erosion and general overuse of the upland areas of Ledges may be intensified because of the Reservoir, as recreational use shifts.

Imaginative and environmentally sensitive plans and management techniques will be needed to offset or prevent these effects, and preserve scenic and natural values found in Ledges and unique in central Iowa.

Considerations of Flooding Effects on Vegetation at the Confluence of Pea's and Davis Creek in the Ledges State Park

R. Q. Landers
25 March 1973
Roger Q. Landers
Wendell Beardsley

A survey of the lower valleys of Pea's and Davis Creeks in the Ledges State Park was conducted on March 21 and 24, 1973, by us to consider the impact of maximum flooding levels on local vegetation. The precise location of the 890' elevation contour was not apparent. Based on topographic maps from the Conservation Commission and position of flagging markers, the position of the 890' contour was approximated within 2-1/2 to 5 feet. Until a more accurate determination of the elevation is made the specific values in this report are only tentative.

It appears that the 890' elevation contour extends several feet above the upper floodplain level at the junction of Pea's and Davis Creeks. Maximum flooding would damage, if not kill, almost all of the trees to the

TABLE 1

Trees greater than three inches DBH in upper floodplain and valley floor near the junction of Pea's and Davis Creeks.

Boxelder *Acer negundo*	10
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Elm *Ulmus* spp.	29
Total	164

base of the valley walls in this vicinity and possibly upstream from the rock footbridge. Table 1 shows the composition of tree species in the upper floodplain and valley floor near the junction of Pea's and Davis Creeks. The mixture of species suggests that this site is reasonably well drained. Inundation longer than ten days would probably result in severe damage to all species except cottonwood, hackberry, boxelder and sycamore and perhaps even to some of these because their root systems developed under a different moisture regime. Trees such as black cherry have been reported killed with only one day of inundation. Little is known of the effects of changes in ground water levels on tree species growing on sandstone derived soils, such as in the lower ledges.

Shrubs are less apparent and less abundant in the valley floor because of past management for picnicking and other recreational uses. Specimens of the rare leatherwood (Dirca palustris) and blue beech (Carpinus caroliniana) found at the base of the north-facing valley walls would be the only loss of shrubs of any consequence.

Native herbaceous growth has largely been replaced by bluegrass and other species more resistant to mowing and trampling. Numerous early spring ephemeral species, such as snow trillium (Trillium nivale), dog tooth violet (Erythronium albidum) and many others, continue to bloom in the valley floor each spring, mature, and become dormant in underground parts before mowing and late spring trampling destroy them. It is doubtful that these spring flowers could survive inundation, particularly if it occurred during the early spring during their peak growing time.

From the junction of Pea's and Davis Creeks to the mouth of Pea's Creek, the effects of inundation would gradually increase higher on the

valley walls. Upland species, such as white oak (*Quercus alba*), hop hornbeam (*Ostrya virginiana*), and shagbark hickory (*Carya ovata*) would be adversely affected; however, the largest number of trees affected would be the floodplain species of willow (*Salix* spp.), cottonwood and soft maple (*Acer saccharinum*). If the large trees at the mouth of Pea's Creek were removed by the effects of inundation or mechanical means, it is expected that large amounts of floating trees and other debris would be dumped by the river at this site because of the present position of the river channel. A barrier dam would serve two functions, (1) to protect the valleys of the Pea's and Davis Creeks from destructive inundation and (2) to prevent the deposition of floating debris in the lower Ledges as far upstream as Davis Creek.

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Ames, Iowa 50010

DEPARTMENT OF
AGRICULTURAL ENGINEERING
Telephone: 515-294-2871

May 30, 1973

Dr. Merwin Dougal
Civil Engineering
Town Engineering Building
Iowa State University
Ames, Iowa 50010

Dear Dr. Dougal:

Dewey Bondurant and I spent the afternoon of May 23 reviewing maps and aerial photos of, and touring and hiking in the Pea's Creek Watershed associated with the Ledges State Park. We present the following conclusions related to sediment production from the 10 square mile Pea's Creek Watershed.

1. We estimate the sediment production to be 500 tons per square mile per year. About 2800 acres are in tilled crop land; the rest is in pasture and woodland. About one third of the crop land has natural drainage to the ravines which form a part of Pea's Creek valley.

2. Inspection of several branches of the valley indicates that bank sloughing is a relatively minor problem. There are a few places where slides were observed, but only a small percent of the slide material was in a location from which water would scour and transport it to the outlet at the Des Moines River.

3. If the invert of the outlet works of the proposed barrier dam is placed at elevation 860 or above, most of the sediment will be deposited in the oxbow lake. Some will be distributed above elevation 860 and some material will go through the gate. As the oxbow lake fills with sediment, trap efficiency will decrease somewhat and more sediment will move through the gate. In cases when the gate is closed, nearly all the sediment will be deposited in the lake.

Sediment will be deposited above elevation 860 with the barrier dam in place. The pattern of deposition will be controlled by the range of water level elevations and flow frequencies occurring as a result of runoff from Pea's Creek. Thus, the barrier dam would reduce sediment deposition from the river but will increase sediment deposition from Pea's Creek.

4. Sediment amounts delivered to the lake could be reduced considerably by installation of small sedimentation ponds near the upper reaches of the valley.

Sincerely yours,

Howard P. Johnson

Howard P. Johnson
Professor

HPJ/bjk

cc: Dewey Bondurant

Iowa State University
Environtology Council

June 20, 1973

Brief Review of Release Rates
Saylorville Dam and Reservoir
by
Ronald L. Rossmiller and Merwin D. Dougal

A brief study was made of three alternative but potential reservoir operation plans for flood control, using the 1954, 1965 and 1969 floods as examples. The three alternative plans as selected would bracket the feasible range of outflow or release possibilities, and all other operational plans would fall among these or between at least two.

The Three Alternative Release Rates Studied

The three release rates selected for study were as follows:

Alternative 1. The proposed release rate schedule of the Corps of Engineers. The same schedule was used for rising and falling reservoir levels, although this might not strictly be true for actual operation during periods of falling reservoir levels. Downstream flood conditions might dictate a lower rate.

Reservoir elevation, feet MSL.	Proposed reservoir release rate, cfs
833	8,000
870	8,000
875	10,000
879	12,000
880	14,000
881	16,000
882	18,000
883	20,000
884	21,000
884-889	21,000
889-890	go from 21,000 to 42,000

Alternative 2. Use the maximum capacity of the outlet works (gate structure, conduit and stilling basin) and the spillway at all times when a flood is occurring.

This capacity is as follows (from Appendix I):

Reservoir elevation, feet MSL	Maximum capacity, outlet works and spillway, cfs
833	11,800
840	13,600
850	15,900
860	17,600
870	19,200
880	20,600
884	21,000
890	42,000

Alternative 3. This alternative is a combination of alternatives 1 and 2. It assumes the Corps of Engineer's plan would be used for reservoir elevations up to 884, and that the maximum capacity of the system would be used above that level (or the alternative 2 plan above elevation 884).

Results

The 1954, 1965, and 1969 flood data of the U.S. Geological Survey were used in a digital-computer reservoir-operational model. This mathematical model solves the reservoir routing equations, and reservoir outflows, elevations or flood levels, and storage quantities are obtained as results. These three floods are characteristic of the maximum flood history of the Des Moines River at the Saylorville Reservoir site. The 1954 flood had the maximum instantaneous (peak) discharge, and the 1965 flood had the maximum runoff volume. The 1969 flood is a recent flood of moderate size.

The results are listed in Table 1. These results can be interpreted along several viewpoints. First, operating the reservoir with alternative 2, using the maximum outflow capacity, would reduce any additional flooding

Table 1. Summary of flood operation study for Saylorville Reservoir, for three floods of historic record.

Year of flood	Peak inflow, cfs	Operation alternative	Maximum outflow, cfs	Maximum reservoir elevation, feet	Approximate duration of reservoir being above elev 862, days
1954	55,900	1	8,000	869.7	20
		2	17,600	859.9	0
		3	8,000	869.7	20
1965	47,100	1	25,000	889.2	85-86
		2	19,900	875.0	23
		3	26,700	886.4	84-85
1969	23,800	1	13,700	879.8	56
		2	16,400	852.7	0
		3	13,700	879.8	56

of the lower Ledges State Park to a negligible amount. The 1965 flood (the record volume flood), as routed through the reservoir would have caused the flood pool to be above 862 for 23 days. The natural flooding was about the same duration (See Appendix H). All other floods of the period of record would not exceed the spillway crest elevation of 884, if routed through the reservoir in a mathematical sense. This alternative does increase the magnitude and frequency of outflows downstream. Therefore, its physical accomplishments must be weighed against the economic losses incurred from the greater flood damage risk. These are discussed in the main report.

The study shows, as a second item of importance, that flood plain management is required for all alternatives. The maximum release rates would be from 20,000 to 25,000 cfs for the maximum volume flood of record (1965), regardless of which operation plan is selected. This is greater than the 8,000 cfs bankfull capacity, and a flood plain management program is an identifiable need.

Third, the use of alternative 3 does not reduce the duration of flooding above elevation 884 appreciably. Practically the same flooding duration exists, for elevations above 862. About 20 days duration exists for each alternative, also, above elevation 878. This alternative would reduce the maximum reservoir elevation reached by three feet, from 889 to 886. This would also reduce the stress on the unlined spillway chute at the dam site.

These results show the effect of physical changes. The comparable economic values are needed before meaningful conclusions and decisions can be made. The determination of these remains the primary responsibility of the Corps of Engineers. Two additional facts, that (a) much of the

lower Ledges State Park is flooded naturally (to elevation 878 in the 1954 flood) and (b) the proposed changes in future park emphasis and use patterns, also need to be considered.

Appendix D

Geological Resources

and

Effects of Flooding within the Lower Ledges State Park

Boone County Iowa

Date furnished by

Iowa Geological Survey

March 1973

GEOLOGICAL RESOURCES AND EFFECTS OF FLOODING WITHIN THE LOWER LEDGES STATE PARK, BOONE COUNTY, IOWA

Jean C. Prior
Iowa Geological Survey

The lower portions of Ledges State Park are characterized by the level floodplain and terrace sediments of the Des Moines River valley and the narrow intersecting alluvial valley of Peas and Davis Creeks. These intersecting valleys are deeply incised into the landscape, cutting through glacially deposited materials (Pleistocene) and into massive sandstone bedrock (Pennsylvanian, Des Moines Series, Cherokee Formation). This exposed sandstone forms the picturesque, mural-like valley walls within the lower Ledges Park. In addition, differential cementation within the sandstone, a variety of prominent concretionary forms, and the accentuation of cavities and convexities by differential erosion has resulted in the protuberant "ledges" and overhangs characteristic of the sandstone escarpments.

The Pennsylvanian geologic section is typically composed of an alternating series of limestones, shales, sandstones and coal seams representing deposition within shallow marine and terrestrial environments. However, the massive sandstone formation exposed near the mouth of Peas Creek in the lower Ledges area represents an interruption in this sequence. Here the older Pennsylvanian units have been eroded away and replaced by a massive "channel sandstone," formed by rapid continuous deposition within a Pennsylvanian-age river channel. This channel sandstone is quite local in its occurrence, its identity being lost within two miles of the exposures at Ledges Park.

Many of Iowa's parks and recreation areas are associated with water, either natural lakes or large man-made reservoirs. Ledges Park is unique in that its picturesque terrain and appeal as a recreation area are based on patterns of erosion and exposure of bedrock geology.

Such areas are relatively rare in Iowa where glacial deposits blanket the state, subduing the landscape and covering the bedrock surface. Exceptions to these circumstances exist in extreme northeast Iowa where bedrock provides the dominating influence on the topography because of the general absence of glacial deposits. Other bedrock exposures are commonly found in east-central, southeast, and south-central Iowa, but are generally confined to the deeper river valleys where dissection through the glacial sediments has exposed the bedrock. The availability of these geologic exposures decreases to the northwest in the state. Thus, the Ledges Park exists in an area where exposed bedrock features are becoming increasingly rare. The irregular forested terrain associated with the Des Moines and Peas Creek valleys, and the accompanying scenic bedrock formations provide an interesting change from the surrounding uplands of gently rolling farmland. Additional uniqueness exists in the sandstone escarpments themselves. Sandstone exposures of this type and magnitude exist only in Dolliver State Park in Webster County, along portions of the Red Rock Reservoir in Marion County, and in Wildcat Den State Park in Muscatine County.

Alluvial sediments such as those underlying the Des Moines River valley floodplain and terraces potentially contain economic deposits of sand and gravel. Of the well data on file at the Iowa Geological Survey, records from only one well are available from which interpretation can be made as to the nature and thickness of the alluvial sediments in the area of the lower Ledges. That well was drilled for Camp Hantesa in 1947 and is located in the SE¼, NE¼, SE¼ of Sec. 17, T. 83N., R. 26W. (See topographic map, page 4.) The well, drilled near the valley margin, shows the unconsolidated sediments to be 32 feet in thickness, underlain by Pennsylvanian shale, and consisting of alluvial-colluvial silts in the upper 20 feet and alluvial sand and gravel in the lower 10 to 12 feet. Additional indication of the existence of deposits of sand and gravel is seen on the topographic map, where

gravel operations are shown on the west side of the Des Moines River valley. Because of the diverse and discontinuous nature of alluvial sediments, evaluation of economic deposits of sand and gravel in the Ledges area can be made only after a detailed drilling program to inventory these resources. Such information is also necessary for proper evaluation of the seepage potential for the proposed Peas Creek barrier dam.

Backwater flooding resulting from periodic rises in the flood pool of the Saylorville Reservoir will temporarily cover the lower portions of Ledges Park. The most serious effect of this flooding, from the geological viewpoint, will be the denial of access to the area where the sandstone formations are best exposed and offer the most picturesque scenery and educational value. The effects of floodwater on the exposed sandstone ledges themselves will be minimal. There is little potential for undermining and erosion as floodwaters will rise and fall slowly and currents will be slow-moving. To whatever possibility exists for erosion of some of the more weakly cemented zones in the sandstone, can be added the possibility of the opposite effect, "case-hardening." Through this process, the surface of a porous rock, such as sandstone, becomes hardened through contact with mineral-bearing waters. If floodwaters remain at a single elevation for an extended period of time, it is also possible some staining of the rock surface may occur. However, water seeping down the rock faces from above has already resulted in extensive natural staining of the sandstone walls.

There are other effects of a geological nature that will have to be considered with backwater flooding from the Saylorville Reservoir. These are the problems of siltation and the effects of a regional rise in the water table with the existence of the reservoir. Peas and Davis Creeks are high-gradient streams, capable of moving large volumes of water

over short distances, and have abundant unconsolidated glacial materials within the watershed available for erosion. Deposition of this material will become more of a problem in the slackwater of reservoir backflooding. The rise in the regional water table, likely to accompany the filling of the reservoir, will slow infiltration rates, increase the potential for flooding during high water on Peas Creek, and may affect ecologically sensitive vegetation systems.

Sources:

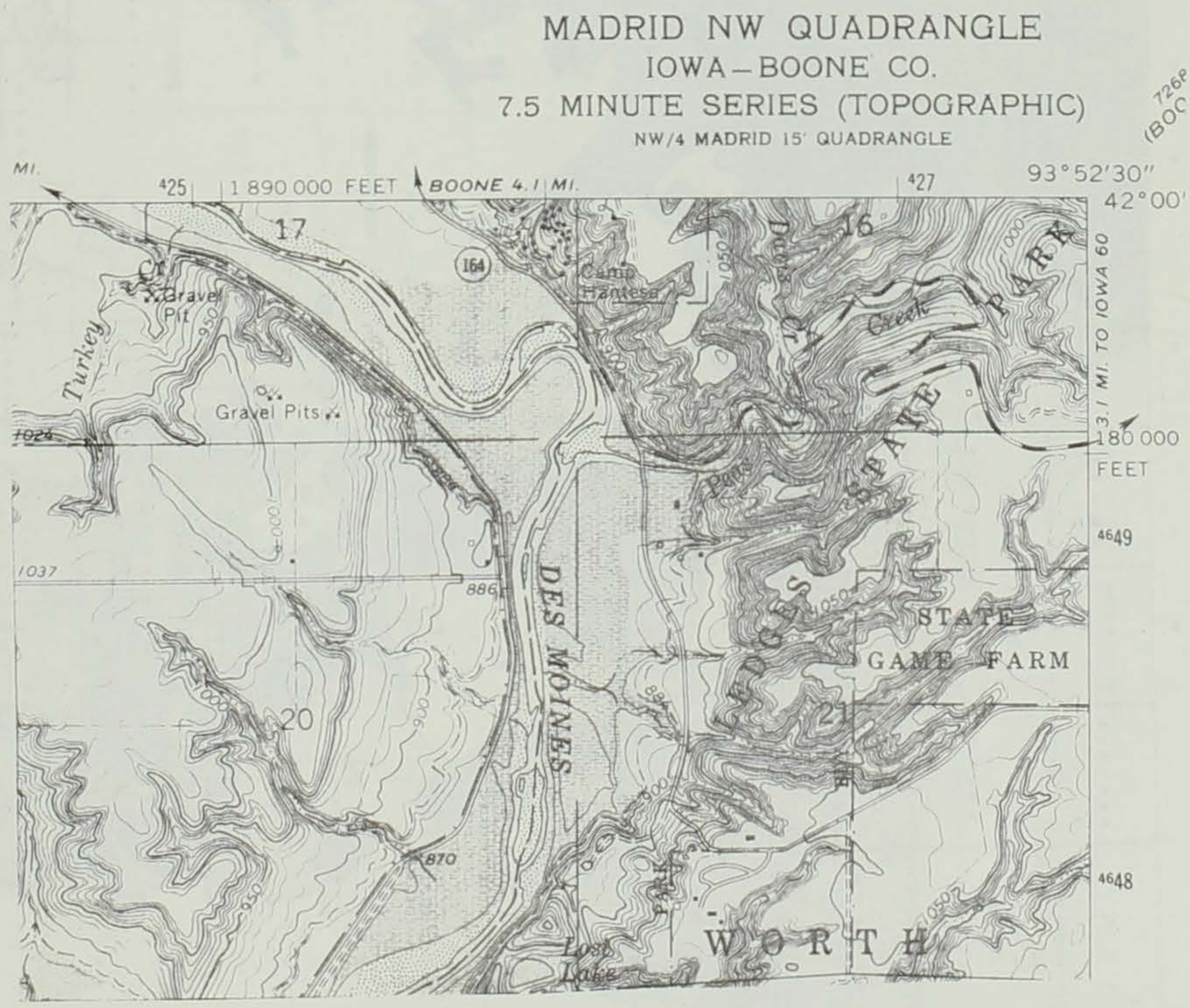
Beyer, Samuel W., 1896, Geology of Boone County: Iowa Geological Survey Annual Report for 1895, Vol. 5, p. 187 - 190.

Gwynne, Charles S., 1951, Ledges Park: The Iowa Conservationist, Vol. 10, p. 179.

Twenter, F.R., and Coble, R.W., 1965, The Water Story in Central Iowa: Iowa Geological Survey Water Atlas Number 1, pp. 4, 44.

R. 26W.

T. 83N.



Scale: 1:24,000
Contour Interval: 10 feet

BEDROCK OF IOWA

LEGEND

CRETACEOUS

- Ku — Undifferentiated

JURASSIC

- Jfd — Fort Dodge Beds

PENNSYLVANIAN

- Pv — Virgil
- Pm — Missouri
- Pdm — Des Moines

MISSISSIPPIAN

- Mu — Undifferentiated

DEVONIAN

- Du — Upper
- Dm — Middle

SILURIAN

- Undifferentiated

ORDOVICIAN

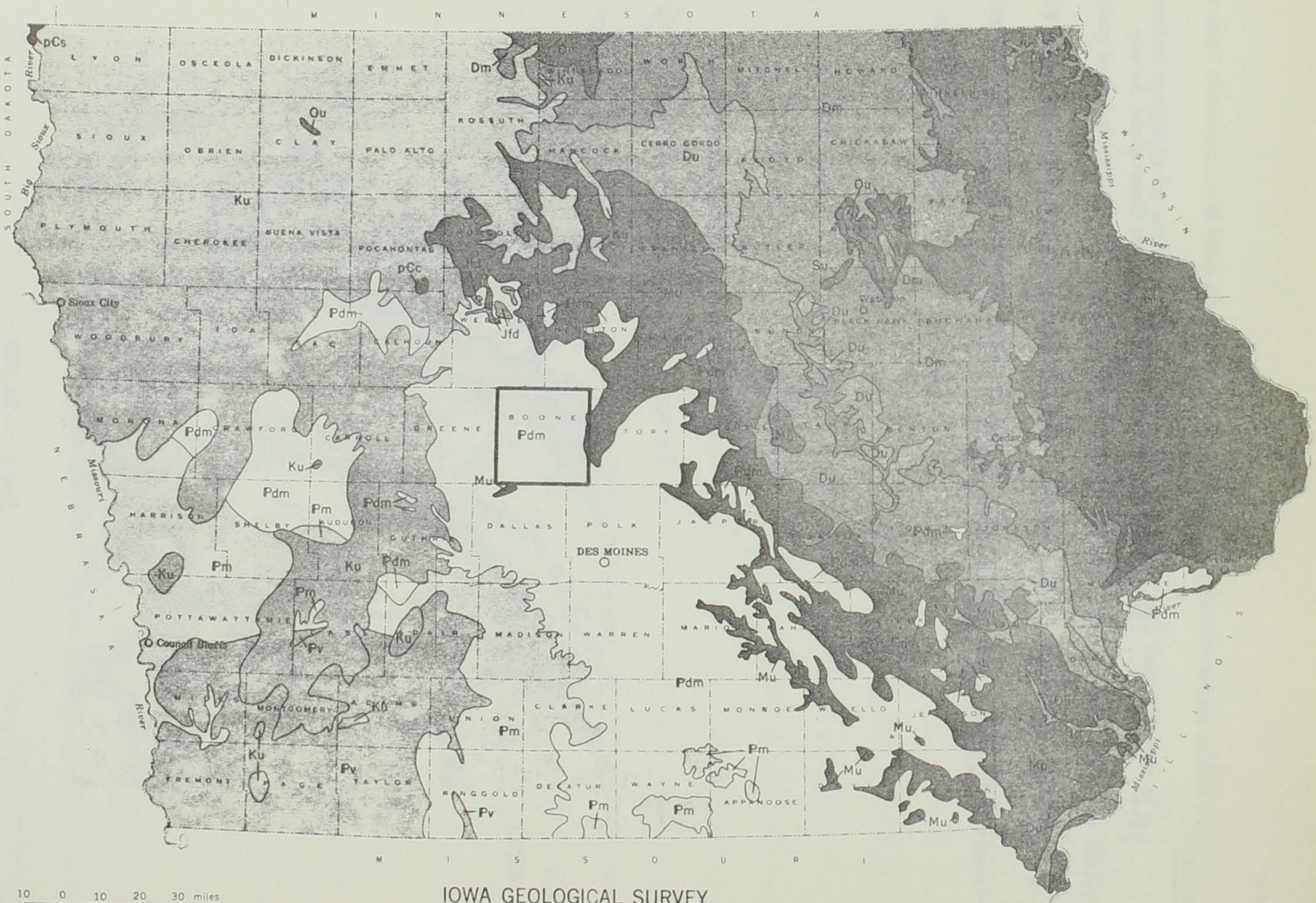
- Undifferentiated

CAMBRIAN

- Cu — Undifferentiated

PRECAMBRIAN

- Crystalline
- Sioux



IOWA GEOLOGICAL SURVEY

H. GARLAND HERSHEY

DIRECTOR AND STATE GEOLOGIST

1969

Williams & Heintz Map Corporation, Washington, D.C.

D-6

Appendix E

Plans for Continued

Extraction of Sand and Gravel

Data furnished by

Boone County Engineer's Office

April 1973

SUBJECT: REPORT OF THE PROPOSED PLANS FOR CONTINUED EXTRACTION OF SAND AND GRAVEL FOR MATERIALS PROCESSING FOR THE LEDGES STATE PARK SAYLORVILLE RESERVOIR ENVIRONMENTAL STUDY

DATE: APRIL 26, 1973

BY: C.F. SCHNOOR

In the past ten years from 350,000 to 400,000 tons of aggregate and road surfacing material have been produced annually in Boone County. Of this total, Boone County usually produces about 40 percent and Hallett Construction Company produces and sells most of the balance. The gravel deposits from which these materials are extracted are all located along the Des Moines River.

By 1965 it was evident to the Boone County Board of Supervisors and me that all of the deposits lying within the Saylorville taking lines could soon be forever lost and as a result the county would be forced to pay considerably more for their road surfacing material.

The Corps of Engineers, appreciating our problem, agreed to honor Boone County gravel leases, subject only to periodic flooding, for a 25 year period and as a direct result the county leased or purchased five separate pits containing an estimated four to five million tons of gravel. Hence, the county secondary roads are well supplied with a source of road gravel in the Saylorville Lake area.

There are no known commercial deposits of gravel in the Ledges State Park. There may be deposits in the Des Moines River flood plain area at such depth that they would not be economical to obtain at this time.

The Hallett Construction Company has not, at this time, entered into an agreement with the Corps of Engineers for their major deposits of gravel lying within the Saylorville taking lines. It is expected and this writer sees no logical barrier to the end that satisfactory agreements will be negotiated so that the construction industry will not have to shoulder the expenses of hauling aggregates into the areas serviced by these deposits.

Appendix F

Needs for Archaeological Studies

Data provided by

State Archaeologist

and Historic Preservation Program

May 1973

1 May, 1973

To: Governor's Inter-Agency Resource Council
Technical Task Force
Saylorville Environmental Impact Study.

From: Adrian D. Anderson, Office of State Archaeologist.

Subject: Project Impact Upon Archaeological Sites in Ledges State Park.

Following the Task Force inspection trip to the Ledges State Park I was able to obtain copies of the two archaeological site survey reports which describe work accomplished by Ashworth and McKusick in 1964, and by Brown in 1966. I also have had an opportunity to discuss these reports with Dr. David Gradwohl, Iowa State University, who has had the National Park Service contracts for archaeological salvage within the Saylorville reservoir.

On the basis of the reports and my conversations with Dr. Gradwohl, I must contend that the original surveys in Saylorville were inadequate and do not properly reflect the presence of archaeological resources which have significant potential for contributing to the understanding of Iowa prehistory. To support this contention I call attention to the fact that Dr. Gradwohl located an additional 40 archaeological sites in Boone County, simply on days when weather did not permit excavations, and during leisure time. Another 40 sites were located in Polk County in the same fashion.

In the Ledges State Park two sites were identified and tested in the area which would be adjacent to the proposed barrier dam site. These are sites 13 BN-6 and 13 Bn-201. It is probable that other sites are present within the area which would be affected by barrier dam construction.

Project Impact Assessment:

If the work area for the construction of the barrier dam encroaches on the prehistoric occupation area, the sites will be destroyed. If the barrier dam is constructed, the sediments from Peas Creek will eventually fill the low area at the mouth of the creek with sand and silt, burying sites. At the same time, wave action behind the barrier dam will result in back-slump, destroying the low knoll which is another site location.

If the dam is not built we should expect the same kind of destruction to occur as reservoir water storage level changes cause bank-slump.

Recommendations:

Additional archaeological survey and salvage projects should be undertaken prior to the initiation of such a project. If the barrier dam is not constructed, additional excavations should still be required.

Appendix G

Effects of Barrier Dam

on

Camp Hantesa

Data provided by

Camp Fire Girls

April 1973

HEART OF THE HAWKEYE COUNCIL Camp Fire Girls G-1
HAWLEY WELFARE BUILDING, DES MOINES, IOWA 50309 Phone (515) 244-1181 EXTENSION 18
VIRGINIA LEE CUNNINGHAM, EXECUTIVE DIRECTOR

April 26, 1973

TO WHOM IT MAY CONCERN:

REGARDING: Future plans for the Ledges State Park and the planning being done for this area.

CAMP HANTESA: Located to the west of the Ledges State Park and owning land on both sides of highway 164 with the south side land reaching the river.

1) Well location for the entire water system at Camp Hantesa (300 each week in the summer and 150 each weekend during the entire year) is located on the bottom land across highway 164 from the main camp development.
Wells are shallow wells with depth being 30-40 feet. Have two wells and both are being used.
Would like to suggest a Geological Study be done to see if the barrier dam would eliminate seepage of water from river into wells--this may be the primary source of water for these wells. If so, the barrier dam or levee could completely eliminate water for the entire camp.
Result: Group putting in levee would need to put in adequate water facility for year round camping at Camp Hantesa.

2) The Barrier Levee would leave Ox Bow Lake as stated in plans reaching newspapers.
With no inlet or outlet, would not this water become stagnant and therefore become polliant in the future? If this were being done for ecological studies it would be one thing, BUT we already have such a lake in the State Park--Lost Lake which is a part of the Nature Trail. One such lake should be ample for ecological study.
Suggestion: That if the plan for the Barrier Levee is accepted that Ox Bow Lake be filled from the material dug out to put in the base of the Barrier Levee.

3) Since the Barrier Levee would come right next to our property with public property on all sides of us,,we are most concerned about the policing plans for this area. We would like to see the public agencies involved fence their land and thereby keep the public off of the private land in between.

CAMP HANTESA, ROUTE 1, BOONE, IOWA

HEART OF THE HAWKEYE COUNCIL Camp Fire Girls G-2
HAWLEY WELFARE BUILDING, DES MOINES, IOWA 50309 Phone (515) 244-1181 EXTENSION 18
VIRGINIA LEE CUNNINGHAM, EXECUTIVE DIRECTOR

4) If the barrier levee built is not going to eliminate all seepage, then the result would be stagnant water pooling the entire bottom land and being there much longer than a flood would leave water. Flood water would be better water to have over the land than water that has stood for a long period of time.

If water is to stand on the bottom land for a long period of time I question the quality of the water and what it will do to the wells at Camp Hantesa.

It seems that moving water (which I think it would be if a levee was not there) would be better than the stagnant water.

5) At present time we have good access to the river front area for our campers to use. We have a beach that affords much enjoyment and education for our campers. Under the plan of the barrier levee, the access would be eliminated and the view of the entire area would be eliminated. I think this would be a consideration in the plan.

6) If the State Park desires only one entrance into their area and this is not going to be through highway 164, we would suggest that highway 164 be cut at the bottom of the hill west of the Ledges State Park. This would be at the location of the start of the barrier levee on the west end.

Respectfully submitted,

Susan Welch

Susan Welch
Director of Camping

HEART OF THE HAWKEYE COUNCIL Camp Fire Girls G-3
HAWLEY WELFARE BUILDING, DES MOINES, IOWA 50309 Phone (515) 244-1181 EXTENSION 18
VIRGINIA LEE CUNNINGHAM, EXECUTIVE DIRECTOR

APPENDIX G Addition. Page 3

Camp Hantesa, the oldest girls' camp in Iowa, is located next to the Ledges State Park. This Camp is the Camp Fire Girls camp serving members in the central part of Iowa. As of August 31, 1972, the girl membership count was 6,678. The camp also serves adult members as well as families of the girl members.

The Heart of the Hawkeye Council of Camp Fire Girls owns 132 acres with the camp boundry located next to the Ledges State Park on two sides. At the west entrance of the park, the Camp Hantesa land begins and includes land on both sides of the road (the low land and the upper land).

Most of the Camp Hantesa land is upper land and not affected by the 890 flood line for the Saylorville Dam.

Due to the construction of the Saylorville Dam, the Corps of Engineers entered into a contract with Camp Hantesa; resulting with the camp still owning the land but granting a flowage easement to the Corps covering the lower land flooding.

As a result of Saylorville Dam, the wells at the camp had to have casing extensions, electric units placed above the flood line and the electric line going to the wells placed above the flood line.

Also, since the entrance road would have been below the flood line, the Corps of Engineers agreed to build a new road into the camp which comes off of highway 164 to the west of the Camp Hantesa line. A parking lot was needed on the land above the flood line and was constructed on borrow land of the US Government west of the Camp Hantesa land.

The service entrance road was also below the flood line so a bridge was built between the dining room and the swimming pool so that service trucks could get into Camp Hantesa during high water times.

The septic tank location was below the flood line and some work was done on this so the seepage lines would be protected during high water times.

Over 5,000 girls and their families used Camp Hantesa during the year of 1972. The camp is in operation the entire year, with all weekends and some week days throughout the year beinguutilized.

Appendix H

Report of Engineering Sub-Group

Task Force Committee

Saylorville Reservoir Environmental Impact Study

Data Summarized

by State Agency Sub-Group

April 1973

REPORT OF ENGINEERING SUBCOMMITTEE-TASK FORCE FOR STUDY ON LEDGES STATE PARK, SAYLORVILLE RESERVOIR ENVIRONMENTAL STUDY

At the Task Force Meeting held on March 15, 1973, Dr. Merwin Dougal, Chairman, assigned the following persons to the Engineering Subcommittee:

Chris M. Carrier, Chm.	Iowa Natural Resources Council
Tom Albright	Iowa Conservation Commission
Richard Wilcox	Iowa Department of Soil Conservation
Dewey Bondurant	U. S. D. A. - Soil Conservation Service
Howard Johnson	Agricultural Engineering, I. S. U.
Jean Prior	Iowa Geological Survey
Carl Schnoor	Boone County Engineer
George Johnson	Corps of Engineers
John Merritt	Corps of Engineers

In general, the purpose of this subcommittee was to examine the pertinent engineering factors relating to possible plans whereby the Ledges State Park would be protected from flooding due to the backwater effects from Saylorville Reservoir during periods of high pool levels. This group itself did not study alternate reservoir operational plans, but merely examined the various engineering alternatives for protecting the park given the currently planned operational procedure.

We wish to express our thanks to Mr. George Johnson and Mr. John Merritt (and others) at the Rock Island District, Corps of Engineers, for making their engineering data and studies available for our review and use. Our studies of the problems and their alternatives would not have been possible without their assistance.

MAGNITUDE OF PROBLEM

Prior to the examination of possible alternatives for protecting the Ledges State Park from flooding due to the operation of Saylorville Reservoir, the Engineering Subcommittee has assembled the following information to help more clearly define the magnitude of flooding problem for which protection is being considered.

A) PERTINENT ELEVATIONS:

Some pertinent elevations (in mean sea level datum) at Saylorville Reservoir and the Ledges State Park are as follows:

Elevations of Saylorville Reservoir:	
Conservation Pool	833.0
Maximum Flood Pool	890.0
Elevations at Ledges State Park:	
Channel Bottom	853.0
Top of Channel Bank	860.0
Average Flood Plain (in park)	862.0

B) DEPTHS AND DURATIONS OF FLOODING:

One of the primary concerns of many persons and/or groups seeking protection for the park area is that the currently planned operational procedure for Saylorville Reservoir will result in deeper depths of flooding for longer durations than under existing (or natural) conditions. The data tabulated below shows such comparisons for three years during which significant flood events occurred. The "natural peak elevation" refers to the highest water surface elevation actually reached at the Ledges Park during that year, whereas the "reservoir peak elevation" refers to the peak reservoir level that would have been reached for the proposed operational procedure if Saylorville Reservoir had been in operation that year. Further, the number of days indicated for which a given elevation was or would have been exceeded refers to the total number of days during said year and not particularly to any consecutive number of days.

1954: Natural Peak Elevation = 878.0 ft.
Reservoir Peak Elevation = 879.5 ft.

Elevation of Mile 246.1*	Number of Days that Elevation is Exceeded	
	Natural Condition	Reservoir Condition
860.0	16	38
864.0	7	29
870.0	3	21

*River Mile 246.1 is at the southern edge of Ledges State Park, which is 1.1 miles downstream from the confluence of Peas Creek and the Des Moines River.

1965: Natural Peak Elevation = 874.3 ft.
Reservoir Peak Elevation = 889.1 ft.

Elevation at Mile 246.1	Number of Days that Elevation is Exceeded	
	Natural Condition	Reservoir Condition
860.0	48	102
864.0	16	88
870.0	7	79

1969: Natural Peak Elevation = 867.0 ft.
Reservoir Peak Elevation = 882.8 ft.

Elevation at Mile 246.1	Number of Days that Elevation is Exceeded	
	Natural Condition	Reservoir Condition
860.0	60	123
864.0	24	105
870.0	0	72

It should be noted, for example, that although a 1954 flood produced a higher instantaneous peak than occurred in 1965, three smaller floods in 1965 actually produced a much greater total volume of water. Thus, had the reservoir been in operation, it would have reached a higher level in 1965 (as shown) than in 1954.

In addition to the above, it has been determined that, for flood magnitudes occurring more frequently than once in five years (on the average), the reservoir will not appreciably increase either flooding depths or durations.

Examination of the above figures will show that, during certain years, the operation of Saylorville Reservoir will result in increased flooding depths and durations, depending on the total volume of water to be handled. Such increases may be detrimental to the trees and brush in the lower Ledges Park area, and could force existing recreational facilities to be relocated or otherwise protected. Whether or not the increased flooding in the park will cause the accumulation of additional debris and/or silt in the area will depend upon a number of interrelated factors which have not been studied adequately, to date.

C) AREAS FLOODED:

In addition to examining depths and durations of flooding, it is also important to note the amount of land area affected by any increased flooding depth.

For comparison purposes, the flood plain area near the Ledges Park has been sub-divided into three zones as follows: (See Attachment No. 1)

Area A - Area flooded on the east Des Moines River flood plain at the Ledges Park (excluding the area above the mouth of Peas Creek)

Area B - Area flooded above mouth of Peas Creek.

Area C - Area flooded on the west Des Moines River flood plain adjacent to the Ledges Park.

The table shown below indicates the number of acres in each zone that were flooded by the deepest flood on record (1954 flood) and the number that would be flooded at the maximum reservoir flood pool level of 890.0 ft. It should be noted that, under natural conditions, the 1954 flood has a recurrence interval of approximately 40 years, whereas, under reservoir conditions, elevation 890.0 would be reached approximately once in 76 years.

Elevation	Areas Flooded (Acres)		
	Area A	Area B	Area C
878.3	98	9	97
890.0	115	15	101

As pointed out by the above figures, although flooding depths and durations may be increased by the operation of the reservoir during certain years, flooding up to the maximum flood pool elevation in the reservoir would result in the flooding of an additional 23 acres on the east side of the river over and above the number of acres inundated, to date, by the flood of record.

D) PERCENT OF TIME INUNDATED:

In addition to the above, it is also interesting to note the percent of time that water would be above a given elevation, both under natural and reservoir conditions. This data is given below:

Elevation	Percent of Time that Elevation is Exceeded	
	Natural Condition	Reservoir Condition
860.0	3.6	5.4
862.0	2.0	4.0
864.0	1.1	3.2
870.0	0.1	2.0
876.0	0.02	1.2

Thus, as shown by these figures, the amount of time that the Ledges Park area will be flooded, even under reservoir conditions, is quite small.

PREVENTING OR REDUCING FLOOD DAMAGES CAUSED BY SAYLORVILLE RESERVOIR IN THE LEDGES STATE PARK AREA

Assuming that there is no way of altering the proposed operational plan for Saylorville Reservoir, there appears to be only three ways that flood damages resulting from said reservoir could be reduced or eliminated in the Ledges State Park area. These alternatives are discussed below:

A) RELOCATION OF EXISTING FACILITIES:

If, for one reason or another, the structural features discussed in subsequent sections are rejected and not constructed, the only possible way of insuring that park facilities are not damaged is by the relocation or protection of said facilities. Existing facilities that may need to be relocated or protected are as follows:

1-Well and Pumphouse
2-Service Building
3-Latrine Facilities
4-Lodge and Concession Facilities
5-Access Road to Ass't. Custodian's House
6-Park Roads
7-Picnic Shelters
8-Waterlines
9-Landscaping

In addition to the relocation of man-made facilities, it would also be desirable to provide additional land areas to replace those that would be inundated as a result of high reservoir levels. During field inspections of the Ledges Park area, it was noted that the land lying within the Peas Creek and Davis Creek flood plains upstream of the existing park boundaries would appear to be acceptable recreational areas. Thus, some facilities might be relocated into these areas. Further, since these draws extend northward toward Boone, it is possible that hiking and/or bicycle trails could be constructed in these areas that could, then, extend from Boone into the Ledges Park area. Other areas are also available outside of the existing park boundaries that could be used for replacement areas.

Besides the relocation of man-made facilities and the replacement of land inundated, it must be noted that it would not be possible to relocate the existing geological features currently located in the lower Ledges Park area. In a report entitled "Geological Resources and Effects of Flooding Within the Lower Ledges State Park, Boone County, Iowa", Mrs. Jean C. Prior, Iowa Geological Survey, states that "Backwater flooding resulting from periodic rises in the flood pool of the Saylorville Reservoir will temporarily cover the lower portions of Ledges Park. The most serious effect of this flooding, from the geological viewpoint, will be the denial of access to the area where the sandstone formations are best exposed and offer the most picturesque scenery and educational value. The effects of floodwater on the exposed sandstone ledges themselves will be minimal. There is little potential for undermining and erosion as floodwaters will rise and fall slowly and currents will be slow-moving. To whatever possibility exists for erosion of some of the more weakly cemented zones in the sandstone, can be added the possibility of the opposite effect, "case-hardening." Through this process, the surface of a porous rock, such as sandstone, becomes

hardened through contact with mineral-bearing waters. If floodwaters remain at a single elevation for an extended period of time, it is also possible some staining of the rock surface may occur. However, water seeping down the rock faces from above has already resulted in extensive natural staining of the sandstone walls."

If this alternative is chosen, the existing trees and brush in the lower park areas would not be protected from flooding and could, therefore, still be damaged by the higher flood stages and longer durations. The Corps of Engineers is, however, considering a plan whereby the lower Ledges area would be cleaned up and otherwise renovated after large flood events.

In addition to the above, we wish to point out that any relocation of facilities could be made only so long as sufficient funds are made available. It is estimated that the cost of this alternative would be, at a minimum, at least $300,000, excluding the costs of park renovation after floods and any additional land that may be obtained. Further, any such plan would also need to be coordinated with the general park use plans of the Iowa Conservation Commission.

B) BARRIER DAM AT MOUTH OF PEAS CREEK:

Another alternative that would protect from flooding at least a portion of the critical area within the park is the construction of a barrier dam at the mouth of Peas Creek. Although such a structure would not protect the land in Area A (mentioned above) from flooding, the uplands along Peas Creek and Davis Creek (Area B) would be protected.

From discussions with all parties concerned, it is apparent that this alternative is entirely unacceptable. Construction of a barrier dam at this location would involve the building of an embankment 25-30 ft. high at the mouth and any such feature would alter the natural beauty of this area. Further, in addition to the dam itself, some provision would need to be made to handle the flows from Peas Creek. If this runoff were to be temporarily stored behind the dam, it is possible that it would result in the periodic flooding of the upstream areas anyway.

C) CHANNEL CHANGE AND BARRIER DAM LOCATED ON WEST EDGE OF DES MOINES RIVER FLOOD PLAIN:

The last alternative to be investigated consists of making a channel change on the Des Moines River and constructing a barrier dam across the flood plain as far to the west as possible (See Attachment No. 1). Those parties favoring this alternative point out that, by putting the dam at this location, the greatest land area would be protected from any increases in flooding and the existing trees and brush would help obscure the dam from the view of the park users. Further, the oxbow lake created by the channel change and dam could be used for recreational purposes.

In the subsections below, various aspects of this alternative are discussed from an engineering standpoint. It should be noted that this discussion must, of necessity, remain in rather general terms, as complete and detailed engineering studies are quite expensive and will not be made unless it is definitely decided to proceed further with this alternative.

1) BARRIER DAM DIMENSIONS:

If the barrier dam is to be built, as proposed, it must be capable of withstanding the maximum expected stages without overtopping and thus failing. This would mean that the structure would have an average height of 32 feet including three feet of freeboard to allow for wave action, etc. Accordingly, upon completion of preliminary studies of this alternative by the Corps of Engineers, it would appear that the barrier dam cross section would need to have the dimensions shown on Attachment No. 2 in order to be a stable structure and perform adequately. This dam would be approximately 7000 ft. long and cover a land area of about 55 acres. It is estimated that such a dam would require approximately one 1.3 million cubic yards of compacted soil to construct. Further, since the alluvial soil on the flood plain area is generally unacceptable for this use, an adequate soil would need to be hauled in from higher ground in the area. It is estimated that to obtain this volume of soil, it would require the excavation of 130 acres to a depth of approximately 6-8 feet.

2) SUBSOILS BELOW BARRIER DAM:

In addition to providing for a safe dam above the natural ground level, it is equally important to place the structure on an adequate foundation. If, for example, the dam was constructed of an almost impervious material so that water could not seep through it, it would still be possible for the structure to fail if the foundation soil was pervious and sufficient seepage occurred beneath the dam and weakened its foundation.

Although the Corps of Engineers has not yet undertaken a detailed study of the subsoils in the area of the barrier dam, it is felt that some problems could exist as the soils on the flood plain (as mentioned above) are alluvial type soils that could be unsatisfactory foundation materials by themselves. Further, it is also known that this soil extends to a depth of approximately 25-30 feet below the natural ground level. Thus, it is possible that, in addition to the construction of the dam above ground, extensive work would need to be done to insure a minimum of seepage in the foundation soils. This could result in the construction of cutoff walls, core trenches, etc. (as a minimum) and greatly increase the cost of the structure.

3) INTERIOR DRAINAGE AND PONDING AREAS:

In order to build the barrier dam, it will be necessary to provide areas in which the runoff water from the Peas Creek and Davis Creek watershed areas can be stored (or temporarily ponded), if necessary, behind the dam during times of high reservoir levels. Since the drainage area of these watersheds are approximately 9-10 square miles (total), a considerable volume of water may need to be stored in the ponding areas thus possibly flooding many acres of land behind the dam. For this reason, it was necessary to coordinate the design of these ponding areas and related outlets (through the dam) with biologists and botanists to insure that this ponding of interior drainage waters would not harm the trees and brush in the area, thus possibly defeating part of the purpose of the dam.

To illustrate the situations during which these interior drainage facilities must operate, see Figures A and B below. Figure A shows that, under low river conditions, the outlet through the dam would be open and, during normal runoff periods on the interior watersheds, the conduit would pass all the flow. Note, however, that if the runoff rate from the watersheds exceeds

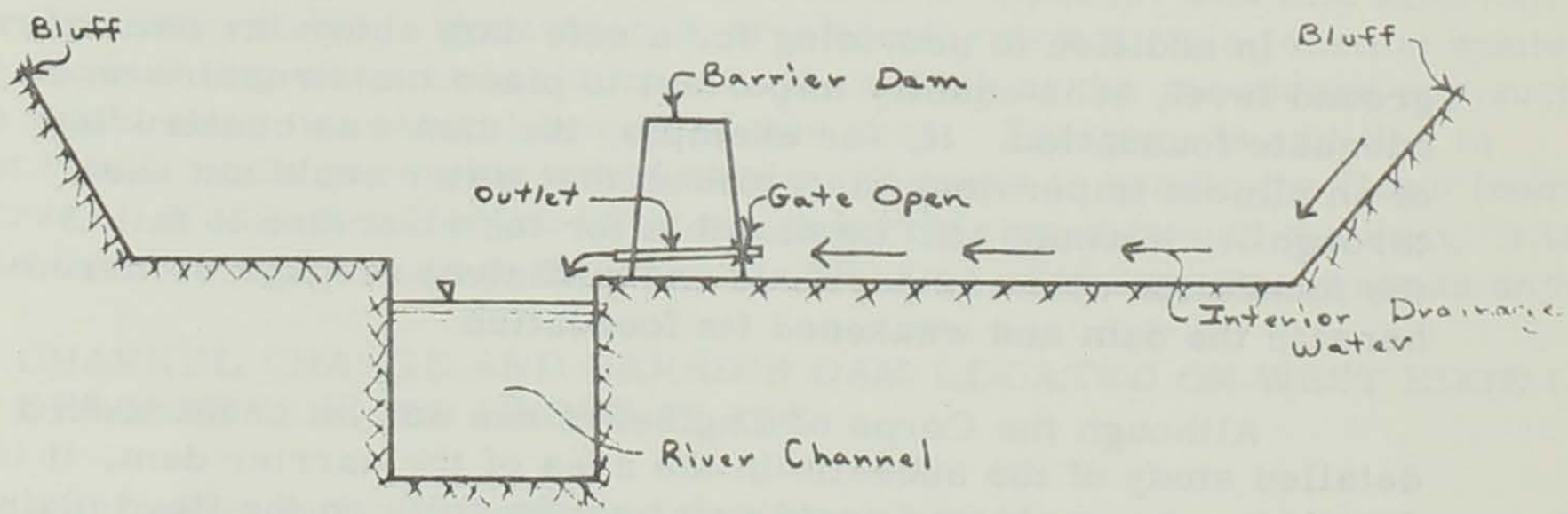


FIGURE A - LOW FLOW CONDITION

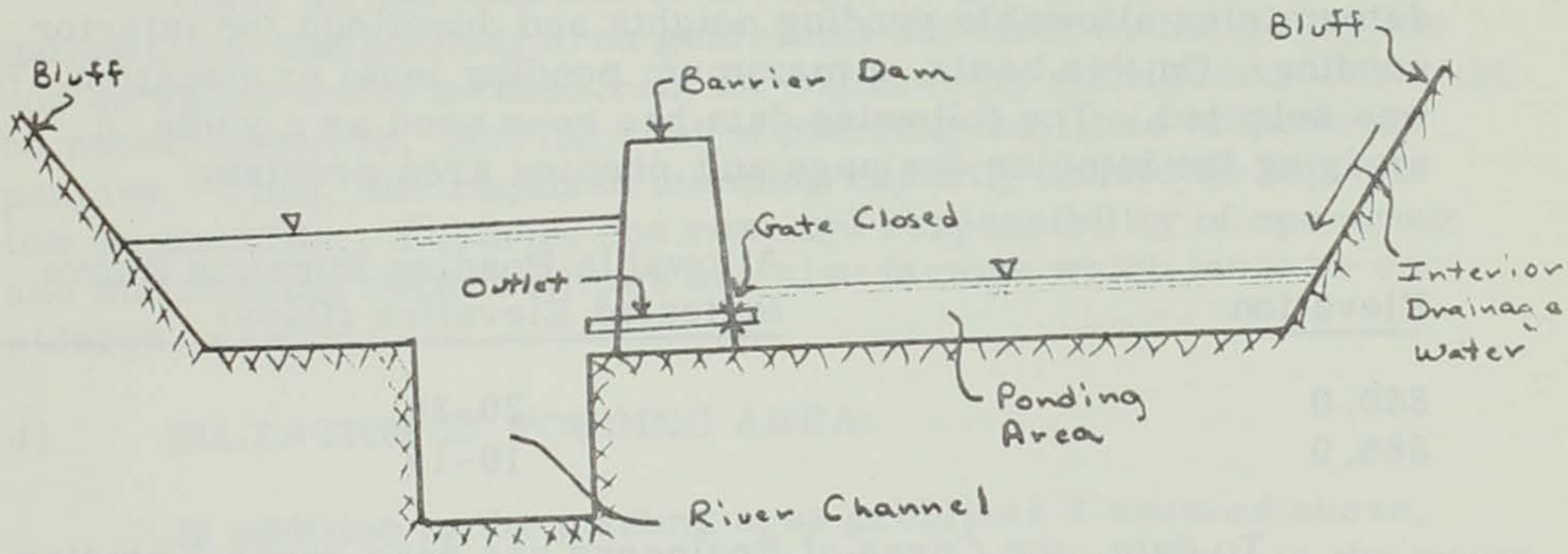


FIGURE B - FLOOD FLOW CONDITION

the capacity of the outlet to pass said runoff, then some interior ponding would occur. In Figure B, a high stage exists on the riverward side of the barrier dam necessitating the closing of the outlet so as to prevent water from backing up behind the dam. With the outlet closed, the interior drainage water cannot escape and must be stored behind the dam in the ponding areas. If, for one reason or another, the water in the ponding area must be removed or lowered; this could be accomplished by pumping the water over the dam itself.

In discussing the need for interior ponding areas with persons knowledgable in the fields of biology and botany, it was determined that some interior ponding could occur behind the barrier dam at the Ledges without significantly harming existing trees or brush. Since it is known that these trees have withstood past flood events, these natural floods were used as a guide in determining allowable ponding heights and durations for interior ponding. On this basis, a maximum ponding level at elevation 878.0 was selected. The following data has been used as a guide in studying the interior drainage and ponding area problem:

Elevation	Allowable Ponding Duration Above Indicated Elevation (Days)
860.0	20-30
865.0	10-14

To date, the Corps of Engineers has done several studies on the interior drainage problem in light of these limitations. These studies were conducted by assuming that a 6 ft. x 8 ft. culvert is to be used as the outlet from the ponding area.

Assuming that there was gravity drainage through the dam (Figure A above), several different magnitudes of storms were applied to the interior watersheds with the following results:

Storm Frequency (years)	Peak Elevation Reached in Ponding Area	Duration above Indicated Elev.	
		860.0	865.0
25	871.4	30 hrs.	18 hrs.
50	873.3	33 hrs.	22 hrs.
100	874.8	35 hrs.	25 hrs.

If, on the other hand, the outlet was closed (Figure B above), the following peak elevations were obtained as a result of the indicated storms being applied to the Peas Creek and Davis Creek watersheds:

Storm Frequency (years)	Peak Elevation in Ponding Area (m.s.l.)
1	869.0
2	870.7
5	872.8

In the latter case, and if the reservoir was up sufficiently long, it may be necessary to pump the water from the ponding area

in order to meet the "allowable ponding duration" guidelines. From preliminary studies, the Corps of Engineers estimates that, by using a 50,000 g.p.m. capacity pump, the above elevations could be reduced to elevation 862.0 in 3, 4, and 5 days respectively.

Thus, an examination of the figures given above tends to indicate that the ponding area guidelines set forth by the biologists and botanists could be met from an engineering standpoint. It should be noted, however, that the cost of pumping facilities is quite expensive. Thus, the required pumping capacity should be kept as low as possible. Further, the cost and responsibility of operating and maintaining such facilities are also factors which must be considered.

4) SILTATION IN PONDING AREA:

In addition to the ponding area problems discussed above, some problems may also exist due to the presence of silt in the water that would be temporarily stored behind the barrier dam. As this silt settles out in the ponding areas, said areas may, over a period of time, tend to lose their capacity. Thus, although the magnitude of this problem has not been thoroughly investigated, this siltation could result in a maintenance problem in the lower Ledges Park areas behind the barrier dam.

5) SUBIMPOUNDMENTS ON PEAS CREEK AND DAVIS CREEK:

The possibility of constructing small dams on Peas Creek and Davis Creek (outside the Ledges Park area) was investigated. These structures would be located in the general area as shown on Attachment No. 1. If constructed, these dams could be made to retard the interior drainage waters of the watersheds and thus reduce the volume of water that would need to be ponded within the ponding areas. Further, said structures may tend to reduce the silt load of the water entering the ponding areas.

The Corps of Engineers has undertaken preliminary studies on these sub-impoundments and the following data relative to them has been obtained:

	Peas Creek Impoundment	Davis Creek Impoundment
Height of Dam	70 ft.	55 ft.
Length of Dam	700 ft.	430 ft.
Conservation Pool Data:		
Pool Elevation	969 ft.	982 ft.
Area Flooded	27 ac.	3 ac.
Flood Pool Data:		
Maximum Pool Elevation	994 ft.	1,018 ft.
Area Flooded	66 ac.	23 ac.
Flood Control Storage Available	1,210 ac.-ft.	430 ac.-ft.

It must be noted that, although it would certainly be possible to construct said dams, it would require the inundation of 30-83 acres of land on the Peas Creek and Davis Creek valleys. As previously indicated, said areas appear to be quite suitable for recreational purposes and whether or not lakes are the best use for these areas would need to be determined by other persons through further studies. Also, the recreational benefits resulting from said lakes would need to be weighed against their costs. It should also be noted that, although these structures could reduce the inflows into the ponding areas, it is felt that the ponding area requirements can be met without the construction of these reservoirs.

6) CHANNEL CHANGE:

The channel change, as shown on Attachment No. 1, would be necessary to enable the placement of the barrier dam as far to the west as possible. This would, in turn, necessitate placing the channel next to the west bluff and would also create an oxbow lake at the location of the old channel. Due to the fact that the channel change will reduce the channel length in the vicinity of the project, the stream slope will increase resulting in higher velocities of flow. This fact, combined with the absence of any overbank area due to the presence of the barrier dam, could result in highly erosive velocities during the flood events for which the reservoir pool will not extend up into the area of the dam. These high velocities could result in severe erosion of the bed and banks of the channel as well as the riverward face of the dam. This could necessitate the placement of riprap on the exposed face of the dam.

In addition to the above, it should be noted that channel changes, such as the one proposed, appear to have adverse effects on the fish habitats in the vicinity of the change. Additional details on this matter can be obtained through the Iowa Conservation Commission. This channel change, along with the construction of the barrier dam itself, would also necessitate the use of many acres of land that could, during periods of normal flows in the river, be used for open space and/or recreational purposes.

7) COST ESTIMATES:

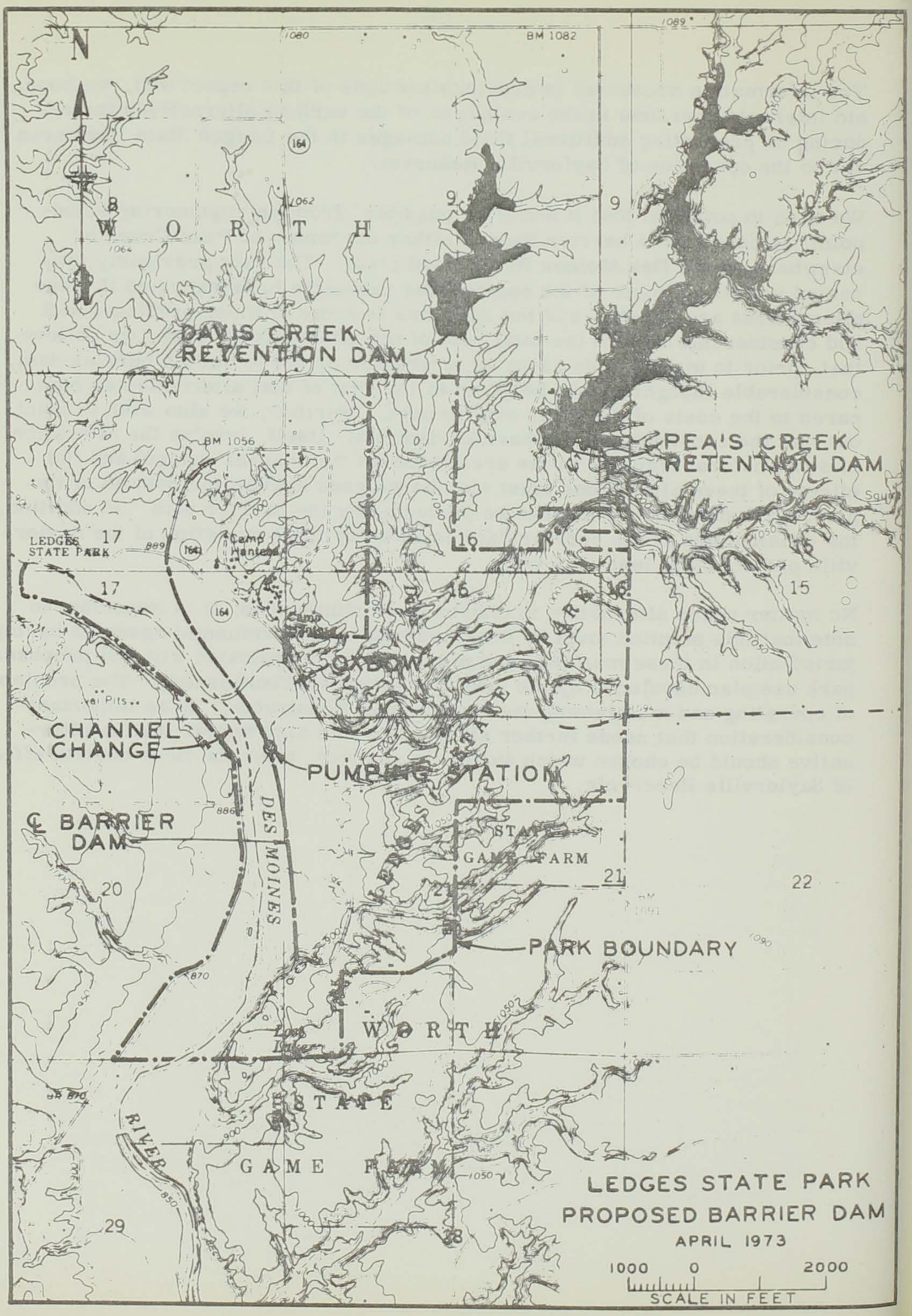
On the basis of the preliminary studies conducted, to date, by the Corps of Engineers, it is estimated that the cost of the barrier dam and channel change alternative will be approximately 5.4 million dollars. It should be noted that this estimated cost reflects the use of maximum permissible (temporary) ponding in the park with a 50,000 g.p.m. capacity pumping system. Other barrier dam alternatives with less ponding and retention reservoirs on Peas and Davis Creeks are considerably more costly.

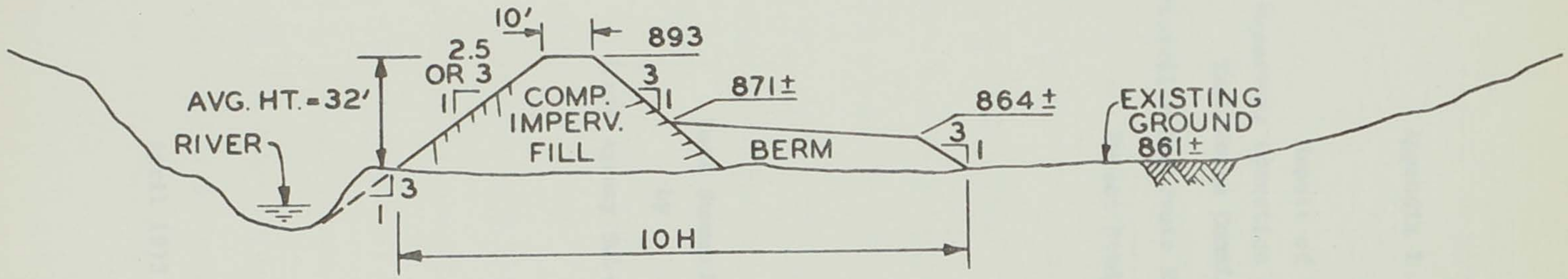
CONCLUSIONS

The information presented in previous sections of this report will, we hope, aid interested persons in the evaluation of the various alternatives for reducing or preventing additional flood damages in the Ledges State Park area due to the operation of Saylorville Reservoir.

We wish to point out that it would be possible, from an engineering standpoint, to construct a barrier dam at either the mouth of Peas Creek or elsewhere on the Des Moines River flood plain. The data previously presented points out some of the engineering problems to be expected if these alternatives are chosen, and the solutions to some of these problems will add considerable cost to the total cost of the alternative. Thus, we believe that, prior to making a decision as to whether or not to build a barrier dam, considerable thought should be given to the cost of that alternative as compared to the costs of the other alternatives. Further, we also wish to point out that the construction of a barrier dam will, itself, involve the alteration of some natural features in the area (such as the channel change) and the effects of these alterations must also be weighed against the results of the periodic flooding of the area to be protected by the barrier dam. In addition, the construction of the barrier dam could delay the completion of the Saylorville project by at least one year.

No matter which alternative is chosen or recommended, it is important to note that this solution must be acceptable to all governmental agencies having jurisdiction in these matters, and must also be coordinated with the proposed park use plan developed by the Iowa Conservation Commission. The problems of operating and maintaining the works, once constructed, is an important consideration that needs further study. It would also appear that no alternative should be chosen which would, in any way, alter the flood control effects of Saylorville Reservoir.


N
BM 1082
DAVIS CREEK
RETENTION DAM
PEA'S CREEK
RETENTION DAM
BM 1056
LEDGES
STATE PARK
Camp
Hanford
Camp
Stanley
OXBOW
CHANNEL
CHANGE
PUMPING STATION
℄ BARRIER
DAM
DES MOINES
STATE
GAME FARM
PARK BOUNDARY
LOST
RIVER
STATE
GAME FARM
RIVER
LEDGES STATE PARK
PROPOSED BARRIER DAM
APRIL 1973
1000 0 2000
SCALE IN FEET



BARRIER DAM

TYPICAL SECTION
OF
BARRIER DAM

Appendix I

Report of

Reservoir Operation Sub-Group

Task Force Committee

Saylorville Reservoir Environmental

Impact Study

Data Summarized

by

State Agency Sub-Group

April 1973

MEMORANDUM TO CHAIRMAN, GOVERNOR'S INTERAGENCY RESOURCES COUNCIL TECHNICAL TASK FORCE SAYLORVILLE ENVIRONMENTAL IMPACT STUDY

SUBJECT: REPORT OF RESERVOIR OPERATION SUBGROUP

DATE: April 18, 1973

Background

On March 15, 1973, the members of the Governor's Interagency Resources Council Technical Task Force Saylorville Environmental Impact Study met to organize a review and study of the impact of the operation of Saylorville Reservoir upon the Ledges State Park. Said Technical Task Committee was formulated through the Interagency Resources Council to which a summary report will be submitted upon completion of the task assignment.

At the organizational meeting of the Technical Task Force, the following four subgroups were formed:

1. Engineering Subgroup
2. Planning Subgroup
3. Reservoir Operation Subgroup
4. Materials Extraction Subgroup

The following is the report of the Reservoir Operations Subgroup.

Introduction

On March 21, 1973, the following individuals met in the conference room of the Rock Island District of the Corps of Engineers to review and obtain information relative to the operation of the Saylorville Reservoir.

George Johnson	Corps of Engineers
Satyesh K. Nanda	Corps of Engineers
Steve Brenton	State Conservation Commission
Tom Albright	State Conservation Commission
Sam Switzer	State Conservation Commission
J. F. Cooper	Iowa Natural Resources Council

The following topics of operation were discussed:

1. Release rates from reservoir based on current operating Procedure;
2. Alternative Operating procedure;
3. Flood water storage available at Ledges State Park;
4. Frequency of flooding of Ledges State Park;
5. Effect of operation of reservoir in downstream reaches of Des Moines River.

At the conclusion of the meeting the following information was requested:

1. Outlet rating curve 22' diameter, Saylorville Lake;
2. Elevation - capacity curve for area east of proposed barrier dam at Ledges State Park;
3. Area inundated on the east side of Des Moines River at Ledges State Park;
4. Flood area - Des Moines River Saylorville Dam site to Euclid Avenue;
5. Computed water surface profiles, Des Moines River between Saylorville Dam site and 2nd Avenue bridge.

The above five requested items were received March 23, 1973.

On the basis of the information received March 21, and March 23, 1973, and the Master Reservoir Regulation Manual, Des Moines River, Iowa, and Minnesota, the following findings and conclusions are made relative to the operation of Saylorville Reservoir.

Findings:

1. The following release rates from Saylorville Reservoir will be made in accordance with the currently proposed operating procedure for the reservoir.

   Inflow into the reservoir from upstream reaches of the Des Moines River up to 8,000 cfs. will be released. For inflow into the reservoir of greater than 8,000 cfs., a release rate of 8,000 cfs. will be maintained until the level of the reservoir increases to elevation 875. For reservoir levels of elevation 875 or greater, the following release rates corresponding to the indicated reservoir level will be maintained:

Reservoir Level Ft. above msl.	Reservoir Release Rate cfs.
875	10,000
879	12,000
880	14,000
881	16,000
882	18,000
883	20,000
884	21,000
884-889	Maintaining 21,000 cfs. by closing conduit
889-890	Increase release rate to 42,000 cfs. by opening conduit

2. The 22 ft. diameter conduit through which all reservoir outflow passes for reservoir levels of elevation 884 and below has the following uncontrolled discharge capacity.

Reservoir Level Ft. above msl.	Conduit Discharge Capacity (cfs.)
833 (conservation pool level)	11,800
840	13,600
850	15,900
860	17,600
870	19,200
880	20,600
884	21,000

3. Assuming a flow of 60,000 cfs. in the Raccoon River the following listed flood plain areas along the Des Moines River between the Saylorville Dam site and the City of Des Moines (Center Street Dam) will be inundated due to the occurrence of the corresponding listed flows in the Des Moines River.

Flow in Des Moines River cfs.	Area Inundated acres
8,000	Bankfull Stage
10,000	619
12,000	1,300
14,000	1,700
16,000	2,050
18,000	2,325
20,000	2,542
40,000	3,974
60,000	5,140

For lesser flows in the Raccoon River the indicated areas of inundation would be reduced because of reduced influence in stage from the Raccoon River in reaches downstream from approximately Euclid Avenue.

4. During the period of 1922 to 1970 the Ledges State Park was flooded

at or above the elevation of 860.0 five hundred and eighty three (583) days. Had the reservoir been in place and operated according to the procedure presently proposed, the Ledges State Park would have been flooded at or above the elevation of 860.0 nine hundred and twenty four (924) days.

5. Upstream Pease Creek from the Des Moines River bluff line land areas at or below the indicated elevation are listed as follows.

Elevation Ft. above msl.	Areas below given Elevation (Acres)
870	4
878	9
884	12
890	15
892	18

6. The approximate volume of flood storage which would be removed from the Saylorville impoundment due to construction of the barrier dam would be approximately 3,000 acre feet.

7. The alternatives to the presently proposed procedure of operation as studied by the Rock Island District of the Corps of Engineers are listed below:

a. Maintain conservation pool at elevation 833 with flood pools at elevation

1. 884
2. 878
3. 870

b. Maintain no conservation pool with flood pools at elevation

1. 890
2. 884
3. 878
4. 870

c. Maintain no conservation pool in Saylorville or Big Creek

with flood pools at elevation

1. 890
2. 884
3. 878
4. 870

d. Maintain no conservation pool at Saylorville, Big Creek, and Red Rock, with flood pools at elevation

1. 890
2. 884
3. 878
4. 870

e. Discontinue work on project and leave structures in place as it presently exists.

f. Discontinue project and remove partially completed dam and appurtenant works.

g. Retain flood pool at elevation 890, conservation pool at elevation 833, and build barrier dam around Ledges State Park.

h. Retain conservation pool at elevation 833, build dikes or barrier dams at Ledges Stste Park and provide flood pools at elevation

1. 884
2. 878
3. 870

i. Retain conservation pool at elevation 833.0, improve downstream channel and provide flood pools of elevation

1. 884
2. 878
3. 870

j. Purchase all lands to edge of 890 flood pool.

8. That the Red Rock and Saylorville Reservoirs will be operated as a system in series.

9. That reducing the flood control storage in Saylorville reservoir by reducing the flood pool elevation or other wise changing the reservoir

operation scheme would reduce the level of protection provided by the Des Moines local protection project up to 50% depending upon the alternative selected.

Conclusions

1. That up to the Saylorville pool elevation 884, the maximum attainable release rate through the 22 ft. diameter conduit equals or exceeds the release rate provided for in the proposed scheme of operation.

2. That of the 25 alternate schemes of operation for Saylorville Reservoir being studied by the Corps of Engineers, 20 of those will increase the frequency of flooding in downstream reaches of the Des Moines River when compared with the presently proposed operating procedure.

3. That should any one of the 20 alternate schemes which increases the frequency of flooding in downstream reaches of the Des Moines River be considered for implementation, further review will have to be given by

   a. The City of Des Moines
   b. Polk County
   c. Various State Agencies including
      1. State Conservation Commission
      2. Iowa Natural Resources Council

4. That loss of flood storage in the Saylorville Reservoir through construction of a barrier dam would be negligible.

5. That change in the presently proposed operating procedure for Saylorville Reservoir to increase the frequency of flooding in downstream reaches may require renegotiation of flooding

easements within Red Rock Reservoir impoundment area.

This report is respectfully submitted by the members of the Reservoir Operation Subgroup,

Tom Albright,
State Conservation Commission

Steve Brenton,
State Conservation Commission

Jim Cooper,
Iowa Natural Resources Council

Appendix J

Initial Report of
Second Technical Task Force
Land Use and Flood Plain Management Program
Saylorville to Des Moines Reach
Des Moines River

Data summarized by

State and Local Agency Committee

April 1973

Governor's Inter-Agency Resources Council
Technical Task Force
Landuse Evaluation Between Saylorville Reservoir
and Des Moines Local Protection Works

Summary of Meeting of April 17, 1973

The meeting was called to order at 1:30 P.M., April 17, 1973, in the library of the Argonne Armory by Dale R. Tekippe, Chairman. An attendance list is attached. (Addendum 1) Also attached is a copy of the tentative meeting agenda. (Addendum 2) The Chairman opened the meeting with the following introductory remarks.

The Governor's Inter-Agency Resources Council at its February 23, 1973, meeting set up two technical task forces.

1. A technical task force to study the environmental effects of the reservoir upstream of Saylorville dam and specifically in the Ledges State Park Area.
2. A technical task force to evaluate green belt programs, environmental corridors, and landuse controls downstream of Saylorville dam to the upstream limits of the Des Moines local flood protection works (approx. 6th Avenue).

The first technical task force has already met and set up the following sub-groups to do detailed studies and report back to the task force.

1. Engineering Sub-group regarding Ledges
2. Planning Sub-group regarding Ledges
3. Reservoir Operations Sub-group
4. Materials Extraction Sub-group, sand and gravel in reservoir area.

These sub-groups are to report back to the task force on April 26, 1973. It would appear that the primary coordination of our downstream task force would be with the reservoir operations sub-group.

It is the intent of this meeting then, to promote further coordination of any downstream studies, review the current status of said studies, and determine if additional coordination or studies are needed.

The meeting then moved on to the second phase indicated in the tentative agenda, "Status of Current Studies and Proposed Future Work."

The first report was given by Mr. Ray Stearns, Rock Island District, Corps of Engineers. Mr. Stearns began with an outline of their proposed Des Moines River Environmental Corridor (Addendum 3) He further indicated that the environmental corridor proposal was being coordinated with the State Conservation Commission and the City of Des Moines. The State Conservation Commission has, at the request of the City of Des Moines, asked that the environmental corridor be extended downstream to the Sixth Avenue bridge in Des Moines (Addendum 4).

The Des Moines River Environmental Corridor is one portion of the total Des Moines River Basin Study. Funds for this study were exhausted in 1972. It is anticipated that additional funding will be available to continue the study in the fall of 1974. When the study is continued it will be coordinated with the local units of government. Mr. Stearns indicated that if the environmental corridor is approved by higher authority the earliest possible appropriations would be in 1976.

Mr. Tekippe then outlined the authority and responsibilities of the Iowa Natural Resources Council. He indicated that currently, under Chapter

455A.33, Code of Iowa, 1973, approval of the Resources Council is required for any construction project on the flood plain. The flood plain in this area would be outlined by the Corps of Engineers Standard Project Flood.

Chapter 455A.35, Code of Iowa, 1973, gives the Resources Council authority to do comprehensive studies on defined reaches of streams and to establish encroachment lines and minimum protection levels appropriate to the flooding characteristics of the stream and to the reasonable use of the flood plains. This section of the Code further indicates that the Resources Council may cooperate with and assist local units of government in the establishment of encroachment limits, flood plain regulations and zoning ordinances relating to flood plain areas within their jurisdiction. Encroachment limits, flood plain regulations, or flood plain zoning ordinances proposed by local units of government shall be submitted to the Council for review and approval prior to adoption by such local units of government. Changes or variations from an approved regulation or ordinance as it relates to flood plain use shall be approved by the Council prior to adoption. Individual applications, plans, and specifications and individual Council approval orders shall not be required for works on the flood plains constructed in conformity with encroachment limits, flood plain regulations, or zoning ordinances adopted by local units of government and approved by the Council.

Mr. Tekippe indicated that the floodway study needed as a technical foundation for flood plain landuse controls had not yet been completed. He did indicate, however, that the study has been initiated and a target date of fall 1973 has been set for its completion.

Mr. Brenton, Iowa Conservation Commission, indicated that their position on the environmental corridor, as referenced earlier by Mr. Stearns, had been formalized and forwarded to the Corps at an earlier date (Appendix IV). He had nothing further to add to this time.

Mr. Wilcox, Iowa Department of Soil Conservation, indicated that his department had no comments at this time.

Mr. Samel, CIRALG, had no comments.

Mr. Brown, Polk County Planning Director, indicated that they were interested in flood plain landuse controls and would probably await completion of the floodway study.

Mr. Bills, Polk County Conservation Board, expressed concern with the cost of managing the environmental corridor if this management is eventually turned over to the local units of government.

Mr. Mickle, City of Des Moines, Plan and Zone Department, indicated that it was his feeling that the floodway area should be purchased outright and that the floodway fringe should have some form of negative construction easements, etc., as it has been his experience that the local governments are very susceptible to pressure from influential local developers. He also indicated that the City wants to coordinate their proposed bicycle trails with the Corps and the State Conservation Commission to be assured that they will fit into overall recreation planning. He expressed extreme concern regarding any change in the operational plan for Saylorville Reservoir that would result in a lowering of the level of protection afforded the City of Des Moines.

Several participants at the meeting indicated that they felt that further progress on the downstream problems could not be made until a firm operational

plan for Saylorville was arrived at and further floodway studies on this reach have been completed. It was, therefore, indicated by the Chairman that further action of this task force would await the report of the reservoir operations sub-group previously referenced.

The meeting was adjourned at 4:02 P. M.

Addendum 1

IOWA NATURAL RESOURCES COUNCIL

A Meeting / ~~Conference~~ on Des Moines River, Saylorville-Des Moines
Subject

held at Argonne Armory, Des Moines on April 17, 1973
Location Date

NAME	ORGANIZATION	ADDRESS
e R. Tekippe	Iowa Natural Resources Council	Des Moines, Iowa
A. Wilcox	Dept. of Soil Conservation	Des Moines, Iowa
amel	CIRALG	Des Moines, Iowa
Brown	Polk County	Des Moines, Iowa
ne A. Bills	Polk County Conservation Board	Granger, Iowa
y L. Pryor	Plan & Zone Department City of Des Moines	Des Moines, Iowa
ick Ziuchkovski	City of Des Moines, Plan & Zone	Des Moines, Iowa
e Brenton	Iowa Conservation Commission	Des Moines, Iowa
is M. Carrier	Iowa Natural Resources Council	Des Moines, Iowa
Davis	Corps of Engineers	Rock Island, Illinois
ert K. Baker	Corps of Engineers	Rock Island, Illinois
ant N. Nerikar	Iowa Conservation Commission	Des Moines, Iowa
G. Stearns	Corps of Engineers	Rock Island, Illinois
e Cockerill	Corps of Engineers	Rock Island, Illinois
Mickle	City of Des Moines	Des Moines, Iowa

Addendum 2

GOVERNOR'S INTER-AGENCY RESOURCE COUNCIL

TECHNICAL TASK FORCE
LANDUSE EVALUATION BETWEEN SAYLORVILLE RESERVOIR
AND DES MOINES LOCAL PROTECTION WORKS

TENTATIVE MEETING AGENDA
APRIL 17, 1973
ARGONNE ARMORY, DES MOINES

1) Introduction
   - Iowa Natural Resources Council

2) Status of Current Studies and Proposed Future Work
   - Federal
     - Corps of Engineers
   - State
     - Iowa Natural Resources Council
     - State Conservation Commission
     - Department of Soil Conservation
   - Local Units of Governments

3) Immediate Work Needed

4) Future Coordination Meetings

Addendum 3

DES MOINES RIVER ENVIRONMENTAL CORRIDOR

GENERAL

The primary purpose of this project is to provide additional flexibility in the operation of the Saylorville Reservoir. In anticipation of the release of discharges from the reservoir in excess of the existing channel capacity, it is considered essential to take measures that would eliminate, insofar as practicable, the flood damage that would otherwise occur as a result of such discharges. The reach of flood plain contemplated in this project extends to the city limits of Des Moines, about 7 river miles or about 4.5 valley miles. Purchase of corridor lands in this reach would control their use and provide for more flexible operation of Saylorville Reservoir.

PROJECT OBJECTIVES

The project would have the following objectives:

a. Provide flexibility of operation for the Saylorville Reservoir.

b. Preserve the natural features of undeveloped areas in the reach.

c. Prevent encroachment of the nature areas.

d. Discontinue cultivation of bottomland areas in the reach with subsequent prevention of crop damage.

e. Provide special recreational facilities and opportunities.

PROPOSED PLAN

The project would involve purchase in fee by the Federal Government of 1,100 acres and acquisition of flowage easements on an additional 3,180 acres. These lands are in the Des Moines River flood plain between the Saylorville Dam and Des Moines. The channel in this reach has a bankfull capacity of about 10,000 cubic feet per second and a capacity 2 feet below bankfull of 8,000 cubic feet per second. Releases during reservoir elevations greater than 875 would exceed channel capacity and cause crop damage. Saturation of land adjacent to the river would begin as discharges exceed 8,000 cubic feet per second. The land to be purchased in fee, therefore, would be that inundated by a reservoir release of 11,000 cubic feet per second. This taking would insure against saturation damage from flows of 10,000 cubic feet per second, a flow that will have a frequency of once in about 3.7 years. Flows of that quantity occur naturally once in about 1.8 years.

The land on which floware easements would be acquired is that which would be inundated by coincident flows on Beaver Creek and from the reservoir having recurrence intervals of once in 100 years. A stock fence would be erected on the project boundary.

RECREATIONAL DEVELOPMENT

The development would include foot and bicycle trails, staging and parking areas, and bridging of streams entering the Des Moines River. A foot trail 5 feet wide on one side of the river and a bicycle trail 8 feet wide on the other side would be constructed, both for the entire length of the corridor. The trails would be formed by clearing and compacting the existing soil to blend with the natural environment. The width of the trails would allow the use of small utility vehicles for maintenance.

Streams tributary to the Des Moines River and crossing the trails would be bridged with rough-form precast concrete slabs. These slabs would have curbs to retain a thin layer of compacted soil which would provide a surface in keeping with the trails.

Four access and public use areas would be provided in conjunction with the trails, two on each side of the river. Locations would be at the downstream end of project and at the approximate mid-point. Two additional areas, part of Saylorville Dam and Reservoir project, are proposed for the tailwater region of the dam. Included in the corridor areas would be surfaced parking areas, sanitation facilities, water supply, boat launching ramps, and necessary facilities for day-use and camping. Because of the special features of the corridor, the project would offer opportunities to the fisherman and the hunter without significant adverse effects upon the environment.

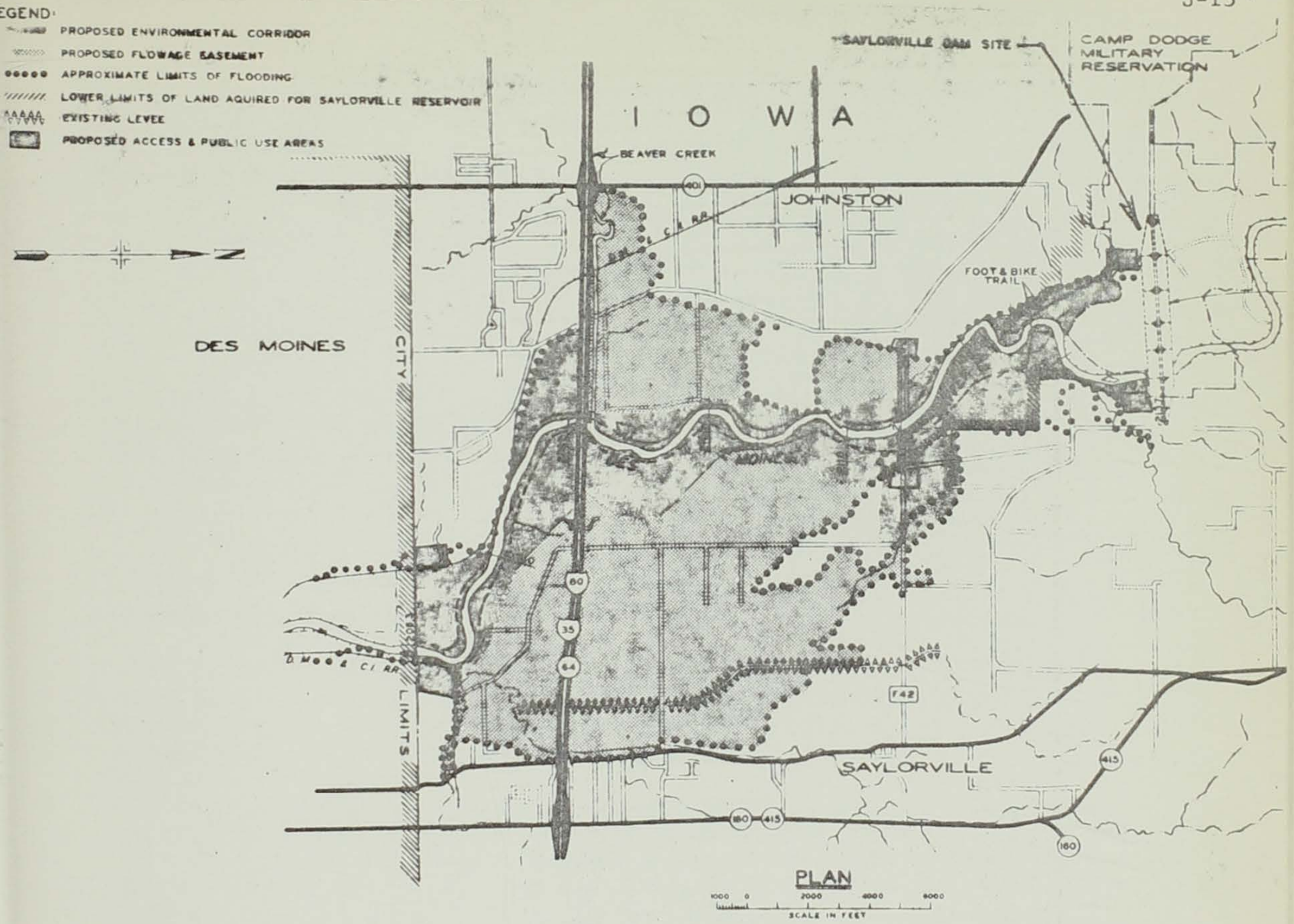
To provide additional flexibility in the Saylorville Reservoir operation the feasibility of increasing the existing channel capacity to allow larger in-bank flows was investigated. Another plan investigated utilized levees along both sides of the river. The estimated cost of both of these alternatives greatly exceeded the cost of acquiring the land for an environmental corridor.

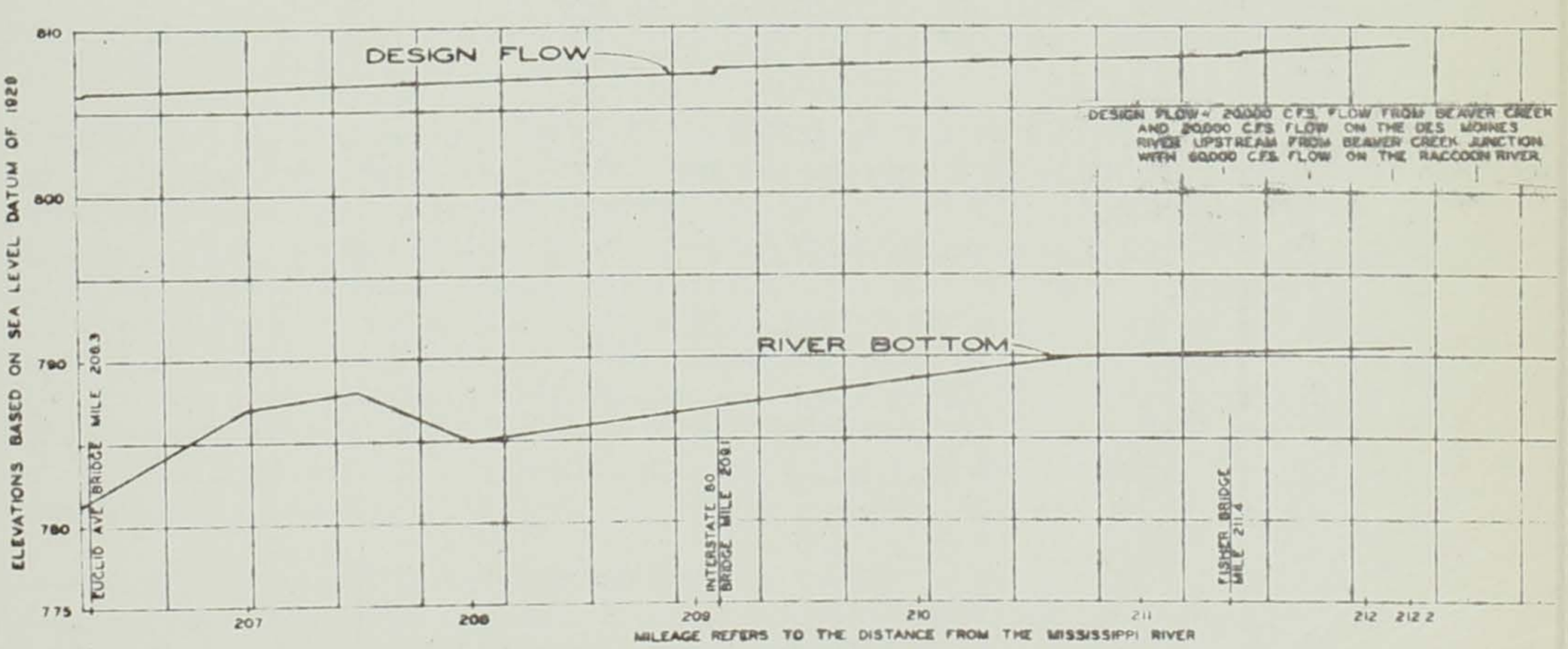
ESTIMATED COST FOR DES MOINES RIVER ENVIRONMENTAL CORRIDOR

Estimated first cost to the Federal Government	$3,215,000
Estimated first cost to the local cooperating agency	153,000
Estimated annual cost to the local cooperating agency for operation, maintenance & replacement	26,000

LEGEND:

- PROPOSED ENVIRONMENTAL CORRIDOR
- PROPOSED FLOWAGE EASEMENT
- APPROXIMATE LIMITS OF FLOODING
- LOWER LIMITS OF LAND AQUIRED FOR SAYLORVILLE RESERVOIR
- EXISTING LEVEE
- PROPOSED ACCESS & PUBLIC USE AREAS





PROFILE

DES MOINES RIVER
IOWA & MINNESOTA

DES MOINES RIVER FROM SAYLORVILLE DAM TO DES MOINES IOWA

ENVIRONMENTAL CORRIDOR

SCALE AS SHOWN

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT

SURVEYED

RECOMMENDED

APPROVED

DRAWN BY
TRACED BY
CHECKED BY

TO ACCOMPANY REPORT DATED

Addendum 4

PLANNING & REPORTS

See Mooney R. Cones Etc.

MCRED-PB

23 August 1972

Mr. Fred A. Priewert, Director
Iowa Conservation Commission
300 Fourth Street
Des Moines, Iowa 50319

Dear Mr. Priewert:

This is in response to your letter of 21 July 1972 wherein you state that the Iowa Conservation Commission at its 11 July 1972 meeting agreed to participate in the recreational development of the Des Moines River Environmental Corridor.

You stated that participation by the Iowa State Conservation Commission is subject to conditions that (1) the environmental corridor be extended to encompass the area below Saylorville Dam to the Sixth Avenue bridge in Des Moines, (2) the city of Des Moines be involved as set forth in letter dated 22 June 1972 from Mr. Tom Chenoweth, City Manager, Des Moines, Iowa, to the Iowa Conservation Commission, and (3) availability of participation funding.

I appreciate notification of the formal action of the Commission on this matter. As you know, the Des Moines River Environmental Corridor was proposed as a part of the Final Report, Des Moines River, Iowa and Minnesota. Also, as a part of that report, there were proposed three projects, Jefferson Lake, Walnut Creek Lake, and Walnut Creek Environmental Corridor, for which your agency was requested to consider participation in cost-sharing of recreational facilities. At the meeting of the Iowa Conservation Commission on 4 April 1972 this request was considered and was not approved. Your letter of 11 April 1972 informed this office on the action of the Commission as it pertains to the aforementioned projects.

With regard to your offer to arrange meetings with representatives of the city of Des Moines to discuss the Des Moines River Environmental Corridor, please be assured we will coordinate these activities. However, I should inform you that because of the lack of cooperation for recreational development in the Jefferson Lake, Walnut Creek Lake, and Walnut

PLANNING & REPORTS BR
RGStearns/tfb

NCRED-PB
Mr. Fred A. Priewert

23 August 1972

Creek Environmental Corridor, considerable revisions to our Des Moines River report will be needed. These revisions will require additional funds to process the necessary economic and engineering considerations for only minimal recreational development. Accordingly, until such funds are made available our study effort to consider the extension of the Des Moines River Environmental Corridor will be held in abeyance. You will be informed when our study is reactivated and coordination meetings can then be arranged.

Sincerely yours,

BERNARD P. SLOTER
LTC, Corps of Engineers
Deputy District Engineer

cc: Dist File
Engrg Div
Pl & Rep Br (3)

IOWA CONSERVATION COMMISSION

FRED A. PRIEWERT, Director

300 Fourth Street, Des Moines, Iowa 50319

Phone: (area code 515) 281-5145

NCRED-PB

July 21, 1972

Colonel James E. Bunch, District Engineer
Rock Island Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Dear Colonel Bunch:

As previously requested by your office the Iowa Conservation Commission at its July 11, 1972 meeting has agreed to participate in the recreation development of the Des Moines River Environmental Corridor. This participation is subject to three conditions:

1. Extension of the project area in order that the environmental corridor would encompass the area below the Saylorville dam to the Sixth Avenue bridge in Des Moines.

2. Involvement of the City of Des Moines as indicated in the attached correspondence and action by the city council.

3. Availability of participation funding.

The Conservation Commission will be pleased to arrange a meeting to discuss this project and to coordinate the efforts of the City of Des Moines, the Conservation Commission and the Army Corps of Engineers. It will be an asset to the area and we are indeed pleased that the Corps of Engineers has requested our participation in the recreation development of this unique project.

Sincerely,

Fred A. Priewert, Director
Iowa Conservation Commission

FAP/GFS/hg
Enc.
cc: Commissioners
Division Chiefs

INTER DEPARTMENTAL COMMUNICATION

J-18

(PLEASE CONFINE TO ONE SUBJECT)

STATE CONSERVATION COMMISSION - DES MOINES, IOWA

TO Fred A. Priewert, Director DATE June 30, 1972

FROM G. F. Schnepf, Chief Planning and Coordination

SUBJECT: Commission Item
City of Des Moines - Des Moines River Environmental Corridor

Attached please find correspondence concerning the City of Des Moines' interest in extending the proposed Des Moines River Environmental Corridor to include the Des Moines River Valley south of the north city limits.

This is the action that was requested at the May Commission meeting. Permission is requested to prepare a letter for the Director's signature indicating to the Rock Island District of the Corps of Engineers the Conservation Commission's interest to participate in the recreation development of this project subject to the extension of the corridor into the City of Des Moines.

G. F. Schnepf, Chief
Planning and Coordination

GFS/hg
Attached
Commissioners

city of des moines

Office of the City Manager

June 22, 1972

Mr. G. F. Schnepf
Iowa Conservation Commission
State Office Building
300 Fourth Street
Des Moines, Iowa 50319

Dear Gerry:

At the June 19 City Council meeting, the Council authorized the City Manager to request that the U.S. Army Corps of Engineers extend its study of the proposed Des Moines River Environmental Corridor to include the Des Moines River valley south of the north City limits.

Based on your conversation with Scott Johnson of my office today, it is my understanding that you will bring this matter before the Conservation Commission at its July meeting, and that if approved by the Conservation Commission a request will be made of the Corps of Engineers to include the portion of the Des Moines River valley between the nc h City l mits and the Sixth Avenue bridge in the proposed environmental corridor.

I have attached a copy of the City Council's action for your use and information.

Sincerely,

Tom Chenoweth
City Manager

TC/pu
attachment
c.c. Chairman, Riverfront Improvement Commission

Roll Call Number: 2842

Date June 19, 1972

J-20

BE IT RESOLVED by the City Council of the City of Des Moines, Iowa:

That the City Manager be and hereby is authorized and directed to request that the U.S. Army Corps of Engineers extend its study of the proposed Des Moines River Environmental Corridor to include the Des Moines River Valley south of the northern City limits.

(Council Letter Number 2158 attached)

Moved by Woods to adopt.

P-6A

COUNCIL ACTION:	YEAS	NAYS	PASS	ABSENT
BUSS				
GROTHE				✓
LAVINE				
RABINOWITZ				
SCOTT				
WOODS				
[illegible] SON				
TOTAL	6			1

MOTION CARRIED APPROVED

Mayor

CERTIFICATE

I, MARGARET VERNON, City Clerk of said City hereby certify that at a meeting of the City Council of said City of Des Moines, held on the above date, among other proceedings the above was adopted.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal the day and year first above written.

City Clerk

CITY OF DES MOINES, IOWA
Office of City Manager

Council Letter Number 2158

Agenda of June 19, 1972

The Honorable Mayor
and
Members of the City Council
City of Des Moines

Gentlemen:

Re: Des Moines River Environmental Corridor

At its meeting on April 24, 1972 the City Council directed the City Manager to work with various appropriate committees on the recommendation of the Riverfront Improvement Commission that development of the Des Moines River Environmental Corridor be extended into the City of Des Moines.

The proposed Des Moines River Environmental Corridor is the land which c ld be flooded by the operation of Saylorville Dam when it is necessary to release from the reservoir in excess of the existing capacity of the channel. Designation of this area as an environmental corridor and acquisition of the land would provide flexibility in the operation of Saylorville Reservoir, would preserve the natural features of the area, would discontinue cultivation and thus prevent subsequent crop damage in the area, and would provide an opportunity for recreational development.

Although the environmental corridor extends from Saylorville Dam to the Sixth Avenue Bridge in Des Moines, Corps of Engineers plans for development of the environmental corridor end at the north City limits. The City Manager referred the letter to the Riverfront Improvement Commission for consideration and recommendation to the City Council. The Riverfront Improvement Commission recommended the extension of the environmental corridor into the City and recommended study of the costs and other aspects be made. The City Council directed the City Manager to work with various committees and to report to the City Council within sixty days.

At a meeting of the Riverfront Improvement Commission attended by City staff and by staff of the Iowa Conservation Commission it was learned that it would be possible to extend the Des Moines River Environmental Corridor from the north City limits to the north end of existing protective flood works at approximately Sixth Avenue. Extension of this corridor could aid the City by providing funds for greenbelt open spaces, bike trails, and right-of-way for future City utility projects. The environmental corridor concept would require expenditures from the City for the purchase of property and for recreational development, but would provide for federal participation. The 1980 plan anticipates this development, but without federal aid.

Proper evaluation of the costs and benefits involved depends upon inclusion of the area between the north City limits and Sixth Avenue in studies being made by the Army Corps of Engineers. The City can be included in these studies at no cost. Passage of the related resolution on the June 19 City Council agenda would direct the City Manager to request that the Corps of Engineers extend its study into the City as far downstream as possible. The results of this study would allow the proper evaluation of the feasibility of this project as well as its approximate benefit and costs to the City.

Respectfully submitted,

Tom Chenoweth

Tom Chenoweth
City Manager

TC/pu

c.c. Chairman, Riverfront Improvement Commission
Public Works Director
Parks Director
Acting Planning Director

ity of des moines

Office of the City Manager

June 2, 1972

G. F. Schnepf, Chief
Planning and Coordination
Iowa Conservation Commission
300 Fourth Street
Des Moines, Iowa 50319

Dear Mr. Schnepf:

This is in answer to your letter of March 6 concerning possible City interest in extending the Des Moines River Environmental Corridor south from the northern City limits to the protective flood facilities within the City of Des Moines.

The Des Moines Riverfront Improvement Commission has expressed to the City Council its interest in pursuing this corridor concept, and s been asked for more detailed information by the Council. The Riverfront Improvement Commission will shortly recommend to the City Council that the City request the U.S. Army Corps of Engineers include in its study of the Des Moines River Environmental Corridor the area between the northern City limits and flood protection works within the City.

The City of Des Moines is actively interested in this project. Please communicate the City's interest along with the interest of the Iowa Conservation Commission to the U.S. Army Corps of Engineers.

Sincerely,

Tom Chenoweth
City Manager

TC/pu

c.c. Chairman, Riverfront Improvement Commission
Public Works Director
City Engineer

Appendix K

Environmental Impact Zones in Multipurpose Reservoirs

Data provided

Through

Environtology Council

Iowa State University

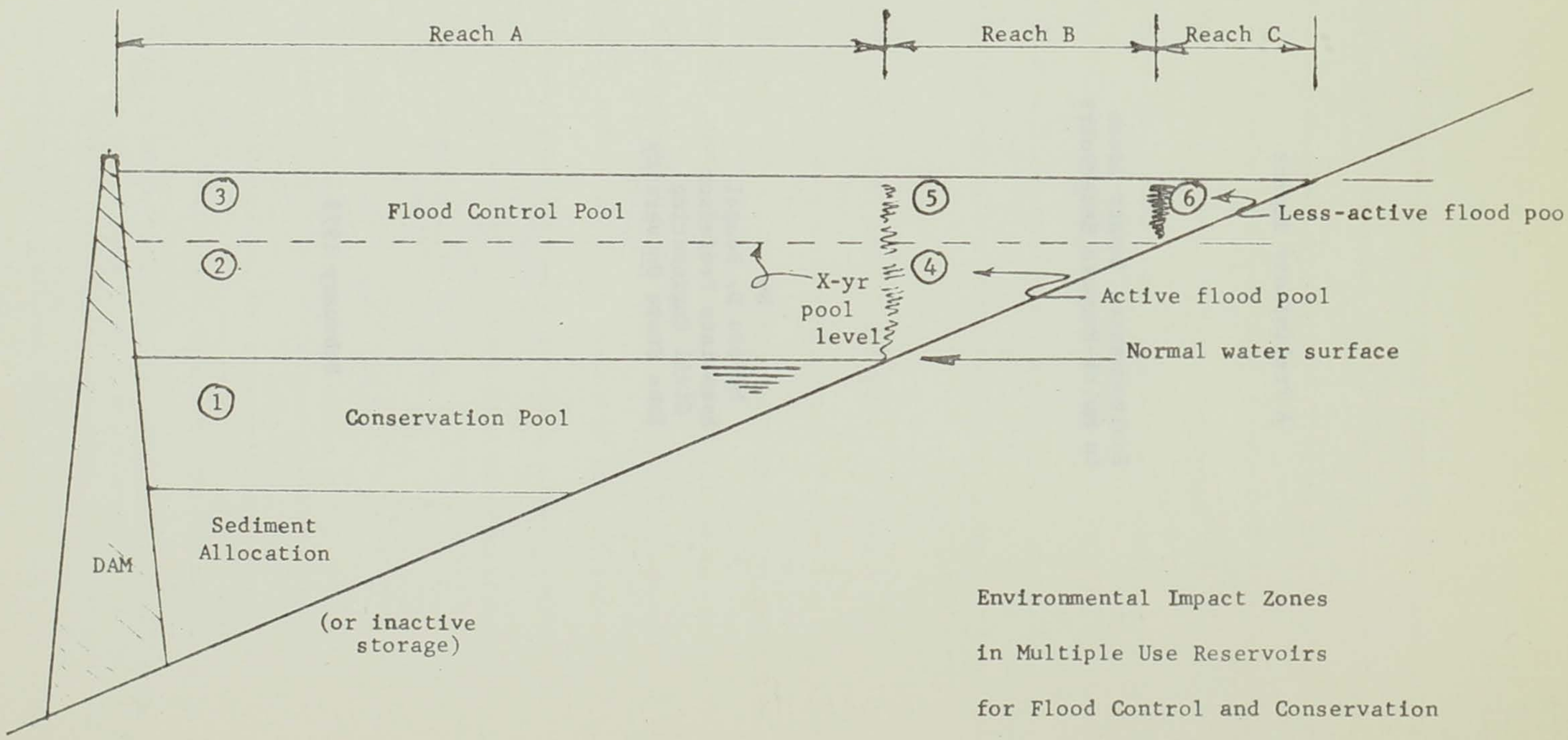
April 1973

A Preliminary Report

Environmental Impact Zones in Multi-Purpose Reservoirs

by
Merwin D. Dougal
Associate Professor
Civil Engineering
Iowa State University

February 1973



Environmental Impact Zones

in Multiple Use Reservoirs

for Flood Control and Conservation

Uses -- 6 Zones in 3 Reaches --

M. D. Dougal
Jan. 1973

Environmental Impact Zones in Multi-purpose Reservoirs

M. Dougal
February 1973

Introduction

During the course of the Ames Reservoir Environmental Study, the characteristics of the three large flood control reservoirs constructed by the Corps of Engineers in Iowa have been evaluated. These three are the Coralville, Red Rock and Rathbun Reservoirs. Based on these studies, it is believed that three (3) reaches and six (6) environmental impact zones can be identified for multi-purpose reservoirs having allocation for both (a) conservation storage and (b) flood control storage. These are shown in the attached figure.

Three environmental reaches

The three reaches are designated as A, B, and C. Reach A extends through the conservation pool, from the dam site to the headwater area where the low water profile or stream gradient is encountered. In this reach the conservation pool offers a fairly stable water surface for a large percentage of the time. It is the most aesthetically desirable reach of the reservoir, or at least has that potential if adverse effects or environmental damages are mitigated.

Reach B extends from the conservation pool headwaters upstream to the upper end of the "active" flood pool. This location is determined by the elevation of the "X-year" flood pool level. Below this elevation the frequency and duration of flood storage essentially eliminates the existing timber and vegetative habitat. Above this elevation the frequency and duration of flooding are sufficiently infrequent that most of the existing or succession vegetation will have a good chance to survive. The active flood pool, then, extends vertically

from the normal conservation pool level to the X-yr flood pool level. Based on the Iowa experience to date, the value of the "X-year" level is in all probability at least the 5-yr level, or the elevation reached once every five years, based on operation studies and experience. The 2-yr value appears to be too low, and a 10-yr value may be a realistic maximum.

Reach C extends from the headwaters of the active flood pool to the point where the maximum design flood pool elevation intersects the low water channel or stream gradient. This vertical distance also outlines the "less-active" flood pool. Water tolerant vegetation may have a good chance of survival in this reach.

These three reaches are established, therefore, by this three-level vertical subdivision of the reservoir into a conservation pool, an active flood pool and a less-active flood pool. One also might subdivide the conservation pool into active and less-active zones, as for example in irrigation and hydroelectric storage structures. However, for the purposes of low-flow augmentation in Iowa this does not seem so necessary. The headwater area of the conservation pool has been labeled as an "inactive mud-flat" area, since it is usually submerged. Even if the conservation pool is drawn down temporarily, it will soon be submerged or would be within a season.

Six environmental impact zones

Inspection of the figure shows the location of the 6 environmental impact zones. Zones 1, 2 and 3 are in Reach A, the conservation pool reach; zones 4 and 5 are in Reach B, between the headwaters of the conservation and active flood pools; and zone 6 is in Reach C, at the far headwaters of the reservoir. In a corollary sense, zone 1 is in the vertical profile allocated to conservation, zones 2 and 4 are in the active flood pool and zones 3, 5 and 6 are allocated to the less-active flood pool.

General environmental impact

Reach A. This is the conservation pool reach where public use is high and visual aesthetics are most important. Trees and brush are frequently removed in shallow reservoirs in zone 1, although deeply submerged trees are sometimes left for fisheries habitat or as an economy measure. Submergence of tree roots will eliminate the timber habitat and for aesthetic appearances complete clearing can be recommended. One exception could be in small tributaries and ravines where they would not pose a hazard to boats, especially during periods of conservation pool drawdown.

In zone 2, fluctuations of the flood pool are so frequent and long in duration that most trees will not survive. This zone is also characterized by steeper slopes higher up on the valley walls, except for flood plain areas of tributaries and local ravines. Hardwood timber species normally would pre-dominate over the softwoods found on the flood plain. Wave erosion and bank sluffing or slumping of side slopes can be a real problem. A vegetative management plan has highest priority in this zone. Selective timber clearing should be evaluated for this zone; possibly all large trees should be removed if they are not water-tolerant.

In zone 3, the timber and other vegetation have a good chance for survival. The water-tolerant species, if existing, should especially be able to survive the infrequent flooding expected in this zone. Early spring (snowmelt) floods should be stored and released before severe damage occurs.

Reach B. No reservoir timber clearing has been done in Iowa (or probably elsewhere) in Reach B. Zone 4 presents the greatest problem in reservoir management. The active flood pool in this zone covers primarily the flood plain in wide reservoirs. Few if any trees survive in this zone. Extensive areas of mudflats

occur as frequent flooding fills the active zone and is subsequently released through the reservoir outlet works. Dust problems have been encountered at many reservoirs as silt, fine sand, and other non-cohesive materials dry out and are picked up by prevailing winds. Extensive areas of bleached, dead tree trunks have been classified as "ghost" trees.

Two engineering alternatives in zone 4 would be (a) additional timber clearing for initial improvement of aesthetics, and (b) introducing a series of low-level impoundments or marshes through zone 4 which would be a trade-off to submerge the mudflat areas. Either way, zone 4 joins zone 2 in presenting a real problem in vegetative management programs. Zone 5 is comparable to zone 3, except that the sideslopes are lower on the valley sides, and different species of trees may be encountered.

Transportation routes crossing zones 4 and 5 present a problem. Poor visual aesthetics greet the public. Selective timber clearing and/or more complete clearing along each side of the roadway for a distance of ¼ or ½ mile may be desireable.

Reach C. Zone 6 is the only one in Reach C. Inspection of Coralville Reservoir, which has filled once to the spillway crest, and of Red Rock Reservoir reveals that the flood plain vegetation, including brush, small and large trees, have survived these flooding periods. No severe effect on existing visual aesthetics is foreseen, and the probability of damage is very low.

Conclusions

Additional study of zones 2 and 4 is recommended in the planning and design of reservoirs. Location of transportation routes should be planned with care. At Coralville, Red Rock and at Saylorville, there are highway crossings at the headwaters of the conservation pool (beginning of zone 4). The aesthetic appearance is very poor.

Vegetative management programs are a recognized need in these two zones. Additional timber clearing can be recommended, especially if transportation routes give easy access to this zone. The value of low-head impoundments or marshes should be considered in planning and design phases. The public would gain a better perspective of reservoirs if these environmental impacts are evaluated and remedial measures implemented.

Appendix L

Letter Report and Barrier Dam Concept

Iowa Citizens to Save the Ledges

Data submitted by

Dr. Clark Bowen

Member,

Iowa Citizen's Group

April 1973

Specifications for Proposed Remedial Works at Ledges State Park

1. Location as close to west side of valley as possible so as to preserve a maximum amount of flood plain forest. Existing flood plain forest to serve as screen for dike and a visual buffer between lower Ledges and flood plain.

2. Isolation of a bend of existing river forming an "oxbow" lake into which Peas Creek would flow. At low stages of the river, level to be higher than the river. Primary use to be canoeing by public and campers at Camp Hantesa.

3. Pumping station and remedial work in Peas Creek Valley to be as inconspicuous and well-screened as possible. No major construction within present state park boundaries on either Peas or Davis Creeks. No futher road construction along Peas and Davis Creeks within park.

4. Borrow for levee to come from deepening the oxbow lake and new channel bed. Balance from areas above or below park in sites chosen to be as inconspicuous as possible.

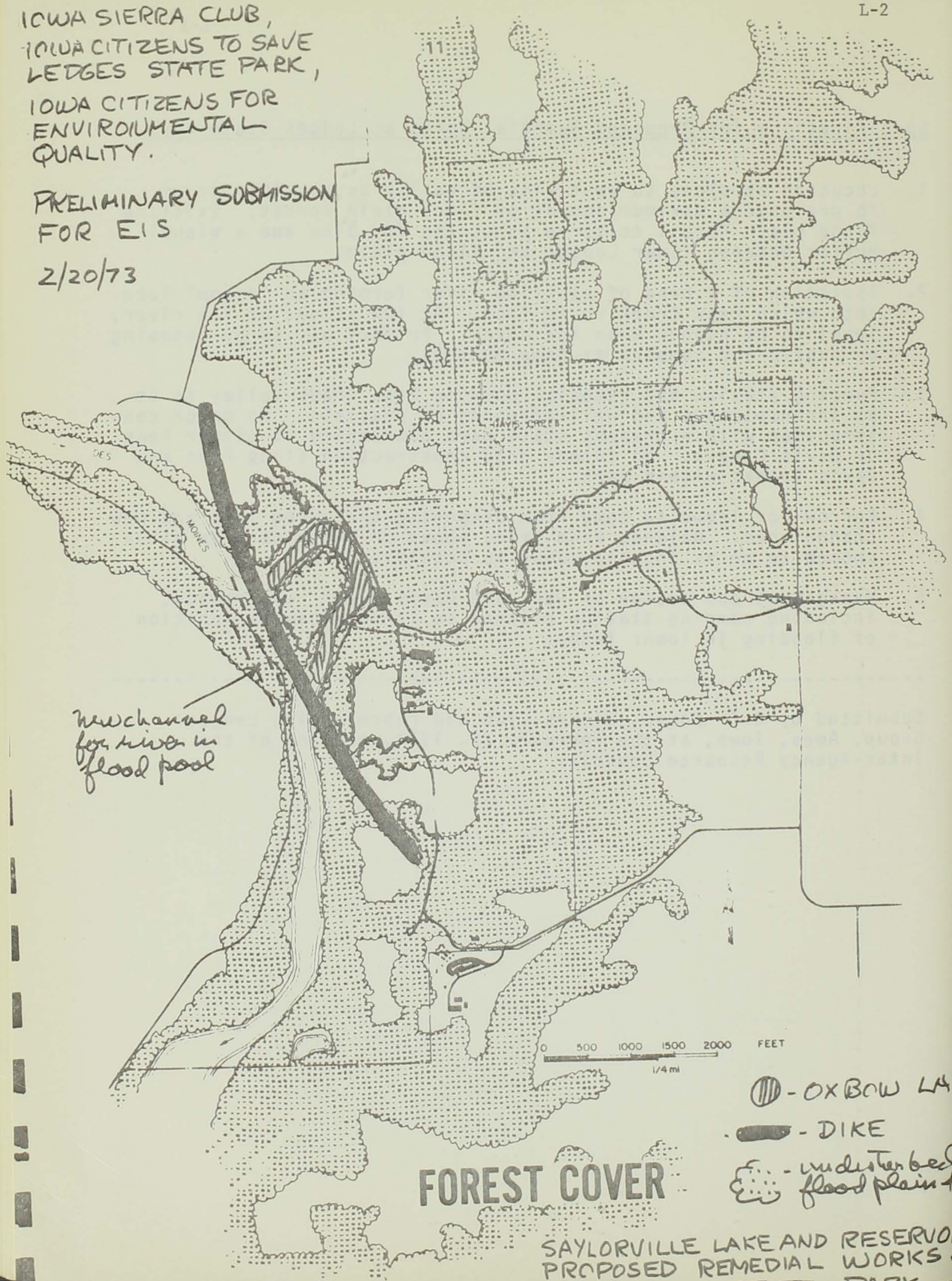
5. Management and design of Peas and Davis Creek watersheds, including pumping station planned so as to minimize duration of flooding in lower ledges.

Submitted by C.C. Bowen, Sierra Club and representing Ledges' Group, Ames, Iowa, at the February 23, 1973, meeting of the Inter-Agency Resource Council.

IOWA SIERRA CLUB,
IOWA CITIZENS TO SAVE
LEDGES STATE PARK,
IOWA CITIZENS FOR
ENVIRONMENTAL
QUALITY.

PRELIMINARY SUBMISSION
FOR EIS

2/20/73



SAYLORVILLE LAKE AND RESERVOIR
PROPOSED REMEDIAL WORKS AT

IOWA CITIZENS TO SAVE LEDGES STATE PARK, INC.
Box 324 Boone, Iowa 50010

State Conservation Commission
Valley Bank Bldg.
Des Moines, Iowa

April 2, 1973

Dear Sirs:

The recent concern over the Ledges State Park as expressed by many individuals and public conservation groups has brought about a heightened interest in the Park as well as an increasing awareness of the many unusual natural features unique to this area. In this regard, we congratulate the Commission for recognizing the important role of the Ledges in answering the public need for natural areas and anticipating the future demands in its planning program. Although much of the public concern has become evident in the last two years coincident with work on the Master Plan, the more recent threat of the Saylorville floodpool has served to bring an even sharper focus on key areas that are both unique and ecologically fragile.

While it is characteristic of human nature that the gradually increasing rate of erosion and wear on the Ledges resulting from the growth in public use has gone largely unobserved until recently, the present state of public concern is expressing itself in a knowledgeable and critical way. We have sensed the public's wishes and needs with respect to the Ledges. This information is based on (1) interviews with leaders of a variety of social, recreational, conservational and service organizations, (2) over 200 non-solicited letters, (3) talks followed by discussion sessions at meetings of service clubs, conservation organizations and other groups with an estimated audience to date totalling over 2,000 people. In addition, we have consulted with professionals in the fields of outdoor recreation, forest ecology, fish and wildlife and landscape planning. In the light of this experience we respectfully submit this letter hoping to provide some useful input with respect to certain details of the Master Plan.

Substantially all of the public who presently use the Park consider the unique scenic values of the Lower Ledges to be the principal attraction and will support any plan permitting continued easy public access for viewing all of lower Peas Creek Canyon. Our appraisal is that there would be a great public outcry in the event the road would be closed through the canyon.

We wish to propose for your consideration the following additions to the Ledges Master Plan whether or not the Corps of Engineers constructs a levee across the mouth of Peas Creek. We believe these are consonant with the public's desire to use lower Peas Creek Canyon as well as minimizing problems resulting from overuse of this beautiful area.

1. Maintenance of the present road loop through Peas Creek Canyon continuing south on the flood plain and then up the hill to the Wildlife Exhibit area.

2. Designate as one-way the scenic drive down the creek as far as the present "trading post" area. This should significantly reduce current week-end traffic congestion.

3. Eliminate access to the Park via Highway 164 (which will remain the access to Camp Hantesa).

4. Maintain two-way traffic to the Wildlife Exhibit arriving from the east, and thence to a parking area to be developed in the vicinity of the present "trading post." This could be along the existing route or a carefully planned new route could be developed to provide a single entrance to the Park if deemed desirable. This would also simplify closing roads in the Lower Ledges when necessary.

5. To reduce overuse and consequent damage to lower Peas Creek Canyon, among other measures, the Commission should consider:

a) Elimination of all vehicular parking on Peas Creek road between the overlook at Inspiration Point and a parking area to be developed in the vicinity of the present trading post.

b) Provision of a hiking trail, paralleling but separate from the Peas Canyon road, with stepping stones or small foot bridges across the stream.

c) Possible elimination of picnic tables and fireplaces from Peas Canyon should be considered as a means of further reducing public impact on this fragile area.

Recent assessment of the unique and fragile habitats in the Park has placed new emphasis on protection of such areas. The Iowa Ornithologists Union has described the upper Peas Creek watershed, upstream from the picnic area, as "the most unique woodland area in the state and deserves more serious attention." Six species of warblers, very rare to Iowa, summer in this habitat and the rare Louisiana Waterthrush has been seen to next there. This unusual habitat is characterized by plant species and associations that will not tolerate heavy human pressures.

A second site of special interest is the upland area east of the proposed interpretive center which botanists say has great potential as a demonstration prairie.

These two areas are typical of the very valuable ecological sites that cannot be replaced. They have been serving as important outdoor laboratories for education and research. With the increasing emphasis on environmental and ecological themes in education such sites become invaluable. It might be pointed out that the Governor's Committee on Conservation Education is presently working with subcommittees of the State universities, private

colleges, the Department of Public Instruction and citizen and industry groups to develop a State Environmental Education Plan. The natural systems of Ledges State Park, with its proximity to population centers, will be able to provide excellent outdoor laboratory experience.

For these reasons we respectfully submit that the following modifications be considered to insure protection of these special areas.

1. The proposed access road up Peas Creek be reconsidered in light of its invasion of a sensitive and fragile habitat.

2. The upland area east of the proposed interpretive center be preserved from roadway intrusion.

We recommend the Commission for the foresight and care that its staff has evidenced in the development of the Master Plan. We also recognize the constantly increasing emphasis being placed on outdoor and natural esthetic values and we sincerely hope that these comments are viewed as constructive suggestions and hope that they will be given careful consideration. We invite your comments and will be glad to substantiate any of the points we have made. We are able and willing to meet with the Commission and its staff at any time.

We realize that many of the problems arising from overuse of state recreational facilities would be alleviated if the Commission had increased funds for staffing, remedial work and land acquisition. Both the Citizens to Save Ledges State Park and the Iowa Sierra Club support increased funding of the Commission and are actively engaged in promoting the Commission's "Open Spaces" legislation now pending.

Respectfully submitted,

C. C. Bowen

C. C. Bowen for
Iowa Citizens to Save Ledges State Park, Inc.

/mh

FRED A. PRIEWERT, DIRECTOR
300 FOURTH STREET, DES MOINES, IOWA 50319
515/281-5145

April 24, 1973

Dr. C. C. Bowen
Iowa Citizens To Save Ledges State Park, Inc.
Box 324
Ames, Iowa 50010

Dear Dr. Bowen:

Mr. Fred Priewert, Director of the Iowa Conservation Commission, has asked that I respond to your letter pertaining to the Ledges State Park.

We appreciate the concern over the Ledges State Park as expressed by the Iowa Citizens to Save Ledges State Park, Inc. in preserving the many unique natural features in the park. We also appreciate your suggestions as to what can be done to preserve the unique natural characteristics of this park.

The Conservation Commission officials are reviewing the suggestions offered by your organization. We will shortly furnish our review comments on the changes proposed in the Ledges State Park Master Plan by your organization.

Sincerely,

Vasant N. Nerikar

Vasant N. Nerikar
Resource & Program Planner
Planning and Coordination

VNN:sk

FRED A. PRIEWERT, DIRECTOR
300 FOURTH STREET, DES MOINES, IOWA 50319
515/281-5145

May 18, 1973

Dr. C. C. Bowen
Iowa Citizens to Save Ledges State Park, Inc.
Box 324
Boone, Iowa 50010

Dear Mr. Bowen,

This is a continuation of our letter of April 24, 1973. We appreciate your interest and desire to restore environmental quality and recreational experience in the Ledges State Park. There is no doubt the Ledges has many unusual natural features. The Iowa Conservation Commission being responsible to maintain and enhance the quality of such natural resource areas, is trying its best to fulfill that objective not only for the Ledges but for other State recreation areas too.

We must thank you and the members of your organization in appreciating my Commission's efforts in planning ahead to counteract recreational area problems in our State parks.

The Commission has long recognized the problem of deteriorating environmental quality and the subsequent degradation of the experience derived from it in the Ledges Park and in many of the other State areas. The present master plan for the area has been developed out of that concern. In developing this master plan, the Commission staff tried its best to get input from a multitude of natural resource management oriented disciplines. Experts in natural resource management preservation and conservation, landscape planning and design, hydrology and recreation planning, etc. from well recognized institutions such as faculty members of Iowa State University, Army Corps of Engineers and the Conservation Commission staff, were consulted. The Ledges master plan was completed by a team of graduate students from the Department of Landscape Architecture after getting technical guidance from the above mentioned institutions.

We are not denying any public access to the sandstone Ledges as well as the lower flood plain. Simply, we are proposing the use of vehicles to visit these areas should be restricted and visits to these areas will be by nature trails. This restriction in conjunction with removal of facilities and re-design will discourage picnic use and automobile use, thereby greatly reducing the traffic demands on single entrance and exit roads. The Pease Creek Canyon is already overused and to accomodate the ever increasing vehicular traffic in the Creek will endanger the public safety. In proposing this change, the public safety, welfare and our concern for restoring environmental quality were the most important criteria. We believe that in parks and recreation areas with limited space, people are more important than automobiles.

The problem of adapting certain protective measures to avoid backwater flooding in the lower Ledges is being investigated by many nature resource oriented State agencies, the Corp of Engineers and private groups interested in the Ledges' future. The Conservation Commission has put substantial effort in providing all required information. Therefore, we suggest to your organization to wait for the final recommendations of this study to know what protective measures would protect the lower Ledges from backwater flooding.

Your suggestions to improve the Ledges master plan are most welcome. The Conservation Commission staff has carefully reviewed your suggestions and they have the following review comments to make:

1. Maintenance of the present road loop through the Pease Creek Canyon, continuing south on the flood plain and then up the hill to the wildlife exhibit area, will simply shift the thru-vehicular traffic impact from the north side of the flood plain (Hwy. 164). We propose to have only one access to the Park and no thru traffic within the Park for efficient management control. Moreover, this suggestion will not reduce the over-use in the creek area which is a concern of the public safety. Therefore, we feel this alternative routing will not do any good to relieve use pressure compounded by automobile traffic in the valley area.

2. Designation of one-way, the scenic drive down the creek up to the present trading post (concession stand) is only feasible if your suggestion (1) is acceptable.

3. Your suggestion to eliminate access to the Park via Highway 164 has already been proposed by the Commission which is the basis for discontinuing thru traffic in the park. This is one of the most significant change proposed in our redevelopment master plan for the Ledges Park.

4. The present two-way traffic to the wildlife exhibit area will be maintained from the east side to avoid traffic thru the Park. The road leading to the lower Ledges will be going downhill but not all through the flood plain. This road thru the flood plain will be discontinued for the public use. Adequate roadside parking and turn-around place will be provided. From there on, the visitors can take up the foot trails and still enjoy the scenic beauty of the lower Ledges. Therefore, construction of a new route in the lower Ledges is not justified. We want the only access to the Ledges Park from the east side for efficient management reasons.

5. It will not be helpful to eliminate vehicular parking at certain designated places along the road between the overlook at Inspiration Point and a parking area as suggested by you in the vicinity of the concession building, as it will simply encourage higher speeds and greater enforcement problems. In our experience, parking on the flood plain area will not solve the overuse problem.

6. Hiking trail in the Pease Creek Canyon has been proposed by the Conservation Commission and certainly we will provide stepping stones and/or foot bridges to cross the stream which will be the case, if necessary constructing other trails also. Your suggestion in this connection is very welcome.

7. Recently we learned that Pease Creek is a favored summer habitat of some species of Warblers and Louisiana Waterthrush, which are rare to Iowa. We would not like to see these birds deprived of their habitat. We will certainly not interfere with this unique opportunity for Iowans to observe and study unfamiliar birds. In that case, we will not have any picnic area development in the Pease Creek area except the foot trail. The natural prairie in the upland area east of the proposed interpretive centre will be preserved as it is, except a foot trail, which will be developed to provide an access and protect the prairie from being indiscriminately utilized. We are aware that the Ledges Park is serving as an outdoor ecological laboratory to impart environmental education and we are trying our best to maintain that status. Sufficient buffer area will be left between the proposed park road and the prairie which will not alter the character of the natural prairie.

The Commission continually attempts to get increased funding to undertake many remedial works, increase staff and land acquisition for our State parks and recreation areas. Often adequate funding is a problem and even though we earnestly desire to undertake some improvement programs, our hands are tied - for want of funding.

We sincerely appreciate the support of Iowa Citizens to Save Ledges State Park, Inc. and the Iowa Sierra Club for funding of our proposed "Open Space Program". We hope the Commission's Open Space Program will be approved and we will get additional funding to protect our unique natural resources.

We have reviewed your suggestions in the light of our obligation to serve for the best possible public interest.

Sincerely,

Vasant N. Nerikar

Vasant N. Nerikar
Resource & Program Planner
Planning and Coordination

VNN:bc

Appendix M

General and Student Reports

Iowa 4-H Camping Center

Information furnished through

Iowa State University

April 1973

Resolution

Whereas, changes have been proposed for the Saylorville Dam project that would affect the Ledges State Park near Boone, the Iowa Arboretum and the 4-H Camp near Luther, and

whereas, the Ledges State Park and the Iowa Arboretum are used as outdoor teaching laboratories, and such use would be adversely affected by possible flooding of the Park, as is contemplated by the proposed changes in the Saylorville project,

whereas, the 4-H Camp is used as an outdoor teaching laboratory as well as for university extension and student activity purposes, and

whereas, it would be most regrettable to lose these resources,

BE IT RESOLVED that the environmental impact and alternatives to flooding of the Ledges State Park, the Iowa Arboretum and the 4-H Camp should be restudied with public participation therein, and

BE IT FURTHER RESOLVED that the Environtology Council be urged to undertake a study of the effects of such losses on university programs and that the results of the study be made available to those charged with assessing the impact of the Saylorville Dam project upon the Ledges State Park, the Iowa Arboretum and the 4-H Camp.

Approved by Faculty Council December 12, 1972.

IOWA 4-H FOUNDATION
and its
4-H CAMPING CENTER

Purpose

The purpose of the Iowa 4-H Foundation is to support and strengthen 4-H and Youth programs to meet the needs of Iowa young people. The Foundation aids experimental program areas and other 4-H programs where financial support is needed.

Since 1951 the Foundation's major project has been the development of the Iowa 4-H Camping Center near Madrid. The camp is being developed with contributions from 4-H clubs and friends of 4-H.

The 4-H Camping Center serves throughout the year as a site for: (a) 4-H and other youth camps, (b) leadership training, and (c) workshops and conferences.

The camp is owned by the Iowa 4-H Foundation and operated by Iowa State University on a non-profit basis.

4-H Programs and Accounts

In a way, the pattern of the Iowa 4-H Foundation has reversed. Originally the need for a camp prompted the formation of the Foundation. Now the scope of the Foundation has broadened to actively fulfill the broad objectives listed in the original articles of incorporation and the 4-H Camping Center has become only one (but still the major one) of the projects of the Foundation.

The Board of Trustees authorized a program account (C-account) for handling contributions from donors for specific

types of 4-H training, scholarships or awards, and revolving accounts for income and expenses for activities or events. There are now some 30 sub-accounts in the program account, each designated for a particular purpose.

The "A" account is from contributions, the "B" account is for maintenance and the "C" account is for programs. Costs of all new facilities and new equipment are paid from the capital development (A-account).

At the end of each year 8 per cent of the gross income from the camp operations is transferred to Maintenance (B-account). Repairs and replacements costing more than $500 are paid from this account. Insurance and taxes are also paid from this account.

Supplies, repairs, and replacement items costing under $500 are paid from the Camp Operation Account. The Camp Operations account is a separate University sub-account because the camp is operated by the University.

All Foundation accounts are handled through the Treasurer's Office, Iowa State University.

A Camping Center of which Iowans are Proud

4-H members and leaders are proud of their 4-H Camping Center. They appreciate the opportunity of a camping experience of such an ideal location. Likewise, they are deeply grateful to the many "Friends of 4-H" without whose generous contributions they would not have been able to accomplish this gigantic task.

In the early days there were few swimming pools in Iowa except in the cities and few campers could swim. Thus, the teaching of swimming was important. Today, with the many municipal pools available, the water program has shifted to teaching water safety and recreational swimming.

With more and more campers being able to swim, more and more can qualify for canoeing and thus the canoeing program has greatly expanded.

Emphasis in the nature program has shifted from learning to identify plants or insects to understanding the ecology of nature and the interdependence of animals, plants, insects, soil conditions and weather. Conservation of natural resources and appreciation of natural beauty as well as the study of pollution are programs now offered.

Crafts have advanced from making stylized articles to more creative crafts using natural materials or adapting the form, line, texture or color found in nature to some material or media. Each camping group decides whether to include crafts in their program and if so what craft. Some craft materials may be purchased at the camp store.

In following previously adopted policies, all groups, both 4-H and others, provide most of the leadership for their own camps. This means that the first state camp staff in 1953 included only the director, two lifeguards for the newly opened pool, a food truck driver, and the custodian. Most of the staff members were high school students.

The camp staff has gradually increased to 18 members in 1970. Specific additions to staff were at the swimming pool; a canoeing supervisor; a registered nurse, an office secretary; and staff persons to teach various phases of health and conservation. The custodian now has three helpers during the summer camp season.

Today a minimum requirement for all program staff is to have completed one or more years of college.

Today there are five villages each on a ridge pointing out from the central campus and apart from others so that campers and programs in one village do not interfere with other villages. Thus, five separate camps can operate at the same time, each with its own program. In the central area are the administration building, swimming pool and play fields used by campers from all villages.

Normal capacity of the villages are: Elm-64, Hickory-84, Oak-48, Maple-96 and Birch-72 for a total of 364. Additional beds in each cabin to take care of emergencies bring the total summer capacity to 420.

Elm, Hickory and Oak Villages are winterized. Additional facilities in winter are Butternut Cabin, summer home for the program director (capacity-16) and Cedar Cottage, summer staff quarters (capacity-24) making normal winter capacity 236, and 270 when emergency beds are included.

The goal both in camp site development and in camp operations, is to have the best camp possible. In 1953 the Iowa 4-H Camping Center became a member of the American Camping

Association (A.C.A.). In 1955 an application was made for a visitation to become an accredited A.C.A. Camp. Areas evaluated included administration, program, personnel, campsite facilities and equipment, health, safety, sanitation, and transportation.

The Camping Center met the required standards in each area and became an accredited camp. Standards visitations have been made every three years since and each time the Camping Center has met required standards thus making it an A.C.A. accredited camp continuously since 1955.

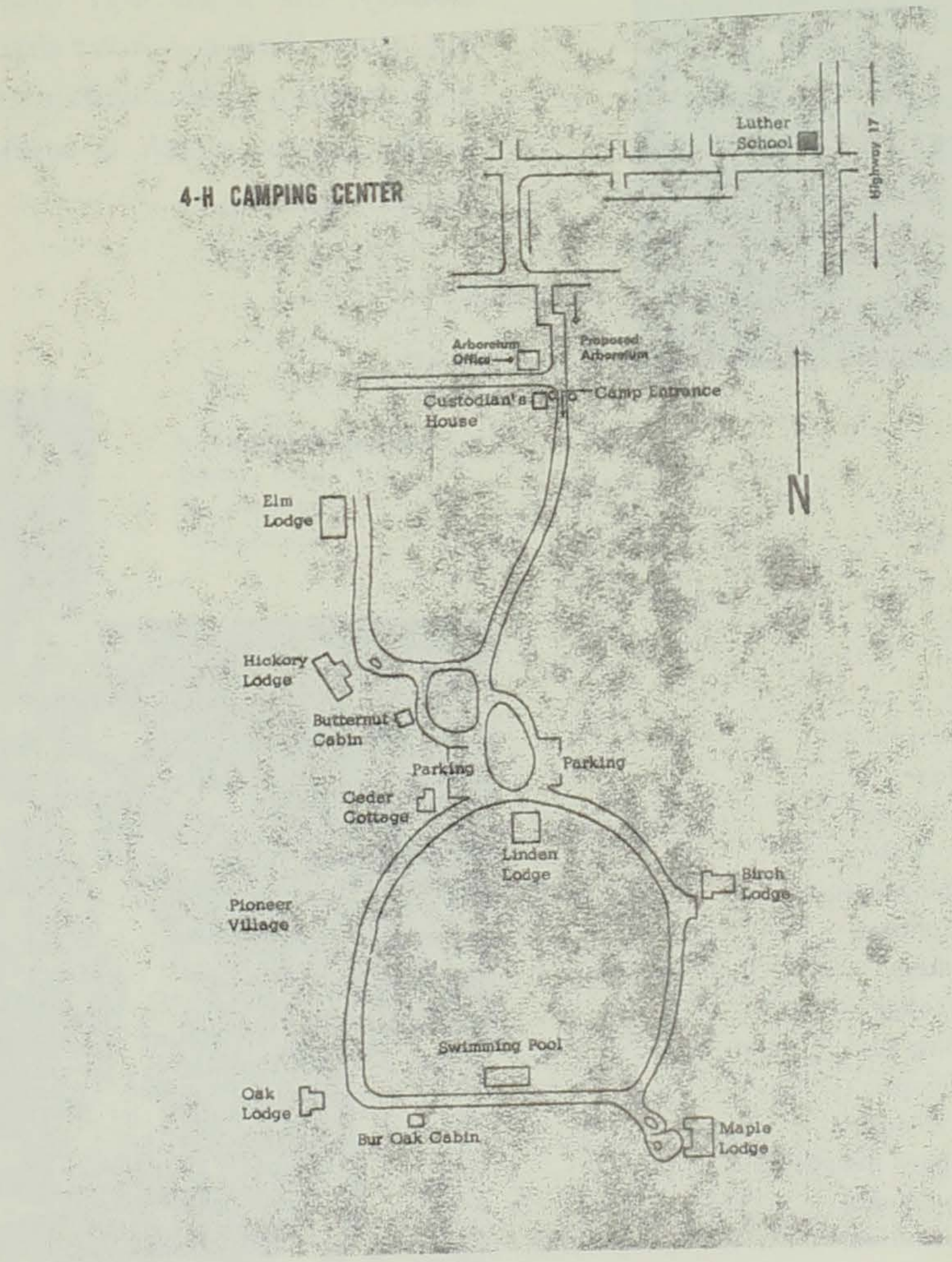
Looking Ahead

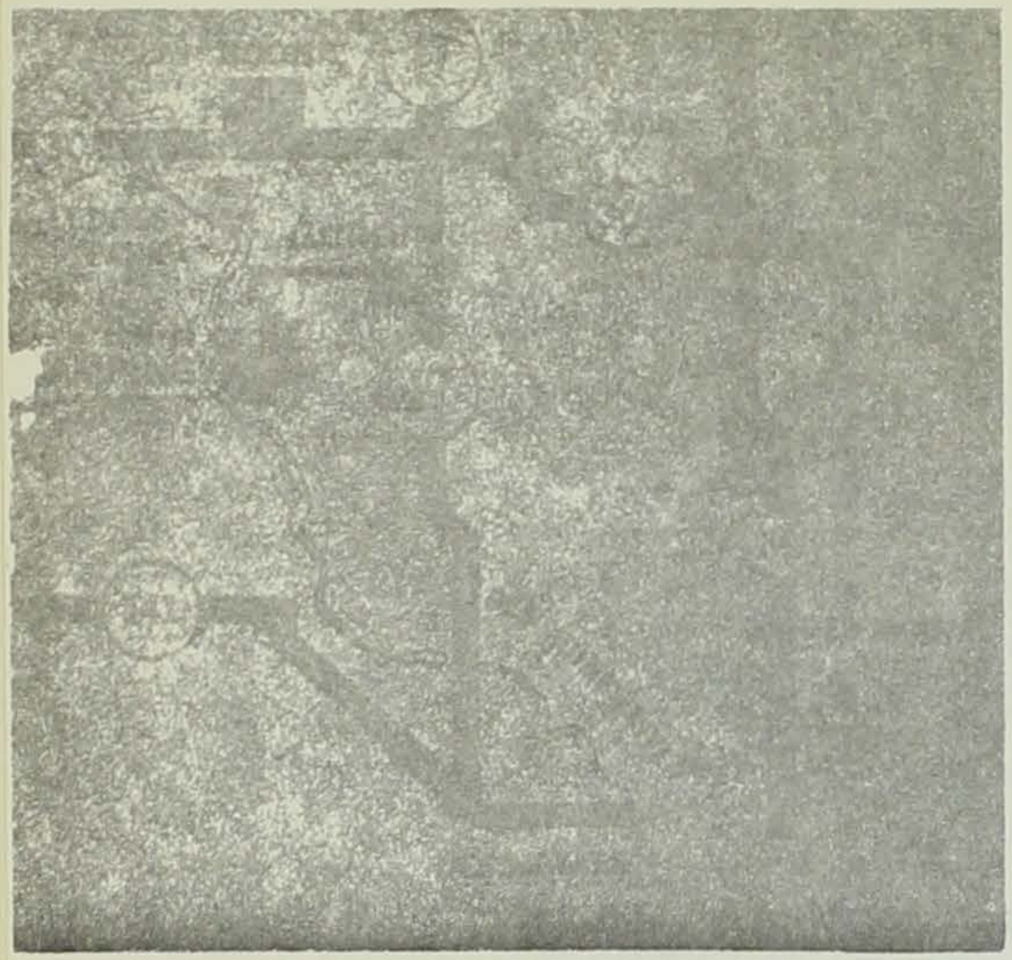
Plans of the Iowa 4-H Foundation--Continue to provide opportunities for the personal development of young people.

Finances for Iowa 4-H Camping Center--Secure contributions to complete payment for land, to develop a proposed recreation lake and Clover Bowl and for such other facilities as may in the future become essential.

4-H Programs financed by or through 4-H Foundation--Secure contributions to finance such county, multi-county, state and national 4-H and youth programs as are not eligible for tax funds or for which sufficient tax funds are not available.

Iowa 4-H Camping Center--Continue to operate on the same basic principles adapted appropriately to new situations and the changing needs of young people.


4-H CAMPING CENTER
Luther School
Highway 17
Arboretum Office
Proposed Arboretum
Custodian's House
Camp Entrance
N
Elm Lodge
Hickory Lodge
Butternut Cabin
Parking
Parking
Cedar Cottage
Linden Lodge
Birch Lodge
Pioneer Village
Swimming Pool
Oak Lodge
Bur Oak Cabin
Maple Lodge



IOWA 4-H CAMPING CENTER

Located near Ledges State Park in Boone County, the Iowa 4-H Camping Center is not more than a 5-hour drive from the most distant county. All-weather gravel roads lead to the camp, which is within 4 miles of a paved highway.

Location of Facilities

A. Entrance
B. Custodians Home
C. Elm Village
D. Hickory Village
E. Butternut Cabin
F. Log Cabin Museum
G. Cedar Cottage
H. Oak Village
I. Linden Lodge
J. Swimming Pool
K. Birch Village
L. Maple Village
M. Clover Bowl (proposed)
N. Dam (proposed)
O. Lake (proposed)
P. Richardson's Creek
Q. Des Moines River
R. Headquarters, Iowa Aboretum, Inc.
S. Iowa Aboretum (proposed)

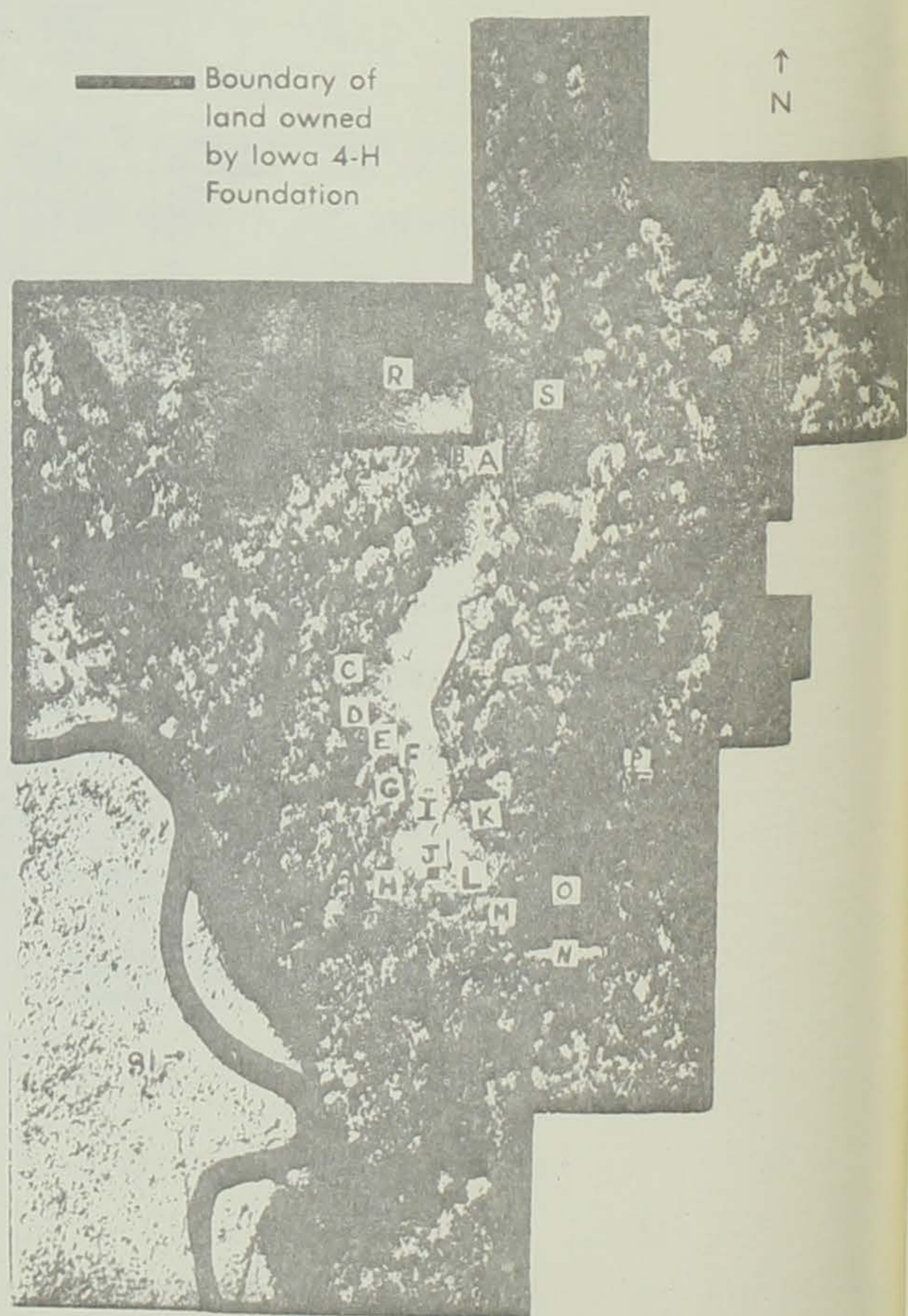


Fig. 9. The Iowa 4-H Camping Center located near Luther

Iowa 4-H Camping Center

Student Study Group Report

Prepared by

Barbara Vogt

Iowa State University

Ames, Iowa

May 1973

4-H CAMPING CENTER

Discussion and Proposals

The 4-H Camp was set up with many specific goals in mind. These goals and objectives initially included to provide:

--an experience in group living
--an opporturnity to accept responsibility and develop leadership
--a new experience for Iowa boys and girls
--training in conservation, recreation, discussions, nature study and crafts.

These, along with many others, must be kept in mind at all times as planning for the future continues.

Because of the uniqueness of the area, conservation and preservation to the greatest extent possible should be of foremost consideration in making any long range plans for the camp. On the West, the Des Moines River winds through wooded slopes, rock formations, and other natural and diverse features. On the East is Richardson's Creek, with year round flowage, sand bottom along much of the way, and unique geological formations on the sides. The creek is abundant with life, both botanical and animal. The camp itself follows over 1½ miles of Des Moines River frontage and contains over 1100 total acres.

The concentrated use is at this time on the upper areas of central camp. Five villages, consisting of a lodge and nearby cabins, plus a main lodge, a staff cabin, a custodian's home, and a swimming pool area. Hiking has been greatest along the West side in the trail system as it exists there. A canoe program also has a "put-in" site on this side of the camp on the Des Moines River.

Heavy use and poor care have led to the gradual degradation of the trails in the areas on the west side of camp. Some have been washed to the extent that gullies areas much as 1½ feet deep in some areas. Steps should be made to stop this degradation.

The Saylorville Project has great implications for the future of this area. Periodic flooding and considerable loss of present vegetation will permanently affect the ecology of the area. In anticipation of the problems the project will cause for the Camp site, an inventory of present use and the effect on these uses should be made.

The following pages include the overall recommendations along with a discussion of some of the various programs at camp which will be affected by Saylorville. Some concrete suggestions have been made, but more information is needed to make these or any others as sound as they should be.

Overall Policy Recommendations

1. Because of the beauty and uniqueness of the area, preserve as much as possible the Richardson's Creek area and valley.

2. Put more emphasis and money into programming and staff at the Camp. Where some people may insist that their money designated for a definite purpose or facility be so spent, to that extent, and only to that extent should funds be so allocated. Better staff and planning in utilization of what now exists may be an answer, since additional facility improvement is going to cost, not only now, but in the future.

3. Work toward opening the camp to a wider audience. Within the 4-H program as it now exists, there are still groups who are unable to fully utilize the camp's resources. Such groups include low income youth, the elderly, and disabled persons of all ages. Scholarships could help the low income youth. Better planning in facilities and trails, and special camps held year round could open up the camp to the elderly and the disabled.

4. Utilize the inevitable to the greatest extent possible. Make the Saylorville project a learning experience for each camper who views her degradation and her beauty.

Canoeing

This program at the present time fluctuates with the seasons and the river condition. After the Saylorville project is completed, river conditions will no doubt be as unstable if not more so. Some way of stabilizing this program would be good because especially of the popularity of this activity. The lake proposal would have partially solved this problem, but now it looks like it will not be built. It is suggested therefore, for the time being that canoers be taken farther up the river, and taken out sooner if necessary. This would depend on the level of the lake. Perhaps alternative put-in spots could be predetermined for alleviation of some of the uncertainty in the program. The future of this program may in a large part be dependent on a change in overall camping philosophy in Iowa in making the camping period longer. If campers had a longer period for more extensive use of canoeing programs, there could be experiences in canoeing on smaller, yet "sportier" Iowa rivers. Trips down such rivers as the Boone River, not too far from the camp, could give the campers invaluable experience in more varied canoeing, and give them an introduction to a sport which is gaining in Iowa popularity. Use of local lakes, such as Don Williams and Big Creek, could also be considered.

Fishing

This program has not been offered to campers before, and could have real potential for the 4-H Camp. We should find out the possibilities of carrying out such a program on the Des Moines River. Another alternative might be to develop a small pond stocked with fish. We must insist that each possible site for such a pond be weighed carefully before any development be done. To keep in line with the overall recommendations, however, money should be put into the camp program first. Better staff, good equipment,

and the existing Des Moines River may turn out to be a winning combination.

Hiking

This is probably the most popular in user participation judgements, and where the most improvement is needed. A whole nature program can center around an effective and useful trail system. Much of the inspirational and spiritual growth often associated with the camp by past users centers around getting out into nature, alone or with others. It is necessary that we make it possible for as many capability ranges be satisfied as possible. A rather carefully planned, shallow grade trails are recommended which would wind slowly down a hill in such a fashion that even the most reluctant of adult leaders at a camp be tempted to accompany a group down to the unique and beautiful areas below. In their present condition, it is difficult to navigate most of the trails. In fact, conditions are so bad on most trails that they probably should be shut off from use, replanted, and the areas rejuvinated as much as possible. A whole new system of trails should be developed which reach into areas of the camp now seen only by the most adventurous of visitors. Some measure of control over poison ivy in the trail areas should be developed.

The Richardson Creek valley is so unique and beautiful an area that development there be held to as little as possible. Trails, carefully planned and maintained, could serve this area sufficiently, and still not disturb the habitat too much. The sand-bottom creek itself proves to be an especially nice path during hot summer days. Some of the most valuble teaching experiences occur while hiking up the creek itself, and campers find this one of their most vivid memories.

Again, specifically, a gradual-sloped trail down to Richardson's Creek should be developed; that a trail system include especially those parts of camp not now connected to the camp by trails (to the Northeast and Northwest of the central camp area); that old trails be repaired where needed, and shut off and planted over where degradation is too great; that a continuation of a new trail following around the main camping area, along the side of the hill, be done; that more interpretive developments be made on the heavier used trails.

Other Nature Activities

As long as Saylorville is going to be constructed and operated, the nature program staff should make use of it. Many discussions of man's effect on nature, observing the river for a discussion of findings, and other things can be done with campers. Nature study will in effect have a counter study that can accompany it--namely, people study.

Swimming will definitely have to be continued at the pool. It is suggested, however, that more canoeing instruction be done also at the pool so that campers will have a better orientation to it.

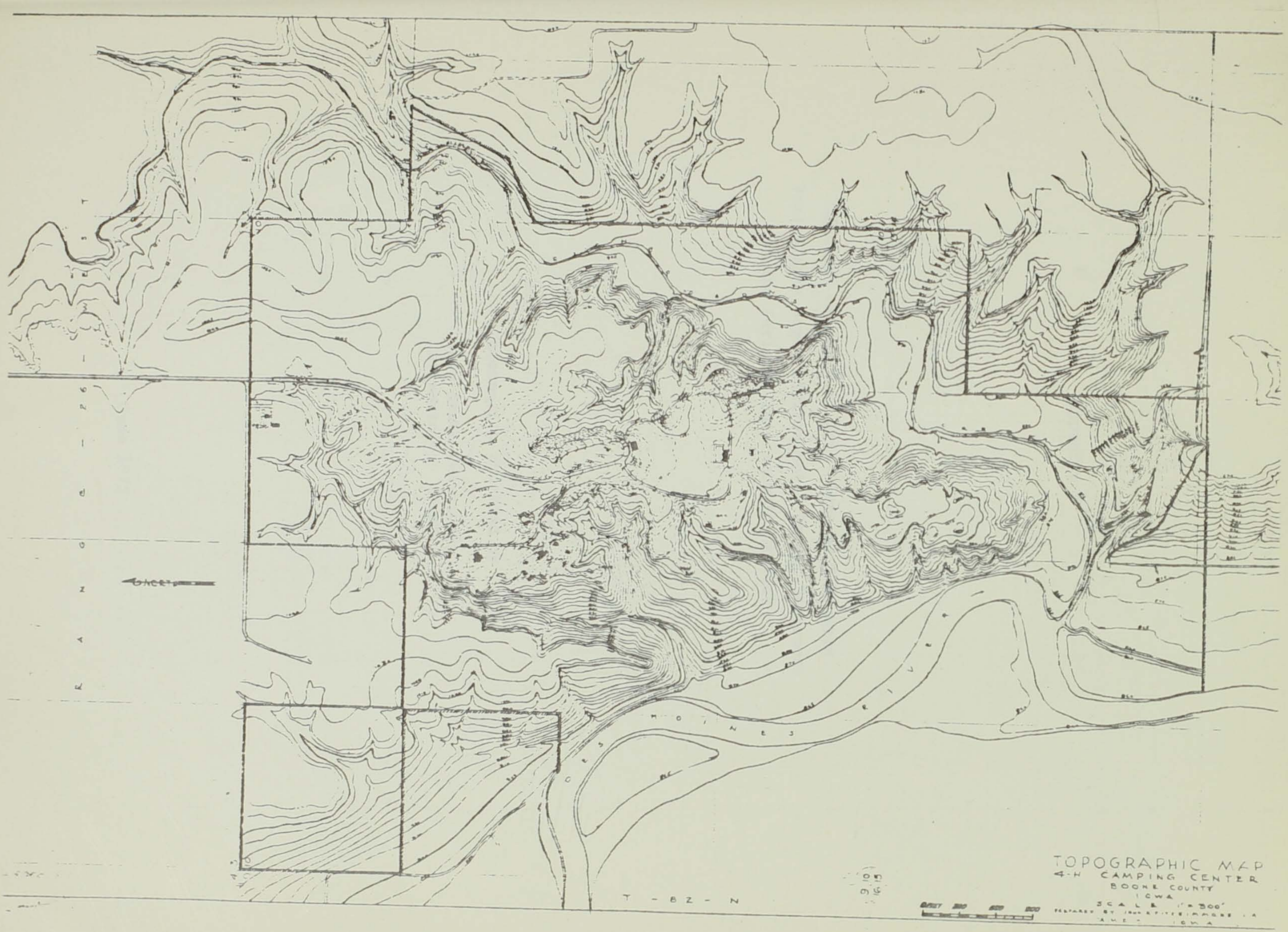
Wading has already been discussed as it applies to Richardson's Creek. In the future we see more and more use of bogs and marshes as actual places of participation in nature, whether it be wading or sitting right down in them as they study nature. This aspect cannot be laughingly overlooked.

Motor Vehicle Use

There definitely should be no use by motorcycles and snowmobiles. There needs to be many more areas in the Des Moines River valley designated for these uses. This should be a concern of land use planners for the area. With somewhere else to go, motor vehicle use on the camp would seem to be much less of a problem. Perhaps the camp should be pushing hard for a total land use plan and development for this part of the Des Moines River valley.

Camp Craft

This is one area that 4-H Camp has little instruction in. An inexpensive way to develop interest in the new skills in backpacking might include a camp craft center with sample equipment for campers to use and set up in a learning matter.


R 26 W
T 82 N
DES MOINES RIVER
T - 82 - N
TOPOGRAPHIC MAP
4-H CAMPING CENTER
BOONE COUNTY
IOWA
SCALE 1" = 300'

Appendix N

Comments on the U.S. Army Corps of Engineers
Preliminary Draft Environmental Impact Statement
on the Saylorville Reservoir Project

Information provided by

Iowa State University
Environtology Council

June 1973

IOWA STATE
UNIVERSITY

Environtology Council
141 Bessey Hall
Ames, Iowa 50010

Telephone 515-294-7252

June 14, 1973

Colonel Walter H. Johnson
Corps of Engineers
District Engineer
Rock Island District Corps of Engineers
Clock Tower Building
Rock Island, IL 61201

Dear Col. Johnson:

The Preliminary Draft Environmental Impact Statement on the Saylorville Reservoir Project has received some review by the Environtology Council at Iowa State University. The short time available has limited any detailed analysis. This time factor has apparently placed considerable constraint on the Corps Environmental Impact Statement process as well. This is evinced by the incomplete and cursory treatment of areas that we hope will be given adequate analysis in the official Draft Statement.

In addition to comments which will point out areas that we feel need more attention, the Council raises a number of issues that have been either overlooked or else assumed to be irrelevant and as a result have not been mentioned.

Specific errors, some mechanical and technical, have been listed according to page number. Other disparities which we view as errors in scientific judgment are also pointed out. We wish to emphasize that these latter errors or disparities might best be treated within the framework of scientific advocacy; that is, by requesting the appropriate and recognized agency, or scholar, to provide comments. In the present Draft, a paucity of this approach is evident. In this connection, we feel that the reports of the Governor's Inter-Agency Council have not been examined adequately, perhaps because of the previously-mentioned time constraint.

Sincerely yours,

James J. O'Toole

James J. O'Toole, Ph.D.
Chairman, Environtology Council

JJO/m
Enclosure

COMMENTS ON THE U.S. ARMY CORPS OF ENGINEERS PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE SAYLORVILLE RESERVOIR PROJECT

In anticipation of the Draft E.I.S. to be released in July, we suggest that these considerations be added or reenforced.

A master plan for operation of the reservoir be included as part of the Draft E.I.S. The subjective judgments contributing to the operational schedule should be clearly expressed in view of the recognized aesthetic and economic impacts both upstream and downstream. Without this information, it is not possible to evaluate fully the potential alternatives and thus the full choices available.

The Benefit/Cost Analysis report should be a part of the Draft E.I.S. It is evident that several decisions relating to mitigation of impacts will turn on economic consideration. Moreover, the Preliminary Draft E.I.S. is replete with reference to benefits and costs which are not documented. This process should be placed in public view as expressed in Court interpretations of the National Environmental Policy Act and the Freedom of Information Act.

Less specific in nature but equally important is that consideration be given to actual efforts for soliciting expertise in other federal agencies, e.g., Bureau of Sport Fishers and Wildlife, Soil Conservation Service, U.S. Geological Survey, Farmers Home Administration, Department of Transportation and others able to contribute informed judgment. While such comments are required under NEPA, too often they consist of nothing more than casual tacit approval.

The above criticisms are supported by the incomplete and casual discussion in "Section V Alternatives to the Proposed Action" set out in the Preliminary Draft Statement, which, among alternatives, considers certain irrational options and fails to provide comment on rational ones.

We also urge the Corps to clarify the future Draft EIS text, especially in the description of impacts, by the use of photographs and illustrations. The present text is difficult for even technical personnel to interpret and a combination of less rambling and more precise text combined with accessory illustrations are essential for public understanding.

The following comments address more specific areas in the Preliminary Draft EIS and follow the general arrangement of subject matter.

Under Geology, several points need clarification and additional information.

1. Inadequate description of problems encountered during the construction which might provide information on stability of slopes in excavated areas.

2. The general problem of stability of soils on slopes, especially under shales has not been discussed. This consideration is a serious one when rising reservoir waters saturate such soils on slopes and conditions conducive to slippage develop.

3. The additional impact of wave action on the soil stability mentioned above has not been adequately appraised,

4. The reservoir impact on ground water and aquifers has not been treated adequately.

5. The possible impact of ground water changes on the geological stability factor which would be encountered in potential future coal operations has important economic considerations and should be treated in detail.

In considering impact on Soils, the problem of soil erosion and sediment transport are interrelated with hydrology of the reservoir; besides, the accumulation of sediment in the basin resulting from river transport and contribution from the reservoir lake wave action is not appraised. Wave erosion can contribute considerable sediment as a function of soil type, slope and subsoil or bedrock conditions. A word on loss of reservoir capacity; although total capacity would be diminished by 1% in 50 years, the conservation pool would receive most of this sediment and roughly 40% of conservation storage would be lost in 50 years. In regard to stabilization of slopes (p. 99 of Preliminary Draft) there is a need for USGS opinion. Stabilization may never occur on considerable stretches of shoreline within the lifetime of the reservoir.

The problem of downstream bank erosion has not been fairly treated. Comparison with Coralville Reservoir experience would perhaps assist in projection of the problem and suggest remedy and costs.

In the remarks (p. 101) on channel stabilization, the evidence is lacking. Case data should be included to document this argument. Such considerations come under close scrutiny when reviewing the impact of flooding and resultant deposits in Pease Creek Valley of Ledges State Park. Sediment loads deposits from the Des Moines River of 180 tons per square mile are obviously not uniform and currents directed toward the lower Ledges during flood may exacerbate sediment fallout.

The Botanical and Zoological comments on this area of the Rough Draft EIS are contained in separate attachments enclosed.

A review on Archaeological statements contained in the Rough Draft EIS could not be reviewed in this brief period but will be treated when

the Draft EIS is available.

Under Social Economic considerations, several specific areas have been subjected to review.

1. The impact on transportation in the area surrounding the Saylorville Reservoir has not been treated in sufficient detail. The problems arising from the closed roads along with increased pressure of recreating public can be projected in the light of those problems experienced at the Coralville Reservoir. Have these problems been clearly ventilated with the State Highway Commission and more importantly, the Polk, Dallas, and Boone County Supervisors?

The population shifts anticipated by the remarks on p. 72 are not adequately reflected in the material reported on p. 47-48. The regional economy under the impact of the reservoir is hardly discussed. Specific economic impacts have not been measured such as effect of changing ground water levels on the region in the future (a) as it may preclude development of coal resources when technology in the next 15-20 years makes Dallas and Boone County coal a valuable resource, (b) as it affects, in specific cost analysis, present water supplies and structures such as Polk City sewage lagoon which may lie below high ground water levels.

Special attention should be directed to the statements on p. 72 of the Rough Draft EIS. Although included under botanical, the seven points express more nearly economic and social impacts. First of all, it should be questioned that the flood plain developments implied in these statements can be considered in any sense benefits. In the light of the history of impoundments costs of flooding have not been mitigated where flood plain management is absent; it has actually increased. What role

will the Corps play in clarifying these facts and point out the importance of successful reservoir operation to flood plain zoning? Are easements and purchases adequate to anticipate the full life of the reservoir under planned operational procedures and potential changes in watershed characteristics?

In regard to both flood plain and reservoir land management, the vegetation management plan alluded to on page 75 and 76 should be given careful treatment in the next Draft EIS, especially regarding responsible parties and costs.

Finally, the recreational and aesthetic impact of the project should receive much more attention. The present draft sadly understates the importance of the Ledges State Park while overstating such dubious values as "Naturama" which has not and may never be developed. In any case, the special values of "The Ledges" cannot ethically be traded off on the basis of land exchange or development of substituted values in which the public has not been asked to make a choice.

There have been considerable efforts expended both by the Corps and the task force teams of the Governor's Inter-Agency Council in evaluating impact on the Ledges. In view of this effort, we urge that a separate section be developed in the Draft EIS addressing this problem. The public concern has already been expressed in litigation with the Corps as well as in the press. The almost one-half million visitors to the Ledges annually make it highest priority consideration for people in the state. The recently accumulated information on the Ledges problem including aerial photos, maps, and site surveys both by the Corps and state agency staff, could provide the public with much of the information

necessary in understanding the problem.

The alternatives available for mitigating the impact on the Ledges have seemingly not been explored adequately. The problem of minimizing the impact of reservoir flooding can never be thoroughly analyzed until a study of possible dam operational procedures is optimized in the light of the range of run-off models anticipated.

We recognize that reservoir operational procedures pose a range of economic considerations downstream; nevertheless, the additional effort needed to analyze these economic values is part and parcel of the spirit and substance of the National Environmental Policy Act. The present rough draft we believe falls short of providing the needed information.

In conclusion, we appreciate the opportunity to respond to the rough draft E.I.S. and recognize the sincere efforts of the Corps to open up the review process in this manner. We also applaud the Corps cooperation and positive attempts to bring in the many interested state and public groups on the Environmental Impact process.

The Environtology Council
Iowa State University
June 1973

SUPPLEMENTARY COMMENTS ON THE U.S. ARMY CORPS OF ENGINEERS
PRELIMINARY DRAFT ENVIRONMENTAL IMPACT
STATEMENT ON THE SAYLORVILLE RESERVOIR PROJECT

6 June 73

Very brief comments are included here which reflect the time available for review rather than the detailed analysis that it deserves.

In general, the natural vegetative resources of the region are inadequately described regarding aesthetics as well as habitat security for wildlife, protection of soil, regulation of runoff, and other less obvious features. Comprehensive studies of the Des Moines River Valley vegetation have not been made by others; however, this does not relieve the Corps of responsibility for knowing the composition and extent of natural vegetation to be inundated and otherwise affected. Some of the forests are second growth, cut-over lands that continue to show the heavy impact of man, yet other forests are healed over to a degree reapproaching the original. Portions of the 4-H Camping center and Ledges State Park along the lower slopes are in this latter category.

In general, there is a lot of emphasis on the vegetation management plan for the project area after inundation, but there is a lack of detail which makes it impossible to evaluate. We have not found adequate management of vegetation in relation to Corps flood control projects in the state whether the land is still handled by Corps or is assigned to the Conservation Commission. Partially this is due to the lack of ecological information and experience of the managers but mainly to the lack of funds committed for that purpose. There is nothing in this study which suggests the procedure will be different from past management of such areas.

More specific comments are given below according to page numbers in the draft report:

1. Page 33, line 3. Prairie is not used according to your definition. The land was once covered by prairie, however.

2. Page 33, 2nd para. This description does not do justice to the vegetation of the Des Moines River Valley. As one of the westward extensions of the great eastern deciduous forest, the Des Moines Valley forest holds a number of tree species which do not make it farther west. Ecologically it is an important breaking off point, more important perhaps than the Missouri valley system for the understanding of plant geography.

3. Page 35, Figure 5. There are numerous errors in the spelling of scientific names. Also, rather than give the impression that this is a complete list, it should be stated in the title as a partial list.

4. Page 39a, Figure 6. Mice and voles?

5. Page 65. No mention is made of wave action on undermining of sandstone ledges. What has been your experience at Red Rock where similar sandstone exposures occur? The fetch of the lake at the Ledges with SW winds would be expected to have an effect.

6. Page 65. Changes in ground water levels will occur. I assume this will affect drainage. How can you make a flat statement that there will be no effect on future coal mining if access to coal involves drainage problems?

7. Page 69, E. Hydrology. Conservation pool level should be 833.

8. Page 73. Reforestation is not well defined; is it plantation style or natural? How long before reforestation is begun? What other forestry practices are being proposed depending on authority and availability of funds? Are there plans for prairie restoration as well? Marshes? Are there plans for reestablishing herbaceous plants of the forest community understory?

9. Page 73, 2nd para., Line 7. What annual flowers are indicated? Bidens, smartweed, sunflower?

10. Page 74. Concerning pasture land to be managed, does this mean it will be grazed by livestock, mowed, burned, sprayed for weeds, fertilized, or what? Does this mean the Corps will be hiring range managers?

11. Page. 75. Territorial birds and mammals will be forced into adjacent environments and either be destroyed or destroy roughly an equal number of their own kind, unless it can be shown that the habitat is not already saturated with each species.

12. Page 78, H. It is hard to understand how the project can have a favorable impact on archaeological features. The amount of funding for exploration and salvaging has been very small in relation to the job which could yet be done. Will the Corps provide for the display and preservation of archaeological materials once they have been salvaged?

13. Page 84, 2nd Para. Last sentence. Richardson Creek is used regularly for field classes for 300+ Ames 6th graders in May as well as 100+ conservation teachers in October and various groups in between.

14. Page 92, last line. The last line is typical of the lack of vegetative detail in the whole report. I presume it was seeded to grasses and legumes suitable for mowing management.

15. Page 99, B. Slopes devoid of vegetation will eventually be weed-covered with annuals, cottonwood and willow, dying back after each high and long period of flooding. Stability is a relatively unattainable condition under presently known procedures.

16. Page 100, 2nd para., last sentence. It may be that the majority opinion would not rest in favor of the dam. Has the majority opinion been determined by survey at any stage of this project?

17. Page 100, 3rd para. Mudflats don't stabilize as far as we can tell in Iowa. They begin a successional trend after each major inundation but are forced back to the bare and weed stages with the next high water.

18. Page 106, 4. Occasional flooding of regularly used areas.

19. Page 111. The calculation of $4 million annual flood damage as with other figures in the report dealing with costs are in the design memorandum, I presume? And supplements?

20. Page 112a. Footnotes 10 and 12 are missing.

21. Page 117, line 7. Why would there be no clearing of trees required?

22. Page 121, last of 1st para. It is inappropriate to imply that a prairie biome can be established in one growing season. It is foolish to suggest that it can be done. It is appropriate to say that grasses will be established or that some prairie species will be planted, but our experience does not support a very quick reestablishment sequence of something so complex as a prairie biome.

23. Page 135. Percent of time inundated can be deceiving when trying to show what these values mean. At 870 the lake impact on vegetation would be approximately 20 times that of natural conditions and at 876 (note error) it would be 60 times. Although the amount of time that the area will be flooded under reservoir conditions is quite small, the amount of increase is rather large, and the impact on vegetation is more closely related to the increase in duration, not the absolute percentage of time. This comparison can, of course, be carried to extreme. In comparing the increase at 884 or 890 which both begin at zero, any increase would be impossible to calculate because a number cannot be divided by zero.

24. Page 149, line 4. There are those who say the region SE of Des Moines is also deficient in water-oriented recreational resources,

especially regarding quality. Are there similar problems regarding Saylorville compared with Red Rock? Other natural and man-made processes in the valley hardly approach in extent the changes which will be wrought with inundation by Saylorville dam. The biosphere will not be measurably affected by this project just as it will not be measurably affected by the flight of one SST, but there are small cumulative effects which can be measured locally. Local impact is what the people are concerned about until we understand how these small effects can be translated to worldwide impact.

25. Page 150, Line 6. Isn't biosphere consideration out of place here? We are looking at one major valley ecosystem, not the biosphere.

26. Page 153, para. 1. It has not been shown that better land and forestry management occurs on project lands than on private lands. Some private owners show excellent management, some very poor, but you cannot guess at this without facts to back you up.

25. Page 153, para. 2. The restricted water activities which now exist, particularly in the unique setting of the lower Ledges, cannot be replaced by sailing, power boating and swimming. Many users of this resource do not have the money or time to take advantage of sailing and power boating, and often very small children and grandparents are involved who do not find swimming a desirable activity. Also, the idea is expressed at several points in this report that the loss of such areas as the lower Ledges will be replaced by the acquisition of upland areas. Is the Corps able to show how over 400,000 visitors annually to the Ledges will be compensated for the loss of this area by the development of upland areas?

26. Page 153, last line. What is meant by environmental productivity? Does this mean the continuation of natural cycles will remain intact? or

that new and favorable environments will be produced? Statements like this are nothing more than smoke screens to hide the emptiness of meaning.

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6 June 73

COMMENTS ON SAYLORVILLE RESERVOIR ENVIRONMENTAL IMPACT STATEMENT - ZOOLOGY SECTION

Page

39a "transient" categories are of questionable value.
Scientific names of mammals are needed to clarify items like: southern rather than northern flying squirrel (G. volans, G. sobrinus)
Near bottom: should probably read, "Mice and voles".

40-4 rabits = rabbits

42 Discussion of phytoplankton does not belong in zoology section. There is no discussion of limnology and eutrophication impact.
2nd last - Flagelate = flagellate

43 sitings = sightings

43a "figures" = tables

43a, b These lists have relatively little value among aquatics; it includes lake species not likely to occur on river. Habitat classifications are essential to show even minimum relevance.
Errors: Herons & Bitterns - add "heron" to black-crowned and yellow-crowned
Geese - delete blue (color phase of the Lesser Snow) add "Lesser" to Snow
Ducks - black is pretty rare!) white-winged Scoter rare) Old Squaw very rare) implications for Saylorville are misleading
Throughout - clarify which common name with which bird group where two are included, i.e., Rails & Coots: Yellow Rail.

43c fig. 9 Suggest listing fishes into game species & non-game species, e.g.

Game Species	Non-game and forage species
Northern pike	Goldeye
Buffalo (2 species)	Carpsuckers (3 species)
Carp	Redhorse suckers (3 species)
Channel catfish	Hogsucker
Flathead catfish	White sucker
Black bullhead	Shiners (8 Notropis species)
Walleye	Creek chub
Rock bass	Suckermouth
Bluegill	
Green sunfish	Chubs (4 Hybopsis & Nocomis species)
Orangespotted sunfish	Brassy minnow
Smallmouth bass	Bullhead minnow
White crappie	Bluntnose minnow
Black crappie	Fathead minnow
Yellow perch	Madtoms (3 species)
	Darters (6 species)
	Brook stickleback

Several species listed in fig. 9 are either totally absent or very rare in the study area - blue catfish, brown and yellow bullheads.

43e, fig. 11 Additional amphibians - tiger salamander, cricket frog, chorus frog, green frog.
Notice also that mudpuppy should be listed with amphibians and not with reptiles.
Additional reptiles - ornate box turtle, spiny softshell turtle, smooth softshell turtle (your notation of western softshell turtle is ambiguous), eastern hognose snake, Texas brown snake, western smooth green snake, prairie ringneck snake, red milk snake, plains garter snake.

43f, fig. 12 Water boatman and mosquito are not really benthic, i.e., bottom dwelling organisms.
Caddisfly not Caddice fly.

46-6 remanent = remnant

74 G-Zoological
This is trite. Can't be quantified because time hasn't been taken to plot water levels on present cover map and calculate habitat losses. Although there are some estimates of timber loss, borrow bits, etc., more complete cover map is needed in order to calculate habitat losses which should be reported in the Draft E.I.S. Moreover, species lists do not show habitat associations so the two can't be related.

We do not need an exotic pine orest to destroy the esthetic quality of a deciduous forest area. These turn out to be pine barrens as far as wildlife is concerned, anyway. This is not mitigation!

75 Statements on this page are idealistic and conflicting.
A. Flood plain species will be lost if there is no other flood plain created for them.
B. With territorial vertebrates, you can't just cram more into the same habitat; it will create more than "stress", it will eliminate individuals as successful breeders in the area.

150-51 This is not a clear statement of logical predictions because it stresses saving of upland habitat and ignores loss of the flood plain and lower woodlands. Some of the terminology is pseudo-scientific and obscures the facts.

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