

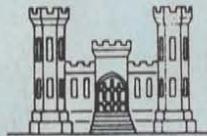
Hyd. Branch

**SCHUYLKILL RIVER BASIN
TULPEHOCKEN CREEK, PENNSYLVANIA**

**BLUE MARSH LAKE
DESIGN MEMORANDUM NO. 15**

MASTER PLAN

JUNE 1975



**DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106**

DEPARTMENT OF THE ARMY
Philadelphia District, Corps of Engineers
Custom House - 26 & Chestnut Streets
Philadelphia, Pennsylvania 19106

NAPEN-N

03 AUG 1982

Honorable Stanton Clay
Mayor of Bernville Borough
Bernville, PA 19506

Dear Mayor Clay:

Your attention is called to our previous letter dated 15 June 1982 confirming discussions held in the Borough Hall on the evening of 9 June 1982.

As a result of subsequent Borough Council decisions regarding the proposed hydrant modifications which were transmitted to this office by telephone conversations between yourself and our Mr. McDonald, we have re-evaluated our position on the matter of responsibility for maintenance of the system after completion. Based on our reconsiderations, we will accept the responsibility for electrical costs involved with operation and all costs associated with maintenance and repair costs associated with the entire system.

It is understood that with the Government assuming maintenance of the system, Borough Council will agree to accept the system as a satisfactory replacement for pre-project conditions.

We request that you advise us, as soon as practicable, in writing of the Borough's position with regards to the proposed concepts and responsibilities.

Sincerely,

NICHOLAS J. BARBIERI, P.E.
Chief, Planning/Engineering Division

✓ Copy Furnished:
Bernville Community Fire Company
ATTN: Les Weidman
P. O. Box 161
Bernville, PA 19506

16 JUN 1982

WAFEN-N

Honorable Stanton Clay

Mayor of Barnville Borough
Barnville, VA 22806

Dear Mayor Clay:

This is to confirm the discussions held in the Borough Hall on the evening of 9 June 1982 among representatives of the Borough, the Barnville Fire Company and the District concerning the water source for fire fighting purposes provided by the Corps along the west side of Route 183 as a part of construction of the Blue Marsh Lake Project.

At the meeting, some comments were made by Borough representatives as to the possibility of installing a tank on the opposite side of Route 183 in the vicinity of the existing borough water supply tank above the town which could be connected to the existing municipal potable water system. As District representatives noted, our authority permits us only to replace those municipal facilities which are lost as a result of construction of the Blue Marsh Project. The facility being considered, of course, is the previous natural source of water from the Northkill Creek, on the west side of Route 183, which was utilized before the introduction of the Barnville protective works. In order to replace this lost source we have already provided piping to the creek, hardstands and hydrants and we are now proposing to add a pump and storage tank to insure complete reliability. Any improvements made, on the east side of Route 183 which would be connected to the existing municipal water system would clearly represent a betterment and is not within our authority.

Preliminary plans outlining the arrangement of the proposed additions to the present system are inclosed; these plans were presented at the meeting and appeared generally satisfactory from a technical point of view. More detailed plans will be made available as they are developed.

In order to conclude this matter, we plan to have construction completed by the end of 1982. To meet this target, we must proceed with design and award a construction contract as quickly as possible. We accordingly request that you advise us, as soon as practicable, of the Borough's position with regard to the concepts presented including complete assumption by the Borough of future operation and maintenance of the system after an agreeable trial period.

MAPEN-8

Honorable Stanton Clay

If the Borough agrees with these concepts we will proceed with design and construction and undertake action to incorporate these additional items into the existing agreement between the Borough and the Corps.

During the meeting Mr. Sheets noted that prior to relocation of the Northkill Creek by the Corps, the Borough boundary was established at the center of the Creek and asked if the boundary was changed by relocation of the Creek. We have informally asked our Counsel to investigate this matter and will advise you as soon as possible.

We wish to express our thanks for the courtesies extended to members of our staff and for your prompt response to our current proposal.

Sincerely,

1 Incl
As stated

NICHOLAS J. BARBERI, P.E.
Chief, Planning/Engineering Division

Copies Furnished:
Bernville Community Fire Company
ATTN: Leo Weidman
P. O. Box 161
Bernville, PA 19506



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER

NAPEL E

SUBJECT: Transmittal of Master Plan Design Memorandum No. 15 and
Recreation-Resource Management Design Memorandum No. 15A,
Blue Marsh Lake, Pa.

Division Engineer, North Atlantic
ATTN: NADPL-R

Inclosed for approval are six (6) copies each of both of the subject
design memoranda which have been prepared in accordance with the
guidelines in ER 1120-2-400, ER 1130-2-400 and others.

FOR THE DISTRICT ENGINEER:

2 Incl (sext)
as

Worth D. Phillips
WORTH D. PHILLIPS
Chief, Engineering Division

**SCHUYLKILL RIVER BASIN
TULPEHOCKEN CREEK, PENNSYLVANIA**

**BLUE MARSH LAKE
DESIGN MEMORANDUM NO. 15**

MASTER PLAN

PREPARED FOR: DEPARTMENT OF THE ARMY

**PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA**

**BY: FAHRINGER, McCARTY,
GREY, INC.**

**LANDSCAPE ARCHITECTS AND ENGINEERS
MONROEVILLE, PENNSYLVANIA**

SCHUYLKILL RIVER BASIN
TULPEHOCKEN CREEK, PENNSYLVANIA
BLUE MARSH LAKE

DESIGN MEMORANDUM NO. 15
MASTER PLAN

Previous Design Memorandums

<u>No.</u>	<u>Title</u>	<u>Date Submitted</u>	<u>Date Approved</u>
1	Site Selection	31 Mar 66	7 Jun 66
2	Hydrology and Hydraulics	11 Aug 66	7 Dec 66
3	Site Geology	28 Nov 66	18 Apr 67
4	General Design Memorandum	24 Aug 67	2 Jun 69
5	Land Requirements Plan/Public Use	24 Feb 69	12 Dec 69
6	Concrete Aggregates Investigations	19 Mar 68	9 May 68
7	Real Estate	28 Mar 68	25 May 70
	Real Estate Supplement No. 1	29 Dec 71	11 Apr 72
8	Embankment and Spillway	28 Aug 68	11 Apr 69
9	Outlet Works	28 Jun 68	13 Mar 69
10	Access Roads and Oper. Facilities	27 Dec 68	20 Mar 69
11	Highway Relocations	11 Jun 74	29 Aug 74
12	Utility Relocations - Part I	25 Nov 68	17 Feb 69
12	Utility Relocations - Part II	14 Sep 74	-----
13	Bernville Protective Works	16 Jan 75	-----
14	Reservoir Clearing	6 Aug 74	6 Sep 74

Scheduled Design Memorandums

<u>No.</u>	<u>Title</u>	<u>Date Scheduled</u>
16	Cemetery Relocation	FY75
17	O and M Manual	FY76
18	Reservoir Regulation Manual	FY76

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2 Project Vicinity	1" = 6,000'
3 Aerial Mosaic	1" = 3,000'
4 Facilities Development Plan	1" = 3,000'
5 Soil Suitability for Recreation Development	1" = 3,000'
6 Potential Problem Areas	1" = 3,000'
7 Land-Use Plan	1" = 3,000'
8 Bemville Area Development Plan	1" = 1,200'
9 Conrads Bridge Area Development Plan	1" = 1,200'
10 Dry Brooks Area Development Plan	1" = 1,200'
11 Spring Creek Area Development Plan	1" = 1,200'
12 Typical Layouts: Picnic Area - Beach - Boat Launch Ramp	None
13 Typical Layouts: Camping Areas - Road Sections	None
14 Dry Brooks Area Water and Sewer Plan	1" = 1,200'

<u>Plate Number/Title</u>	<u>Scale</u>
15 Spring Creek Area Water and Sewer Plan	1" = 1,200'
16 Administration - Picnic Shelter (Architectural)	None
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1 INTRODUCTION

1.1 PURPOSES OF THE PROJECT.

1.1.1 Flood Control. Impoundment of flood waters in Blue Marsh Lake will reduce flood stages at Reading, Birdsboro, Pottstown, Conshohocken and Philadelphia, the major downstream centers of past flood damage. It will have the potential to store 32,390 acre-feet or 10.6 billion gallons of flood water above the normal winter season water supply pool, sufficient to contain a flood of about 1-in-100 years' frequency. The flood water capacity above the summer season water supply pool is 27,110 acre-feet, enough to contain a flood of about 1-in-50 years' frequency. Increased discharge during the period of warning before a major storm, if it is considered necessary, could substantially increase the lake's flood-control capacity.

If the Blue Marsh Lake project had been operating since 1 January 1929, when records were first kept of Tulpehocken Creek's flow, the lake would have contained all recorded floods without attaining the spillway crest elevation. Discharge of flood waters would not at any time have exceeded Tulpehocken Creek's estimated maximum safe channel capacity -- 3,000 cubic feet per second (cfs).

1.1.2 Water Supply and Water Quality Control. The Blue Marsh project will be operated to enhance the quality and, when necessary, the quantity of water flowing downstream. In addition, the Western Berks County Water Authority will make withdrawals directly from the lake to be distributed after treatment throughout much of western Berks County.

The Federal Water Pollution Control Administration has projected the need to insure a flow along the Schuylkill River of 373 cfs at Norristown by the year 2020 to supply the municipal and industrial water needs of both the Norristown area and Philadelphia -- the anticipated points of peak withdrawal downstream from Blue Marsh Dam. A daily release of 8,000 acre-feet from Blue Marsh Lake will maintain the necessary flow in the event of a severe, 1-in-100 years' frequency drought. Since most water withdrawn for industrial purposes eventually is returned to the watershed, downstream points of withdrawal with lesser requirements than Norristown and Philadelphia such as Reading and Pottstown also will be served by flow augmentation operations.

The supplementation of stream flow will also contribute to water quality improvement. It could dilute contamination in the Schuylkill River and help maintain the flushing effect of moving current. Blue Marsh Lake thus will enhance the river as a source of drinking water, as an environment for fish and as a scenic and recreational resource.

The Western Berks County Water Authority will withdraw an estimated average of 15.4 million gallons per day for water supply purposes upon completion of the lake. Facilities are designed to accommodate possible future consumption of up to 30.8 million gallons per day.

1.1.3 Recreation. The area available for recreation and related uses within the Blue Marsh Lake project includes 5,500 acres of Federal land and water and 460 acres of state-owned land. Part of the land allocated for public use will be developed and administered exclusively for recreation, and part of it will be managed to serve multiple functions, including recreation. In addition, Pennsylvania Game Commission lands adjoining the project (1,850 acres) will be open to hunting; Berks County's Tulpehocken Creek Valley Park covers 380 acres adjacent to and downstream from the project; and the Pennsylvania Fish Commission will supervise and augment fishing and boating activities on the lake's 960-acre normal winter pool and 1,150-acre normal summer pool.

1.1.4 Summary of Project Benefits. Monetary benefits have been estimated for each project purpose based on projections of trends in population growth, employment, land development and recreation demand.

A. Flood Control. Flood control benefits were estimated based on an analysis of damage incurred during the flood of 1955. Existing and projected development trends were also considered, based on comprehensive planning reports. In addition to those benefits accrued through protection from damage, the estimate of flood control benefits includes "land enhancement," or increased usability of flood plains. Average annual flood control benefits over the 100-year period of economic analysis were estimated at \$847,000 (July 1974 price level).

B. Water Supply. The value of water supply benefits was assumed to be equivalent to the cost of the least expensive potential alternative project developed for the purpose of water supply only. Alternatives studied were water supply reservoirs at the Blue Marsh Lake and Maiden Creek Lake sites and development of groundwater sources. The water supply reservoir at the Blue Marsh Lake site was found to be the

least costly alternative. Average annual water supply benefits over the 100-year period of economic analysis were estimated at \$871,000 (July 1974 price level).

C. Water Quality Control. Water quality control benefits were derived using the same method employed to estimate water supply benefits, i.e., they were assumed to be equivalent to the cost of the least expensive single-purpose alternative project. Average annual water quality control benefits over the 100-year period of economic analysis were estimated at \$644,000 (July 1974 price level).

D. Recreation. Benefits for recreation use of the Blue Marsh Lake project were computed using the method set forth in Supplement No. 1 to Senate Document No. 97, 87th Congress, Second Session. Benefits were assigned an average value of \$1.25 per visitor-day. Average annual recreation benefits over the 100-year period of economic analysis were estimated at \$434,000.

E. Fishing and Hunting. The U. S. Fish and Wildlife Service estimated the average annual benefits to fishermen over the 100-year period of economic analysis at \$35,000. No significant gain or loss in hunting benefits was expected to take place in the project area as a result of inundation.

Table 1-1: RESUME OF ESTIMATED TOTAL ANNUAL BENEFITS

Flood Control	\$ 847,000
Water Supply	871,000
Water Quality Control	644,000
Recreation	434,000
Fishing and Hunting	<u>35,000</u>
Total Annual Benefits	\$2,831,000

1.1.5 Summary of Project Costs. Estimates of Federal and non-Federal project costs in tables 1-2 through 1-4 are from Project Cost Estimate (PB-3) dated 1 July 1974.

Table 1-2: ESTIMATED FEDERAL COSTS

Lands and Damages	\$13,790,000
Relocations	9,915,000
Reservoir and Pool Preparation	615,000

Dam	\$ 6,570,000
Fish and Wildlife	11,000
Roads	280,000
Levees	1,241,000
Pumping Plant	1,240,000
Recreation Facilities	3,335,000
Buildings, Grounds and Utilities	910,000
Permanent Operating Equipment	88,000
Engineering and Design	3,020,000
Supervision and Administration	<u>2,085,000</u>

Total	\$43,100,000
Required Non-Federal Reimbursement	<u>9,145,000</u>

Total Federal Cost	\$33,955,000
--------------------	--------------

Table 1-3: ESTIMATED NON-FEDERAL COSTS

Reimbursement for Water Supply Storage	\$ 9,145,000
Recreation Facilities	<u>6,230,000</u>
Total Non-Federal Cost	\$15,375,000

Table 1-4: ESTIMATED AVERAGE ANNUAL CHARGES

Interest and Amortization	\$1,633,000
Operation, Maintenance and Major Replacements	427,000
Economic Cost of Land	<u>46,000</u>
Total Average Annual Charges	\$2,106,000

Table 1-5: COMPARISON OF BENEFITS TO COSTS

Estimated Total Annual Benefits	\$2,831,000
Estimated Average Annual Costs	\$2,106,000
Benefit-to-Cost Ratio	1.3:1

1.2 PROJECT AUTHORIZATION.

1.2.1 Background. Two studies of Delaware River Basin water resources and problems were in progress in 1955, one by the Corps

of Engineers and one by the governors of the four-state basin area, when two disastrous hurricanes struck the region in one week. Congress then directed the Corps to undertake a comprehensive basin-wide survey and plan.

The views and desires of as many interests as possible were incorporated into the creation of the Delaware River Basin Plan through public hearings and a multi-agency coordinating committee. Estimates were made of future demands for water, electricity and recreation. An assessment of potential flood damages was also prepared, along with an investigation of means for flood prevention. Nineteen major flood control and multi-purpose projects were recommended for development, including a dam on Tulpehocken Creek.

1.2.2 Project Document. The 87th Congress authorized a comprehensive plan for the development of water resources of the Delaware River Basin in 1962 as House Document No. 522. It included eight of the major projects proposed in the original Delaware Basin Plan, including Blue Marsh Lake.

1.2.3 Authorizing Law. The project document was approved for Federal implementation by the Omnibus Rivers and Harbors and Flood Control Act of 1962, Section 203 (Public Law 87-874, dated 23 October 1962).

1.2.4 Requirements for Local Cooperation. The requirements specified in the project document for local cooperation are as follows:

"... provided that, prior to construction, responsible non-Federal interests give assurances satisfactory to the Secretary of the Army that they will:

"(1) Make demands for the use of water-supply storage in the several projects within a period of time which will permit paying out the costs allocated to water supply within the life of the project, as determined by the Chief of Engineers, in accordance with the provisions of the Water Supply Act of 1958, as amended by the Federal Water Pollution Control Act Amendments of 1961; such costs to be determined by applying the percentages given in table 2 to actual costs for construction, operation, maintenance and major replacements, with such modification in these percentages as may be necessary to reflect adjustments in the storage capacity for water supply and other purposes, presently estimated for the eight-reservoir system at \$89,100,000 for construction, and \$450,000 annually for maintenance, operation, and major replacement;

"(2) Prevent encroachment on the stream channels downstream from the reservoirs to the extent needed to provide reasonably efficient reservoir operations;

"(3) Hold and save the United States free from all water rights claims, resulting from construction and operation of the reservoirs; and

"(4) Agree to undertake establishment and prosecution of programs for acquisition of lands, and to develop facilities, as needed, for the recreation developments assigned to them."

1.2.5 Application of Other Public Laws.

A. Flood Control Act of 1944 (Public Law 534-78).

This act authorized construction of certain public works on rivers and harbors for flood control and other purposes to include recreation. It requires coordination with state agencies in developing public facilities.

B. Fish and Wildlife Coordination Act of 1958 (Public Law 85-624). This act provides for effective integration of Federal water-resource development projects with fish and wildlife conservation programs at both Federal and state levels. Under its authority, the U.S. Fish and Wildlife Service and the Pennsylvania Fish and Game Commissions are participants in planning and policy making for the Blue Marsh Lake project.

C. Reservoir Salvage Act of 1960 (Public Law 86-523). This act provides for the preservation of historic sites, buildings, objects and other antiquities of national significance which might otherwise be lost or destroyed as the result of any dam or other construction project built or licensed by the Federal government. It authorizes agencies undertaking construction projects to spend up to one percent of the total funds appropriated for project development to carry out the purposes of the act. The "Historical Survey, Blue Marsh Lake Project" (see subsection 1.5.16) was prepared in compliance with this act.

D. Federal Water Project Recreation Act of 1965 (Public Law 89-72). This act established recreation as an official purpose of Federal water-resource development projects and provided uniform guidelines for incorporating recreation and other uses into project benefit-cost analyses. It also sets forth requirements for cost sharing and division of responsibility in project operations between Federal and non-Federal interests.

E. Water Resources Planning Act of 1965 (Public Law 89-80). This act provided for the coordinated area-wide planning of water resources and water-related resources through establishment of a water resources council and river basin commissions and through financial assistance to the states. Compliance with this law requires coordination with the Delaware River Basin Commission and other state, regional and local planning organizations.

F. National Historic Preservation Act of 1966 (Public Law 89-665). This act makes available Federal assistance for state, local and private historic preservation programs and activities. It also established the National Register of historic places and landmarks under which the Gruber Wagon Works, now under Federal ownership on project lands, has been designated as a nationally significant historic building requiring special treatment. Registry of several other project structures is currently under consideration.

G. National Environmental Policy Act of 1969 (Public Law 91-190). This act established the environmental impact statement as a requirement for all Federal actions significantly affecting the quality of the human environment. An environmental impact statement has been prepared for the Blue Marsh Lake project to include analyses of the following points, as required by this act: ". . . (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 long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed actions should it be implemented."

1.2.6 Departures from Project Document.

A. Dam Location. During the preparation of Design Memorandum No. 1: "Site Selection," the dam site presented in the project document was found to be geologically unsuited to support the dam structure. A new location about 2,500 feet upstream from the site originally proposed was recommended and approved. This revision also necessitated adjustments to the dimensions and capacity of the spillway and outlet works.

B. Bemville Flood Hazard. Hydrologic studies showed that many more properties within the borough of Bemville would be endangered by impoundment of flood waters than were indicated by the project document. The two practical alternatives -- acquiring the endangered properties or building

protective works -- were investigated. Construction of a levee and pump station was found to be the most economical solution.

C. Scope of Recreation Development. Economic and social changes in the project region have accelerated the growth of outdoor recreation demand since project document authorization. The proposed recreation facilities have been upgraded in extent and quality to accommodate more intensive public use and to conform to revised, more stringent design standards.

D. Relocations. A total of about 6.5 miles of additional road relocations not presented in the project document have been planned to maintain the existing pattern of traffic circulation around the lake site.

Oil and gas pipeline relocations proposed in the project document have also been slightly revised to safeguard lake crossings in two locations.

E. Real Estate Acquisition. The project document established the fee simple purchase line at elevation 294 to coincide with the top of the flood pool statistically expected to recur once every five years. Flowage easements were to be obtained between elevations 294 and 306, which in the original design was three feet above the spillway crest. Current project land acquisition standards, as set forth in ER 405-2-150, require that the fee simple purchase and easement lines include all land within 300 horizontal feet of the maximum normal pool level, now elevation 290, or at 3 vertical feet above the elevation 307 flood pool crest, whichever is greater. The change in the dam location necessitated further revisions in the planned acquisition of real estate immediately surrounding the dam site.

1.3 PURPOSE OF THE MASTER PLAN. The purpose of this master plan is to provide a working document as a guide for the orderly development of the natural and man-made resources of the Blue Marsh Lake project, in consonance with sound environmental principles.

1.4 SCOPE OF THE MASTER PLAN. The master plan has been developed in accordance with guidelines set forth in ER 1120-2-400. It consists of the following major components:

1.4.1 Analysis of Planning Considerations. The planning potentials and design constraints created by the project's physical resources and demographic situation are identified and discussed as they relate to such

subjects as topography, soils, existing vegetation, "special" or unusual features, past exploitation of natural resources, water quality, the effects of planned lake operation, relocated roads and utilities, surrounding land uses and zoning, the project's accessibility from places of potential visitor origin, and estimates of potential project attendance.

1.4.2 Land-Use Plan. The land-use plan identifies in diagrammatic form the areas most environmentally suited for each of several broad categories of land use, or for combinations of two or more types of uses.

1.4.3 Recreation Development Plan. Based on a comprehensive analysis of the site and of the regional demand for outdoor recreation, the development plan includes design criteria, site plans, architectural character plans, cost estimates and a proposed phasing schedule for construction of recreation facilities and related administration, maintenance, sanitation and water distribution systems.

1.5 PERTINENT PRIOR REPORTS. Information from certain previous Corps of Engineers reports was used in preparing this master plan and its recreation-resource management appendices (Design Memorandum 15A). The relevance of each of these reports to the master plan is noted in the following paragraphs.

1.5.1 Hydrology and Hydraulics (Design Memorandum 2. Submitted 6 September 1966; approved 7 December 1966). This document provides details on the hydrologic characteristics of the project's drainage area and outlines the proposed lake regulation plan.

1.5.2 Site Geology (Design Memorandum 3. Submitted 28 November 1966; approved 18 April 1967). This document contains a geologic analysis of the project area, including information on the underlying rock formations, soils, groundwater and past exploitation of mineral resources.

1.5.3 General Design Memorandum (Design Memorandum 4. Submitted 24 August 1967; approved 31 January 1968, with revisions dated January 1969, May 1969, August 1969). This document provides a general background of the project, a description of the dam and other planned structures, supplemental information on hydrology and water quality, and preliminary estimates of project costs and benefits.

1.5.4 Land Requirements Plan/Public Use (Design Memorandum 5. Submitted 24 February 1969; approved 3 May 1971). This document

presents a preliminary conceptual plan for the organization of land uses and physical development on the project site. By letter reproduced in exhibit 15-1 herein, Design Memorandum 5 was considered as fulfilling the requirements for a recreation-resource appendix to the master plan.

1.5.5 Embankment and Spillway (Design Memorandum 8. Submitted 28 August 1968; approved 11 April 1969). This document contains detailed designs of the dam embankment, spillway and saddle dikes.

1.5.6 Access Roads and Operational Facilities (Design Memorandum 10. Submitted 27 December 1968; approved 20 March 1969). This document indicates the planned locations and designs of buildings and access roads in the vicinity of the dam, including the overlook building, operation building, operators' residences, storage building and public parking lot.

1.5.7 Highway Relocations (Design Memorandum 11. Submitted 11 June 1974; approved 29 August 1974). This document presents the designs of new and relocated highways planned in conjunction with project development, with detailed analyses of the various site and transportational factors that were considered in relocation planning.

1.5.8 Utility Relocations (Design Memorandum 12, Part I. Submitted 25 November 1968; approved 17 February 1969. Design Memorandum 12, Part II. Submitted 14 September 1974; approval pending). These two documents detail relocation plans for all pipelines, electric lines and telephone lines to be moved or removed as a result of project construction.

1.5.9 Berville Protective Works (Design Memorandum 13. Submitted 16 January 1975; approval pending). This document presents an environmental assessment and detailed designs for construction proposed within the project at the borough of Berville including the levee embankment, new creek channel, drainage structures, pumping station and relocations.

1.5.10 Reservoir Clearing (Design Memorandum 14. Submitted 6 August 1974; approved 6 September 1974). This document outlines plans for clearing the lake site before inundation, with a brief discussion of planning considerations and expected environmental effects.

1.5.11 Environmental Statement (Submitted April 1971). This report summarizes the anticipated environmental effects of the project and documents coordination with other agencies on environmental concerns.

1.5.12 Supplement to the Final Environmental Impact Statement (Dated June 1973). This document details the changes anticipated in the project area after the completion of the lake, particularly the projected modification of water quality.

1.5.13 Investigation of the Arsenic Conditions at Blue Marsh Lake Project Site, Pennsylvania (Submitted 15 January 1973 by the Department of Environmental Sciences, Rutgers, The State University, New Brunswick, New Jersey; Addendum submitted 16 April 1973). Based on an analysis of arsenic contamination in the project area, this study predicts how the arsenic compounds will behave in the lake under various hydrologic conditions. It discusses the possible effects of the arsenic pollution on recreation, and suggests means of operating the lake to avoid potential problems.

1.5.14 Ecologic Simulation of Blue Marsh Reservoir (Submitted 1 December 1972 by Daniel J. Glanz, Water Resources Engineers, Inc., Springfield, Virginia). In the preparation of this study, data from the project site was inserted into an existing lake ecology model, and the variation in water quality of Blue Marsh Lake was simulated by computer. The role of outlet operations in influencing water quality was investigated. The simulation also produced curves showing expected seasonal variations in water temperature.

1.5.15 Blue Marsh Lake Water Quality Report (Draft dated October 1973). This study summarizes all previous water quality analyses. It further outlines management procedures for meeting all the applicable water quality criteria and for solving potential problems relating to the planned uses of the lake.

1.5.16 Historical Survey, Blue Marsh Lake Project (Submitted 8 May 1974 by Ltc. S. J. Newsom, Jr.). This study draws from earlier surveys and investigation in the field to catalog the historic structures and artifacts known to exist within Blue Marsh Lake project boundaries.

1.6 COORDINATION. Coordination has been maintained throughout the course of recreation planning for the Blue Marsh Lake project with appropriate Federal, state and local governmental agencies, regional and local planning bodies, local interest groups and interested individuals and institutions. The following paragraphs list some of the parties contacted in preparing the General Design Memorandum (D. M. 4) and the Land Requirements Plan/Public Use (D. M. 5), and briefly reviews the coordination conducted during the creation of this Master Plan (D. M. 15) and the Recreation-Resource Management Appendices to the Master Plan (D. M. 15A).

1.6.1 Previous Planning Coordination.

A. General Design Memorandum (D. M. 4). Among the agencies contacted in the preparation of the General Design Memorandum were the following:

- (1) U. S. Department of the Interior
U. S. Fish and Wildlife Service
Federal Water Pollution Control Administration
National Park Service
- (2) U. S. Department of Health, Education and Welfare
Public Health Service
- (3) U. S. Department of Commerce
Bureau of Public Roads
- (4) Federal Power Commission
- (5) Pennsylvania Department of Environmental Resources (formerly
Department of Forests and Waters)
- (6) Pennsylvania Department of Health
- (7) Pennsylvania Department of Transportation
- (8) Berks County Planning Commission

B. Land Requirements Plan/Public Use (D. M. 5). Organizations contacted in the preparation of the Land Requirements Plan/
Public Use document include the following:

- (1) U. S. Department of the Interior
Bureau of Outdoor Recreation
U. S. Fish and Wildlife Service
- (2) Pennsylvania Department of Environmental Resources (formerly
Department of Forests and Waters)
- (3) Pennsylvania Game Commission
- (4) Pennsylvania Fish Commission

- (5) Pennsylvania Department of Health
- (6) Berks County Planning Commission
- (7) Berks County Historical Society

1.6.2 Coordination for the Master Plan (D. M. 15) and Recreation-Resource Management Appendices to the Master Plan (D. M. 15A). The coordination conducted in preparing Design Memorandums 4 and 5 provided a wealth of information needed to develop this master plan. Further coordination has been carried on to acquire additional information. The following paragraphs present brief summaries of the contributions of each contacted agency and organization. Correspondence is reproduced in exhibit 15-I herein and in exhibits 15A-I through 15A-VI in Design Memorandum 15A.

A. Pennsylvania Department of Environmental Resources, Bureau of Resources Programming. Because the Department of Environmental Resources will manage and operate the recreation lands and facilities of the Blue Marsh Lake project, all plans were reviewed by this agency in the course of the design process. In addition, data from existing state parks supplied by the Bureau of Resources Programming was helpful in developing general planning concepts, design criteria and attendance estimates.

B. Pennsylvania Department of Environmental Resources, Bureau of State Parks. The Bureau of State Parks was contacted through the Bureau of Resources Programming to review the master plan and to provide information on management goals, needs and practices applicable to the preparation of the Project Resource Management Plan (Design Memorandum 15A, Appendix A). This Bureau will be responsible after project implementation for the management of most recreation-related activities within the project.

C. Pennsylvania Game Commission. There was coordination with the Game Commission in planning the allocation of land uses within the project. This agency also contributed much of the information used in completing the Fish and Wildlife Management Plan (Design Memorandum 15A, Appendix C). The Game Commission currently manages a 1,850-acre State Game Lands unit adjoining the Blue Marsh Lake project. This agency will also manage a portion of project lands owned by the Corps of Engineers.

D. Pennsylvania Fish Commission. The Fish Commission was contacted to provide input on the Fish and Wildlife Management Plan (Design Memorandum 15A, Appendix C). The water safety zoning plan (see

Design Memorandum 15A, plate A4) was also developed by this agency. The Fish Commission will have the responsibility of managing fish and other aquatic life in the project's waters and of policing fishing and boating on the lake's surface.

E. Pennsylvania Historical and Museum Commission. Representatives of the Historical and Museum Commission were interviewed concerning the possible prehistoric and historic significance of the project area.

F. Berks County Planning Commission. The Berks County Planning Commission contributed information on the county's traffic network, a bulletin summarizing the Berks County Open Space and Recreation Plan, and a copy of the current Berks County Comprehensive Plan. They also provided a list of the officials of the municipalities surrounding the project who could be contacted for zoning information.

G. Local Municipalities. Officials of the borough of Bernville and Bern, North Heidelberg, Lower Heidelberg, Heidelberg, Penn and Jefferson townships provided information on the current zoning classifications of lands adjacent to the project boundary.

H. U. S. Department of Commerce, Soil Conservation Service. The Soil Conservation Service supplied a copy of the Berks County soil survey and a supplement interpreting soil characteristics for recreation development. This agency also contributed additional information on the project's soils relating to the growth of individual tree species and a list of trees suitable for planting within the project (reproduced in Design Memorandum 15A, exhibit 15A-IV).

2 PROJECT SUMMARY

This project summary is a brief synopsis of information presented in greater detail in the project summary section of Design Memorandum 15A, Appendix A. It includes descriptions of all the major man-made features planned for construction at Blue Marsh Lake, including the lake itself.

2.1 LOCATION. The Blue Marsh Lake project is located in Berks County in southeastern Pennsylvania (see plate 1). It extends across the western Berks County townships of Bern, Lower Heidelberg, Heidelberg, North Heidelberg, Jefferson and Penn, and the borough of Bernville. Villages adjacent to project lands are Mt. Pleasant, State Hill and Brownsville (see plate 2).

The project is on Tulpehocken Creek, which has its source near the city of Lebanon and flows generally eastward toward its confluence with the Schuylkill River, about seven miles below the dam site at Reading. The Tulpehocken Creek watershed covers approximately 215 square miles. More than 80 percent of the drainage area is located above the dam site.

Major population centers within an hour's drive of the project are Reading, Pottstown and Lebanon. Portions of metropolitan Lancaster and Allentown-Bethlehem-Easton are also within a driving radius of one hour.

Table 2-1
PERTINENT DATA

Tulpehocken Creek

Drainage Area of Tulpehocken Creek	215 sq. mi.
Drainage Area above Dam	175 sq. mi.
Approximate Maximum Capacity of Channel Downstream from Dam	3,000 cfs

Dam Embankment

Distance to Mouth of Tulpehocken Creek	6.6 miles
Type	Random Fill with Impervious Core
Height at Maximum Section	98 feet
Width at Top	30 feet
Length at Top	1,775 feet
Slope on Upstream Side	1 vertical unit to 3 horizontal units (el. 332-288) 1 vertical unit to 4.5 horizontal units (el. 288-ground)
Slope on Downstream Side	1 vertical unit to 2.5 horizontal units (el. 332-300) 1 vertical unit to 3.5 horizontal units (el. 300-ground)
Freeboard above Spillway Design Flood	5.6 feet

Spillway

Type	Uncontrolled Open-Channel Cut
Control Structure	Concrete Sill
Base Width	300 feet

Outlet Works

Intake Tower Construction	Wet Well
Type of Service Gates	Caterpillar
Number of Service Gates	2
Type of Emergency Gate	Caterpillar
Number of Emergency Gates	2
Type of Control Gate	Sluice
Type of Water Supply Gate	Caterpillar
Type of Outlet Conduit	Modified Oblong
Inside Dimensions of Outlet Conduit	9 ft. 1 in. high 10 ft. 4 in. wide
Inside Diameter of Water Supply Conduit	4 feet
Capacities of Outlet Conduit:	
Reservoir Design Flood	3,980 cfs
Standard Project Flood	4,300 cfs
Spillway Design Flood	4,500 cfs

Elevations Above Mean Sea Level of Impoundment Features

Sediment Reserve	261
Winter Season Water Supply Pool	285
Summer Season Water Supply Pool	290
Flood-Control Pool (Spillway Crest)	307
Top of Dam	332
Streambed at Dam	234

Limit of Clearing	293
Intake Tower Top Deck	332
Range of Left Wet Well Intake	271-279
Range of Right Wet Well Intake	255-285
Range of Bottom (Main Conduit) Intakes	237-246
Intake of Outlet Conduit (Invert)	237
Outlet of Outlet Conduit (Invert)	235
Reservoir Design Flood (Pool Surface)	307
Standard Project Flood (Pool Surface)	317.5
Spillway Design Flood (Pool Surface)	326.4

Pools

Length of Creekbed Inundated:

Winter Season Water Supply Pool	8.0 miles
Summer Season Water Supply Pool	8.8 miles
Flood-Control Pool	11.8 miles

Length of Shoreline:

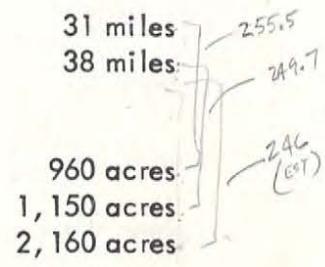
Winter Season Water Supply Pool	31 miles
Summer Season Water Supply Pool	38 miles

Area of Pool:

Winter Season Water Supply Pool	960 acres
Summer Season Water Supply Pool	1,150 acres
Flood-Control Pool	2,160 acres

Volume:

Sediment Reserve	3,000 ac-ft
Winter Season Water Supply Pool	17,620 ac-ft
Summer Season Water Supply Pool	22,900 ac-ft
Flood-Control Pool	50,010 ac-ft



Flood Capacities

Reservoir Design Flood:	
Maximum Inflow	21,300 cfs
Maximum Outflow	2,000 cfs
Standard Project Flood:	
Maximum Inflow	54,270 cfs
Maximum Outflow	30,300 cfs
Spillway Design Flood:	
Maximum Inflow	128,600 cfs
Maximum Outflow	74,800 cfs

2.2 DESCRIPTION OF THE LAKE AND IMPOUNDMENT STRUCTURES.

2.2.1 Lake Characteristics. Blue Marsh Lake's three standard pools are referred to throughout the master plan and appendices as the winter season water supply pool or normal winter pool (elevation 285), the summer season water supply pool or normal summer pool (elevation 290), and the full flood-control pool (at spillway crest elevation 307).

The lake will meander generally southeastward through low northeast-southwest trending ridges. The lands immediately surrounding the lake site are primarily former farmlands interspersed by small woodlots (see aerial photograph, plate 3).

The lake's main feature will be an embayment of approximately 470 acres to be formed over two 180-degree bends in the streambed behind the dam. An island of over 60 acres will extend from a point just off the north shore southward about 3,000 feet into the center of the embayment. This section of the lake will be joined at its northwest corner by the 680-acre narrow, steep-sided upstream portion. The upper part will divide into three major branches along tributary streams.

The lake's irregular shoreline will wind in and out of many coves and inlets for a distance of about 31 miles (normal winter pool) to 38 miles (normal summer pool). Most of the steeper banks are wooded, but about 50 percent of the shoreline is level enough to have been under cultivation at the time of acquisition.

The lake will have a maximum depth of 56 feet (normal summer pool) near the dam. The lake bottom will be generally level or moderately sloping with a few steep areas close to the shore.

2.2.2 Impoundment Structures. The principal impoundment project structures are as follows: dam embankment, outlet works, spillway, three saddle dikes, Bemville protective works, visitors' overlook building, operations building, operators' residences and access roads and parking lots in the vicinity of the dam. Descriptions of the structures which will be involved directly in the impoundment of lakewaters are given below.

A. Dam Embankment. The dam embankment will be constructed of rolled earth and rock. It will be about 1,775 feet long. Its maximum vertical dimension will be 98 feet. The top of the dam will be at elevation 332, 25 feet above the spillway crest, with 5.6 feet of freeboard above the peak spillway design flood pool. A graveled maintenance-pedestrian road will run the length of the dam's 30-foot wide crown.

B. Spillway. The spillway (plate 10) will consist of an unlined open channel through a natural saddle about 1,500 feet south of the dam. The channel will be 300 feet wide and approximately 1,360 feet long along the centerline. The reinforced concrete sill will be 300 feet wide and 30 feet long, with side walls extending from the crest elevation of 307 to elevation 323.

C. Outlet Works. The outlet works will consist of an approach channel, intake tower and service bridge, conduit, stilling basin, and exit channel. The intake tower will be located 293 feet upstream from the axis or top centerline of the dam. It will incorporate the operating house, intakes, gates to regulate intake flow and conduits to convey withdrawals through the dam embankment.

There will be four intake apertures -- two feeding the main conduit, controlled by two service gates backed up by two emergency gates; one feeding the left wet well, controlled by a single stoplog; and one feeding the right wet well, controlled by a series of stoplogs at different levels. The left wet well will empty into the water quality control conduit, regulated by a single sluice-type gate. The right wet well will empty into the gated water supply conduit. This system of intakes will allow selective withdrawal from several levels within the lake (see table 2-1). All gates and stoplogs will be manipulated to control the quality of the lakewater, downstream tailwaters and water supplies.

D. Flood Dikes. Three dikes (plate 10) will be located in natural saddles in the vicinity of the dam and spillway where the surface elevation is lower than the dam crest. The tops will be at elevation 332 and will measure 15 feet across. The northernmost dike will be about 600 feet long, the southernmost dike, about 900 feet long, and the dike closest to the dam, about 300 feet long.

E. Bemville Protective Works. A 4,800-foot levee along the left bank of Northkill Creek (plate 8) will protect the borough of Bemville from damage during high lake levels or creek flood stages. Pennsylvania 183 will run along the top of the levee for about 1,500 feet at its downstream end. Drainage works to convey run-off from the Bemville side across the levee to Northkill Creek will consist of a drainage ditch, gated gravity outfalls, ponding area, pumping plant, pump station outfall, and a 350-foot long saddle dike to keep floodwaters from flanking the levee. Partially relocated Northkill Creek will flow through a new channel along the base of the levee for about 2,200 feet. A bend in the old channel and flood plain on the opposite side of the levee will serve first as a source of borrow and then as a permanent ponding area.

2.2.3 Relocated Roads and Utilities. Of the nine road relocation projects planned in connection with the Blue Marsh Lake project, two have been of special significance to project land-use planning. One is relocated L. R. 06038 between Rebers Bridge and Pennsylvania 183, roughly paralleling the old alignments of Palisades Drive and unpaved Plum Creek Road. The other is the continuation of L. R. 06047 north from the vicinity of North Heidelberg Church, across the lake to an intersection with Pennsylvania 183 one and a half miles southeast of Bemville. The significance of these roads is discussed in greater detail on page 3-25.

Electric lines, oil pipelines, gas pipelines and telephone lines have been or will be relocated or reinforced where necessary in connection with project development. Of these, only the oil pipeline relocations have had a direct bearing on project land-use planning.

ARCO's two adjacent parallel lines formerly cut through the spillway and dam sites and now bypass the area to the east in an 11,240-foot arc. The Buckeye Pipeline Company's single 12-inch pipe runs approximately east-west across the Spring Creek arm of the lake, through the northern end of the State Park lands, across the lake northwest of the dam, and approximately parallel with and slightly inland from the north shore.

About 5,240 feet of Buckeye's pipeline will be reinforced to withstand inundation. The impacts that these underground utilities have had on planning are discussed on page 3-30.

2.3 LAKE OPERATION. Before lake operation is begun, a Blue Marsh Dam and Reservoir Regulation Manual will be prepared as an appendix to the Schuylkill River Basin Regulation Manual. In place of that document, the current tentative operation plan (figure 2-1 and table 2-2) has been used in formulating management and development plans. This operating scheme is designed to serve the needs of flood control, water supply, water quality control and recreation. The following four paragraphs summarize the operations planned in response, respectively, to normal stream flows, high flows, low flows and thermal stratification. The effects that these operations plans have had on the design of facilities are described in subsection 3.3: Hydrologic Considerations.

2.3.1 Operating Rule Curve. When neither flood nor drought conditions exist, the volume of water stored in the lake will be fluctuated according to a "rule curve." The planned curve (see figure 2-1) calls for the pool to be held at elevation 285 until 15 March, gradually raised to elevation 290 by 15 April, and gradually lowered again to elevation 285 between 15 July and 15 August. This scheme is designed to store some of the normally abundant spring run-off for use during the dry summer and to provide maximum floodwater retaining capability during the late summer hurricane season.

2.3.2 Floodwater Retention. The rate of discharge from Blue Marsh Lake during periods of high stream flow will be regulated, insofar as possible, to maintain non-damaging flows along Tulpehocken Creek and the Schuylkill River. Release rates will be determined according to stream flow readings taken on the Tulpehocken at Reading and on the Schuylkill at Pottstown and Philadelphia. Each station's maximum allowable stage -- the stage at which discharge from Blue Marsh Lake is to be curtailed -- is set at slightly less than the flood damage stage. This allows for flood travel time between the dam and the stations.

2.3.3 Streamflow Augmentation. During periods of low flow along the Schuylkill River, release rates at Blue Marsh Dam will be regulated to allow continued normal water supply withdrawals at Philadelphia and at major industrial centers from Reading to Norristown. The tentative Schedule of Regulation and Minimum Required Flow at Philadelphia chart (table 2-2) shows the preliminary scheme for low flow operations. The minimum required

flow figures were derived from projections of water supply demand in the year 2020 and estimates of flows needed to maintain the desired water quality.

2.3.4 Multiple Level Discharge. All four gated intake ports will be manipulated to reduce the detrimental effects of thermal stratification on the quality of water both in the lake and downstream. The two main service gates will permit releases between elevations 237 and 246. The stoplog on the water quality control intake will permit releases between elevations 271 and 279. The stoplogs on the water supply intake will allow withdrawals between elevations 255 and 285, up to the amounts required to feed the water filtration plant. Releases through the former three intakes will be returned to Tulpehocken Creek below the dam, while water supply withdrawals will not. Release levels and flow rates will be determined based on water quality monitor readings at four levels in the lake and at one location in the downstream tailwaters.

2.3.5 Water Supply Withdrawal. Water will be withdrawn at the intake tower to supply the Western Berks County Water Authority's filtration plant 0.9 miles downstream from the dam. Upon completion of the project, estimates of water supply needs indicate that an average of 15.4 million gallons per day will be withdrawn for this purpose. The water supply structures are designed to handle a maximum future average withdrawal of double the anticipated initial need, or 30.8 million gallons per day.

2.4 SYNOPSIS OF RECREATION DEVELOPMENT PLAN. The overall plan of facilities to be developed for recreation at Blue Marsh Lake is shown on plate 4. Details of planning concepts, design criteria, utility plans, architectural concepts and costs are presented in section 5. The following paragraphs briefly describe the planned facilities as they will appear when built.

2.4.1 Day-Use Facilities. The principal day-use complex will be the Dry Brooks area, encompassing all facilities proposed on and near the northeast shore of the lake's main lower section and on the island. These include two beaches and associated picnic areas, two 2-lane boat launch ramps and a boat rental concession. Access will be provided through a single control point off relocated L. R. 06038, with the exception of the east shore boat launch ramp, whose access road will intersect independently with L. R. 06038. The main internal park road into the area will branch and end in several cul-de-sacs.

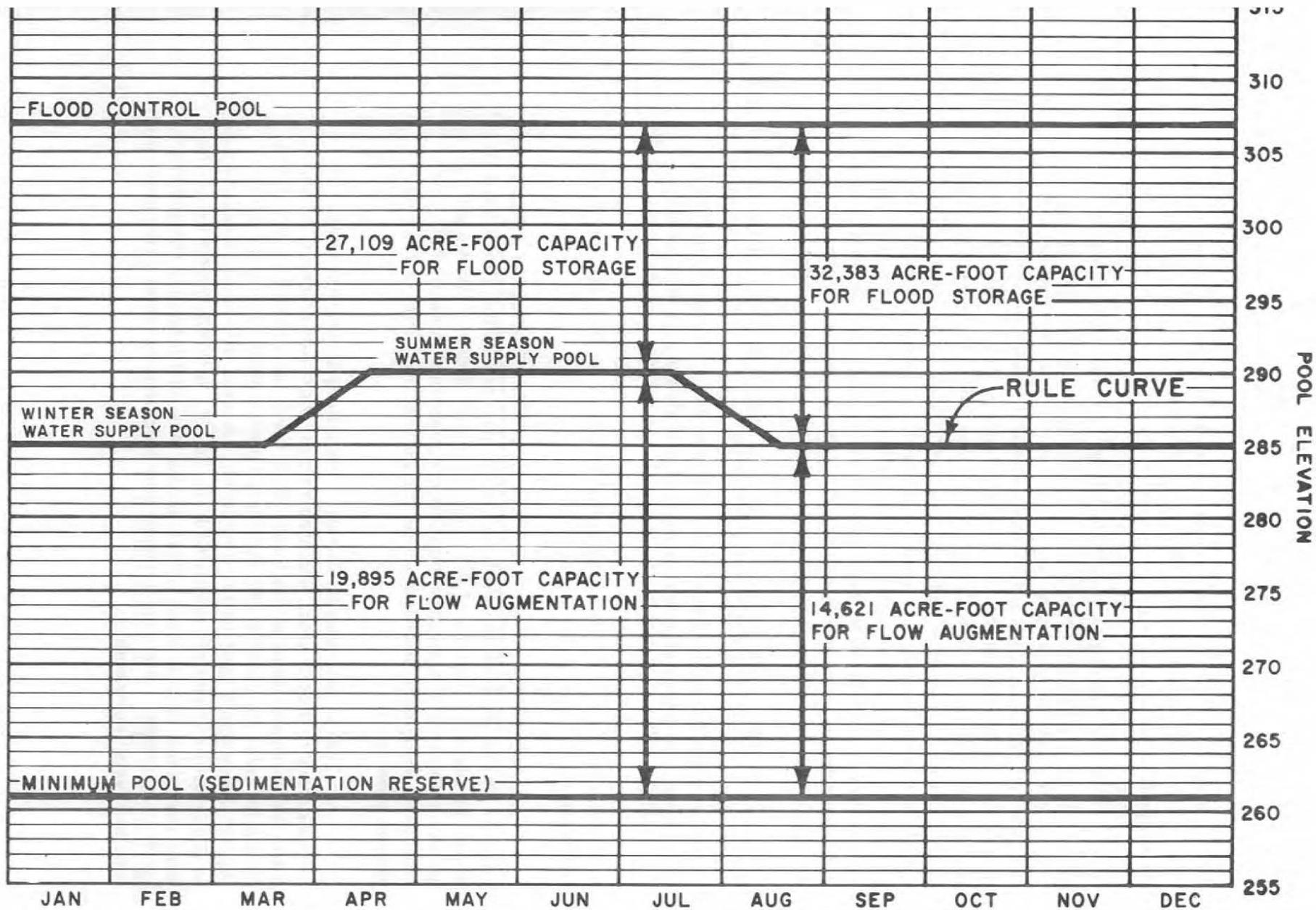


FIGURE 2-1
LAKE OPERATION PLAN

CONTROLLING FACTORS		REGULATION
PHILADELPHIA FLOW	POOL ELEVATION	
< 20,000 CFS	261 TO RULE CURVE	MAINTAIN RULE CURVE AS NEARLY AS POSSIBLE WHILE MAINTAINING FLOW AT PHILADELPHIA AS INDICATED IN CHART "A" BELOW.
	RULE CURVE TO 307	RELEASE AT RATE INDICATED IN CHART "B" BELOW.
> 20,000 CFS	261 TO 307	MAKE WATER SUPPLY WITHDRAWAL OF 29 CFS.
NOT CONSIDERED	307 TO 309*	RELEASE INFLOW UP TO 2,000 CFS. MAINTAIN DISCHARGE UNTIL POOL RECEDES TO SPILLWAY CREST. MAKE WATER SUPPLY WITHDRAWAL OF 29 CFS.
	ABOVE 309	MAINTAIN MAXIMUM RELEASE RATE (CONDUIT GATES FULLY OPEN) UNTIL POOL RECEDES BELOW ELEVATION 309. MAKE WATER SUPPLY WITHDRAWAL OF 29 CFS.

CHART A
MINIMUM REQUIRED FLOW AT PHILADELPHIA**

MONTH	FLOW	MONTH	FLOW
JAN	318 CFS	JUL	428 CFS
FEB	326 CFS	AUG	426 CFS
MAR	352 CFS	SEP	422 CFS
APR	389 CFS	OCT	400 CFS
MAY	409 CFS	NOV	373 CFS
JUN	424 CFS	DEC	342 CFS

CHART B
ALLOWABLE FLOOD STORAGE RELEASE

POTTSTOWN FLOW	ALLOWABLE RELEASES***
UNDER 7,000 CFS	2,000 CFS
7,000 TO 9,000 CFS	1,700 CFS
9,000 TO 11,000 CFS	1,300 CFS
11,000 TO 13,000 CFS	900 CFS
13,000 TO 15,000 CFS	500 CFS
OVER 15,000 CFS	0

* FLOOD POOL ELEVATION WITH 2,000 CFS DISCHARGE (SPILLWAY PLUS OUTLET WORKS).

** 300 CFS SUPPLY FOR PHILADELPHIA PLUS 28% OF FLOW NEEDED BY YEAR 2020 TO MAINTAIN WATER QUALITY.

*** PLUS WATER SUPPLY WITHDRAWAL OF 29 CFS; DISCHARGE MUST NOT CAUSE FLOW AT GAUGE ON TULPEHOCKEN CREEK NEAR READING TO EXCEED 2,000 CFS.

TABLE 2-2
SCHEDULE OF REGULATION (TENTATIVE)

A portion of the Dry Brooks complex to include the east beach, approximately 25 percent of the total proposed picnicking facilities, the two boat launch ramps, and water supply lines, sanitary sewer system, access roads and parking lots for these facilities -- together with a vista parking lot off L. R. 06056 near State Hill -- will comprise the initial phase of recreation development at Blue Marsh Lake. These and the nearby dam overlook complex are the facilities which are planned to be open to visitors upon project completion in 1978.

The other major proposed day-use area is the State Hill complex at the southern end of the lake immediately north and northwest of State Hill. A beach and picnic area are planned on the site's nearly level, 50-acre peninsula. A 3-lane boat launch ramp will be located in a sheltered cove to the northwest. Access will be provided from L. R. 06056 via a park road terminating in several cul-de-sacs.

A minor day-use area is planned along Tulpehocken Creek below the dam at Rebers Bridge. This will include a small picnic area, a launch ramp for canoes and rafts, and parking for fishermen, boaters, picnickers and users of the nearby Union Canal towpath, to be renovated to carry a bicycle-foot trail. The site of the Tulpehocken access area adjoins Berks County's Tulpehocken Creek Valley Park.

2.4.2 Boating Facilities. The three boat launch ramps described in the preceding subsection of the text, planned as adjuncts to the major day-use complexes, will be designed to accommodate trailer launchings. The small canoe and raft launch ramp on Tulpehocken Creek will be for hand-launched craft only.

An additional 2-lane ramp for trailer-launched boats will be provided on the lake's main lower basin for exclusive use by campers.

Two launch ramps, also double-lane trailer types, are planned to serve the narrow, upper reaches of the lake. Both will be located near the upper limits of the minimum recreation season pool (surface at elevation 283 during a 1-in-5 years frequency drawdown period), one on the Spring Creek branch and the other on the main Tulpehocken Creek arm.

A boat rental concession is proposed opposite the north end of the island within the Dry Brooks day-use complex. This will facilitate access to the island for nonboat-owning visitors. Mooring facilities will be provided at several locations along the island's shore. The group camp, boat-to camp and hike-in camp areas will also be supplied with mooring areas.

2.4.3 Camping Facilities. Five types of camp facilities are planned for development at Blue Marsh Lake: trailer and tent units, tent-only units, hike-in units, boat-to units and a group camp area.

All camping facilities other than the group camp will be part of the Spring Creek camp complex south and west of the Spring Creek branch of the lake. All visitors to this complex will enter through the camp control and camp center development planned just off L. R. 06056 west of State Hill. Facilities in this area will include the camp control station, camp store, play fields, amphitheater, recreation center, nature study area and parking on both sides of the control point for both campers and non-campers.

About 79 percent of the total capacity of proposed camp facilities will be in trailer and tent units. These will be arranged, wherever topography permits, on both sides of loop roads, each generally between 2,000 and 4,000 feet in circumference. Most will occupy hilltop sites overlooking the lake. Each loop or cul-de-sac will be provided with at least one wash-house.

Tent-only camp units will accommodate about 8 percent of the project's total camp capacity. These will be somewhat more resource-oriented than trailer and tent units, with choice locations in existing forests or close to the lakeshore. Automobile access will not normally be provided directly into tent camp units, but most sites will be within 200 feet of parking.

The Spring Creek camp complex will contain its own double-lane boat launch ramp, two beaches, and a system of bikeways with separate alignments from camp roads wherever possible. The beaches and boat launch ramp will be located in small, protected coves along the west shore of the lake's main lower basin.

Hike-in and boat-to camp units will be provided on relatively isolated sites immediately east and west, respectively, of the upper Spring Creek branch of the lake. Both will be accessible to campers only through the camp control station: the former via 0.25 to 0.5 miles of trail from a small parking lot, and the latter across 2.7 miles of water from the camp area boat launch ramp. These units will provide 6 percent of the project's total camp capacity.

The group camp area will be separated from the Spring Creek complex by the Spring Creek branch of the lake. It will occupy the entire narrow peninsula between the Spring Creek and Tulpehocken Creek arms, with

developed facilities concentrated close to the peninsula's base. An attractive fieldstone house and barn -- formerly the Skinner farm -- will serve as control and activities center. Two large group tent camping areas will flank the farm to the north and east. Each will be supplied with a rest room. Boat tie-ups and trails will be provided for exclusive use by group campers. Access will be via T-374 (Lake Road) and Church Road (formerly L. R. 06048) from L. R. 06047.

2.4.4 Trails. Four major trail systems will be developed at Blue Marsh Lake: hiking trails, nature education trails, equestrian trails and bicycle trails.

The hiking trail system will be confined to the southwest side of the lake, where potential conflicts with intensive use areas and roads are limited and where designated conservation areas and existing forests are abundant. The system will extend for 16.2 miles, including a 2.5-mile loop intended for group camp use only. The main access point for day-users will be a small parking lot and group assembly shelter at T-374 and Church Road. Campers will pick up the trail at an access point in the approximate center of the Spring Creek camp complex.

The nature education area, between the proposed camp control area and the lake, will be accessible via 2 miles of interconnected trail loops. Access for both day-users and campers will be provided in the vicinity of the camp control station.

The equestrian trail system will consist of a 17.5-mile "primary" loop encircling the lake and spurs 1 and 3.2 miles long. In order to keep the main loop within project boundaries, it was designed to cross planned game food plots on both sides of the lake west of Mt. Pleasant. During the water-fowl migration and nesting seasons, these areas will be off limits and a "secondary" route will need to be found outside project boundaries. Cooperation with private landowners will be necessary to create alternate routes and to extend spur routes beyond project boundaries.

Equestrian trails are planned to approach project boundaries and external roads in several locations to provide access points from potential privately owned stables on private lands. No stables will be developed inside the project.

A 3.1-mile bikeway will be built to connect the proposed Dry Brooks day-use area with the Union Canal towpath bicycle trail in Tulpehocken

Creek Valley Park. This will provide a minimum-grade bicycle link between the project and the city of Reading. The Blue Marsh Lake project portion of the trail will be paved along the top of the canal towpath from Rebers Bridge to a point just below the dam. From there it will follow a new alignment, including a 600-foot segment along the top of one of the saddle overflow dikes.

Bikeways will also be provided in the Spring Creek camp complex to connect trailer and tent camp units with the camp center and camp beaches. These will be generally parallel to camp roads but have separate alignments wherever topography permits.

2.4.5 Administration and Maintenance Facilities. The administration center, headquarters of the State Park resource manager (Park Superintendent), will be located on L. R. 06038 between the dam complex and L. R. 06149.

Maintenance facilities will be provided on both the northeast and southwest sides of the lake. Existing buildings of a former Berks County institutional farm and of the former Stowell farm will be rehabilitated for this purpose if this is found to be economically feasible.

The houses of the Ohnmacht and Stowell farms will be restored and retained as permanent personnel residences. The Skinner farmhouse -- to be used eventually as group camp headquarters -- and the Staudt farmhouse -- proposed as part of a future historical interpretation complex -- will also be utilized temporarily as residences.

The Ohnmacht, Skinner, Staudt and Stowell farm buildings have historic and architectural value and will thus serve multiple purposes -- as maintenance, residential or recreational structures and as aesthetic resources.

2.5 CONSTRUCTION STATUS. Relocation of the ARCO oil pipeline to bypass the dam site was completed in October 1973. The contract was awarded and construction begun on 7 February 1974 on the dam embankment, spillway, approach channel, intake tower, service bridge, conduit, stilling basin, exit channel, operations building, two operators' residences, overlook building and access roads and parking lots for these facilities. All other project structures, including road and utility relocations, protective works and recreation facilities, are in the design phase.

Real estate acquisition is continuing. The target date for completion is 1 January 1977.

Diversion of Tulpehocken Creek through the outlet works is scheduled for May 1976. Impoundment of Blue Marsh Lake is planned to begin in April 1978.

3 RESOURCE INVENTORY AND PLANNING CONSIDERATIONS

This section presents brief summaries of information given in detail in the resource inventory section of Design Memorandum 15A, Appendix A. It includes descriptions of the natural and historic features of the Blue Marsh Lake project, and focuses in on those features which represent opportunities or constraints for the land and water uses planned for the project. These planned uses include recreation, fish and wildlife management, aesthetic and ecologic management of plant materials, and the supportive functions of administration, maintenance, safety, fire protection, transportation, water supply and sanitation.

3.1 GEOLOGIC CONSIDERATIONS.

3.1.1 Summary of Project Area Geology. The rocks underlying the Blue Marsh Lake project were deposited as sediment nearly half a billion years ago. After consolidating into solid rock, they underwent folding; and in relatively recent times, the folded strata were exposed by erosion.

Two major layers of sediment crop out immediately beneath the soils of the Blue Marsh Lake project. The Beekmantown limestone group is the older of the two, having been deposited during the lower Ordovician period some 480 to 500 million years ago. The younger rocks are collectively termed the Martinsburg formation. They were deposited during the middle and upper Ordovician period, about 480 to 440 million years ago.

The Beekmantown limestone has been exposed by the erosion of the overlying shales in only one place within the project. At the crest of an anticline, the outcrop forms a 5,600 by 1,000 foot oval about 1,800 feet north of the dam. The bedrock in this exposure is encountered within 20 feet of the surface.

The hard dolomitic limestone presents severe engineering limitations. Excavation is costly and difficult, and solution cavities may create additional problems. Any pollutants released in the vicinity of this outcrop would have the potential to contaminate distant groundwater supplies through uncharted underground solution cavities.

The Martinsburg formation has two divisions: the lower shaly member, which underlies most of the project, and the upper sandy member, which rests atop the lower section and underlies only the northwestern portion of the project. The rocks in both divisions occur in numerous layers. Most of the layers are composed of some kind of shale, but beds of sandstone, limestone and conglomerates also occur.

One shale bed in the project has been extensively quarried to supply materials for brickmaking. This shale layer, like all others, has been subjected to high tensile stress near the crests of anticlines, where subsequent fracturing has admitted weathering agents. The shale's mineral composition has thus been altered to a form desirable for brickmaking. One of these shale quarries lies 3,600 feet upstream from the dam site. Another quarry is located about 9,000 feet in a west-southwesterly direction along the same anticlinal crest. Also, a shale gravel pit unrelated to the brick shale quarries is located near the confluence of Northkill Creek with Tulpehocken Creek at Bernville. Gravel from this pit has been used locally for fill.

The depth to Martinsburg bedrock varies, but generally averages only 2 to 3 feet. The overburden is somewhat thinner on the ridges and steep slopes but may reach depths as high as 6 feet or more in a few level areas. The engineering properties of this rock formation vary with the compositions of the several layers. Excavation and grading in the softer shales is not difficult; interbedded layers of sandstone and limestone, however, offer far greater resistance. Tilted, interbedded shale formations like the Martinsburg present additional engineering problems not commonly encountered in other types of bedrock. Tilted beds of shale alternating with soft clay fail when subjected to heavy loads. Tilted layers of shale interbedded with sandstone and limestone, when steepened by grading, can become unstable and cause landslides. Such situations require detailed investigation by engineers or geologists before any major development is undertaken.

The soil series and types within the project have been mapped by the U. S. Department of Agriculture's Soil Conservation Service in Soil Survey: Berks County, Pennsylvania (1970). The majority of the project's soils are of three series and types. Weikert-Berks shaly silt loam covers about 40 percent of project lands above elevation 290, Litz shaly silt loam covers about 20 percent, and Berks shaly silt loam, about 15 percent. All tend to be somewhat dry, to contain many shale fragments and to be relatively shallow over bedrock. The soil characteristics which have influenced project planning are discussed on page 3-4.

The depth to groundwater in the project varies with rainfall, rock type and the presence of folds, faults and cracks. It averages from about 5 feet beneath the valley floor to 25 feet under hilltops. Where steep slopes occur at higher elevations, groundwater may be as deep as 50 feet. The lake will raise groundwater levels near the shore, but should have little effect elsewhere.

The groundwater is generally hard. The limestone bedrock contributes soluble carbonates, and stained joints and fractures visible in the rocks indicate the presence of iron.

3.1.2 Topography. Topography is the most readily apparent of the geologic resource elements important to land planning. The main purpose of topographic analysis is to identify potential sites for recreation development. The siting of picnic areas, beaches, camp areas, boat launch ramps and administrative facilities within the hilly Blue Marsh Lake project has been determined largely by the lay of the land.

The topographic requirements are not as stringent for low-intensity uses such as hiking, forest and wildlife conservation, hunting or cross-country skiing. Unless other resource characteristics or land-use policies demand otherwise, lands generally have been allocated for these activities outside any major blocks of land topographically suited for recreation development.

Plate A6 in Design Memorandum 15A gives an overview of the project's topography and slope. The contours and slope breakdown served to identify possible sites for development, potentials for access and circulation, and visual relationships among the various land and water features.

Development of recreation facilities other than trails will essentially be limited to locations with slopes of less than 16 percent. Many isolated tracts of moderately sloping land occur throughout the project, but major blocks of developable land exist in only four places.

One area topographically suited for recreation development is the large complex of rounded hilltops connected by moderately sloping "sags" and ridges between the Spring Creek arm and the main body of the lake. About 670 acres are in the developable slope range of 0 to 16 percent. Resembling a small dissected plateau, this area is almost completely surrounded by, and to some extent interspersed by, steep downslopes which descend a vertical distance of 200 feet or more. Access to the lake is

restricted to only a few, small, moderately sloping sites. Views from the hilltops take in parts of the lake and opposite shore, other wooded hills and valleys within the project area, and the distant silhouettes of Blue Mountain and the Reading Hills. This area is planned for development as the project's major camp complex.

The other three major blocks of moderately sloping land are smaller but are located adjacent to the lakeshore. A 50-acre rounded peninsula extends into the southernmost portion of the lake at the foot of State Hill. Directly opposite, on the north shore of the lake's main lower body, moderate slopes meet the water in two units separated by a steep-sided stream hollow. Here about 100 acres slope less than 16 percent. Another peninsula is formed by an oxbow in the upper, narrow portion of the lake just southwest of the village of Mt. Pleasant. Moderate slopes account for about 150 acres. The two former sites offer open views of hills and mountains across wide expanses of water. These are proposed as sites for major day-use complexes. The latter area, for reasons given on page 4-10, will be cultivated as pasture for waterfowl.

3.1.3 Soil Suitability for Recreation Development. The soil is one of the most important elements of the total resource picture analyzed for planning purposes. Soil properties influence what kinds of vegetation will grow, which in turn determines the potential distribution of wildlife. Different soil types also have distinctive engineering characteristics, as well as properties which make them suitable or unsuitable for certain recreation activities.

The supplement to the Berks County soil survey, "Soil Limitations for Components of Recreational Development," rates each of the soil mapping units according to its suitability for recreational use. Five of the uses listed apply to development planned at Blue Marsh Lake: tent camp sites, trailer camp sites, service buildings without basements, paths and trails, and picnic and play areas.

The limitations of each soil mapping unit for each use are rated "slight," "moderate" or "severe." The degree of limitation in each case was estimated based on the presence and extent of the following conditions: high water table, flooding, shale fragments, shallowness of soil over bedrock, slow permeability, erosion and slope.

The "good," "fair" and "poor" classifications that appear on plate 5 were derived from the limitations for recreation development cited in the

soil survey. Soil mapping units with no "severe" limitations and "moderate" limitations for no more than four of the five recreation uses considered are shown on plate 5 as "good" for recreation development. Soils with a single "severe" rating or "moderate" ratings under all five use categories are indicated as "fair," and those with more than one "severe" rating appear as "poor" for recreation use.

The map of soil suitability for recreation use has served as a conceptual tool for identifying the overall pattern of developable land. To determine the feasibility of a specific construction design in a particular location, an on-site investigation must be made including, if necessary, soil analyses and test borings.

3.2 CLIMATOLOGICAL CONSIDERATIONS.

3.2.1 Summary of Project Area Climate. The project is located in the temperate northeast Atlantic Coast climatic zone, an area of frequently changing temperatures and moderate, year-round precipitation.

The frost-free season in the Tulpehocken valley begins, on the average, in mid-April or late April and ends in late October. Based on records compiled at Allentown, which is physiographically similar to the Blue Marsh Lake area, July and August have average daily maximum temperatures above 80 degrees F. May through September have average highs over 70 degrees F. The temperature rises above 90 degrees an average of about 17 days per year. High temperatures in combination with average relative humidities between 50 and 90 percent result in typically very hot summers.

Winters in the Blue Marsh Lake area are relatively mild for Pennsylvania owing to the site's low elevation. Average minimums for December, January, February and March, again based on data compiled for Allentown, are below freezing, but average daily maximums for the same months are in the high 30s or 40s. An average of only two days per year have low temperature readings below 0 degrees F.

Precipitation is relatively uniform throughout the year. A precipitation rate of 0.1 inch or more per day occurs an average of 5 to 8 days per month, while a daily fall of 0.5 inch or more has a mean frequency of only 2 or 3 days per month. On most of these days, precipitation occurs in the form of showers. However, three types of storms occasionally occur in the Tulpehocken Creek watershed: warm front storms, cold front storms and hurricanes. The most severe basin-wide floods of record in the Tulpehocken watershed were

caused by warm front storms and hurricanes. Cold front storms frequently cause flash floods and bank overflow along tributaries.

Snowfall averages about 30 inches per year over the entire Tulpehocken watershed. Historically, snow has never accumulated and melted suddenly in sufficient quantities to cause flooding. However, snowmelt flooding remains a statistical possibility.

3.2.2 Wind and Wave Action. The wind above the highest topographic features, or "major" wind, will remain essentially unchanged in speed and direction as it sweeps across the hilltops and the surface of the broad, lower section of the lake. Some of the narrower valleys and upper sections of the lake may experience "local," topographically influenced winds. The local winds may move either slower or faster than the major winds, and their direction will vary by a few degrees one way or the other in conformance with the terrain.

When the major winds blow strongly in the project area, they most often come from the west and northwest. Strong winds occur most frequently in the spring, winter and fall, in that order, and considerably less frequently during the summer. Moderate winds are fairly evenly distributed throughout the year, coming most often from the southwest but also commonly blowing from the west, northwest, east and northeast.

Waves on lakes are formed by wind blowing across the water's surface. Their size is governed primarily by wind speed and fetch (distance across open water in the direction of the wind). The greater the wind speed or fetch, the higher the waves will reach.

Whitecaps appear when the wind speed exceeds about 10 miles per hour, regardless of fetch. Wind speed records indicate that whitecaps will be a common occurrence on Blue Marsh Lake, especially during the spring, winter and fall.

Waves large enough to cause concern among boaters should occur only under strong northwesterly, westerly and southwesterly winds, in the directions where the fetch is greatest. Fetch could be as long as 12,000 feet in the unlikely event that the wind might continuously blow exactly parallel to the longest straight stretch of the lake, between Mt. Pleasant and State Hill.

Strong winds are generally uncommon during the summer recreation season but, when they do occur, they are most likely to be from the north-

west and west. For this reason, boat launch facilities have been planned in locations protected from waves generated by northwesterly and westerly winds.

The design of planned beaches also takes into consideration both wind and wave action. Strong winds and relatively large waves will occur frequently in the fall, winter and spring. Drawdown will expose beach bottoms to at least 120 feet out from the normal summer pool shoreline (5 vertical feet at 6 percent slope). On a traditional sand beach, wind and waves would cause considerable destruction each year, requiring annual replacement of lost beach sand. Beaches therefore will be built of concrete, as has been done successfully at such Corps of Engineers-built lakes as Allegheny Reservoir, Tygart Lake and Raystown Lake, in order to withstand wind and wave action with virtually no maintenance (further discussion on page 5-12).

3.3 HYDROLOGIC CONSIDERATIONS.

3.3.1 Summary of Project Area Hydrology. Blue Marsh Lake will drain an area of about 175 square miles. Most of the watershed consists of the fertile farmlands of west-central Berks and eastern Lebanon Counties. A smaller but significant acreage falls within the forested slopes of Blue Mountain and South Mountain and in woodlots interspersed throughout the farmed valley. Urban and village lands in Myerstown, Womelsdorf, Robesonia, Wernersville, and numerous smaller communities make up the remainder of Blue Marsh Lake's drainage basin.

The pre-impoundment stream flow records show that Tulpehocken Creek flowed at an average rate of 234 cubic feet per second (cfs) at the damsite during the period of record from 1965 through 1972. Instantaneous high and low flows were recorded at 16,100 and 22 cfs. Simulated flow readings based on 1951 to 1965 data taken at a gauge near Reading suggest that the average, the high and the low flows at the damsite during that period were 288, 9,230 and 27 cfs, respectively.

A study by the Soil Conservation Service contained in Appendix H of the project document (House Document No. 522) presents sedimentation rate figures used to predict sediment accumulation in Blue Marsh Lake. These figures were based on data from 45 lakes in areas physiographically similar to the Delaware River basin, including six in the Schuylkill River watershed. For purposes of design, an average annual sediment production rate of 0.17 acre-feet per square mile was estimated for the Blue Marsh Lake watershed. This indicates a probably total yearly accumulation of nearly 30 acre-feet. This is equivalent to about 275 cubic yards per year

per square mile of watershed, or 48,000 total cubic yards per year around the entire lake. Most sediment will be deposited in alluvial deltas near the mouths of tributary streams.

The distribution of land area among tributary watersheds and the estimated total sedimentation rate in combination give a general picture of what can be expected to happen where the tributary streams meet the lake. For example, assuming that runoff is proportional to drainage area, Spring Creek will contribute approximately 12 percent of the expected inflow of water and sediment to Blue Marsh Lake. Therefore, about 156,000 cubic feet per year of sediment and clay will pass the stream's mouth. The wide, shallow pools near Spring Creek's confluence with the lake will act as settling basins, and if the predicted accumulation rate turns out to be reasonably accurate, these pools will become shallower and gradually be replaced by marshes and swampland.

Potential water quality problems associated with pollutants and thermal stratification have been identified in three studies relating to Blue Marsh Lake (bibliographical information on page 1-11). The findings of these reports indicate that the lake will act as a retaining basin, trapping nitrates, phosphorus, and arsenic compounds, as well as biological contaminants from domestic sewage. The concentrations of these pollutants will depend on such variables as water inflow and outflow rates, pool levels, dissolved oxygen content, water temperatures, amounts of suspended sediment, pH values, aquatic plant and animal activity, and the presence of reactive or catalytic agents.

Arsenic compounds adsorbed (adhering in a molecule-thin layer) onto particles of sediment and mud is released into the water under either anaerobic or high temperature conditions. Any situation which can lead to a shortage of dissolved oxygen in Blue Marsh Lake is therefore potentially dangerous. Excessive algae growth and thermal stratification are conditions which could cause an increase in the lakewater's arsenic concentration.

Eutrophication -- the increase in the fertility of water usually caused by nitrate and phosphorus contamination -- may or may not cause excessive algae growth, depending on variables which are difficult to predict. An overabundance of algae, if it dies off suddenly, can result in a serious depletion of the dissolved oxygen content of the water. Fish kills have resulted in lakes when algae is deprived of sunlight over an extended period, dies off, and provides nutrients for bacteria which raise the biochemical oxygen demand (BOD) to a point which is lethal to most gill-breathing

organisms. An algae-related increase in BOD and subsequent decrease in dissolved oxygen could also increase the arsenic concentration in Blue Marsh Lake, affecting human lake-users as well as aquatic life. In addition, algae could also degrade the aesthetic quality of the lake.

A computer-simulated model has been devised to indicate the expected patterns of thermal stratification in Blue Marsh Lake. It was based on tests of Tulpehocken Creek's water quality made from 1962 through 1972, and on the weather and hydrologic records of 1960, chosen as a climatically typical year. Several simulation runs for each parameter -- temperature, dissolved oxygen and algae concentration -- were conducted, using variable outlet operation schemes, phosphorus content, nitrogen content and BOD level. It was found that stratification would begin sometime close to mid-March each year, become unstable in late July, restratify through August, and "overturn" around the first of September prior to the beginning of the winter phase. The hypolimnion or lower layer would remain essentially devoid of oxygen from mid-May through the beginning of August if water were released through upper intake levels only or through both upper and lower intake levels according to a scheme devised to maintain the outflow temperature at pre-project levels.

Controlling the intake depth of discharged lakewater should prevent oxygen depletion at lower levels during normal climatic and ecologic conditions. Additional measures such as direct aeration of the hypolimnion may be needed under certain conditions. If a drought, algae die-off or other extraordinary circumstance were to create anaerobic conditions in spite of preventive techniques, the arsenic concentration would have to be closely monitored. If this were to exceed the maximum safe level, water contact recreation would be prohibited until reoxygenation, dilution and flushing by runoff would return the dissolved arsenic to an acceptable level.

3.3.2 Effects of Lake Operation on Recreation Development.

The lake operation scheme described on pages 2-8 and 2-9 will have a considerable impact on project planning and operation, especially for water-oriented recreation development. Three phases of lake operation are of special interest to planning -- drawdown, flood pool utilization and multiple-level discharge.

A. Drawdown. Operation of the lake in adherence to the planned regulation schedule will result in a yearly drawdown of 5 feet from the normal summer pool elevation of 290 feet. This will take place gradually over a period of about one month from mid-July to mid-

August. Restoration of the elevation 290 pool will occur between mid-March and mid-April.

During years of abnormally low runoff in the Schuylkill basin, Blue Marsh Lake will be operated to augment low flows along the Schuylkill River to maintain downstream water supply sources. This will on occasion cause the pool to fall below elevation 285.

The most visible effect of drawdown will be the strip of lake bottom that will be exposed along the lake's perimeter. The exposed lake bottom will present moderate engineering, aesthetic and accessibility constraints. The severity of the problems will vary from one location to another according to the width of the exposed area, its slope, soil drainage and fertility, and its visibility from public use areas.

Beaches and boat launch ramps have been designed to accommodate swimmers and boaters when the pool is at any elevation between the normal summer level and the minimum probable recreation season pool during a drought of once-in-five years' probability. At Blue Marsh Lake, this is estimated to be approximately elevation 283.

Insofar as possible, intensive recreation areas, circulation roads and overlooks will not be placed where large expanses of lake bottom exposure will be in conspicuous view.

The exposed lake bottom will allow access to the water for shore fishermen, hikers and sightseers only where soils are well-drained enough not to form "mud flats." Soil fertility is also a factor in accessibility -- that is, fertile, damp soils may grow relatively impenetrable thickets soon after exposure, while drier, shaly soils will support sparse vegetation more conducive to walking. Since people tend to gravitate toward water while engaging in recreation activities, facilities have been planned with these potential limitations on shoreline accessibility in mind.

B. Utilization of Flood Pool. Blue Marsh Lake will be filled beyond the full summer pool elevation of 290 when necessary to maintain non-destructive downstream flows during periods of heavy runoff in the Schuylkill basin. A flood of an estimated once-in-100 years' frequency would require utilization of the flood pool to the spillway elevation of 307. However, simulations based on past climatological data indicate that the 307 mark would not have been attained during any recorded flood.

The various probabilities of flooding at elevations between the 290 and 307 contours have influenced the design of recreation facilities. The single building proposed within this zone -- the rest room at Conrads Bridge boat launch ramp -- will be made entirely of non-porous or sealed materials, anchored against flotation, and sealed against spillage or leakage into floodwaters. All other buildings will be located above the maximum flood pool elevation or downstream from the dam. Through roads and trails will also be located to maintain emergency access in the event of flooding.

C. Multiple-Level Discharge. Water will be discharged through several levels of gated intake ports in varying proportions in an effort to prevent oxygen depletion in the hypolimnion during the summer phase of thermal stratification. This will serve several purposes in addition to maintaining minimum dissolved oxygen levels throughout the lake. It will help prevent the anaerobic release of arsenic from bottom muds and allow fish to utilize the hypolimnion for much of the summer season. Computer simulations indicate that it will also tend to depress algae growth.

3.4 ECOLOGIC CONSIDERATIONS.

3.4.1 Summary of Project Area Ecology. The process of ecologic succession is probably the most important of all ecological concepts to Blue Marsh Lake project planning. The original stable end community -- virgin forest dominated by upland oaks and chestnut -- has been completely removed and replaced by seral communities throughout the project area. Because people have occupied the land for a long time and used it in many different ways, the seral communities that exist today are numerous and varied.

Each seral stage has some value or interest to man. Open fields support certain plants and animals not found elsewhere -- ring-necked pheasants, prairie-type wildflowers, certain songbirds and Pennsylvania's limited variety of lizards, for example. Shrub communities and the various stages in forest development also have their endemic plants and animals, while some species, white-tail deer for example, prefer to frequent two or more seral communities. Left alone, all the seral stages would progress gradually toward a relatively uniform final composition. Usually it takes human intervention in the form of management to preserve some of the existing variety. Habitats for rare or unusual species and game species are considered especially worthy of conservation efforts.

The new land uses and management procedures planned for the Blue Marsh Lake project will have numerous ecologic ramifications. Direct con-

tact by greater numbers of people and vehicles, changes in the environment due to new construction, and the innate capabilities of the various animal and plant species to adapt to changed conditions will influence ecologic processes.

Increased use of the land by people on foot and in cars will inevitably cause some degradation of the environment. Soil compaction, tree root exposure, other vegetative damage, and road-killed wildlife are among the effects which will increase as project lands are subjected to more intensive use.

Developing recreation facilities around Blue Marsh Lake will entail a limited amount of earth-moving and paving, both of which can cause significant ecologic impacts. Disturbing the existing topsoil contour can open the way for erosion, which could lead in turn to sedimentation and increased turbidity in the lake. Planting of ground covers and trees and proper design of drainageways will help prevent this from happening.

Paving of parking lots, roads and walkways will create what in effect are ecologically non-functioning surfaces. Virtually no plants or animals will be able to utilize these areas. Concrete and asphalt pavements will also be impervious to water, effectively reducing the absorptive surface necessary to replenish underground aquifers. Runoff will be concentrated into storm drain outlets and delivered directly into the lake via existing creekbeds or ripped drainageways. The sparsity of planned development at Blue Marsh Lake should insure that these effects do not become serious problems.

3.4.2 Existing Vegetation. Blue Marsh Lake project lands consist of a mosaic of former properties and fields whose vegetation is in various stages of ecologic succession. The species composition in any one field or woodlot is the result of many influences, including characteristics peculiar to the individual plant species, the soil and the topography. Man's prior use of the land is also an important factor, as well as the amount of time elapsed since the termination of any intensive uses such as farming, earth-moving and timber cutting.

All of the seral stages in vegetative growth represented within the project area fit into three general categories -- forests, rejuvenating areas, and open fields. Each of these groups has its own potentials and limitations for project planning.

A. Forests. Woodlands presently account for about 1,400 acres or 24 percent of project lands. They occur primarily on steep slopes and along the bottoms of narrow ravines.

The dominant tree species are red oak and white oak. Other major components include black oak, chestnut oak, several hickory species, beech, tulip, hemlock, flowering dogwood, choke cherry, white ash, black cherry, black locust, sassafras, juneberry and red maple. Less common species include walnut, basswood, elm, black gum, American hornbeam, hop hornbeam, Virginia pine, white pine, sweet cherry and black birch. The common understory shrubs include honeysuckle, blueberry, several viburnum species, witchhazel, spicebush, poison ivy, pink azalea and scrub oak.

The forests on project lands range in age from woodlots less than 50 years old to older stands containing numerous trees with trunks several feet in diameter.

From a naturalist's or sightseer's point of view, the most outstanding forest unit in the project is a mature stand which will extend along the south shore of the lake's Spring Creek branch. It covers the face of the ridge that, prior to impoundment, forms the south wall of the lower Spring Creek valley near the confluence of Spring and Tulpehocken Creeks. This forested area includes north-facing slopes, the level ridgetop, and a ravine -- representing both dry, shaly soils and moist, fertile soils. Each of these environments supports an entirely different association of plant species. Hemlocks dominate the north slope, while oaks line the ridgetop. Trees such as elm, basswood, black gum and red maple grow along the moist ravine floor. On the dry, shaly soils, a small stand of unusually large Virginia pines is present, along with other dryness-tolerant trees -- e.g., sassafras and chestnut oak.

Woodlands are one of the project's greatest scenic assets. They can be appreciated from a distance as components of the landscape, especially where they cover the tops and steep faces of ridges. They can also be appreciated from within by walkers on trails, who may observe the rich diversity of plant and animal life, geologic features, springs and running brooks.

Woodlands can be used throughout the year by hikers, photographers, sightseers and nature observers, and during certain seasons by hunters and cross-country skiers. They will also serve as partitions between intensive recreation areas to maintain optimum low density. And they will provide habitats for wildlife retreating from the disturbance of project development and intensive use.

Outstandingly attractive or mature woodlands, such as the one described above, will remain free from the development of roads and facilities. These will provide rare opportunities within project boundaries for a wilderness-like experience, where solitude and the sights and sounds of nature may be enjoyed without interference.

Forests which are neither mature nor aesthetically outstanding will be thinned in some locations for use in conjunction with intensive development. Selective thinning will encourage the growth of preferred species and allow the individual trees that remain to grow faster with less competition for light, water and soil nutrients. The open, park-like woodlands which will result from selective thinning of immature stands will provide ideal settings for camping and picnicking.

The edges of woodlots, where they adjoin areas of low growth, are also good environments for camping and picnicking development. The woods form an appealing backdrop for these activities, as well as providing shade on hot days and a nearby place to hike and observe nature.

B. Rejuvenating Areas. Fields growing up in shrubs and very immature trees presently cover approximately 870 acres or 18 percent of project lands. They exist primarily on land which was formerly farmed, abandoned often because of low soil fertility or lack of moisture. The more common woody plant species growing in these areas include sassafras, sumac, aspen, hawthorn, red cedar, green ash, box elder, black locust, blackberry and elderberry.

One of the most important features of "old-field" vegetation is its impermanence. It represents only a temporary stage in the natural progression toward the region's climax oak forest. How rapidly the transformation will be made from shrub thicket to full-fledged forest depends on such factors as sun and wind exposure, soil fertility, moisture and the degree of competition offered by existing grasses and other plants.

Shrubs and young trees of the species listed above can form attractive thickets. Spring flowers and fall foliage of contrasting colors and textures make these thickets especially appealing during these seasons. In all seasons, this type of vegetation provides food and cover for wildlife.

Rejuvenating areas are well suited as sites for intensive recreation development. Networks of clearings and paths will be created within fields grown solid with shrubs and small trees where space is to be provided for

picnic tables and camp pads. These cleared areas may be planted with tree seedlings to add scenic variety and shade. In more open, grassy rejuvenating areas -- typical of the dry-soil portions of the project -- the less desirable species will be thinned, and seedlings tolerant of dry soils and competition (e.g., scarlet oak) will be planted where needed to help create more suitable environments for intensive development.

The shrub environment will be preserved in some locations -- e.g., in the planned nature education area -- to provide cover for wildlife, to preserve a scenic vista and to maintain variety along nature trails. This will be accomplished by periodic cutting. On moist, rich soils, cutting may be required frequently. On dry, infertile soils, cutting must be undertaken more cautiously, if a prolonged return to an herbaceous meadow environment is to be avoided.

C. Open Fields. Open meadows and recently cultivated or grazed fields presently make up about 2,840 acres or 58 percent of project lands. They occur primarily on level or moderately sloping land and most often on relatively fertile soils. The common herbaceous plant species include yarrow, queen anne's lace, goldenrod, meadow grasses, broomsedge, poverty grass, mustard, dandelion, aster, cinquefoil and wild strawberry. In addition, the cultivation of corn, wheat, rye, clover and fescue will be continued by the Pennsylvania Game Commission on several hundred acres within the project.

Open fields represent an early stage in ecological succession. Except where cultivated or mowed, fields soon sprout shrubs and trees and eventually grow into forests. As in the case of the rejuvenating areas described above, the rapidity of this transformation depends on the soil and exposure characteristics.

The grasses and forbs growing in the project area can compose attractive meadows. The varied spring, summer and fall colors and constantly changing wildflower displays place open fields on a par aesthetically with other plant communities. Wildlife is often abundant and highly visible. Meadows and cultivated fields also provide strong scenic contrast alongside woods, streams and fencerows.

Open fields are generally suitable for intensive recreation development, although the plan in nearly all cases calls for some tree planting. Where neither trees nor mowed grass are required, the natural succession process will be allowed to take its course.

In addition to the cultivation of the game food species listed above, some areas may be simply mowed periodically to maintain a grassy environment for wildlife. This would encourage many interesting game and non-game species to stay within the project, including deer, pheasants, woodchucks, shorebirds, owls and hawks.

3.5 HISTORICAL AND ARCHAEOLOGICAL CONSIDERATIONS.

3.5.1 Summary of Project Area Prehistory and History. Men and women may have inhabited the site of Blue Marsh Lake even before Tulpehocken Creek valley was eroded out of the frozen, treeless plains of Pleistocene North America. The first evidence of man in the region dates back about 10,000 years. Since then, various peoples have migrated to and from the Tulpehocken valley and surrounding areas, gradually evolving a variety of lifestyles. Many centuries of technical and social change took place between 8000 B.C., when spear-wielding nomads hunted mastodons and other big-game animals, and A.D. 1500, when village-dwelling folk were subsisting by hunting small game and waterfowl, fishing, gathering wild plant foods and cultivating gardens.

The recorded history of the Tulpehocken valley probably began in the 1680's when people from the then-small European colony of Philadelphia staked out a trail to the Susquehanna River, passing within about 2.5 miles of the Blue Marsh Lake project site. The advent of Europeans began a period of greatly accelerated change in the region, starting with the arrival of Lenape Indians displaced from their original village homes around Philadelphia. German-speaking farmers and their families, fleeing the war-torn principalities of the Rhine Valley, arrived in 1723. The Union Canal, linking the Delaware and Susquehanna Rivers, was completed in 1828. The canal's opening led to the development of 17 mills within the project site and to the gradual anglicization of the valley's German-speaking communities. The canal's demise in 1884, the construction of railroads and highways bypassing the area and the growth of industrial Reading shifted the local economic emphasis back to farming. Many of the valley's farms in turn were abandoned in the wake of the mass emigration in the mid-twentieth century from rural communities. In the near future, the project site once again will be subject to intensive human use -- this time by recreationists, chiefly from metropolitan Reading and other urban and suburban areas.

3.5.2 Historic Sites and Structures to Remain after Project Implementation. Many sites and structures of historical value exist within the Blue Marsh Lake project. Three major surveys have been conducted to ascertain

the project's impact on the cultural remains of the site: "An Archaeological Survey at Certain Reservoir Areas in Pennsylvania" (National Park Service, 1966); "Historical Survey of Blue Marsh Project Area" (George M. Meiser IX, Historical Review of Berks County, Summer 1971); and "Historical Survey, Blue Marsh Lake Project" (Ltc. S. J. Newsom, Jr., U. S. Army Corps of Engineers, 8 May 1974). Structures identified in these surveys will be treated in accord with the requirements set forth in the National Historic Preservation Act of 1966, section 106, and in ER 1105-2-11.

In general, these structures will be photographed and measured, and salvageable items removed. This will be done in cooperation with the Berks County Park and Recreation Board and other interested agencies or organizations.

One building, the Gruber Wagon Works, has been placed on the National Register of historic places and landmarks and will thus be accorded special treatment under the provisions of the National Historic Preservation Act. Eight other historic structures within the project have been nominated for National Register status. Their eligibility will be determined by the U. S. Department of the Interior, National Park Service, Office of Archaeology and Historic Preservation.

The architectural features of structures listed on the National Register will be exhaustively recorded, and the records deposited in the Library of Congress. All feasible efforts will be made to salvage parts or all of these buildings. Numerous proposals have been made already for salvaging the Gruber Wagon Works. The chief proposal under consideration at this writing is to dismantle the building and reconstruct it in Tulpehocken Creek Valley Park downstream from the Blue Marsh Lake project.

The remains of the Union Canal and related structures are fairly abundant within the project area. Several of the 16 locks originally located on what are now project lands are fairly well preserved. Some of the stone and iron parts from these locks will be salvaged for display. Lock 45, originally located in the dam embankment area, has been relocated in Tulpehocken Creek Valley Park for eventual restoration by the Berks County Park and Recreation Board. About 1.8 miles of the canal and its towpath including the ruins of lock 46 will remain intact within the project between the dam and Rebers Bridge.

In addition to the structures to be recorded and dismantled or moved out of the project, four entire farmsteads which lie above the maximum

pool elevation will be used after project implementation for various park functions.

The Staudt property north of Brownsville Road is an extremely picturesque and well-kept farm with several structures of historic value. One is a small log cabin dating from the colonial period, now used as a farm outbuilding. The farmhouse is also of log construction with clapboard siding. Other structures include a large wooden barn, several sheds and a windmill. The latest owners have arranged to stay on as tenants indefinitely. Thus for the immediate future the property is unavailable for use by the public or by project personnel. However, it will be maintained by the residents until it does become available.

The Ohnmacht property, which is serving during dam construction as the headquarters of the Resident Engineer, includes a well-maintained nineteenth century farmhouse and barn. These buildings are located within 600 to 800 feet of the planned dam overlook and dam operations complex. The barn presently houses a temporary exhibit of artifacts salvaged from the lands to be inundated by the lake.

The Skinner property, located along Lake Road (T-374) overlooking Spring Creek, features an outstandingly attractive native stone house and barn. This farm is possibly more valuable from an aesthetic viewpoint than an historic one, since it appears to have been built in the late nineteenth or early twentieth century. The buildings are located 200 to 300 feet horizontally from the normal summer pool shoreline, standing on a hill about 50 feet above the lake's normal summer surface level.

The Stowell property, on the west side of Highland Road (T-534) south of Landis Road (T-513), includes a two and a half story stone house with a clapboard addition, a stone and wood barn, and stone foundations that once supported smaller outbuildings. The farmstead was constructed in the late eighteenth or early nineteenth century.

These farms are generally in good condition and are both historically and aesthetically interesting. The buildings will be restored, renovated or modified for project uses. These will include State Park personnel housing, maintenance, storage, historic displays and demonstrations, and group camp administration. Specific plans are recommended on pages 5-33, 5-34, 5-36 and 5-37.

3.6 AESTHETIC CONSIDERATIONS.

3.6.1 Summary of Project Area Aesthetics. The Blue Marsh Lake project contains numerous potentials to elicit positive -- or pleasurable -- aesthetic responses. The following paragraphs present a brief inventory of some of the more aesthetically important features. This inventory is limited to those features which (1) are native to the site and (2) people may come specifically to enjoy.

The project will offer numerous views of natural, somewhat undeveloped landscapes. The dominant natural and natural-like landscape elements will be the lake itself, the hills all around the lake, vegetation, wildlife and the mountains which nearly surround the project. In addition, the dam with its outlet works, the largest of the three overflow dikes near the dam, the dam overlook and any preserved historic structures will provide artifact-oriented aesthetic interest.

People engaging in the popular recreation activity known as driving for pleasure will be rewarded with an attractive view of the lake along Pennsylvania 183 just southeast of Bernville. Here the lake will be narrow but highly visible from the highway. Steep, wooded hills will form a backdrop. Boats will be visible during much of the recreation season. Waterfowl may also be observed, especially during the migration periods.

Sightseers may also glimpse the lake from roads at several other locations: along Pennsylvania 183 near Pleasant Valley, at the new L. R. 06047 lake crossing, from L. R. 06056 and L. R. 06149 at State Hill, and from relocated L. R. 06038 near the dam. The dam overlook off L. R. 06038 will provide a place for sightseers to leave their cars and view the dam complex and lower lake. The small turnout planned on State Hill off L. R. 06056 also will provide a panoramic overview of the lake and surrounding hills with mountains visible in the background.

The Blue Marsh Lake project also contains several relatively minor potential sources of aesthetic displeasure or irritation. These include possible causes of both unsightliness and noise.

Examples of noise sources which will be within hearing range of project visitors are highway traffic, motorboats, aircraft and portable radios. Of these, only highway traffic noise may be mitigated through physical planning.

The main source of traffic noise at Blue Marsh Lake is Pennsylvania 183. This is a heavily traveled road with considerable truck traffic. Several fairly

steep hills make it necessary for the trucks to shift into lower gears which tends to increase their sound output. The other roads which complete the project's perimeter access route will also contribute noise, but to a lesser degree. Few trucks use these routes. Automobile traffic volume is also lower, and speeds are limited by the roads' designs and by posted legal limits. Much of the traffic noise problem has been minimized by planning such noise-critical facilities as camp areas and nature trails on the opposite sides of hills from noisy highways.

Unightly visual elements which could be introduced at Blue Marsh Lake but which will be mitigated by proper planning and management include excessive crowds, unrelieved expanses of parked cars, and incompatible or inappropriate peripheral development. Unobtrusively designed facilities, a moderate level of development, and plenty of natural buffer space will tend to de-emphasize these urban-like elements in the project landscape.

3.6.2 Special Features. A special feature is anything natural or man-made within the project which is worthy of special preservation efforts by virtue of its rarity or special appeal. Park facilities have not been designed in any way which would endanger these valuable resources. Special features may be divided into the following categories: wildlife, plant communities, geologic features, and archaeologic or historic sites.

A. Wildlife. There is an enormous variety of vertebrate and invertebrate animal species on the project. Some of these species are unusual and a few have even been classified as endangered. Among the unusual species which have been reported in the Blue Marsh Lake area are ravens, pileated woodpeckers, rough-legged hawks, snowy owls, glossy ibis and bog turtles. Animals which are present in limited numbers though not rare, and which are also of special interest include deer, ruffed grouse, wild turkeys, Canada geese, woodcock, and various birds of prey.

Recreation facilities have been planned to have minimum impact on these animals' habitats. Large buffer areas will be left in a natural or near-natural state and used only by people engaged in non-intensive recreation activities. The marshy habitats of waterfowl, wading birds and the bog turtle will be left undeveloped. A wildlife management program, enforcement of wildlife protection laws, and efforts to educate park visitors will also help insure that these animals are not driven out or destroyed.

B. Plant Communities. Although the general assortment of plants in the Blue Marsh Lake project is not unusual for this region, one

80-acre stand of forest should be considered a special feature because of its maturity, diversity and outstanding aesthetic quality. It extends south from the Spring Creek arm of the lake about 1,000 feet to the top of the ridge, and about 2,000 feet along a small ravine. Its east-west dimension is about 2,500 feet, extending from the ravine toward the main Tulpehocken Creek portion of the lake.

Topographically, this unit of forestland contains a steep north-facing slope, a relatively level hilltop, and the ravine. The maximum relief within the area is over 200 feet. The soils vary from poorly drained material along the bottom of the ravine to well-drained, fertile soils and rapidly permeable, infertile soils on higher ground. This mixture of soil types and exposures to sunlight, wind and cool air drainage has produced a mosaic of contrasting forest types unusually close to one another.

Hemlock is the dominant tree in the lower elevations along the north slope. Elm, basswood, white ash and black gum are found principally along the bottom of the ravine. Virginia pine, chestnut oak and sassafras inhabit dry, shaly soils. Red oak, white oak, shagbark hickory, red maple, tulip, ironwood, hop hornbeam, beech, black cherry and dogwood grow generally throughout the woodlands, often occurring in relatively homogeneous clusters.

The most effective measure that can be taken to conserve this special feature is to prevent its overuse by recreationists. Circulation roads and intensive development are planned a reasonable distance away from the area. Clearly marked trails will be provided to concentrate and absorb the greater part of habitat erosion caused by the passage of hikers and nature observers.

C. Geologic Features. The geologic features of the project -- the ridges, stream-cut ravines and valleys, rock outcrops, and strata exposed by quarrying and roadbuilding -- occur in very similar fashion throughout the physiographic province. None are special features in the sense that they require protection or special attention.

D. Archaeologic and Historic Sites. One or more structures of historic importance will be dismantled, moved and restored elsewhere. These are certainly to be considered special features, although those that will be reconstructed outside the project are beyond the scope of the planning sections of this report. Structures above the flood pool elevation which are to be retained for their historic value also fall into the category of special features, as do artifacts and structural elements salvaged from buildings to be razed.

The Gruber Wagon Works is the most significant of the historic structures within the project. It is said to be one of the best-preserved early American wagon works still in existence. At this writing, it is intended to be dismantled for reassembly and restoration in Tulpehocken Creek Valley Park downstream from the Blue Marsh Lake project.

Artifacts and structural elements of several razed structures have been salvaged and are displayed temporarily in the Ohnmacht barn near the dam site. The visitor overlook building to be constructed nearby will house a permanent display of salvaged historic items, as will a planned county-owned museum in Tulpehocken Creek Valley Park. Display items may include such things as machinery from the Pleasant Valley Roller Mill, interior details from the Blue Marsh Hotel, and stone and metal parts from some of the 16 Union Canal locks once located within the project. Scale models of several historic buildings will also be exhibited.

About 1.8 miles of the Union Canal and its towpath will remain within the project below the dam. This segment includes the badly deteriorated ruins of lock 46. The nearly level, elevated towpath will be used as a scenic walkway and bicycle path along tree-lined Tulpehocken Creek. Cleanup and partial restoration of the lock will provide an additional special attraction.

Several farmsteads above the flood pool elevation will remain as functioning park buildings after project implementation. They are described on page 3-18. Specific plans for their use appear on pages 5-33, 5-34, 5-36 and 5-37.

3.7 GEOGRAPHIC AND DEMOGRAPHIC CONSIDERATIONS.

3.7.1 Peripheral Land Uses and Zoning. The present and future uses of the lands surrounding the Blue Marsh Lake project will have considerable impact on aesthetics for visitors both as they approach the project and while they are inside. Although the present level of development is generally visually pleasing or at least innocuous, there is a strong potential for future change in the local land-use pattern.

Privately owned farms and woodlots constitute the majority of lands along the periphery of the Blue Marsh Lake project. State Game Lands, abutting project property on the north, also consist of farmlands and woodlands. The Berks County institutional lands to the northeast of the project are also composed partially of cultivated fields and woodlots, interspersed by scattered buildings.

Residential and commercial development presently covers a very small percentage of the lands surrounding the project. It is mostly concentrated in the borough of Bernville (population about 800) and in the village of Mt. Pleasant. State Hill consists of a sparse, linear arrangement of residential lots extending for about 1.5 miles along L. R. 06149 and L. R. 06056. Brownsville and North Heidelberg are very small hamlets adjacent to the southwestern and western fringes of the project. The sparsely developed Pennsylvania 183 corridor accounts for much of the remainder of the project's peripheral development.

The main force presently at work to change the land-use pattern around the project is the "centrifugal" expansion of metropolitan Reading as developers of new residential, commercial and industrial areas seek less expensive suburban building sites. Urban sprawl has been reaching farther and farther from the centers of all major American cities since the popularization of the automobile. Although this process may on occasion have been slowed by economic slumps and disruptions, there is no reason to believe that it will stop or reverse itself substantially in the near future.

The U. S. Department of Commerce, Bureau of the Census, defined the limits of Reading's urbanized area in 1970 to include significantly greater land area and about 6,000 more residents within Spring and Bern townships than were contained within the urbanized area designated in 1960. This urbanized area (1970 census) in these two townships extends to within 2.5 miles by road from the project's eastern boundaries.

Several additional factors indicate that urban expansion toward Blue Marsh Lake is likely to continue. A large new shopping mall and business complex has been opened on State Hill Road about 3.5 miles southeast of the project. The Reading Outerloop and the Warren Street Bypass (U. S. 422) are partially completed, providing rapid access to the entire area between the project and Reading from all points in the region. General Carl A. Spaatz Field, Reading's principal airport, lies about 3.5 miles east of the project on Pennsylvania 183. Finally, the project itself may provide an impetus for residential development in its immediate vicinity.

Each municipality has its own official zoning terminology, but the zoning classifications of lands surrounding the project almost uniformly represent some variation of "agriculture" or "low-density residential." The major exceptions are (1) Bern Township's "institutional" zone encompassing the landholdings of Berks County, (2) the commercial and highway commercial zones of the borough of Bernville and of Penn Township, mostly

along Pennsylvania 183, and (3) North Heidelberg Township's medium-density residential zone paralleling L. R. 06056 west of Brownsville.

So long as low-density residential and agricultural zones are maintained in their present forms, significant aesthetic damage to the project's environment may be averted. However, economic pressures brought about by increasing land values around Reading may eventually result in zoning changes. New zoning classifications could open the way for incompatible development. The responsibility of preserving the scenic setting of the Blue Marsh Lake project and the beauty of the communities surrounding the project thus belongs to those communities and to their governmental officials.

Forms of development which are aesthetically compatible with project uses when placed on adjoining lands are farming and low-density residential development. Institutional and medium-density residential development may also be considered aesthetically non-destructive if done with sensitivity to the existing natural environment. Heavy industry, quarrying, commercial strip development and any use which requires heavy grading of the land or produces noise, air or water pollution are undesirable land uses both immediately adjoining project boundaries and along visitor approaches.

3.7.2 Accessibility. The Blue Marsh Lake project lies slightly northwest of the hub, near Reading, of a five-spoke highway system (see plate 1) which will provide high-speed access from all major population centers within a one-hour drive. U. S. 422 runs east and west from the project, U. S. 222 northeast and southwest, and Pennsylvania 61 northward. Connection with interchanges on this system will be from 1.5 to 4 miles from the project's boundaries.

U. S. 422 leads east toward the project from Lebanon and west from Pottstown. U. S. 222 links the project with the near suburbs of the Allentown-Bethlehem-Easton and Lancaster metropolitan areas. Pennsylvania 61 approaches Blue Marsh Lake from Schuylkill County, funnelling traffic through a mountain gap north of the project. Both U. S. 422 and 222 are partially completed limited-access highways, scheduled for completion within the county by the late 1970's. Pennsylvania 61 is a four-lane, but not limited-access, highway.

In addition, two major east-west highways cross Berks County north and south of Blue Marsh Lake: Interstate 78 and the Pennsylvania Turnpike (Interstate 76). They carry a great deal of long-distance traffic, and will provide access primarily for overnight recreationists and transient day-users.

The lower hierarchy of roads, classified arterials and major collectors by "Highway 1990 Classification" (Berks County Planning Commission, 1970), will constitute the project's local access road system. Pennsylvania 183 is the main arterial road leading northwest from Reading. It will be the principal transportation link to the project from the city of Reading and from U. S. 422, U. S. 222 and Interstate 78.

Pennsylvania 183 forms one side of an approximately rectangular system of roads which will enclose the main lower portion of the Blue Marsh Lake project (see plate 2). Points of access to potential recreation facilities will be located along this roughly three-mile by five-mile perimeter route.

Relocated L.R. 06038 will form the northeast side of the rectangle. It will provide access into the project at a point along its route from Pennsylvania 183 between Mt. Pleasant and Leinbachs to Rebers Bridge Road (L.R. 06149) at Rebers Bridge. Relocated L.R. 06047, the northwest side of the rectangle, will leave Pennsylvania 183 at Powdermill Creek near Bemville and cross the lake. Both of these roads will meet Brownsville and Rebers Bridge Roads (L.R. 06056 and L.R. 06149), which together form the southwest side of the enclosing road system, opposite and paralleling Pennsylvania 183.

Project visitors coming from the west on U. S. 422, from the south on U. S. 222 and from the southwestern suburbs of Reading will have the option of joining the perimeter route via three other access roads besides Pennsylvania 183. L. R. 06038 connects Brownsville and Rebers Bridge Roads at State Hill with the growing suburban area around Wyomissing Hills; interchanges are planned at the Reading Outerloop and the Warren Street Bypass (U. S. 422). L. R. 06058 approaches from Wernersville and a planned interchange with U. S. 422 to meet Brownsville Road (L. R. 06056). L. R. 06047 extends to Brownsville Road from the town of Robesonia and another planned interchange with U. S. 422 to the southwest.

An additional possible access route is the county road from L. R. 06149 near Leinbachs past the Berks County health, welfare and prison facilities. This route, however, is not a desirable one, since the county facilities generate a significant amount of traffic in themselves, and since two alternate routes -- L. R. 06149 and L. R. 06038 -- will be available. Use of the county road as an access route into the Blue Marsh Lake project will be discouraged by means of traffic directional signs.

3.7.3 Analysis of Market Area. The market area of the Blue Marsh Lake project is the region from which the people who will use the

project originate. This area may be broken down into more specific units for analysis. Since people who visit a recreation area for one day or part of a day average shorter travel distances than those who stay overnight, it is convenient to separate the camping market area from the day-use market area. The latter may be further subdivided into concentric zones based on increasing driving times. For the purposes of this discussion, the zone of day-use visitor origin is said to consist of a "primary day-use market area," equivalent to the zone within one hour's drive of the project, and a "secondary day-use market area" outside the one-hour zone (see Design Memorandum 15A, plate A15).

In Analysis of Recreation Data (prepared by the Battelle Memorial Institute for the Pennsylvania Department of Forests and Waters, 1968), the day-use visitors originating within about one hour's drive of the state parks surveyed in southeastern Pennsylvania were reported to average slightly more than 84 percent of total day-users. This is considerably greater than the reported statewide average of about 70 percent, owing to the region's disproportionate concentration of large cities. State parks tend to attract most of their visitors from towns, cities and metropolitan areas whether they lie within an hour's drive or not.

This means that less than 16 percent of day-use visitors to the parks surveyed in southeastern Pennsylvania originated from the secondary day-use market zones. For reasons cited in the last paragraph of this subsection (page 3-28), this percentage may be even less at Blue Marsh Lake. Furthermore, in conformance with Volume XI of the Delaware River Basin Report (Corps of Engineers, 1960), overnight visitors are assumed for planning purposes to account for about 10 percent of the expected total attendance at future recreation projects. Of the three market area components considered in this master plan, therefore, by far the greatest proportion of total project visitors is expected to come from the primary day-use market area. Some of the characteristics of this area which will influence attendance at Blue Marsh Lake are discussed below.

General relationships have been noted between outdoor recreation consumption and certain characteristics of the people living in the market areas of existing recreation sites. These characteristics include population distribution, socio-economic composition, income levels, leisure habits and mobility.

In general, the greater the population within a recreation project's primary day-use market area, the greater the demand will be to use the project. The total number of people living within an hour's drive of Blue

Marsh Lake is estimated (based on 1970 census information) to be approximately 800,000. At least half this number is distributed among five principal urban areas -- Reading, Lebanon, Pottstown, and portions of Lancaster and Allentown-Bethlehem-Easton.

The composition of market area population is interrelated with recreation consumption in ways which are extremely complex. However, certain very general correlations have been noted between the socio-economic characteristics of American recreationists, and of American communities in general, and patterns of outdoor recreation consumption.

In general, users of public outdoor recreation facilities are people with (1) moderate to moderately high "discretionary" incomes (i.e., income that is not needed for subsistence), (2) considerable leisure time and (3) means of transportation. The latter characteristic usually entails automobile ownership, although some recreation areas near cities are served by public transportation. There are a few possible exceptions to this general picture of the average outdoor recreation participant. For example, government aid programs sometimes provide free transportation to recreation areas for lower income city dwellers.

Economic statistics (see Design Memorandum 15A, table A-5) reveal much about the demographic composition of Blue Marsh Lake's primary day-use market area. The overall picture that emerges is of a generally prosperous region where family incomes are higher (except in Schuylkill County) than the state average (\$9,558 in 1969). Industrial-urbanization is highest in Lehigh and Montgomery Counties and moderately high in Berks and Schuylkill. Employment in agriculture is as prevalent or more so in Chester and Lancaster Counties than in the state as a whole.

Another market area characteristic which will influence project visitation is competition from other recreation facilities. Each potential recreationist living within the project's primary day-use market area also lives at the center of his own "primary day-use destination zone" -- the area within one hour's drive of his home. The sum of all these overlapping individual destination zones is approximately equivalent to a circle representing a two-hour driving radius with Blue Marsh Lake at its center. This area, (see Design Memorandum 15A, plate A15), is called the "competing day-use facilities zone." The recreation areas within this zone will all compete with the Blue Marsh Lake project in attracting visitors from the project's primary day-use market area.

Several considerations enter into an individual's choice between alternative recreation sites. Habit is a significant factor which tends to place new

facilities at a slight initial disadvantage. The duration of travel required and the ease or difficulty of the drive are also major considerations. Perhaps most important are the specific characteristics of the recreation areas themselves: the amount and quality of facilities, scenic qualities, the presence or absence of a body of water, etc.

The project's competing day-use zone contains numerous state, county and Federal recreation areas. Thus, potential visitors to Blue Marsh Lake living outside the one-hour driving zone have a wide range of choices within their own "primary day-use destination zones," i.e., within one hour's drive of their homes.

Analysis of Recreation Data (Pennsylvania Department of Forests and Waters, 1968) reported that a statewide average of about 30 percent of day-use visitors to the state parks surveyed originated from outside the primary day-use market areas. In southeastern Pennsylvania, the average was only about 16 percent. Based on the number of currently undeveloped recreation areas which will compete with Blue Marsh Lake, there is a good chance that this percentage figure will be still further reduced in the future. Based upon this probability, the visitation estimates developed in exhibit 15-IV predict attendance from the secondary day-use market zone at about 10 percent of the day-use total.

3.7.4 1981 Visitation Projections. The recreation development scheme proposed in the project document (House Document No. 522, 87th Congress, 1962) would have had the capacity to accommodate a total of 437,500 visitors per year. The plans set forth in Land Requirements Plan/Public Use (Design Memorandum 5, dated January 1969) provided for a total yearly attendance of 263,000 after completion of the proposed initial (Federal) construction and 373,000 after completion of the second (non-Federal) phase of construction. These estimates have been revised in accordance with E. R. 1120-2-403, dated 26 March 1970, which states: "Technical Report No. 2, 'Estimating Initial Reservoir Recreation Use' will be used as a basis for project planning requiring such use estimates."

A summary of the "Tech 2" method as it applies to the Blue Marsh Lake project is contained in exhibit 15-IV: Recreation Visitation Methodology. Applying the "Tech 2" method using 1970 U. S. census information and revised population projections from the Commonwealth of Pennsylvania yields an estimated initial annual visitation in 1981, three years after scheduled project completion, of 1,563,000. This figure, although six times larger than the Design Memorandum 5 projection of 263,000, has been accepted

by the Commonwealth of Pennsylvania, Department of Environmental Resources as a more reasonable estimate (see letter in exhibit 15-1).

3.8 SUMMARY OF DESIGN CONSTRAINTS. Many of the inventory items discussed above have acted as constraints or limitations influencing project planning. Plate 6 shows some of these "problem areas" diagrammatically and provides a comprehensive view of areas which are relatively free of constraints. Although some of the limitations identified are discussed elsewhere in the text, they are briefly reviewed in the following paragraphs.

3.8.1 Steep Slopes. Steep slopes are "problem" areas only in a narrow sense relating to facilities development. The slopes on Blue Marsh Lake project lands are neither so steep nor so tortuous as to impose undue limitations on accessibility, sewer and water system development and the extent of developable land. Steep slopes, nonetheless, may present an occasional design problem at specific sites within the project. In general, however, they may be considered as a framework for design and as insurance for the preservation of the project's natural beauty and low density of use.

3.8.2 Land Exposed by Drawdown. Each year beginning in July normal lake operation will expose a band of lake bottom along the shore. The dimensions of this band will normally be 5 feet vertically (between elevations 285 and 290) and anywhere from 10 to 500 feet horizontally back from the normal winter pool shoreline. In addition, there is a probability that on an average of once every five years the lake will be drawn down to elevation 283. This will add about 40 percent to the lake bottom area normally exposed by drawdown.

The seasonal exposure of lake bottom will detract aesthetically from the overall natural appearance of the lake and shoreline. It will limit accessibility to the shoreline where the soil remains wet. Occasional stagnant pools may generate large numbers of mosquitoes.

In planning the proposed recreation facilities at Blue Marsh Lake, a special effort was made to minimize the problems of aesthetics and accessibility. Intensive development was avoided in locations with views of particularly large drawdown exposures. Beaches and boat launch ramps were designed to provide access to the water across exposed lake bottom on permanent hard surfaces. In one location, near the mouth of Spring Creek, a channel may need to be created to permit boat access across a former alluvial plain which will become shallow or exposed during drawdown. Elsewhere visitors will be forced to modify their activities during periods of drawdown, either

by excluding shoreline activities altogether or by adapting to the changed conditions.

3.8.3 Soils Poorly Suited for Recreation Development. Many acres of poorly drained, flooded, shaly, shallow or eroded soils have been identified (plate 5) as poor for one or more types of recreation development. Location and design of facilities will compensate for some of these soil limitations. Other measures such as importing limited amounts of topsoil might be employed to improve soil conditions in certain situations. In general, however, development will be located on soils rated good and fair for planned uses and, as a rule, never on soils with water-related problems such as a high water table or flooding.

3.8.4 Underground Utilities. Three major utility pipelines cross project property. Where these run through proposed recreation development sites, they were considered in planning the arrangement of facilities. Where they cross wooded areas, the visual impact of their cleared rights-of-way have been assessed in locating trails.

No permanent structures including buildings of any type will encroach on pipeline rights-of-way. Where crossings by roads, parking lots, sewers or water lines could not be avoided, the existing pipelines will require additional treatment. All such crossings must be amply marked to prevent accidental damage to either facility should re-excavation of the other become necessary. Any future construction plan which involves grading the surface above or below its existing contour must be extremely sensitive to pipeline alignments.

3.8.5 Traffic Noise. The main cause of noise in the Blue Marsh Lake area is traffic. Several public roads run along project boundaries or cross project property. Pennsylvania 183 in particular generates considerable noise owing to its high-speed alignment and heavy truck traffic.

How far traffic noise carries from a highway is dependent on many factors. Topography, wind, humidity and vegetation all influence the traveling ability of sound. Solid ground in the form of a hill between the source of sound and a listener is the best natural sound insulator. Trees and ground cover attenuate noise to some degree but serve mainly to mask distant noises. Under certain conditions, such as a calm, humid night, noise may travel great distances over hills and through dense vegetation.

The effective limits of major traffic noise are roughly approximated on plate 6. This representation is based on analysis of the topography, estimated noise intensity and limited observation on the ground.

Existing traffic noise can be slightly reduced by planting trees and ground cover. A somewhat greater reduction might be achieved by creating mounds of earth, although this would be a poor practice where conservation of the natural environment is important, as it is in an outdoor recreation area.

The most effective way to mitigate traffic noise problems at Blue Marsh Lake has been incorporated into the recommended plan. This is to make effective use, through placement of facilities, of the noise reducing capabilities of the existing terrain. Those facilities which are most sensitive to noise -- camp areas and nature trails, for example -- will be located where noise protection is provided by surrounding hills.

3.8.6 Restricted Access Areas. Public access will be partially restricted in three major tracts of land within the Blue Marsh Lake project: the Corps of Engineers' operations areas surrounding the dam, the Game Commission-managed game food plots southwest of Mt. Pleasant, and the privately owned flood easement lands upstream from the confluence of Tulpehocken and Northkill Creeks.

Buffer space will be allocated between proposed development and the operations areas and game management areas mentioned. Where chain-link fences -- installed to prohibit access to the operations zone -- are visible from public-use areas, buffer planting should also be considered to provide a visual screen.

3.8.7 Peripheral Land Uses. Uncontrolled development immediately surrounding the project could degrade the recreation experience by creating noise, visual disruption or deterioration of air or water quality. Potentially incompatible land uses include heavy industry, quarrying and commercial strip development.

At present, none of the development on lands adjacent to the project or along its main approaches causes excessive environmental degradation. However, the existing land use pattern may change considerably in the relatively near future. Suburban Reading is expanding toward the project area and will probably continue to grow for some time to come. Future growth will be encouraged in this direction by new highways in the area, by the proximity of the metropolitan airport and a new commercial center, and by the attraction of the project itself.

Although acquisition of project lands was designed to minimize the impacts of outside development, private lands will be visible from several of the proposed major public use areas. The prevention of inappropriate or incompatible development in these areas and along project access routes can be achieved only by the local municipal governments. By maintaining the existing low-density residential and agricultural zoning classifications at least in a narrow belt around the project's periphery, the surrounding townships would contribute a great deal toward preserving the quality of the environment for thousands of outdoor recreation visitors. At the same time, they would also be enhancing the appearance of their own communities, gaining aesthetic as well as possible economic benefits from the project's presence within their boundaries.

4 LAND-USE PLAN

This section summarizes the reasoning behind the recommended land-use plan illustrated on plate 7. It defines the land-use categories which appear on the plan: intensive and non-intensive recreation, game management, forest management, forest and wildlife conservation and lake operations. These categories are then organized into four small groups of compatible functions which are employed as multiple land-use classifications and assigned to specific land areas within the project. The resultant plan of recommended land uses forms a mosaic of 24 individual land units. In the final paragraphs of the section, each of these units is described in terms of its unique land-use potentials.

4.1 LAND-USE CATEGORIES. The land uses planned for the Blue Marsh Lake project are governed in part by the legislation that regulates the construction and operation of multi-purpose lake projects by the Corps of Engineers. The Pennsylvania Department of Environmental Resources and other cooperating state agencies also help determine how project lands will be used.

The planned land uses can be grouped under seven general categories. The uses within each category are similar in function, in physical site requirements, and in levels of development, management and public use. The categories are individually described in the following paragraphs.

4.1.1 Intensive Recreation. Intensive recreation uses are those which attract high public participation rates and require the development of relatively costly facilities. The presence of large numbers of people and of facilities which require operation and maintenance creates a need for intensive management programs. The high level of public use also demands that intensive recreation lands be accessible from major transportation routes. The degree of development requires that these lands contain some level areas or moderate slopes. Equally important is that access be provided to the project's primary resource -- the water.

The intensive recreation uses at Blue Marsh Lake will be swimming, picnicking, camping, boating, fishing from boats and driving for pleasure.

4.1.2 Non-Intensive Recreation. Non-intensive recreation uses are those which require little or no facilities development. These

activities generally have lower participation rates within an individual recreation project than the intensive recreation activities. Fewer people and facilities require less management. The land requirements of these activities vary, but generally they need accessibility via an appropriate form of transportation as well as natural, aesthetically appealing settings.

Non-intensive recreation uses will include shore and stream fishing, hiking, nature study, bicycling, horseback riding, hunting, sight-seeing, historical pursuits and most wintertime activities.

4.1.3 Game Management. Game management lands are those where active programs will be undertaken to enhance hunting. They include both lands managed specifically for hunting and lands where feeding or propagation of wildlife are the primary objectives. Facilities for recreation generally conflict with the purposes and goals of game management. Exceptions might be hiking trails, vehicular service trails, peripheral parking and hunting or photographic blinds. Public use levels will vary from near zero in areas designated as refuges to low or moderate in open hunting areas. Game management programs will be conducted year-round, and may include such procedures as cultivation of food crops, predator control, disease control, habitat improvement and research studies.

4.1.4 Wildlife Conservation. The goals of wildlife conservation often will require the manipulation of ecologic processes in order to enhance the suitability and productivity of the habitat. Except for access trails and peripheral parking lots, development is unnecessary and usually undesirable. However, development for intensive forms of recreation is not incompatible with wildlife conservation, so long as intensive-use areas include undeveloped buffer zones to prevent excessive disturbances or pressures. Management of non-game wildlife will normally be limited to contingency programs, designed to deal with problems such as disease, overpopulation or the decline of a valued species. Limited hunting or trapping would be indicated, if the need were to arise to control the population of a particular species.

4.1.5 Forest Management. Forest management lands are those where silvicultural programs will be implemented for specific purposes such as aesthetic enhancement or erosion control. Management programs may include reforestation, selective thinning and vector control. Development and public use may be present or absent.

4.1.6 Forest Conservation. The goals of forest conservation are essentially the same as those of wildlife conservation -- to conserve

natural ecologic processes and thus enhance the aesthetic appeal and educational value of the land. Management will be implemented only if problems arise such as disease, infestation by destructive insects or fire hazards. All lands designated for forest conservation will be allowed to mature naturally through the seral stages of ecologic succession.

4.1.7 Lake Operations. Lake operations lands are those where Corps of Engineers-operated facilities are located, including the dam and outlet works, operations building, operators' residences, spillway, overlook and Bernville protective works.

4.2 MULTIPLE-USE CONCEPT. Almost no part of a typical outdoor recreation project is subject to just one land use to the exclusion of all others. Trails bring recreation uses into conservation areas. Tree planting in intensive recreation and lake operations areas represent forest management programs. Game management areas are used for non-intensive recreation in the form of hunting, hiking and nature study.

The land-use plan (plate 7) is organized in recognition of the fact that most project lands will be used for more than one purpose. The land-use categories described above are grouped into four multiple-use classifications. Each multiple-use designation includes one or more primary land use, plus compatible auxiliary uses where they are needed to complement the primary use. The four multiple land-use designations are discussed below.

4.2.1 Intensive Recreation with Non-Intensive Recreation, Forest Management and Wildlife Conservation. Land used for intensive recreation development will also be managed for a number of supportive functions which fall into the categories listed above.

Each intensive recreation use has a set of corollary, non-intensive uses. Camping, for example, will be supplemented by nearby opportunities to hike, bicycle, fish from the shore and study nature.

Forest management procedures will be required to enhance all intensive recreation areas. Camping and picnicking areas in particular will need silvicultural treatment. The most favorable locations for these two activities are either open woodlands or fields interspersed with, and surrounded by, clusters of trees. Where lands chosen for camping and picnicking are presently cultivated, brushy, or grown up evenly in small pole-sized trees, forest management techniques will be implemented to create more suitable recreation environments.

Wildlife has a special value in intensively used areas. There it will become visible to people who do not venture into the more natural areas and who may not otherwise have the opportunity to see wild animals in their native surroundings. Although certain species such as deer and upland birds will tend to shy away from intensive recreation areas, some others such as songbirds and raccoons may actually be attracted in greater numbers than would be found in an equal acreage of undisturbed forestland.

4.2.2 Game Management with Non-Intensive Recreation. In all cases, game management areas will be used for hunting. However, hunting will need to be regulated so as not to interfere with the natural propagation of wildlife. It will also be necessary to prevent the disturbance of waterfowl on their feeding areas. In addition, certain portions of game management areas may be used during certain seasons by non-intensive recreationists other than hunters, including hikers, nature observers and horseback riders.

4.2.3 Wildlife and Forest Conservation with Non-Intensive Recreation. Wildlife and forest conservation lands will be low-management areas where native ecologic communities will be allowed to mature at a natural pace. Hiking, horseback riding, nature study, and shore and stream fishing will be encouraged in these areas. Limited hunting may also be allowed if one or more game species becomes sufficiently abundant.

4.2.4 Lake Operations with Forest Management and Wildlife Conservation. Although many areas reserved for the mechanical operation of the lake will be off-limits to the public, they will be within sight of roads and public-use areas. The sites of operational facilities will be heavily disturbed by cut and fill operations and will require planting and other forest management programs to upgrade them visually. Wildlife conservation is also a compatible function of these protected zones.

Certain lake operations areas will also be open to limited recreation use. The dam overlook in particular will attract numerous visitors with its vistas and exhibits on the historical, recreational and engineering features of the project. Visitors will be permitted to walk across the top of the dam embankment and to fish in Tulpehocken Creek near the embankment's base. Picnic tables will also be placed on a small area of land at the Bemville protective works.

4.3 LAND-USE PLANNING UNITS. The multiple land uses described in the preceding paragraphs have been mapped onto project lands according to the general criteria discussed in section 4.1. A patchwork of 24 discrete

land units has emerged, separated from one another both by function and by spatial barriers such as the lake, roads and topography. These areas are keyed alphabetically on plate 7. The following paragraphs describe how each land unit is qualified to fulfill its assigned functions.

4.3.1 Area A. Area A consists mainly of a 53-acre moderately sloping open field along Tulpehocken Creek adjacent to Rebers Bridge, about one and one-half miles downstream from the dam. It adjoins L.R. 06149, part of the perimeter route of access roads encircling the project. Soils are rated good to fair for recreation development and generally well-suited for the planting of seedlings. The area is enclosed on three sides by non-project farmland and woodland presently zoned "agricultural preservation" and "institutional," including a portion of Tulpehocken Creek Valley Park. The fourth side abuts a steep, wooded section of Area B.

The Union Canal, towpath and ruins of lock 46 parallel Tulpehocken Creek on the north bank. Visually, the entire area is strongly oriented toward the tree-lined creek. From along the creek, the scene appears rural and isolated, although the traffic on L.R. 06149 and L.R. 06038 will most likely be audible from any point within the area.

Area A is easily accessible and lacks any strong restrictions against a moderate level of development. It has several natural attractions, including the fishing potential and visual interest of the creek, and the attractiveness of the canal towpath for walkers, history buffs and bicyclers. The area thus is a logical node for a small-scale, non-disruptive, intensive recreation activity such as picnicking to complement the numerous opportunities which the resource has to offer for non-intensive recreation.

4.3.2 Area B. Area B consists of steep, wooded hillsides and a narrow alluvial plain on both sides of a mile-long segment of Tulpehocken Creek. It also includes moderately sloping open fields encircling a mound-like hilltop south of the dam. Total area is about 230 acres.

Neither the gorge nor the hilltop portion of this land unit is accessible by way of any existing road, except for a small cul-de-sac access road -- unavailable for public use -- into a water filtration plant on the southwest bank of the creek. The area is bounded on the west by the lake; on the north by the dam and lake operations area; on the east by the wooded, abruptly sloping wall of the gorge, part of which is under private ownership; and on the south also by private lands, partly wooded, which lie along the steep face of a ridge.

In the valley portion of this area, the dominant visual element is the forested southwest face of the gorge. It rises as high as 170 feet above the stream. The average slope in the steeper sections is about 40 percent.

The opposite wall is less dramatic, but from a viewpoint on or near the creek, the two slopes are visible and give the distinct impression of a narrow, enclosed valley. The dam embankment and the water filtration plant are also visible from certain vantage points within Area B in and above the valley. The view from most of the area's unforested hilltop section encompasses the entire lower portion of the lake, the surrounding shoreline and the backdrop of distant hills and mountains.

The Union Canal and its towpath parallel Tulpehocken Creek along its northeast bank. There were no locks along this section of the canal.

Much of the soil of Area B has been rated poor for potential recreation development. The 2,000-foot long arm of the lake south and west of the area has been identified as a possible trap for floating debris. Waves along the northeast-facing portions of the shoreline will be among the highest which Blue Marsh Lake will experience, owing to the long fetch toward the source of the prevailing strong winds.

These factors together with the area's inaccessibility limit its potential as an intensive recreation site. Neither does it have any special value for game. It should, however, hold considerable interest for those who would be willing to walk the extra distance for a quieter, more private fishing or towpath-walking experience. The area has thus been designated for wildlife and forest conservation with non-intensive recreation as an auxiliary use.

4.3.3 Area C. Area C coincides with the area surrounding the dam to be managed by the Corps of Engineers. It includes the embankment, outlet works, spillway, operators' residences, dam overlook and fishermen's parking lot.

Area C encompasses about 155 acres of land, mostly on the hills east and west of the dam embankment. Plans for the development of this area appear in Design Memorandums 8, 9 and 10.

4.3.4 Area D. Area D is a 21-acre, rectangular block of land less than one-quarter mile southeast of the dam. It has about 1,000 feet of frontage on relocated L. R. 06038.

This land was formerly part of an institutional farm belonging to Berks County. Several farm buildings are located in the northwestern corner.

The remainder of the area is covered by low, herbaceous vegetation typical of fields which have been recently cultivated.

Area D is partially surrounded by the woods and fields of Area B and a part of Area C on which no facilities are planned. The ground surface slopes downward steeply from the west side of this area to the bottom of Tulpehocken Creek's gorge. The side fronting on L.R. 06038 faces toward farmland owned by Berks County.

Area D is centrally located with respect to potentially developable lands on both the west and east sides of the lake. It is also situated near the intersection between the two principal approaches to the project -- L.R. 06038 and L.R. 06149. The area's soil type is one of the few within the project which has been rated "good" for all forms of recreation development. Slopes average only about 2 percent.

Considering the above factors, Area D meets the essential qualifications for a recreation administration and maintenance area. Its primary use has thus been designated "intensive recreation", although the site is probably too small and isolated from the water to accommodate actual facilities for public use. In this case, "intensive recreation" refers to intensive management uses intended to support recreation.

4.3.5 Area E. Area E is a 300-acre tract consisting of alternating hills and ravines along the lakeshore north and northwest of the dam. Moderately sloping hilltops descend on relatively gentle grades to the lakeshore in several places, providing a total of nearly one mile of accessible shoreline. About 190 acres are in the "developable" slope range.

Nearly all the moderately sloping area has been recently cultivated. The ravines are forested. Soils on the moderate slopes are rated "fair" for recreation development, while soils in the ravines are rated "poor".

Access to this area will be provided along its eastern margin by relocated L. R. 06038. This road also will generate traffic noise, but it should not penetrate significantly beyond the first or second hill toward the western section of the area.

The dam and dam overlook will be located within walking distance of much of Area E near its southeastern corner. The overlook will provide vistas of major project structures and much of the lower lake. The overlook building will house exhibits and audio-visual displays on the history and archaeology, recreational opportunities and engineering features of the project area. The

maintenance road on top of the dam will be available for pedestrian use. Pedestrian access will also be provided from the overlook area to Tulpehocken Creek's northeast bank.

The dam is visible from most of the eastern section of Area E. Nearly all parts of the area offer panoramic views of the lake, the island, the opposite shore and the far hills and mountains.

Almost all of the surrounding lands are farms and woodlots owned by the Pennsylvania Game Commission. Two other units of project property adjoin the area -- the Corps of Engineers operations area on the southeast and a wooded tract along the shore on the northwest.

Area E is the best site available on project lands for a major intensive recreation development. The combination in this area of slope, soils, accessibility, protection from incompatible adjacent land uses, access to the water and views of the lake is unique in the entire project.

4.3.6 Area F. Area F is the single 55-acre island located in the center of the lake. Its topography is generally moderate, soils are rated mostly "fair" for recreation development, and vegetation is primarily open, with scattered shrubby tracts and fencerows. Access will be by boat only.

The land adjacent to the shoreline slopes moderately along about two-thirds of its length. The exceptions are two fairly steep banks on the west shore and a former shale quarry which forms a semicircular cove on the east shore with a diameter of approximately 400 feet.

This island presents an unusual opportunity to provide facilities for a special, unique kind of recreation experience. Its peaceful isolation and pedestrian pace will be preserved by the lack of cars and recreational vehicles. The necessity of a leisurely approach across the lake by boat will further enhance the feeling of isolation or relief from the ordinary world. It will also introduce elements of a "voyage" into the recreation experience, that is, of setting out across the water to a destination on land for a particular purpose. This unusual feature is designated for intensive recreation use in order to take full advantage of this special opportunity.

4.3.7 Area G. Area G includes the somewhat narrow strip of project property along the lake's northeast shore on both sides of the Licking Creek branch, between the major developable portions of Area E and Pennsylvania 183. Total acreage is about 150. For discussion purposes, the area may

be divided into two portions: the areas on both sides of the Licking Creek arm of the lake adjacent to Pennsylvania 183; and the remainder of Area G, divided from the above portion by steep slopes.

This latter area is inaccessible by existing roads, and any proposal to provide an access route would be severely hampered by steep slopes or the necessity of crossing private property.

The former area, adjacent to Pennsylvania 183, is overlain by soils rated generally poor for recreation development. Highway noise would also be a problem. Noise produced by truck traffic will be aggravated here by the presence of a 4,500-foot long grade on Pennsylvania 183 from the lake crossing toward the east. Adjacent lands are zoned "highway commerce," inviting the possibility of development which might be incompatible with recreation uses.

Area G appears to be generally unsuited for any intensive uses including recreation development. It possesses one outstanding feature, however, which might attract trail users. The section east of the lake's Licking Creek branch and just south of Pennsylvania 183 will offer an excellent view along the lake's longest straight stretch, which will extend a full uninterrupted 2.5 miles south-east almost to State Hill.

The main value of Area G is its capability to act as a buffer. It will shut out or at least moderate the impact of external land uses, development and noise upon the project. Several other narrow, shoreline-hugging land units -- otherwise limited in their potential -- will serve this same important function, including Areas H, K, M and Q discussed below. These and Area G are therefore designated as conservation areas, also to be used for compatible non-intensive recreation activities.

4.3.8 Area H. Area H consists of a narrow shoreline strip surrounding all of the lake's Licking Creek branch north of Pennsylvania 183. The 123-acre area is mostly former farmland, with two major woodlots on steep slopes on the eastern side. Surrounding land uses include residential and commercial development to the southwest in the village of Mt. Pleasant; State Game Lands to the west, north and northeast; privately owned farms and woodlots to the east; and the highway and Area G to the south.

This area's situation is similar to that of Area G. Soil limitations, inaccessibility and the narrowness of the site restricts its potential for intensive use. However, its remoteness from potential intensive recreation areas and

its partial protection from disturbance by adjacent land uses will make it an attractive site for shore fishing and a trail. It has therefore been designated for forest and wildlife conservation and other non-intensive uses.

4.3.9 Area I. Area I is a sizeable tract of farmland covering most of a large peninsula formed by a bend in the lake south of Mt. Pleasant and the entire area between Pennsylvania 183 and the lake for 4,000 feet northwest of Mt. Pleasant. It includes about 300 acres. Slopes are generally moderate. Adjacent lands along the northern edge of Area I consist of State Game Lands and the village of Mt. Pleasant.

The view from any point along Area I's shore will encompass a relatively small portion of the lake and surrounding landscape. This is due to the curvature of the lake along the route of the original creekbed and to the steep hillsides which rise from the opposite shore to heights of 100 to 200 feet above the water's surface.

Most of this land unit is currently managed by the Pennsylvania Game Commission. Local farmers cultivate it under sharecropping agreements to provide grazing lands and winter grain supplies for waterfowl. The characteristics of the area which qualify it for game management use are (1) its location between the State Game Lands and the current nesting grounds of a resident Canada goose flock (at Fox Lake on Spring Creek); (2) its soils, which are rated fair to good by the U.S. Soil Conservation Service for grain, grass and legume crops; and (3) the lack of features such as woodlots and fencerows whose potential to conceal hunters or predators would prevent flocks of wary geese and ducks from landing to feed.

Area I also appears to qualify for intensive recreation use. However, relative to other sites within the project with potential for recreation development, it is isolated from the main body of the lake and possesses little visual interest and almost no major vegetation. For this reason and because it is well suited to its current use, this area is designated for continued management as a waterfowl feeding area.

4.3.10 Area J. Area J is a small, 26-acre tract with essentially the same characteristics as Area I, except that it is not currently used for game management. It is located between the lake and Pennsylvania 183, near where L.R. 06047 will cross the lake southeast of Bemville.

This area has no significant limitations against use as a site for certain forms of recreation development which do not require large expanses of land.

Furthermore, this is the remotest point from the dam where lakeside property is useable for intensive recreation. Project property farther upstream is limited by steep slopes, the location of Pennsylvania 183 close to the shore, and the fact that the lake's upper reaches will become extremely shallow or disappear altogether during the yearly drawdown period.

It will be necessary to provide several widely spaced boat launching points on Blue Marsh Lake in order to prevent congestion both in the water and on land at boat launch ramps, and to promote access to remote portions of the lake, particularly for fishermen. Area J is the farthest upstream location where boat launching facilities may be accommodated. In anticipation of this need, therefore, the area is designated for intensive recreation use.

4.3.11 Area K. Area K, like Areas G, H, M and Q, is in a location where the project take-line was drawn close to the flood pool contour, leaving little room for possible development or construction of automobile access routes.

The potential for any intensive project use is particularly limited in Area K. Pennsylvania 183 cuts off its entire northeastern portion from the lake. Much of the area is saturated by traffic noise. Also, the lake's upper limit will recede downstream during periods of drawdown. Flood plains constitute the major portion of the area northwest and southwest of Bemville. Surrounding lands contain a mixture of residential, commercial, private recreational and agricultural development. The zoning designations allow several density levels of residential development.

Area K's 320 acres have potential for three uses relating to recreation: trail development, hunting and aesthetic protection of the lakeshore environment. In addition, a former landscape nursery in this area is available for use as a source of plant materials for landscape planting at proposed project recreation areas. Area K is thus designated for forest and wildlife conservation and auxiliary non-intensive recreation uses.

4.3.12 Area L. Area L consists of lands to be managed by the Corps of Engineers in connection with the protection of private property in Bemville in the event of flooding. The facilities contained in this area include a levee, gated outfalls, ponding area, pumping plant, saddle dike and a new channel for Northkill Creek. Plans for the development of the area appear in Design Memorandum 13.

4.3.13 Area M. Area M is the narrow strip of project property along the southwest shore opposite and adjoining Area K. Its 113 acres

extend for more than 1.5 miles along the shore from a point near the confluence of Northkill Creek with the lake to the L.R. 06047 lake crossing. The topography is the most extreme to be found anywhere within the project. Two hills reach as high as 300 feet above the normal summer season pool surface, with slopes approaching 100 percent in places and averaging about 60 percent between the lakeshore and the two summits.

Area M will be a part of the landscape viewed by through-travelers on Pennsylvania 183, at the only major section of this road which will provide a sustained view of the lake. The steep, heavily forested slopes will give this part of the lake a natural, wilderness-like appearance which should appeal to many sightseers and travelers using the highway. Because project ownership extends to the ridgetop, this view is protected from degradation by possible future development of the adjacent private lands.

Area M also will be useful as a link in a potential lake-encircling trail system, although steep slopes may cause design difficulties and traffic noise levels are high.

4.3.14 Area N. Area N extends along more than 3 miles of the shoreline southeastward from the L.R. 06047 lake crossing, and includes all project property back from this portion of the shore except for the moderately sloping, farmed hilltop area adjacent to T-374 (Lake Road), designated as Area O. Its major topographic features are the valley of one of the lake's small tributaries to be bisected by relocated L.R. 06047; a small, east-west trending ridge overlooking the lake; the hollow southeast of this ridge; and a mostly steep, narrow shoreline strip. Both slope and soils are highly variable. Nearly all of the area's 425 acres are covered by old-field type vegetation.

Surrounding lands are privately owned farms and woodlots. The zoning designation is "rural agricultural." A small inholding, enclosed by project lands on three sides and by L.R. 06047 on the fourth, contains a church and cemetery.

This area appears to possess the general qualifications needed for intensive recreation use. However, like Area I, its value for this purpose is quite small by comparison with other sites within the project. It is isolated from the main lower body of the lake, it has little visual interest and almost no major vegetation. In addition, highway noise from Pennsylvania 183 will probably be a problem along the shore and on north-facing slopes.

Area N does have the potential to provide passage for trails. In addition, like Area M, this site will serve as the scenic backdrop for views of

the lake from Pennsylvania 183, the L.R. 06047 lake crossing and the northeast shore. It has therefore been designated for conservation and non-intensive recreation uses.

4.3.15 Area O. Area O is the moderately sloping, cultivated hilltop tract surrounded by Area N and T-374 (Lake Road). It covers about 115 acres. Its potential for recreation use is limited by its lack of access to the water, its vulnerability to disturbance by possible adjacent development west of T-374, and its isolation from the main body of the lake and from other potential intensive recreation sites.

Area O has been selected by the Pennsylvania Game Commission as a potential game management area. It meets the same qualifications as does Area I (see page 4-10) for the cultivation of game food crops.

4.3.16 Area P. Area P is the long peninsula which projects between the lake's main branch and the Spring Creek branch. It consists of a ridge, more than one mile long, with three small "peaks" 115 to 135 feet above the surface of the recreation pool. The steep slopes along the shoreline are forested and the moderately sloping spine of the ridge has been recently farmed. Access to the water is limited. Soils are rated generally "poor" for recreation development except on the broad portion near the peninsula's base. The entire area encompasses about 150 acres.

The Skinner farm, which includes a large and extremely attractive fieldstone barn and farmhouse, lies at the base of the peninsula overlooking the Spring Creek arm of the lake. The farm is skirted by T-374 (Lake Road) which, with Church Road (formerly L.R. 06048), provides the only potential access route to the area. Adjacent lands are project-owned and designated for conservation and non-intensive uses.

This peninsula is comparable to the island (Area F) in the unusual opportunities it presents. Its special features are its isolation and its orientation in respect to the lake. Unlike the island, however, the peninsula is partially forested, steep in many places and will be surrounded, not by wide expanses of water, but by relatively narrow branches of the lake.

To take full advantage of its unique attributes, a land use is planned for Area P which would (1) utilize the architecturally interesting and accessible Skinner farm, (2) make use of the 50-acre "developable" site adjacent to the farm buildings, (3) permit access to the water only by pedestrians and manually launched small boats, and (4) recognize the values of the moat-like ring of water isolating the area from other activities.

The one recreation project use which meets these criteria is group camping. Area P is therefore designated for intensive recreation use.

4.3.17 Area Q. Area Q is similar to Areas G, H, K and M -- a narrow strip included within the project's boundary to embrace lands which may be inundated by the full flood pool and to protect the lake from encroachment by private landowners. Its 110 acres consist mostly of steep slopes and flood plain. Its chief recreational value is its potential to allow the completion of a trail system encircling the lake and to provide an isolated spot for shore fishing. It is therefore designated as a conservation area.

4.3.18 Area R. Area R is a small (31 acres) moderately sloping area along the lakeshore near the upper end of the Spring Creek branch. Its soils are rated generally "fair" for recreation development. Vegetation is mostly of the old-field type. Adjacent non-project lands are zoned "rural agricultural" and "low-density residential." Access is provided via T-503.

The concept discussed in connection with Area J (page 4-10) of counter-acting possible congestion by dispersing boat launching facilities around the lake, is the basis for recommending that boat access also be provided along the Spring Creek branch. Area R is the only site on this arm of the lake which appears suitable for this type of development. During normal draw-down, the upper limits of boatable water are close to this area, and no other site downstream along this branch is easily accessible. Area R is thus designated for intensive recreation use.

4.3.19 Area S. Area S is an almost square block of land comprising most of the portion of the upper Spring Creek watershed which lies within project boundaries. It is extremely variegated topographically, with some moderate slopes in hollows and on hilltops and many steep slopes along ravines and on the sides of ridges. Old fields are interspersed by a network of forests, with almost equal proportions of both vegetation types. Soils are also split about evenly between types which are rated "poor" for recreation development and those which are rated "fair." Despite the area's large size -- 530 acres -- no special features, as defined in subsection 3.6.2, are present.

The small portion of the lake which will extend into Area S will be shallow and will be entirely replaced by exposed dry lake bottom during normal yearly drawdown. This tiny arm of water will also receive most of the sediment carried into the lake by Spring Creek. It is expected to become shallower and eventually be replaced by vegetated wetland communities.

The majority of the surrounding private properties are farms. Some residential development exists along L.R. 06056, especially at the small hamlet of Brownsville on the south edge of the area. Woodlands also adjoin project property in a few places. Surrounding lands are zoned to permit agriculture and low- to medium-density residential development.

This area is the largest block of land in the project which is essentially dissociated from the lake. It has little potential for intensive recreation development due to steep slopes, unsuited soils and limited accessibility. However, it does display outstanding qualifications for non-intensive uses such as hunting, hiking, horseback riding and nature study. Its large size affords protection against disturbance by possible development of nearby private and project lands. Its diversity of habitats has the potential to harbor a great variety of wildlife. Species that somewhat exclusively inhabit meadows, forests or rejuvenating areas are present, as are those animals which need access to a variety of vegetation types.

Area S is designated for forest and wildlife conservation and non-intensive recreation uses. Hunting will be regulated by the Pennsylvania Game Commission in coordination with the resource manager. Provisions will be made to caution non-hunting visitors to stay out of the area during periods when hunting is permitted.

4.3.20 Area T. Area T is the largest designated land unit in the project, with 990 acres. It includes most of the land west of the lake within about 4,000 feet of the shore, except for some heavily forested areas designated separately. It also includes a "bridge" of developable land connecting the main body of the area with L.R. 06056 via T-534 (Highland Road).

Area T consists of a series of open fields with moderate, rolling topography, interspersed by a network of wooded ravines and hollows. The surface structure is that of a dissected plateau, wherein the tops of the hills lie near the elevation of what probably was once a relatively flat region which has since been broken up by the erosion of ravines and hollows.

The moderately sloping old fields encompass about 500 acres. The soils on these fields are rated generally "fair" for recreation development, while most of the ravine and steep slope soils are rated "poor."

The buildings of the Staudt farm and the Stowell farm in this area have been identified as structures of historic and architectural interest with potential to be saved for project use. Other special visual features include

the dramatic views of the lake and the surrounding hills and mountains from the area's hilltops. The area also appears to be especially well insulated against traffic noise.

Adjacent lands are the heavily forested tracts briefly mentioned above; Area S, designated for game management use; and private lands on the southwest, currently mostly in woods and agriculture and zoned "rural residential."

Access to the lake is available at several small, moderately sloping sites along the shoreline. One is a small peninsula extending northwestward into the Spring Creek branch, another faces east along the lake's main branch near the area's northeast corner, and another is located along the southeastern portion of the area's shoreline.

Area T possesses attributes which are unique in the project. It is relatively isolated yet readily accessible. It is composed mostly of upland, hilltop lands but it does have several points of access to the lake. It commands panoramic views on a scale unsurpassed by any of the other project land units.

These site qualities provide an almost ideal setting for the development of overnight recreation facilities. Area T is thus designated for intensive recreation use.

4.3.21 Area U. Area U is the 90-acre densely wooded, steeply sloping tract along the southeast shore of the lower Spring Creek branch. It includes a hilltop, steep northwest-facing slopes and a ravine which penetrates about 2,000 feet back from the shoreline.

This area has been identified as one of the project's outstanding "special features" on the basis of its exceptionally mature and diverse forest communities (see page 3-21 for a detailed description). It is protected to some extent by its isolation and relative inaccessibility. Establishing the surrounding land (Area T) as a potential site for camp development further protects the area from indiscriminate use by presupposing future controls on vehicular access in the general vicinity. To further protect this aesthetic and educational resource from overuse, Area U is designated for conservation and compatible non-intensive recreation uses.

4.3.22 Area V. Area V is a 160-acre ridge continuing as a small promontory into the southwest portion of the lake. It includes moderately

sloping old fields and rejuvenating areas along the spine of the ridge, and forests on both sides to the bottoms of the adjacent ravines. An abandoned road, formerly T-501 (Blue Marsh Road), follows the ravine which forms the area's southeast border.

The area is completely enclosed by project lands. The adjoining southward-extending "foot" of Area T lies on a continuation of Area V's ridgetop. Access to Area V will be provided across this part of Area T from T-534 (Highland Road), just off L.R. 06056.

Area V contains examples of all the terrestrial ecologic communities represented throughout the project. Although it possesses no stands of vegetation which are particularly unusual in terms of composition or maturity, it does feature an unusually complete collection of "typical" communities within a relatively compact area. It also will be conveniently accessible both to day-users via external circulation routes and to campers residing in the land unit designated as the project's potential camping area. For these reasons it has been selected as a potential nature education area, and designated for conservation and non-intensive recreation use.

4.3.23 Area W. Area W contains the greater part of the largest conterminous tract of forestland in the project. Nearly all of its 190 acres are covered by trees. These woodland tracts range widely in age from one portion of the area to another, but at least two-thirds are well beyond any stage which might be termed "rejuvenating."

The topography in this area is tortuous, with ravines and steep slopes separating a minor acreage of moderately sloping land into small fragments. Properties along the area's 4,500-foot exterior boundary are mostly residential lots and small farms. This is the western portion of the village of State Hill. Zoning is "rural residential."

The potential for future development of lands adjoining the project near State Hill was an important consideration in designating land uses for Area W. Certain factors substantiate the hypothesis that the State Hill area may acquire additional development in the near future. First, new suburban development, including residential subdivisions, apartment complexes and a large shopping mall, has been extended to within 2.5 miles of State Hill on State Hill Road. Secondly, the partially completed Warren Street Bypass (U.S. 422), and Reading Outerloop each have been designed with an interchange on State Hill Road 3.9 and 1.4 miles, respectively, from State Hill. In addition, spectacular views of the lake from the north side of L.R. 06056 and L.R. 06149 may attract development.

Existing buildings near the center of State Hill are visible from the lower lake and surrounding lands. The forested hills of Area W should prevent similar aesthetic encroachment by non-project development west of State Hill. This area also serves to screen the land designated as a nature education area from the sight and noise of traffic and development. It is therefore designated as a buffer or conservation zone, both to protect interior areas from outside disturbance and to be used by people on foot for such non-intensive recreation activities as walking, hunting (when permitted by project management procedures), photography or nature study.

4.3.24 Area X. Area X encompasses the area between the shore and the ridge face at the south end of the lake, adjacent to State Hill. The steep slopes immediately below State Hill are wooded. The remainder of the area is covered mostly by old-field vegetation. The total acreage is about 160.

The area's lower, lakeside portion consists of two segments: a large, angular, almost level peninsula and a fairly narrow, moderately sloping strip which arcs westward along the shore. Soils on these segments are rated generally "fair" for recreation development. Access is provided from L.R. 06056 via T-536 (Tulpehocken Road). Adjoining residential and commercial development at State Hill is separated from the developable segments of Area X by the wooded steep slopes mentioned above and by an elevational difference of about 200 feet.

Views from this area, and particularly from the approach route, will take in much of the lower lake and the lake's longest straight stretch, extending 2.5 miles almost to Mt. Pleasant. The Corps of Engineers will develop a small turnout near the ridgetop along L.R. 06056 for visitors who may wish to park to enjoy the view.

There is some chance that the two large coves on both sides of the peninsula may create an aesthetic problem by trapping wind-collected surface debris. If this were to occur, however, mechanical cleaning equipment could be employed when needed to alleviate the problem.

The peninsula in Area X is the largest nearly level area in the entire project. In addition, it has ready access to the water at the lake's widest section. The view northward and northwestward -- downstream and upstream, respectively -- will take in a greater proportion of the lake than will be visible from any other vantage point on developable lands within the project. The site's development-suited soils and accessibility complete the list of characteristics which qualify Area X to serve as an intensive recreation area.

5 RECREATION DEVELOPMENT PLAN

The land-use plan proposed in the preceding section identifies potential sites within the Blue Marsh Lake project for recreation development. This identification is based on a wealth of resource information and analysis. Those units of land designated for intensive recreation have provided the basic framework for planning access, circulation and recreation facilities.

The following section summarizes the process of resolving the major planning challenges: (1) how to make the best use of the project's recreation resources without jeopardizing the quality of the natural environment; (2) how to provide a broad range of opportunity for recreational satisfaction; and (3) how to fulfill as nearly as possible the recreation demand calculated for the project.

The recommended overall plan appears on plate 4. Plates 8 through 11 depict more detailed development plans, and plates 12 and 13 provide small scale plans and elevations of typical details. Plans for water distribution and sanitation systems are shown on plates 14 and 15. Plates 16 through 19 are architectural drawings of proposed project buildings. A phasing plan appears on plate 20.

5.1 PLANNING CONCEPTS.

5.1.1 Planned Activities and Relative Scale of Development.

The first step in formulating a comprehensive recreation development plan was to determine which recreation activities will take place in the project. The list of activities was drawn up based on (1) what forms of recreation are known to be needed or wanted by the public and (2) whether the project's resources provide opportunities for these activities.

Observation of other recreation areas and those with lakes in particular has indicated that the most popular facilities-oriented outdoor recreation activities are swimming, picnicking, camping, boating, fishing and driving for pleasure. Other activities with high participation rates which generally require less investment in facilities than the above include hiking, nature study, bicycling, horseback riding, hunting, historical pursuits and some wintertime activities.

Also taken into consideration were the relationships between different types of activities in terms of both spatial arrangement and relative scales of development. For example, experience at other parks has shown that swimming and picnicking are closely related activities. The potential number of beach users depends to some degree on how many picnic tables are provided, and vice-versa. Participation in swimming and picnicking also depends to some degree upon the distances between facilities provided for these activities. Most outdoor recreation activities have similar affinities -- or in some cases incompatibilities -- with other activities.

A. Day-Use. Picnicking and swimming receive the greatest participation of all recreation activities at outdoor recreation sites in general, and the Blue Marsh Lake project is expected to be no exception. On a fair-weather summer Sunday, based on the 1981 visitation estimates for Blue Marsh Lake (see subsection 3.7.4), beaches sufficient to accommodate about 7,000 people and picnic tables with a capacity for about 5,000 people will be required at the instant of peak use during the afternoon to meet the calculated demand. However, because swimming-picnicking parties tend to split up and usurp space at both kinds of facilities simultaneously, these capacities represent a peak instant attendance of only about 7,500 visitors.

B. Camping. The Blue Marsh Lake project lands are spacious and varied enough to permit a variety of camping experiences. Tent and trailer camping will be furnished for those who enjoy the conveniences of "developed" campsites. Hike-in and boat-to camping will be provided for a quieter, "back to nature" type experience.

Based on information gathered from other parks and on the 1981 visitation estimates, in that year there should be a demand for enough camp units to accommodate about 2,000 people per peak-load night.

C. Boating. Major lakes opened to boating in recent years by the Corps of Engineers, the Pennsylvania Bureau of State Parks and others invariably have been boated close to capacity within a relatively short time. This is especially true in the heavily populated southeastern quarter of Pennsylvania. This region lies near the middle of the huge Eastern Seaboard urban complex where pressure for boating waters is enormous and still growing.

Since the demand appears to be almost unlimited, the water surface acreage will determine the peak number of boaters who will use the lake at one time. Boating capacity is determined by using a maximum density

factor based on allowable boat horsepower. At least five acres per boat must be allowed for each boat where horsepower is unrestricted. One acre per boat will suffice where a "slow, minimum height swell speed" limitation is imposed.

A tentative water zoning plan (see Design Memorandum 15A, subsection A.7.3 and plate A2) has been submitted to the Pennsylvania Fish Commission for consideration, revision and eventual approval. This tentative plan would allow water skiing and other high-horsepower boating activities on the lower one-half of the lake. A "slow, minimum height swell speed zone" would be established on the narrow upper arms of the lake.

An overall average density standard of 2 acres per boat was applied to the 1,150 total acres in the normal summer pool surface. This allows for 5 acres per boat in the lake's lower half, 1 acre per boat in the upper branches, and a 100-foot safety zone along the shore and around beaches. The design load calculations on table 5-4 indicates that the lake's maximum instant capacity will be approximately 575 boats. Capacity equivalent to approximately 14 boat launch lanes (a combination of multi-lane day-use and camp area ramps and boat rental concession) will be required to handle the peak day load.

D. Fishing and Hunting. Impoundment of water behind Blue Marsh Dam and programs planned by the Game Commission on their 1,850-acre holdings just north of the project will create vast new habitats for warm-water fish and waterfowl. Existing warm- and cold-water fishing will be continued in those segments of the lake's tributaries above maximum normal pool elevation and in Tulpehocken Creek below the dam. Upland game species will also continue to inhabit project lands and will be hunted in designated areas apart from intensive recreation facilities.

A certain proportion of the facilities provided for all boaters will be used by boat fishermen. Not all boaters will fish, but based on observation at other lake-oriented parks, the popularity of a lake for boating is heavily influenced by the quality of the fishing. It may therefore be inferred that fishermen make up a relatively large percentage of the total boaters.

The only developed facilities required by shore and stream fishermen and hunters are parking spaces. Their parking needs are expected to be met in large part by parking facilities provided for other purposes.

E. Trail-Oriented Activities. The Blue Marsh Lake project's size, topography and scenic quality will permit the development

of trails for a variety of activities. Hiking, nature study, horseback riding and bicycling can all logically be accommodated within the site.

The demand for each of these activities appears to be growing as people become more educated in pleasurable, beneficial and inexpensive ways to use their fast-growing leisure time. A large part of the appeal of these activities is the contrast in surroundings and pace from the urban and suburban setting where most participants live and work. The trail system will therefore be as extensive as resources and economics permit, and fully separated wherever possible from automobile traffic.

F. Driving for Pleasure. Although sightseeing trips may have declined somewhat since the recent dramatic rise in fuel costs, this activity has been estimated in past years by the Outdoor Recreation Resources Review Commission to be the nation's most frequently engaged-in form of outdoor recreation. In a sense, nearly all park-users engage in driving for pleasure as they travel to and from their destinations within recreation areas.

Most or all of the internal circulation roads in the Blue Marsh Lake project will end in cul-de-sacs and thus be of somewhat limited value to transient sightseers. However, Pennsylvania 183 and L.R.s 06038, 06149, 06056 and 06047 will provide occasional views of the lake, and the Corps of Engineers will develop a major overlook near the dam and a minor one at State Hill.

G. Historical Pursuits. A growing national interest in America's heritage has resulted in an increasing demand for historical restorations and displays. The lands to be inundated by Blue Marsh Lake hold numerous remains of the colonial and early federal periods, some of which have been slated for salvage. Some of this material is planned to be exhibited in Berks County's Tulpehocken Creek Valley Park immediately downstream from the Blue Marsh Lake project. The Corps of Engineers will also develop a display using salvaged historical materials in the visitors' overlook building off L.R. 06038.

H. Winter Activities. Of the normal recreation season activities, only camping, fishing, hunting and certain trail-oriented activities will continue throughout the year. Except for hunting, these forms of recreation will be curtailed considerably by cold weather.

Cross-country skiing, tobogganing and sledding could be added to the wintertime roster of activities during times of sufficient snow cover.

Skiers would utilize hiking and other trails. Tobogganers and sledgers could use any treeless hillsides accessible via those park roads which will be kept clear of snow.

Development of a recreation complex designed specifically for intensive wintertime use is outside the Corps of Engineers' realm of responsibility. The recreation development plan for Blue Marsh Lake therefore does not provide for downslope skiing. However, in view of the success of a privately operated ski area adjacent to the project, public demand for related winter activities within the project may be considerable. Utilization of project lands for non-intensive winter recreation will be a management responsibility of the Pennsylvania Department of Environmental Resources.

5.1.2 Locational Criteria. The recreation facilities to be developed at Blue Marsh Lake have been arranged on the site according to certain locational criteria. These criteria are based on consideration of: (1) each type of facility's unique physical site requirements; (2) the fact that certain kinds of facilities are best located close to or far away from certain others; (3) the need for auto accessibility to all intensively used facilities; (4) optimum density of development; (5) sound environmental conservation principles; and (6) aesthetic quality. Individual types of recreation facilities planned for the Blue Marsh Lake project are discussed below in terms of the locational criteria which guided their planning.

A. Day-Use Beaches. The factors influencing beach location are perhaps the most critical of all the facilities locational criteria observed in planning the project. Sites available for potential beach locations were limited to moderately sloping (about six percent), relatively wide (300 to 1,000 feet) interfaces between land and water. Potential sites were further narrowed down to those where moderate slopes extend far enough into the lake to allow the normal swimming area to be maintained during a draw-down of five years' frequency, which at Blue Marsh Lake will amount to seven feet below normal summer pool level. This means that the underwater slope at all beach sites continues out at least 200 feet from the summer pool shoreline on a grade that can be evened out to six percent.

Each site selected for a beach complex features a large enough area of moderately sloping land to accommodate a sunning area, bathhouse, parking lots and associated picnic area. Soils are generally well drained.

Recommended beach locations are situated where sewer and water lines may be installed with a minimum of pump stations, force mains and

lake crossings, which are costly to build and maintain. At least one point of access to the regional traffic circulation system is available near each site.

Other considerations which influenced the choice of beach locations included: (1) water circulation (in each case appears likely to meet Pennsylvania Department of Environmental Resources minimum flow rate requirements); (2) solar exposure (northern exposure was avoided); (3) wind exposure (sites are generally protected from the prevailing moderate and strong winds of the recreation season); (4) vegetation (heavily forested sites which would require extensive cutting were avoided); (5) noise (no objectionable sources such as highways nearby); (6) aesthetics (as little as possible disrupted by views of development and land exposed by seasonal draw-down); and (7) special features (avoided wherever their character or fragility would be endangered by proximity to high-intensity use areas).

B. Picnic Areas. Since surveys of Pennsylvania state park users have shown that about 62 percent of all picnickers use beaches,* most of the required picnic space will be provided within walking distance (1,200 feet) of beaches. Virtually all of the remainder, which cannot be accommodated within the 1,200-foot radii, will be placed as near as possible to economize on roads, sewers, water lines and other utilities.

Sites selected for picnic area development have average slopes of 0 to 20 percent. Soils are well drained. Enough land is available to construct parking lots for 1.3 cars per table (see detail on plate 13). Level spaces will provide sites for play areas and informal athletic fields. Surrounding lands are generally steep or otherwise undevelopable but well suited to function as buffer.

C. Boat Launch Ramps. The combination of day-use and camp area boat launch ramps and boat rental concession required to accommodate the expected peak day-use load (see visitation estimate on page 5-25) will be distributed as widely as possible around the lake to prevent congestion of boats on the water and of car-trailer traffic on the roads.

Like beaches, boat launch ramps will be located only where there is a sloping (approximately 14 percent) interface between land and water. The lake bottom must allow the slope to be extended at 14 percent for a

* Fogg, George E., Park Planning Guidelines, National Recreation and Park Association, 1975.

great enough distance from shore to accommodate boat launches to the seven-foot drawdown level. This distance will be about 85 feet horizontally from the normal summer pool shoreline.

Each proposed ramp site is wide enough at the shore for construction of two to three boat launch lanes (at 12 to 14 feet per lane) and a small concrete pier. Ramp sites are backed by sufficient moderately sloping land to accommodate 100-foot diameter vehicular turnarounds, parking for 44 car-trailer combinations per boat launch lane (includes 10 percent overflow factor), and small rest rooms. Soils are well drained. The sites are protected topographically from the direct force of the prevailing moderate to strong winds. Locations have been avoided where the shoreline configuration and wind pattern may allow surface debris accumulation. The topography surrounding each site will permit construction of an access road from the nearest highway or park circulation road with minimal earthwork.

D. Camp Areas. Five types of camp areas are proposed for development at Blue Marsh Lake. Each has its own locational criteria.

Trailer and tent units will be located on broad, moderately sloping areas, clustered together to make most efficient use of roads, sewers, water lines and other utilities. Slopes generally do not exceed 16 percent.

Most trailer and tent units will be situated at higher elevations to take advantage of the warmer, dryer air in these locations during periods of nighttime cool air drainage. Sites have been selected where noise other than natural sounds will be minimal.

All clusters of this type of unit will be surrounded by wooded buffer areas which will remain undeveloped. Potential impacts on sensitive scenic, historic and ecologic areas were carefully considered in the selection of all camp area locations.

Sites for tent-only camp units were chosen on the basis of generally the same locational criteria as those listed above. However, flat spaces large enough to accommodate tents can be provided with no appreciable environmental or aesthetic damage to lands in a broader slope range, up to about 20 percent.

The same criteria were observed in choosing sites for hike-in camp units as for tent camp units with the following additional reservations:

they are at least 1,000 feet from the nearest road; works of man except for the lake are not visible or do not intrude upon the landscape; and noise from motorboats, cars and other visitors is minimized by distance and topography. The proposed hike-in camp area is also supplied with a remote parking lot in a location where automobile access is possible only through the camp control point and where the lot will be policed by project personnel.

The siting of boat-to camp units was subject to the same criteria as hike-in units except that they will be placed near a portion of the shoreline with adequate moderately sloping interface for development of a boat mooring facility.

A site was chosen for group camping based on the following requirements: at least 50 acres of land sloping less than 16 percent; structurally sound existing buildings with potential to be converted for use as headquarters and all-weather group activity center; partially wooded surrounding buffer area; and isolation from proposed family camp areas and intensive day-use development. Automobile access will not be by way of the proposed controlled internal camp circulation system since group camp visitors will generally use only those facilities provided within the group camp area and all attendance will be by prior arrangement.

E. Fishermen's Access. Most shore and stream fishermen will park where parking lots are provided for other activities. However, not all nodes of intensive fishing demand will be close to potential lake-oriented recreation sites. Fishermen's access facilities will be provided in locations where it is anticipated that demand for parking will be high. Parking spaces will be located within 2,000 feet of fishable water. On Tulpehocken Creek below the dam -- anticipated to be a very popular fishing spot -- fishermen's access will be combined with a small-scale picnic area to encourage multiple use of roads and parking lots and to make feasible the provision of rest rooms.

F. Trails. Trails have the least stringent locational requirements of all the project's planned facilities. Four kinds of trails are proposed at Blue Marsh Lake. Criteria are nearly the same for each of the four but there are a few important differences.

Hiking trails will not normally exceed a grade of 20 percent, but since they can be as little as 3 feet wide, they will maintain acceptable grades along all but the steepest slopes by roughly paralleling the elevational contours. They will follow scenically interesting routes wherever

possible. In choosing locations for hiking trails, forested areas were favored over open fields and well drained soils over poorly drained soils. Special treatment and maintenance will be required where trails must cross wetlands.

Equestrian trails were planned based on similar criteria except that grades will not exceed 10 percent. The minimum width will be 10 feet. Routes through open fields were selected with equal preference to routes through woods.

Nature trails were designed in accordance with essentially the same criteria as hiking trails. However, their routes were especially designed to allow users to experience a wide variety of natural elements in a relatively short distance. Grades will be kept under approximately 5 percent to permit use by handicapped, elderly and very young people.

Bicycle trails, like equestrian trails, are not proposed against the sides of any slopes steeper than about 20 percent, since the grading and stabilization needed for the 6-foot minimum width bikeway must not be allowed to disfigure the landscape. Routes will be destination-oriented, tying together places of special interest and nodes of intensive recreation development. They will also connect the project with bicycle paths in Berks County's Tulpehocken Creek Valley Park, which in turn lead to central Reading.

G. Hunting Areas. Although no facilities are proposed specifically to serve hunters within the Blue Marsh Lake project, hunting areas will have some bearing on recreation development. Hunting will be permitted only in areas where other activities may be at least temporarily suspended. This means that only areas dedicated to low-intensity or seasonal uses such as hiking and group camping may be opened at certain times of the year to hunting. Provisions will be made to caution non-hunting visitors to keep out of hunting areas during open shooting days and hours. Management and regulation of these areas will be the responsibility of the Pennsylvania Game Commission in coordination with the Pennsylvania Department of Environmental Resources and Corps of Engineers project management personnel.

5.1.3 Circulation. Circulation is one of the most important elements of park design. It is closely related to aesthetics, since much of the time spent observing the character and features of a project is spent while in motion. It is also responsible in large part for the efficient func-

tioning of the total park development. Congestion, difficulty of access, overuse of resources, underuse of facilities, and overcrowding are possible problems which will be averted by effective circulation design.

The location of existing external access roads and the project's topography were the chief circulation planning limitations. Visual elements of the landscape, location of planned development, locations of planned natural or primitive areas, and the relationships between individual land uses also guided circulation design. The planning of access routes was also influenced by economics; one measure of the feasibility of any section of road or path is to compare its projected cost with the anticipated level of use and with the costs of alternate alignments.

A. Circumferential Circulation. The physical nature of any lake-oriented recreation project demands that movement from one part of the park to another be provided in the form of a circumferential route, or one that at least partially encircles the lake. Any other pattern would require a direct lake crossing, which is feasible and desirable only if it can be accomplished across a narrow neck of water not visible from the main body of the lake nor from major potential recreation areas.

The Blue Marsh Lake project is fortunate to have a ready-made peripheral road system completely enclosing the main lower portion of the lake and park property. Four roads form roughly a three-mile by five-mile rectangle, inclined diagonally with respect to the four points of the compass, with its longer dimension oriented northwest-southeast. This external circulation system is referred to throughout the master plan as the "perimeter route."

The roads that form the perimeter route are Pennsylvania 183 on the northeast; relocated L. R. 06038 on the southeast between Pennsylvania 183 and Rebers Bridge; L. R. 06149 and L. R. 06056 which form a single continuous line on the southwest; and partially relocated L. R. 06047 on the northwest, crossing a narrow bend in the upper lake near Bernville. All are or will be state-maintained roads and all are designated as major arterials or collectors in the Berks County Planning Commission's "Highway 1990 Classification" (1970).

The project property line frequently follows or crosses the perimeter route permitting direct access to the project along more than five miles of its length. In locations where the property line is set back from the perimeter route on the lake side, four township roads will provide additional possible access points.

B. Internal Circulation. The most efficient way to provide access to the interior of the project is via cul-de-sac type roads extending inward toward the lake from the perimeter route. All but one of the ten areas designated for recreation use on the land-use plan (plate 7) will require an interior road. The island is the single exception. Where the recreation land units are large enough to support more than one node of development, their access roads will branch out, terminating in two or more cul-de-sacs.

5.2 DESIGN CRITERIA. The plans for recreation facilities at Blue Marsh Lake presented in this master plan generally conform to the design criteria presented in ER 1110-2-400 and EM 1110-2-400 (Corps of Engineers, 1972 and 1971), together with "State Park Planning Guidelines" and "Engineering Report: Sanitary Fixture Requirements for Pennsylvania State Park Facilities" (Pennsylvania Department of Environmental Resources, 1969 and 1973). These criteria are discussed in the following paragraphs. Many of them are also shown diagrammatically on plates 12, 13, 17 and 18.

5.2.1 Beaches.

A. Capacity. The anticipated or planned capacity of a beach directly influences the size of the beach itself and the scale of related structures such as parking lots, bathhouses and toilets. The following criteria were used to relate user requirements to the available resources in determining the desired beach sizes.

Instantaneous average beach user breakdown = 60% in sunning area
30% in water
10% elsewhere

Beach capacity = 8 people per lineal foot of water frontage
Sunning area capacity = 1 person per 50 square feet

Day-use beaches in all cases are planned in conjunction with picnic areas. Surveys of Pennsylvania state parks have shown that a majority of beach-users also picnic and vice versa. Parking requirements for these two activities can thus be estimated by adding the parking spaces needed by the total projected number of picnickers (beach-users as well as non-beach-users) to the spaces needed by the anticipated number of beach-users who do not picnic. Parking capacity criteria for non-picnicking beach-users are as follows:

Average day-use car load = 4 people per car
Percentage of beach-users who do not picnic = 30%

The capacity criteria used to determine requirements for bathhouse facilities (i.e., toilets, urinals, showers, lavatories, etc.) were derived from special charts on pages 26 and 27 of "Engineering Report: Sanitary Fixture Requirements for Pennsylvania State Park Facilities."

B. Beach Design. Beaches are designed to function with the lake surface at any elevation from the normal summer season pool level (elevation 290) to the minimum recreation season level during an estimated drawdown incidence of one-in-five years' probability (elevation 283). To accomplish this, beach surfaces will extend considerably farther from shore than is the case in lakes with only minimal drawdown.

Swimming areas will be outlined by buoyed cables. Maximum depth within these markers will be 6 feet. Cross-sectional dimensions of a typical beach at 6 percent slope are shown on plate 12.

Concrete is recommended as the beach surfacing material for several reasons:

(1) Concrete beaches have been built at several existing Corps of Engineers lakes, e.g., Allegheny Reservoir, Tygart Lake and Raystown Lake. The extra initial construction expense, relative to gravel-based sand beaches, has been justified by the much lower maintenance costs together with the additional advantages listed below. The U. S. Forest Service has reported that no adverse comments have been received from the public concerning the two concrete beaches at Allegheny Reservoir.*

(2) Blue Marsh Lake will be subject to a minimum drawdown of five feet every year beginning in the late recreation season and extending through the winter. Erosion of a sand beach by wind, waves and runoff during any period of drawdown would make mandatory an unusually large yearly investment in maintenance and replacement.

(3) At certain heavily used Pennsylvania state park beaches, the activity of bathers has displaced sand to expose gravel and bottom muds. Both sand and mud can cause significant turbidity problems, and visitors

*Source: Raystown Lake Design Memorandum No. 14: Public Use Plan, endorsements, page 16, dated 22 January 1970.

have complained that exposed gravel is painful to walk on. The Pennsylvania Department of Environmental Resources has constructed concrete beaches (e.g., Prince Gallitzin State Park) and sand beaches with bituminous base (e.g., Moraine State Park) to control these conditions.

C. Plan of Beach Complex. Each beach complex is designed with the following features other than the beach itself:

- (1) Turf sunning area, extending no more than 250 feet from the shore.
- (2) Lifeguard stations; number to be determined by the State Park resource manager.
- (3) Bathhouse (rest room only at camp area beaches) approximately centered on the width of the beach, located as close to the shore as possible but higher than the full flood pool level.
- (4) Designated eating area and concession-operated refreshment stand (day-use beaches only).
- (5) Sand play pits.
- (6) Gravel parking area with bituminous cartways (typical dimensions on plate 13), separated by buffer planting from pedestrian areas.
- (7) Access route to bathhouse (or rest room) and beach for service vehicles.
- (8) Buoyed safety zone to exclude boats from the swimming area.
- (9) Adequate facilities to handle support functions such as trash disposal, sanitary waste removal and water supply.

5.2.2 Picnic Areas.

A. Capacity. The following capacity criterion was used to determine requirements for picnic facilities based on anticipated usage:

Average picnic table use load = 5.5 people per table

The parking capacity standard for picnicking is as follows:

Average picnic area parking lot use load = 1.3 cars per table

Where picnic areas are planned in conjunction with beaches, the combined parking requirements for these facilities are estimated using this standard together with the criteria listed in subsection 5.2.1 A.

The capacity criteria for rest rooms in picnic areas were derived from charts on pages 28 and 29 of "Engineering Report: Sanitary Fixture Requirements for Pennsylvania State Park Facilities." A plan and elevation of a typical picnic area rest room appears on plate 17.

B. Plan of Picnic Area. Picnic tables will be distributed at an average density of approximately 16 tables per acre with slightly higher densities near parking areas, diminishing gradually as walking distance increases. Both grills and trash containers will be provided at the ratio of one per four tables (see diagram of "picnic unit" on plate 12).

Insofar as site conditions allow, both rest rooms and parking space will be provided within 400 feet of most tables. Picnic shelters, play equipment and graded play fields will also be provided within each major picnic area. An architectural plan and elevation of a typical picnic shelter are shown on plate 16.

Landscape planting or selective thinning of existing stands will be done in picnic areas to screen the sun and the wind, to provide a visual buffer between automobile and pedestrian areas, to define play fields, and to separate picnic areas from food-restricted beach areas.

5.2.3 Boat Launch Ramps.

A. Capacity. The capacity criteria for boats and boat launching facilities are as follows:

Average boating party = 3 people per boat
Average ramp capacity = 40 launchings per day per lane

The capacity criteria for rest rooms in launch ramp areas were derived from charts on pages 20 and 29 of "Engineering Report: Sanitary Fixture Requirements for Pennsylvania State Park Facilities." Plans and elevations of typical flush and vault toilet type rest rooms suitable for launch ramp areas are shown on plate 17.

B. Design. Boat launch ramps are designed (1) to function with the lake surface at any level from elevation 290 to elevation 283 and (2) to minimize traffic congestion both on the water and on land.

To compensate for drawdown, the ramp surfaces are designed in the same manner as beaches (see page 5-12), i.e., extending far enough from shore to accommodate launchings during drawdown, and resisting wind and water erosion by means of hard surfaces. To avert congestion, all but one ramp are planned with only two lanes apiece, the other with three. Ramps will be graded to a slope of 14 percent and surfaced with concrete. They will extend from 2 feet above the normal summer pool level to 5 feet below the minimum design level (the minimum recreation season level during an estimated drawdown incidence of one-in-five years' probability), i.e., from elevation 292 to 278. The width will be approximately 14 feet per lane, or 28 feet for 2-lane ramps and 42 feet for the 3-lane ramp.

A small permanent dock will be constructed adjacent to each ramp with provisions to accommodate attached floating docks. Materials will be reinforced concrete and earth fill. The floating docks will consist of independent sections made of wood-surfaced styrofoam.

Each boat launch ramp will have a 100-foot radius, bituminous-surfaced turnaround loop and 44 graveled car-trailer parking spaces per launching lane (see typical plans on plate 12).

5.2.4 Camp Areas.

A. Capacity. An average capacity of 4 people per camp site was used in calculating overall camp area requirements. This figure does not necessarily apply individually to the various planned camp unit types.

Capacity criteria used to determine requirements for washhouse and rest room requirements were derived from charts on pages 26 through 29 of "Engineering Report: Sanitary Fixture Requirements for Pennsylvania State Park Facilities."

B. Classification and Plan of Camp Units.

(1) Trailer and Tent Camp Units. This type of camp unit is designed to accommodate trailers or tents interchangeably. Each unit includes a graveled pad and automobile approach lane. These must be cleared and graded with extreme sensitivity to the natural environment (diagram and typical dimensions on plate 13). Also included will be a fire ring and a table. One trash receptacle will be provided for each 4 units.

Units will be spaced 60 to 70 feet apart along camp roads, averaging 65 feet from center to center. Sources of drinking water will be located within 150 feet of most units. Washhouses will be sited within about 500 feet of most units. Sanitary disposal stations will be provided along access roads with one outlet per 100 units within the area served.

(2) Tent Camp Units. Each tent camp unit will consist of a cleared 15-foot square pad on well-drained soil, surfaced with wood chips and supplied with one fire ring and one table. One trash container will be provided for each 4 units.

Tent camp units normally will be located no closer together than 100 feet on center. Access will be provided via wood chip foot paths. Where site conditions permit, all units will be served by parking lots within 200 feet, sources of drinking water and trash containers within 150 feet and rest rooms within 500 feet.

(3) Hike-In Camp Units. Each hike-in camp unit will be marked only by the presence of a fire ring, provided to confine disturbance to ground vegetation to as small an area as possible. These units will be placed in forests with existing open, level areas suitable for pitching small tents. Grading and surfacing are not necessary. Clearing of ground cover should be kept to a minimum.

Access will be provided into the general hike-in camp area via a wood chip foot path. The area will also be supplied with a minimum number of trash containers, an inconspicuously located flush toilet type rest room (plan and elevation on plate 17), a remote graveled parking area not less than 1,000 feet away from the nearest unit and an inconspicuous vehicular service trail.

(4) Boat-To Camp Units. The criteria for boat-to camp units are identical to those of hike-in camp units with one substitution. A boat mooring station (typical plan on plate 13) will be provided in place of the remote parking lot and trail.

C. Common Camp Complex Facilities. The camp control station will be located where all campers using the types of units described above will pass through. An extra approach lane for stacking, a car-recreational vehicle parking lot and a camp visitor parking lot will be developed in conjunction with the camp control station, as diagrammed on a typical detail plan on plate 12.

Certain common facilities to be used by both campers and non-campers will be provided in the vicinity of the camp control point. These include a camp store, play fields, amphitheater, a recreation center with first aid and administrative facilities, and a nature education area. Parking lots for visitors will be provided both inside and outside the camp complex on each side of the control point, as shown on the typical plan on plate 12.

Beaches and a boat launch ramp will be developed for exclusive use by campers. These will be designed according to the same criteria as described in preceding paragraphs.

Foot paths and bicycle trails will be provided from tent and trailer camp units to all common camp complex facilities. Wherever topography allows, these routes will be built along separate alignments from camp roads. Typical cross-sections and dimensions are shown on plate 12. Design criteria are presented in subsection 5.2.5.

D. Group Camp. The group camp facility is designed to accommodate groups of 50 to 150 people, with capacity for occasional larger groups. Outdoor facilities will include group tent camping areas, play fields, trails and a launch ramp for manually launched boats. Indoor facilities will include administrative headquarters for the group camp complex, flush toilet type rest rooms, a washhouse, a first aid station, food storage and cooking facilities, dormitory-type sleeping quarters and facilities for bad-weather or evening recreation, interpretive and social programs.

5.2.5 Trails. The trails recommended for development at Blue Marsh Lake fall into four categories according to function. On occasion, two or more of these functions are combined into a single alignment on the plan. In such cases, the more stringent of the two sets of criteria will apply.

In addition to the four categories of trails discussed on pages 5-8 and 5-9, a fifth category -- "pathways" -- is described below. This refers to pedestrian walkways intended primarily as circulation routes between areas of intensive activity.

Cross-sectional diagrams of some typical trails are featured on plate 12.

A. Hiking Trails. Hiking trails will be developed with as little disturbance to existing topography and vegetation as possible.

Underbrush and ground litter will be cleared to a width of approximately 3 feet. Grades should not normally exceed 20 percent.

Each hiking trail will be covered with wood chips to inhibit the formation of mud and to encourage hikers to keep within the 3-foot alignment by providing an attractive and well-defined walking surface. Portions of trails underlain by poorly drained soils will receive special treatment, such as installation of an inconspicuous drainage structure or addition of an extra thickness of surface material.

B. Nature Education Trails. Nature education trails are designed to essentially the same criteria as hiking trails, except that grades should generally be limited to a maximum of 5 percent to permit use by children, the handicapped and the elderly. Wide areas should also be provided at points of special interest to permit organized groups to gather for interpretive discussion.

C. Equestrian Trails. Equestrian trails will be approximately 10 feet wide with a maximum slope of 10 percent. No surface treatment is necessary beyond clearing of major obstacles such as large logs or boulders. Where horse trails cross wooded areas, overhanging branches will be trimmed to a height of about 12 feet.

D. Bicycle Trails. Bikeways will consist of graded, bituminous-surfaced paths not less than 6 feet wide. Because they will be graded, their alignments must be chosen with particular sensitivity to the existing topography to avoid undue aesthetic degradation. Allowable slope will vary according to the length of each grade, up to a maximum of 10 percent over very short distances. Grades will be minimized, where possible, by increasing travel distance and curvature. Horizontal curves will be limited to a 14-foot minimum radius wherever possible. Bikeways will be broadened on short-radius curves to a maximum of 4 feet greater than the normal width. Overhanging vegetation will be trimmed to a height of about 7 feet.

E. Pathways. Pathways, as stated above, will be walkways designed chiefly for pedestrian circulation in contrast with other types of trails which are intended to be used primarily for their own recreational and educational values. They will average about 6 feet wide with bituminous asphalt surfacing in beach areas and stone chips elsewhere. Width and thickness of surfacing material will be increased where individual pathways or sections of pathways are intended to double as access routes for service vehicles.

5.2.6 Roads. Roads, like trails, are classified according to function. Cross-sectional diagrams of some typical roads are shown on plate 13.

A. Major Access Roads. Major access roads are designed to convey traffic into major day-use complexes from public arterial and collector roads around the project's perimeter. They will have 22-foot cartways and 4-foot gravel shoulders.

B. Minor Access Roads. All project roads which are designed to carry moderate volumes of two-way traffic (i.e., all roads except major day-use complex access routes) are designated as minor access roads. These include all two-way camp roads, boat launch ramp access routes and cul-de-sacs leading to minor day-use areas or small portions of major day-use complexes. Minor access roads will have 18-foot cartways with 4-foot gravel shoulders in day-use areas and stabilized earth shoulders elsewhere.

C. One-Way Access Roads. One-way access roads with 14-foot cartways and stabilized earth shoulders are planned for use as camp loops and in any other situation which requires one-way traffic, e.g., for access by maintenance vehicles to sewage pump stations, as turnaround loops at boat launch ramps, etc.

5.2.7 Water Supply and Sanitary Sewer Systems. The project's water distribution system has been designed to provide sufficient quantities at each outlet to meet the unit capacity criteria in EM 1110-2-400, Appendix A. The maximum visitor design loads of each water-supplied building or other planned installation were used to calculate capacity needs.

All planned facilities will be serviced by water supply lines fed by the Western Berks County Water Authority's water treatment plant on Tulpehocken Creek, except those with low capacity requirements which are too remote from other facilities to warrant connection. These will be supplied by wells.

The project's sanitary sewer system was designed to meet the unit capacity requirements set forth in EM 1110-2-400, Appendix A. All facilities linked to the municipal water supply system will be served by sanitary sewers. A sealed sanitary vault will be installed at two low capacity, isolated lakeshore and streamside facilities. Septic fields will be maintained at two existing farms to be retained for project use, located among the hills south of the lake.

5.2.8 Architecture. The designs of recreation project buildings exhibit the following general characteristics:

- (1) Sensitivity to the natural setting.
- (2) Use of local materials finished to retain a natural appearance.
- (3) Standardization of architectural details, design elements and materials throughout the project.
- (4) Construction to minimize maintenance and discourage abuse and vandalism.
- (5) Provisions for use of facilities by persons confined to wheelchairs (e.g., toilets, lavatories, walkways, change rooms, showers, etc.).

5.2.9 Landscape Planting.

A. Function. Trees, shrubs, turf and ground cover will be planted where needed for one or more of the following purposes:

- (1) Aesthetic enhancement.
- (2) Shade.
- (3) Wind protection.
- (4) Noise reduction.
- (5) Erosion control.
- (6) Visual screening.
- (7) Definition of space.
- (8) Attraction of wildlife.

B. Criteria for Selection of Species to Plant. The following criteria has been used in selecting tree, shrub, turf and ground cover species to be planted in connection with the development of recreation facilities at Blue Marsh Lake.

- (1) Hardiness.

- (2) Moderate to rapid growth rate.
- (3) Aesthetic value.
- (4) Specific site suitability.
- (5) Resistance to damage by wildlife.

As a general rule, exotic plant materials should be avoided where indigenous species would serve the same purpose.

5.3 DESIGN LOAD AND REQUIRED FACILITIES. A portion of the facilities proposed in this master plan is intended to meet the recreation needs of the number of potential visitors to Blue Marsh Lake projected for 1981 (three years after the planned project completion date), insofar as the project's resources will permit, with no compromise of environmental or recreational quality. The following paragraphs detail how 1981 facilities requirements were calculated, using the visitation projections derived in exhibit 15-III.

Table 5-1: PROJECTED 1981 ANNUAL ATTENDANCE, DESIGN ATTENDANCE AND INSTANT DESIGN LOAD

ANNUAL ATTENDANCE ¹	1,563,800
DESIGN ATTENDANCE (D.A.) ²	1,172,900
INSTANT DESIGN LOAD (I.D.L.) ³	13,383

¹ ANNUAL ATTENDANCE is the total attendance anticipated at the project in one year, including 25 percent who are expected to engage in sightseeing and miscellaneous activities.

² DESIGN ATTENDANCE (D.A.) is the total annual visitation for which swimming, picnicking, boating and camping facilities are provided. It does not include the 25 percent miscellaneous activities factor. (Source: Delaware River Basin Report, Corps of Engineers, 1960: volume XI, section V, page W-33, paragraph 5b).

³ INSTANT DESIGN LOAD (I.D.L.) is the number of people that can be accommodated at any one time by the parking spaces to be provided for swimming, picnicking, camping and boating, plus the total number of people engaging in miscellaneous activities per day, divided by a daily turnover factor of two.

To convert the Design Attendance (D.A.) to a One Day Design Load (D.L. [o.d.]), the following formula was used:

$$D.L. (o.d.) = \frac{80\% \times D.A.}{14} \times 29.4\%^*$$

where:

D.L. (o.d.) = One Day Design Load.

80% = Portion of Design Attendance expected to visit the site during the summer recreation season.

D.A. = Design Attendance for which major facilities are provided.

14 = Number of weeks in the normal recreation season.

29.4% = Portion of weekly visitation expected on the peak day.

The one day design load (D.L. [o.d.]) was distributed among the four major recreation activities in the following proportions: 55 percent for swimming, 40 percent for picnicking, 15 percent for boating and 10 percent for camping (source: Delaware River Basin Report, Corps of Engineers, 1960: volume XI, section V, page W-33, paragraphs 5a, b, c and g). These proportional parts exceed 100 percent because visitors often participate in more than one activity per recreation day.

The following turnover factors were applied to the activity distribution load to determine an Instant Design Load (I.D.L.) for each activity: swimming = 1.5, picnicking = 1.5, camping = 1, and boating = 1.5. Example -- Instant Design Load calculation for swimming:

$$\text{Instant Design Load (I.D.L.)} = D.L. \frac{(o.d.)}{1.5} \times 55\%$$

where:

D.L. (o.d.) = Total one day design load.

55% = Activity allocation standard.

1.5 = Daily turnover factor for swimming.

* Source: Design Memorandum 5: Land Requirements Plan/Public Use, page 5-9.

Table 5-2: ALLOCATION OF PROJECTED 1981 ONE-DAY DESIGN LOADS

DESIGN ATTENDANCE (D.A.):			1,172,900
ONE DAY DESIGN LOAD [D.L. (o.d.)]:	$\frac{D.A. \times 80\% \times 29.4\%}{14}$	=	19,700
INSTANT DESIGN LOADS (I.D.L.):			
Swimming:	$I.D.L. = \frac{D.L. (o.d.) \times 55\%}{1.5}$	=	7,223
Picnicking:	$I.D.L. = \frac{D.L. (o.d.) \times 40\%}{1.5}$	=	5,253
Camping:	$I.D.L. = \frac{D.L. (o.d.) \times 10\%}{1}$	=	1,970
Boating:	$I.D.L. = \frac{D.L. (o.d.) \times 15\%}{1.5}$	=	1,970

To determine the number of facilities needed to accommodate the anticipated 1981 design attendance of 1,172,900, planning criteria from the table below were applied to the activity Instant Design Loads from table 5-2. The results appear on table 5-4.

The total design capacity of the plans presented in this report exceeds the projected 1981 capacity requirements on table 5-4. The assumption was made that future visitation estimates may at some time indicate greater potential levels of use at Blue Marsh Lake than have been projected for 1981. The plans thus are intended to illustrate the maximum recreation development potential of the project's resources, with environmental conservation and preservation of aesthetic quality as the only constraints.

Table 5-3: RECREATION ACTIVITY PLANNING CRITERIA

<u>Activity</u>	<u>Criteria</u>	
	<u>Facilities</u>	<u>Parking</u>
Picnicking	5.5 persons per picnic table	1.3 cars per picnic table*
Swimming	8 persons per lin. ft. of beach	4 persons per car**
Camping	4 persons per campsite	1 space per site
Boating	3 persons per boat 40 boats per day per launch ramp lane	1 space per boat plus 10 percent overflow factor

* Equivalent to 4.2 persons per car.

** Approximately 70 percent of the swimmers also picnic; they are considered picnickers for purposes of calculating required parking facilities.

Table 5-4: PROJECTED 1981 FACILITIES AND PARKING REQUIREMENTS

<u>Item</u>	<u>Formula</u>	<u>Required Development</u>
Beach Frontage	$\frac{\text{I.D.L.}}{8 \text{ persons per lin. ft.}}$	= 903 lin. ft.
Parking for Non-Picnicking Beach Users	$\frac{\text{I.D.L.}}{4 \text{ persons per car}} \times 30\%$	= 541 spaces
Picnic Tables (Includes Picnicking Beach-Users)	$\frac{\text{I.D.L.}}{5.5 \text{ persons per table}}$	= 956 tables
Parking for Picnickers (Includes Picnicking Beach-Users)	Tables x 1.3 cars per table	= 1,243 spaces
Campsites	$\frac{\text{I.D.L.}}{4 \text{ persons per site}}$	= 493 sites
Required Boating Capacity (Based on Projected Attendance)	$\frac{\text{I.D.L.}}{3 \text{ persons per boat}} = 657 \text{ boats}$	
Boating Resource Capacity	$\frac{1,150 \text{ water surface acres}}{2 \text{ acres per boat overall maximum density}} = 575 \text{ boats}$	

(continued on next page)

Table 5-4: PROJECTED 1981 FACILITIES AND PARKING REQUIREMENTS (cont.)

<u>Item</u>	<u>Formula</u>	<u>Required Development</u>
Day-Use Boat Launch Ramp Lanes	$\frac{440 \text{ boats}^*}{40 \text{ boats per lane per day}}$	= 11 lanes
Parking for Day-Use, Non-Renting Boaters	$440 \text{ boats}^* \times 1 \text{ car per boat} + 10\% \text{ overflow factor}$	= 484 spaces

* This figure represents that fraction of the lake's total boat capacity which is anticipated to be launched from day-use launch ramps, i.e., 575 boats minus 50 rental boats and an estimated 85 boats which are expected to be brought to the site by campers and launched at facilities to be provided especially for them.

5.4 FACILITIES DEVELOPMENT PLAN. The facilities to be developed for recreation at Blue Marsh Lake represent a major public investment. Their design has involved the most thorough deliberation to insure that this investment is carried out in a way that will best serve the public interest. The twin goals of user satisfaction and environmental conservation have been held uppermost among planning considerations in the design of these facilities.

The recreation development plan represents a synthesis of all previous sections of this master plan. It reflects careful analysis of all facets of resource inventory, lake operation, land-use allocation, planning concepts and design criteria.

The land-use plan (plate 7) identifies 10 units of land as sites suitable for intensive recreation development. The proposed arrangement of facilities on these land units is shown on plates 4 and 8 through 11. The following paragraphs are intended to supplement and clarify these graphics and to summarize how design concepts and criteria were applied to each land unit's individual potentials and limitations.

5.4.1 Day-Use Complexes.

A. Dry Brooks Day-Use Area. The Dry Brooks day-use area was planned to meet the entire projected 1981 day-use capacity requirement for Blue Marsh Lake. It will encompass all facilities proposed on and near the northeast shore of the lake's main lower section and on the island. This area includes about 190 acres of land which are potentially accessible by automobile and fall within the 0 to 16 percent slope range. The island provides an additional 45 acres of moderately sloping land accessible only by boat.

The key to developing both the mainland and island sections of the Dry Brooks area to their full potential to provide diverse, high-quality recreation is in deepening the channel that separates them. This will be done by extending the impervious fill borrow areas, to be used in constructing the dam embankment and overflow dikes, which currently flank the channel to the east and west (see correspondence in exhibit 15-1). This will accomplish two important objectives: (1) encourage the movement of water along the shore immediately to the east, further improving its qualifications as a beach site, and (2) preserve the island's principal sources of aesthetic appeal -- its isolation -- during any but the most severe incidence of drawdown.

The Dry Brooks area is a very water-oriented site. For reasons given on pages 4-7 and 4-8, it is the best site available on project lands for development of a major day-use complex. Several stretches of shoreline where the land meets the water on moderate grades are suitable for swimming and boat launching. The large acreages of moderate slopes behind the shore will accommodate picnicking, parking, automobile access and non-intensive activities such as bicycling. The steep slopes which penetrate and partially surround the area will serve as a buffer to help protect against overuse, noise and aesthetic encroachment, and as a setting for non-intensive activities such as hiking, nature study and horseback riding. The island will provide opportunities for unusual kinds of recreation experiences as a boat-to picnicking, walking and sightseeing area. Finally, the total recreational value of the Dry Brooks complex will be augmented by the proximity of the dam, dam overlook complex with its planned informative displays, and fishermen's access parking lot at the downstream toe of the dam.

No one potential beach site and adjacent block of developable land at Dry Brooks can provide the required length of beach, associated picnic area and parking facilities required to fulfill the 1981 projections of potential day-use consumption at Blue Marsh Lake (table 5-2). However, the two major blocks of developable land, including two separate, moderately sloping shoreline tracts, each have the capability of fulfilling approximately half the projected consumption. Because of this peculiarity of the site's resources, together with the design objective of keeping the required number of picnic tables within a logical service radius, two beaches are recommended for development in the locations indicated on plate 10.

Two additional mainland portions of the Dry Brooks area's shoreline will permit access to the water. They are planned as boat launching sites, each two lanes wide. The launch ramps will be located and oriented as shown on plate 10 to minimize possible hazards for swimmers.

Visitors to the island will embark by way of the planned boat launch ramps or the proposed boat rental concession northwest of the island. On arriving, they will tie up their boats at one of several mooring stations (see typical detail plan on plate 13) along the island's shore. Picnic facilities will be provided in a few clusters at a very low density.

Access to the Dry Brooks complex will be provided through a single control point off relocated L.R. 06038, with the exception of the east shore boat launch ramp, whose access road will intersect independently with L.R. 06038. The alignment of the main access road will be as remote from the shoreline as project boundaries and topography allows, with minor access cul-de-sacs

branching off toward the shore. This will minimize pedestrian crossings and other conflicts between automobiles and recreation activities.

Landscape planting is recommended as part of the development of the Dry Brooks complex, particularly where picnic areas are planned on what are now open fields. It is expected that reforestation will eventually be undertaken around the area's fringes as a management responsibility (see Design Memorandum 15A, Appendix B).

B. State Hill Day-Use Area. The State Hill day-use area will consist of facilities proposed at the southern end of the lake immediately north and northwest of State Hill. The developable portions of this area include the 50-acre, nearly level peninsula and the relatively narrow terrace-like strips along the shoreline in both directions (about 0.6 mile northwest and 0.2 mile east from the base of the peninsula).

The peninsula's northeast shore offers both protection from the prevailing southwest summer winds and sufficient depth offshore to accommodate a beach. The remainder of the peninsula and "terraces" to the east and west provide space for picnic area development, parking and access roads. In addition, the end of the developable area farthest west of the peninsula provides adequate space, wind protection and offshore depth to accommodate a three-lane boat launching complex.

Excluding the latter appendage to the State Hill area, all the land available for development is planned as a beach-picnic area complex to be developed as future demand estimates may warrant.

An access road will be provided into the State Hill complex from L.R. 06056, utilizing part of the alignment of the former Tulpehocken Road (T-536). A hazard caused by inadequate vertical sight distance at the existing intersection will be eliminated by the creation of a new intersection about 900 feet to the east. A road along the foot of the slope will allow automobile circulation through the complex without interfering with pedestrian movement. A single cul-de-sac will provide access to the facilities planned on the peninsula.

In addition to the water-oriented facilities planned at State Hill, a small turnout will be developed off L.R. 06056 near the top of the ridge. It will provide a place for visitors in automobiles to park and enjoy the sweeping view of the lake, hills and far mountains.

Like Dry Brooks, the State Hill day-use area is unforested and will require

landscape planting in conjunction with facilities development. Eventually, reforestation with seedlings should be undertaken around the area's fringes.

C. Tulpehocken Access Area. One site inside project boundaries is especially suited to provide public access to Tulpehocken Creek below the dam. This is the open field just southwest of Rebers Bridge.

Efforts have been proposed to develop the lower Tulpehocken as a cold-water fishery (see Design Memorandum 15A, Appendix C). Parking for fishermen is therefore planned as a prime function of the Tulpehocken access area. Since most of the creek's approximately six miles to its confluence with the Schuylkill River is under public ownership and boatable, a launch ramp for canoes and rafts is also proposed. Finally, a minor picnic development is planned to take advantage of the size and attractiveness of the site and the opportunities for hiking, bicycling and historical activities available on the nearby Union Canal towpath.

Automobile access will be provided via a cul-de-sac off L. R. 06149. A pedestrian path will be marked leading across Rebers Bridge to the canal towpath.

Some tree planting will be desirable on this old-field site.

5.4.2 Boat Launch Ramps. The three major boat launch ramps described in subsections "A" and "B" above will be designed chiefly to accommodate boat trailers. They are all planned as adjuncts to major day-use areas.

An additional boat launch ramp is proposed on the lower lake for exclusive use by campers. It will also be designed to accommodate boat trailers. It is discussed further in the following section describing the planned Spring Creek camp complex.

Two launch ramps are proposed to serve the narrow, upper reaches of the lake, where suggested regulations (see Design Memorandum 15A, Appendix A) would impose a "slow, minimum height speed swell" restriction on boats. Land suitable for the development of boat launch ramps on the upper reaches is scarce. However, the two locations identified in section 4 of this master plan are nearly ideal. Both are near the minimum design recreation pool headwaters, and both are readily accessible via existing roads.

The Conrad's Bridge boat launch ramp (plate 9) will probably receive the heavier use. It will lie just off Pennsylvania 183 immediately southeast of the causeway and major intersection of L. R. 06047.

The Spring Creek boat launch ramp (plate 11) will offer a more isolated location, a characteristic that may enhance its appeal for boat fishermen. A small channel may need to be created to keep this ramp open when the pool drops to the maximum design drawdown level -- elevation 283.

5.4.3 Spring Creek Camp Complex.

A. Camp Control and Camp Center. The area designated in section 4 for potential camp complex development encompasses 990 acres of varied terrain between the lake's main lower body and the Spring Creek branch. Access is available from L. R. 06056 on the south side of this tract via T-534 (Highland Road).

The site requirements for a camp control point are fully met by the moderately sloping fields northeast of the potential camp complex entrance on T-534. This site also offers the space needed for the construction of those facilities associated with the camp control station. These will include a camp store, play fields, amphitheater and recreation center (plate 11), intended for use by both campers and non-campers. Parking will be provided both inside and outside of the camp complex on each side of the camp control station.

B. Trailer and Tent Camp Area. Most of the camp units proposed for development at Blue Marsh Lake may be used both by owners of the various types of recreational vehicles and by tent campers. This type of camp site offers maximum flexibility to those who represent the majority of overnight visitors to "developed" state parks -- families who prefer the conveniences of washhouses with showers and such nearby recreation opportunities as beaches, boat launch ramps and evening interpretive or social programs.

Wherever topography permits, trailer and tent camp units are arranged on both sides of loop roads generally 2,000 to 4,000 feet in circumference. This design tends to preserve a feeling of spaciousness by avoiding a suburban subdivision-style series of intersections and complex, tightly woven "streets." The loop design also facilitates access to each washhouse by placing a relatively large number of campers within easy walking distance.

Broad hilltops are interlaced with steep ravines in the proposed camping area. The hilltops will provide adequate space for trailer and tent camp loops with sometimes spectacular views of the lake and mountains. The ravines and "sags" between knolls are forested in places and will provide an unusually high-quality buffer between loops. These will do much to preserve

the spaciousness and natural qualities of the entire development. They will also provide plenty of room for wildlife and for the non-intensive activities of campers such as hiking and nature study.

In general, each available knoll with a view of the lake is utilized for trailer and tent camping on the plan (plate 11). The circulation roads serving the camp loops will also serve two beaches and one boat launch ramp planned for camper use only, as well as the parking lots for the three types of camp units described in subsequent paragraphs. Access will be provided to the beaches, boat launch ramp, several boat tie-ups and the camp center from all trailer and tent units by means of footpaths and bicycle trails.

The hills proposed for camp loop development are nearly all meadows or rejuvenating old fields. Trees will be planted in these areas in conjunction with the development of camping facilities. It is recommended that the State Park resource manager undertake seedling reforestation prior to construction; if construction proceeds before this is accomplished, landscape planting will be necessary.

C. Tent Camp Area. Tent-only camping is conceived as a different type of experience at Blue Marsh Lake from the "trailer and tent" camping described above. Because they are not designed to accommodate automobiles and large trailers, tent camp units represent less of an intrusion on the natural environment. They will thus tend to be somewhat more resource-oriented, with choice locations in existing forests or close to the lakeshore.

The principal tent camping area is planned along the backbone of the ridge near the northernmost point of the Spring Creek complex. This is just at the edge of lands designated for intensive use, adjoining the maturing forest identified on page 3-21 as a "special feature." Parking will be provided at several points along a cul-de-sac road, and tent pads, fire rings and tables will be dispersed within several hundred feet of each parking lot. Low density will be strictly maintained.

Tent camping will also be provided in conjunction with several of the trailer and tent loops closest to the lakeshore. Tent pads will be located close to the water. Trees will be planted where needed.

D. Hike-In Camp Area. The hike-in camp area will serve campers who seek to experience nature with a minimum of perceivable man-induced conditions. The site planned for this activity was chosen because

of its isolation, probable reduced noise level, the lack of visible buildings, roads, etc. and its accessibility from a parking lot to be provided within the camp complex.

Access will be provided via foot trail from the parking lot. Public hiking and equestrian trails are designed to avoid the area. Access for periodic servicing of the planned flush toilet-type rest room will be provided via an existing unsurfaced farm drive.

Although surrounded by woodlands, much of the hike-in camp area is at present unforested. Reforestation by seedlings should be undertaken where appropriate as soon as possible after project implementation (see Design Memorandum 15A, Appendix B).

E. Boat-To Camp Area. The boat-to camping experience will be similar to that of hike-in camping, except that the approach will be over water instead of by trail. The site planned for this activity was selected for its isolation and natural qualities, with the additional requirements of boat accessibility.

Access will be provided through the camp control station, with a parking lot to be provided at the camp boat launch ramp. Boat-to campers will traverse a distance of about 2.7 miles from the ramp to the camp area mooring station. The mooring station will be designed, like all water contact facilities in the project, to be used to the maximum design drawdown level -- elevation 283.

The boat-to camp area will also require reforestation. This should be implemented as soon as possible after the installation of the State Park resource manager.

5.4.4 Group Camp Area. The group camp area is planned as an independent unit from the main Spring Creek camp complex. Possible conflicts between family and group camping activities, particularly those involving children and youth groups, will thus be avoided. Public hiking and equestrian trails will also bypass the area.

As indicated in section 4 (page 4-13), the peninsula between the lake's Spring Creek and upper main branches presents an almost ideal situation for group camp development. Plate 11 shows how the resources of the site are planned to be utilized for this purpose.

The extremely attractive fieldstone house and barn of the Skinner farm will be adapted for use as a group camp control and activities center. The

house will provide space for first aid, limited food service and administration. The barn interior eventually will be remodeled as an assembly point for organized group activities and for recreation and interpretive programs in the evenings and during inclement weather. Until it is needed as a group camp center, the Skinner farm will be maintained as a residence for State Park personnel.

Two large group tent camping areas will flank the control center to the north and east. Boat tie-ups and trails along both sides of the peninsula will be provided for exclusive use by group campers. One flush toilet type rest room will be provided for each group tent camping area.

The group camp area will be accessible via T-374 (Lake Road) and Church Road (formerly L. R. 06048) from L. R. 06047.

5.4.5 Trail System.

A. Hiking Trails. Hiking trails are planned on the southwest side of the lake, where potential conflicts with intensive-use areas and roads are limited and where designated conservation areas and existing forests are abundant. The hiking trail system will encompass 16.2 miles of trails, including a 2.5-mile loop intended for exclusive use by group campers.

Basically, the system will consist of a single trail extending from L. R. 06047 on the west, meandering generally close to the shore to a point within the Spring Creek camp complex approximately opposite from the southern tip of the island. Several hiking spurs will be provided to connect the trail to potential automobile access points. The main day-use access point will consist of a small parking lot and group assembly shelter at the intersection of T-374 (Lake Road) and Church Road (formerly L. R. 06048). Another principal access point will be provided in the approximate center of the Spring Creek camp complex.

Project property is extremely narrow along a portion of the shoreline on the lake's upper Spring Creek branch. The hiking trail will therefore follow the same alignment as the proposed equestrian trail, described below, for about 2.2 miles in this location only.

B. Nature Education Trails. The potential nature education area identified on page 4-17 will be penetrated by 2 miles of interconnected trails in the approximate pattern of a single large loop trisected by

a "Y"-shaped connector in the center. This design offers the user several alternatives in length and locale when taking nature walks within the compact area designated for this use.

The automobile access point is in the vicinity of the camp center. There, parking is available on both sides of the camp control station for campers and day-users.

C. Equestrian Trails. The planned equestrian trail system essentially will consist of a loop encircling the lake. This basic or "primary" loop will be about 17.5 miles long.

However, in order to keep it within project boundaries, the primary loop is designed to pass close to lands designated as game food cultivation plots on both the northeast and southwest sides of the lake near Mt. Pleasant. During the waterfowl migration and nesting seasons, public access to these areas will be restricted. If use of the remainder of the loop is to be continued during these seasons, alternate or "secondary" routes on non-project lands must be found, bypassing the game management areas. This might be accomplished by coordination between equestrian organizations and local landowners.

Establishing the primary loop itself will also require one excursion outside project boundaries. An agreement must be reached between equestrian interests and landowners to provide a roughly one-mile connection between the creek crossing at Rebers Bridge and project lands near the dam. Berks County owns much of the land in this area.

In addition to the main loop around the lake, the equestrian trail system will include two offshoots. One is a one-mile loop trail encircling the hill-top between State Hill and the dam. It will offer views of the dam, the main lower portion of the lake, proposed day-use recreation areas and distant mountains. The second is a linear trail extending about 3.2 miles northwestward from the L. R. 06047 lake crossing. It will follow the shore and creek bank to lands where only flood easements have been acquired. Local equestrian organizations plan to seek permission from landowners to continue this trail for some additional distance along Tulpehocken Creek.

Equestrian trails will approach project boundaries and external public roads in several locations to provide access points from potential privately owned stables on private lands outside the project. Development of stables within the project is not recommended at this time.

D. Bicycle Trails. A 3.1-mile bikeway is planned to connect the proposed Dry Brooks day-use complex with Tulpehocken Creek Valley Park, abutting the project at Rebers Bridge. This paved and graded trail will follow the alignment of the historic Union Canal towpath between Rebers Bridge and a point just below the dam. For the remainder of its length a new alignment will be developed as shown on plate 10, with careful attention to preserving natural aesthetic qualities, particularly of the sloping and wooded sections. The trail will utilize the top of a flood-control overflow dike in crossing the major saddle southeast of the Dry Brooks complex.

Additional bikeways will be provided in the Spring Creek complex to connect trailer and tent camp units with the camp center and camp beaches. These will generally parallel the planned camp roads. However, they will be built along separate alignments wherever topography permits.

5.4.6 Potential Historical Interpretation Area. The Staudt house, barn and outbuildings (plate 11), located approximately one-half mile north of the camp center and nature education area, will provide the nucleus of a proposed historical interpretation area.

Although soils in this area are atypically dry and shaly for southeastern Pennsylvania, this farm is representative of the neat, attractive homesteads established by Germanic settlers in this generally fertile region in the eighteenth and nineteenth centuries. Structures include a small log cabin dating from the colonial period, a farmhouse of log construction with clapboard siding, a large wooden barn, several sheds and a windmill. These buildings and a small farm pond are located in a small cove, isolated visually from the proposed intensive recreation development nearby.

The Staudt farm offers many potential opportunities for historical interpretation. The most logical use for this tract is to create a demonstration farm, using the implements, furnishings and methods representative of those used by Pennsylvania German farmers of the eighteenth century. A working farm would provide education in both heritage and agricultural values, with opportunities for students or others to demonstrate skills such as horticulture and blacksmithy. It also would furnish an historical activities center for local historical societies, schools, etc.

The recommendation to use this farm as an interpretation center is tentative. It is suggested that this proposal be carried out in cooperation with one or more interested agencies, public institutions or organizations. This facility therefore was not included in overall project cost estimates.

5.4.7 Administration and Maintenance Facilities.

A. Administration Area. The administration center, headquarters of the State Park resource manager (Park Superintendent), will be located on lands identified on page 4-7 as best suited for this purpose. This site is located along one of the project's main approach routes -- re-located L. R. 06038 -- near its intersection with another major approach -- L. R. 06149. It is also close to the principal proposed day-use complex and almost next-door to the administrative facilities of the lake operations manager (Head Dam Tender).

Landscape planting should be provided for aesthetic enhancement and to screen the adjacent maintenance area described below.

B. Maintenance Areas. Two maintenance areas are recommended as the most efficient means of servicing the widely separated developments planned on the northeast and southwest sides of the lake. Existing buildings are suggested for rehabilitation in each case.

On the northeast side, a cluster of former Berks County institutional farm buildings behind the administration building site are available to be utilized for this purpose. Near the Spring Creek camp complex on the southwest side, the historically and architecturally interesting barn of the Stowell farm is recommended for adaptation.

The former Berks County institutional farm buildings should be replaced by new structures, if this alternative is found to be less expensive than rehabilitation. However, every consideration should be given to salvaging and using the Stowell barn if at all feasible.

C. Personnel Residences. Two houses within the project are to be rehabilitated specifically as residences for State Park resource management personnel. These are the Ohnmacht farmhouse near the dam and the Stowell farmhouse at the Spring Creek camp complex. They are described in section 3 (page 3-18).

Two additional historically and architecturally valuable farmhouses will be available as employee residences during an interim period until they are converted for other planned uses. They are the Skinner house -- a future group camp facility -- and Staudt house -- a potential historic interpretation facility. Using these buildings as residences will encourage their continued upkeep until they are needed for public use.

All existing houses to be retained as personnel residences will be rehabilitated with careful attention to preserving their historical and architectural character. Additional residences will be acquired, if needed, outside the project.

5.4.8 Water Supply and Sanitary Sewer Systems. The project's water supply source will be the Western Berks County Water Authority's filtration plant, located on the southwest bank of Tulpehocken Creek approximately 4,700 feet downstream from the dam. Sewage treatment will be handled in accord with one of two alternative proposals under consideration: (1) linkage with Berks County's nearby regional sewage treatment plant, currently proposed for expansion or replacement; or, if the county plant is not anticipated to be able to accommodate the additional load upon completion of the recreation project, (2) construction of a sewage treatment plant to serve the project only, to be located on Tulpehocken Creek opposite the water treatment plant. With four minor exceptions, all project buildings and other installations requiring water supply and sewer service will be connected to the proposed plants. Water and sewer plans are shown on plates 14 and 15.

The Conrads Bridge boat launch ramp and Tulpehocken access area will be served by hand-pumped wells and vault toilets. The vaults will be emptied periodically by an independent contractor. The west shore maintenance area and adjacent residence (formerly the Stowell farm) and the potential historical interpretation area (formerly the Staudt farm) are served by existing wells and septic systems. These will be upgraded, if necessary, to meet applicable health standards.

Two cost-reducing alternatives may be considered when final designs are prepared for the hike-in, boat-to and group camp facilities: (1) the flush toilet type rest rooms and shower-equipped washhouse now planned could be serviced by septic fields instead of sanitary sewers; or (2) flush toilets and showers could be eliminated (except possibly in the group camp headquarters building -- formerly the Skinner farmhouse) and sanitary vault type rest rooms installed.

Water supply and sanitary sewer systems will be designed and constructed in conformance with Corps of Engineers specification guidelines, the U. S. Public Health Service's "Drinking Water Standards," the Pennsylvania Department of Environmental Resources' "Sewerage Manual," and all other applicable state and Federal water quality regulations.

5.4.9 Buildings. Eight types of buildings have been designed for Blue Marsh Lake recreation project development. Plans and elevations of these buildings appear on plates 16 through 19. A brief description of each of the eight types is given in the following paragraphs.

A. Administration Building. The administration building (plate 16) will be constructed for year-round use by resource management personnel. It will include the Park Superintendent's office, offices for clerical and technical personnel, a conference area, first aid station and a lobby with information counter.

The building exterior will be faced with natural sandstone. Trim and fascias will be redwood. The hip-type roof will be surfaced with cedar shakes.

The planned location of the administration building is shown on plate 10.

B. Picnic Shelters. Picnic shelters (plate 16) will be open structures with wood columns supporting hip-type roofs. Roofs will be surfaced with cedar shakes. Each shelter will be divided into two equal sides by a central sandstone chimney with two fireplaces, one on each side. Fireplaces will feature two cooking grills each. Each picnic shelter will contain 6 picnic tables, serving a maximum capacity of 48 persons (24 to a side).

C. Vault Toilet Rest Rooms. The vault toilet rest room (plate 17) is designed for use at just two locations, the Conrads Bridge boat launch ramp (plate 9) and the Tulpehocken access area (plate 10). These sites are too remote from water distribution and sewage lines for connection to be practical. The rest rooms will be constructed over reinforced concrete sanitary vaults. The vaults will be emptied by pump truck via manholes.

Exterior walls will be sheathed in sandstone and vertical redwood board and batten. Roofs will be gabled and surfaced with cedar shakes. Interior walls will be constructed of painted concrete block and floors will be concrete with a sealer finish.

Provisions will be made for handicapped persons in the design of one toilet on each side.

D. Flush Toilet Rest Rooms. Flush toilet rest rooms (plate 30) will be used in all picnic areas, at certain locations in the

Spring Creek camp complex and at the group camp. They will be supplied with both running water and sewer service.

Exterior and interior surfaces will be constructed of the same materials and finishes as indicated above for vault toilet rest rooms. Roofs will be of hip-type design, surfaced with cedar shakes. One toilet per side will be designed for use by handicapped persons.

Proposed locations of flush toilet rest rooms are shown on plates 10 and 11.

E. Washhouses. Washhouses (plate 17) will be designed for use by campers residing in trailer and tent camp units. Each washhouse will include flush toilets, lavatories, showers and laundry facilities. One toilet on each side will be provided for handicapped persons. A utility room will also be provided for use by maintenance and service personnel.

Exterior treatment will be the same as that of flush toilet rest rooms.

The planned locations of these structures are shown on plate 11.

F. Bathhouses and Concession Buildings. One bathhouse-concession building complex will be provided for each planned day-use beach. These two buildings will in each case be arranged on opposite sides of a plaza.

Bathhouses will provide toilets (including one on each side designed for handicapped persons), showers, lavatories and dressing rooms for public use, and a utility and storage area for use by service personnel. Concession buildings will include a food preparation area, storage room and first aid station. A food sales area, roofed but open at the sides, will be located adjacent to the food preparation area.

The exteriors of both building types will be surfaced in natural sandstone with redwood trim and fascias, including the columns supporting that portion of the concession building's roof which will extend over the sales area. Interior walls will consist of painted concrete block. Cedar shakes will be employed to surface the hip-type roofs of both structures.

Planned locations of bathhouses are indicated on plate 10.

G. Recreation Building. The recreation building (plate 19) will be constructed for year-round use by both campers and day-users. It will be used for interpretive programs and for social and recreational activities during inclement weather and in the evenings.

This structure will contain a large "multi-purpose" area for assemblies, lectures, films, etc. plus storage, utility (furnace, etc.) and rest room facilities. The multi-purpose room will feature a large stone fireplace at one end and provisions for a portable platform at the opposite end. Laminated wooden arches will provide ceiling support.

The recreation building's exterior will be faced with natural sandstone and horizontal rough-sawn redwood board and batten. The gabled roof will be surfaced with cedar shakes.

The planned location of this structure is shown on plate 10.

H. Camp Control Station. The camp control station (plate 19) will serve as the information and fee-collecting center for planned family camping facilities. It will contain a lobby, counter, small storage room and rest room. The exterior will be surfaced with sandstone and vertical rough-sawn redwood board and batten. The hip-type roof will be sheathed in cedar shakes.

The planned site for the camp control station is pinpointed on plate 10.

5.5 PHASING AND DIVISION OF RESPONSIBILITY FOR DEVELOPMENT. The project document in 1962 allocated \$1,900,000 for the development of recreation facilities at Blue Marsh Lake. In the latest project cost estimate (effective 1 January 1975), this figure has been revised to \$3,601,800 to account for price escalation and the upgrading of planned sanitation and water supply facilities to meet revised standards.

The requirements for non-Federal participation in the development of recreation facilities at Blue Marsh Lake were also set forth in the project document. These requirements are quoted on pages 1-5 and 1-6 of this master plan.

Further guidelines for cost-sharing and division of responsibility between Federal and non-Federal interests have been established in Public Law 89-72: the Federal Water Project Recreation Act of 1965 (see page 1-6). This act requires the participating non-Federal agency to bear part

of the costs of installing and all of the costs of managing recreation developments at Federal water resources projects.

Assurances of cooperation in the development of the Blue Marsh Lake recreation project were provided by the Pennsylvania Department of Environmental Resources (then Department of Forests and Waters) in a resolution dated 13 December 1966. This and subsequent letters of confirmation are reproduced in exhibit 15-II.

In conformance with these documents, the development proposed in this master plan is divided into two phases: "initial" and "future".

The initial phase development will consist of a portion of the Dry Brooks day-use area to include the east beach, approximately 25 percent of the total proposed picnicking facilities, the two boat launch ramps, and access roads, parking lots, water supply lines and sanitary sewer system for these facilities, together with the vista parking lot off L. R. 06056 near State Hill. These first phase facilities are shown in red on plate 20. This phase will be developed by the Corps of Engineers at a cost of \$3,601,800 (January 1975 price level) and is planned for opening in 1978.

The future phase development will include all proposed development other than the facilities mentioned above. This phase will be constructed by the Pennsylvania Department of Environmental Resources, at such time as funds become available and as estimated potential visitation warrants. Funds will be provided either wholly by the Commonwealth or by both Commonwealth and Federal governments under possible future cost-sharing agreements.

It must be emphasized that the designs recommended in this master plan are intended to illustrate overall planning concepts. The final designs of all facilities, particularly of those designated for future phase construction, will be determined at a later date. Any changes in demand, patterns of recreation use, availability of funds, construction techniques, etc. may require revisions in the overall plan as it is presented in this design memorandum.

5.6 SUMMARY OF RECREATION DEVELOPMENT COSTS. The cost of developing the recreation facilities proposed in this master plan was estimated based on unit construction costs in general use in January 1975. These unit costs are listed on table 15-IV-1, exhibit 15-IV.

A summary of the total estimated recreation development costs for the Blue Marsh Lake project is presented in the following table. A more specific breakdown of the estimated costs of individual recreation complexes appears on tables 15-IV-2 through 15-IV-17, exhibit 15-IV.

A summary of anticipated operation and maintenance costs, estimated for the first year of project operation, is presented on table 5-6. A letter from the Pennsylvania Department of Environmental Resources supplying information for the completion of this table is reproduced in exhibit 15-1.

Table 5-5: DEVELOPMENT COSTS SUMMARY
(January 1975 price level)

Cost Account Number	Item Description	Phase of Development	
		Initial*	Future
14	Dry Brooks Day-Use Area	\$2,080,400	\$ 2,075,600
	Tulpehocken Access Area	-----	206,000
	State Hill Day-Use Area	12,000	2,170,000
	Spring Creek Camp Complex	-----	5,037,000
	Conrads Bridge Boat Launch Ramp	-----	494,000
	Administration Area	-----	263,000
	Maintenance Area	-----	89,000
	Trails	-----	707,000
	Reforestation	-----	132,000
	Water Supply and Sewerage Systems	1,123,500	2,184,680
		<u>\$3,215,900</u>	<u>\$13,358,280</u>
	Contingencies (12%)	<u>385,900</u>	<u>1,603,000</u>
	Account Subtotals	\$3,601,800	\$14,961,280
30	Engineering and Design	216,000	898,000
31	Supervision and Administration	<u>180,000</u>	<u>748,000</u>
	Totals	\$3,997,800	\$16,607,280

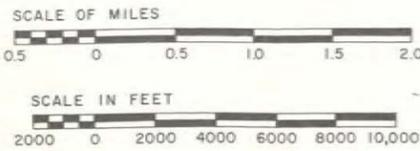
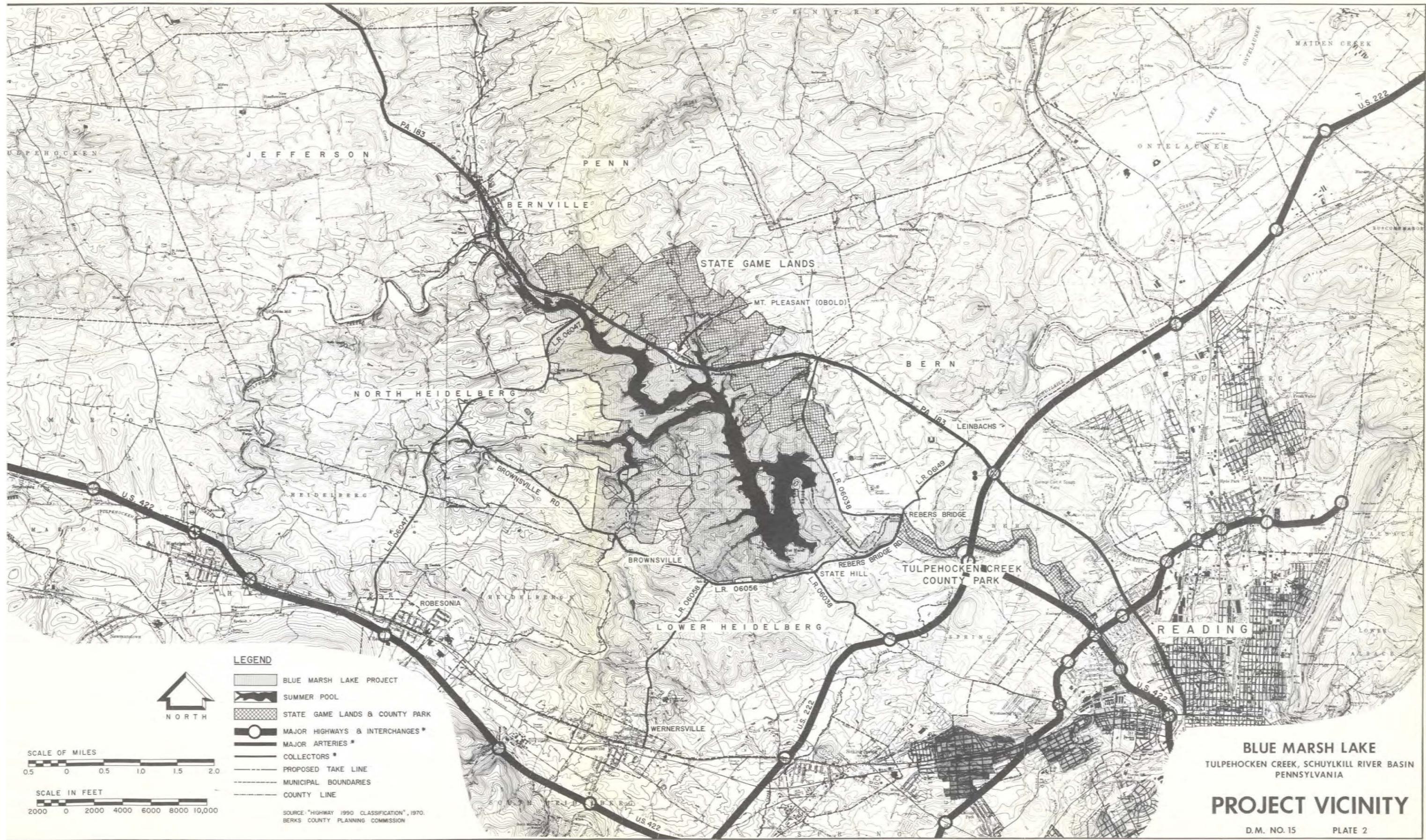
*PB-3 initial phase cost estimate (dated July 1974) of \$3,335,000 has been updated to 1 January 1975 price level (8% increase) of \$3,601,800; only the work indicated as "initial phase" will be constructed by the Corps of Engineers.

Table 5-6: ANNUAL OPERATION AND
MAINTENANCE COSTS SUMMARY
(Estimates prepared May 1975)

A. <u>U. S. Army, Corps of Engineers</u>	
<u>Personnel, etc.</u>	<u>Salary, Wage or Other Cost</u>
Head Dam Operator W-11	\$13,000*
Dam Tender W-08	11,000*
Part-Time Summer Help	4,000*
Total Personnel	<u>\$28,000</u>
Other Operation, Maintenance and Replacement Items (supplies, utilities, vehicle costs, etc.)	<u>60,000*</u>
Total Estimated Annual Operation and Maintenance Costs (Federal)	\$88,000
B. <u>Commonwealth of Pennsylvania, Department of Environmental Resources</u>	
<u>Personnel, etc.</u>	<u>Salary, Wage or Other Cost</u>
Park Superintendent II	\$10,602
Security Officer (Full-Time)	7,159
Equipment Operator (Full-Time)	7,159
Clerk Typist I (Full-Time)	6,592
2 Security Officers (Part-Time)	7,137**
6 Lifeguards (Part-Time)	18,954**
4 Laborers (Part-Time)	13,143**
Total Personnel	<u>\$70,746</u>
Supplies and Materials	<u>25,000</u>
Total Anticipated Annual Budget (Commonwealth of Pennsylvania)	\$95,746

* Based on comparison with project operation and maintenance costs at Beltzville Lake.

** Based on 37.5 hours per week for 26 weeks.



- LEGEND**
- BLUE MARSH LAKE PROJECT
 - SUMMER POOL
 - STATE GAME LANDS & COUNTY PARK
 - MAJOR HIGHWAYS & INTERCHANGES*
 - MAJOR ARTERIES*
 - COLLECTORS*
 - PROPOSED TAKE LINE
 - MUNICIPAL BOUNDARIES
 - COUNTY LINE

SOURCE: "HIGHWAY 1990 CLASSIFICATION", 1970.
BERKS COUNTY PLANNING COMMISSION

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

PROJECT VICINITY

D.M. NO. 15 PLATE 2

BLUE MARSH LAKE
5,960 ACRES - TOTAL AREA OF PROJECT (INCLUDES LAND AND WATER)
38 MILES - LENGTH OF SHORELINE
56 FEET - DEPTH OF SUMMER POOL AT DAM
1150 ACRES - AREA OF SUMMER POOL
8.9 MILES - LENGTH OF SUMMER POOL



OCTOBER 14, 1974

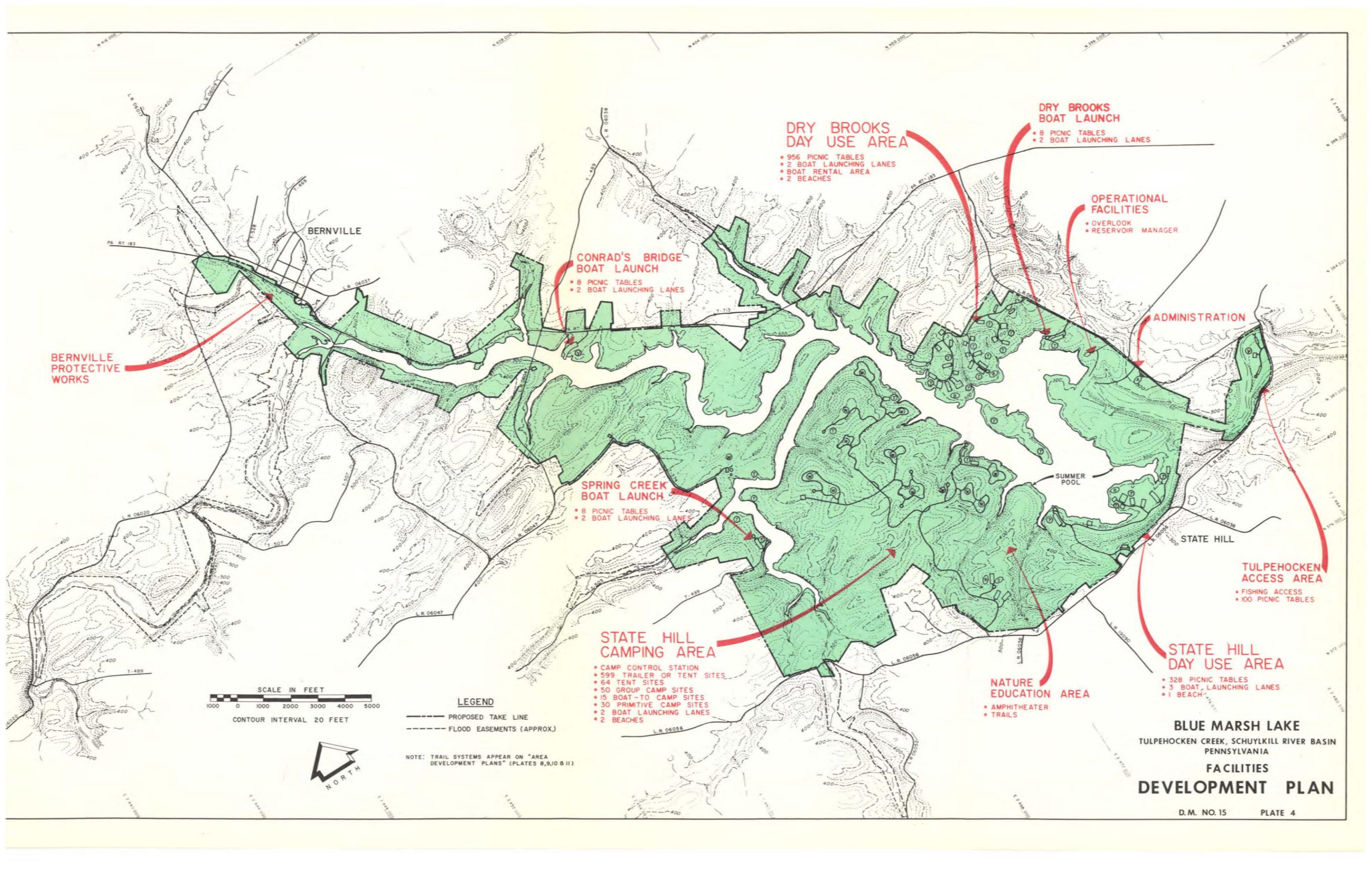


SCALE IN FEET
1000 0 1000 2000 3000 4000 5000

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

AERIAL MOSAIC

D.M. NO. 15 PLATE 3



DRY BROOKS DAY USE AREA

- 956 PICNIC TABLES
- 2 BOAT LAUNCHING LANES
- BOAT RENTAL AREA
- 2 BEACHES

DRY BROOKS BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

OPERATIONAL FACILITIES

- OVERLOOK
- RESERVOIR MANAGER

CONRAD'S BRIDGE BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

ADMINISTRATION

BERNVILLE PROTECTIVE WORKS

BERNVILLE

SPRING CREEK BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

SUMMER POOL

STATE HILL

TULPEHOCKEN ACCESS AREA

- FISHING ACCESS
- 100 PICNIC TABLES

STATE HILL CAMPING AREA

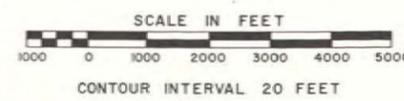
- CAMP CONTROL STATION
- 599 TRAILER OR TENT SITES
- 64 TENT SITES
- 50 GROUP CAMP SITES
- 15 BOAT-TO CAMP SITES
- 30 PRIMITIVE CAMP SITES
- 2 BOAT LAUNCHING LANES
- 2 BEACHES

NATURE EDUCATION AREA

- AMPHITHEATER
- TRAILS

STATE HILL DAY USE AREA

- 328 PICNIC TABLES
- 3 BOAT LAUNCHING LANES
- 1 BEACH



LEGEND

— PROPOSED TAKE LINE

- - - FLOOD EASEMENTS (APPROX.)

NOTE: TRAIL SYSTEMS APPEAR ON "AREA DEVELOPMENT PLANS" (PLATES 8,9,10 & 11)

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

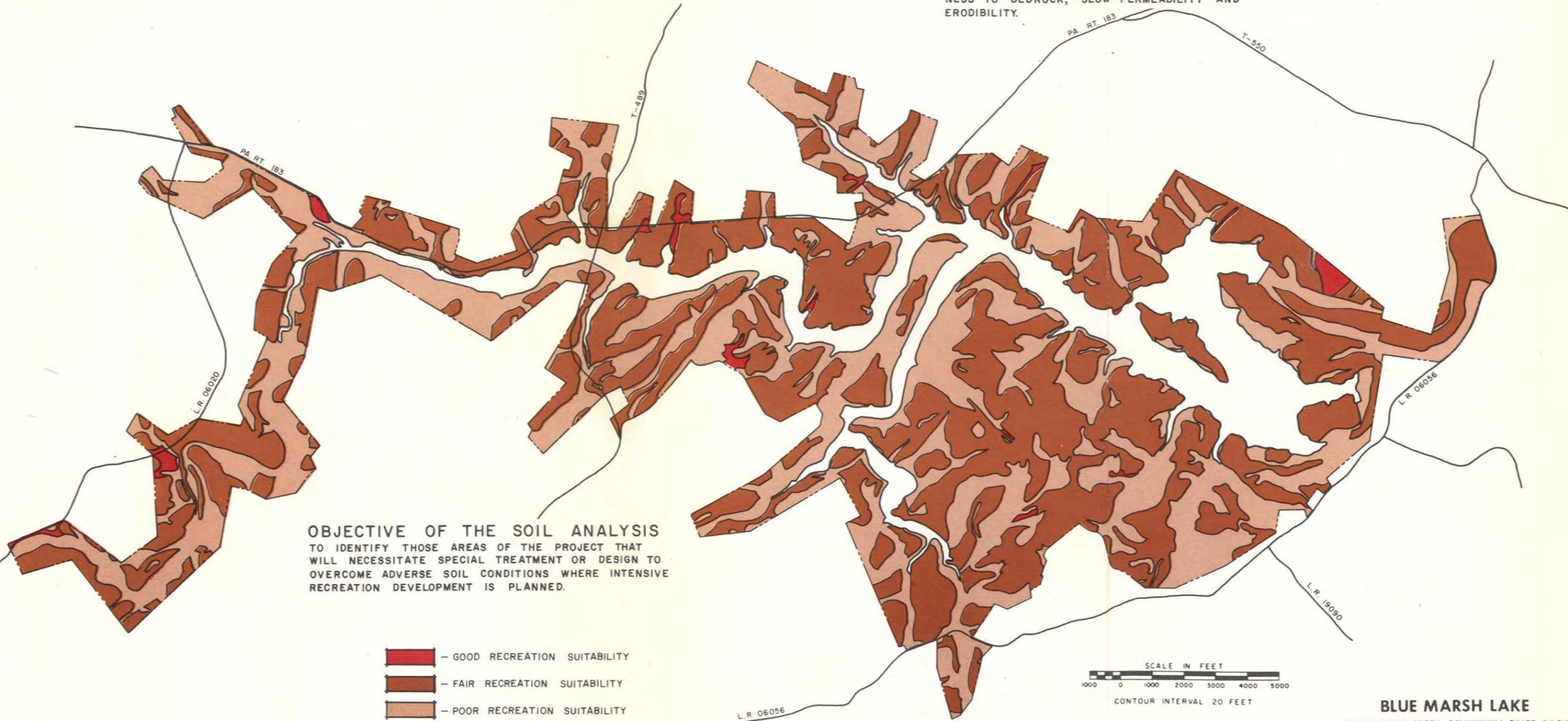
FACILITIES DEVELOPMENT PLAN

SOIL CLASSIFICATIONS FOR RECREATION

"GOOD RECREATION SUITABILITY"
INDICATES SOILS THAT HAVE FEW LIMITATIONS FOR THE INTENDED USES.

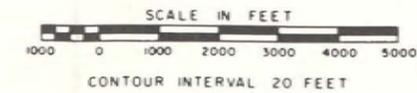
"FAIR RECREATION SUITABILITY"
INDICATES SOILS THAT HAVE SEVERAL LIMITATIONS FOR RECREATION DEVELOPMENT WHICH CAN BE REDUCED OR ELIMINATED BY CAREFUL DESIGN AND PROPER MAINTENANCE AND MANAGEMENT.

"POOR RECREATION SUITABILITY"
DESIGNATES SOILS WHICH PRESENT DIFFICULT BUT GENERALLY NOT INSURMOUNTABLE PROBLEMS FOR RECREATION DEVELOPMENT. THESE PROBLEMS MAY INCLUDE HIGH WATER TABLE, SUSCEPTIBILITY TO FLOODING, AN ABUNDANCE OF SHALE, SHALLOWNESS TO BEDROCK, SLOW PERMEABILITY AND ERODIBILITY.



OBJECTIVE OF THE SOIL ANALYSIS
TO IDENTIFY THOSE AREAS OF THE PROJECT THAT WILL NECESSITATE SPECIAL TREATMENT OR DESIGN TO OVERCOME ADVERSE SOIL CONDITIONS WHERE INTENSIVE RECREATION DEVELOPMENT IS PLANNED.

- GOOD RECREATION SUITABILITY
- FAIR RECREATION SUITABILITY
- POOR RECREATION SUITABILITY

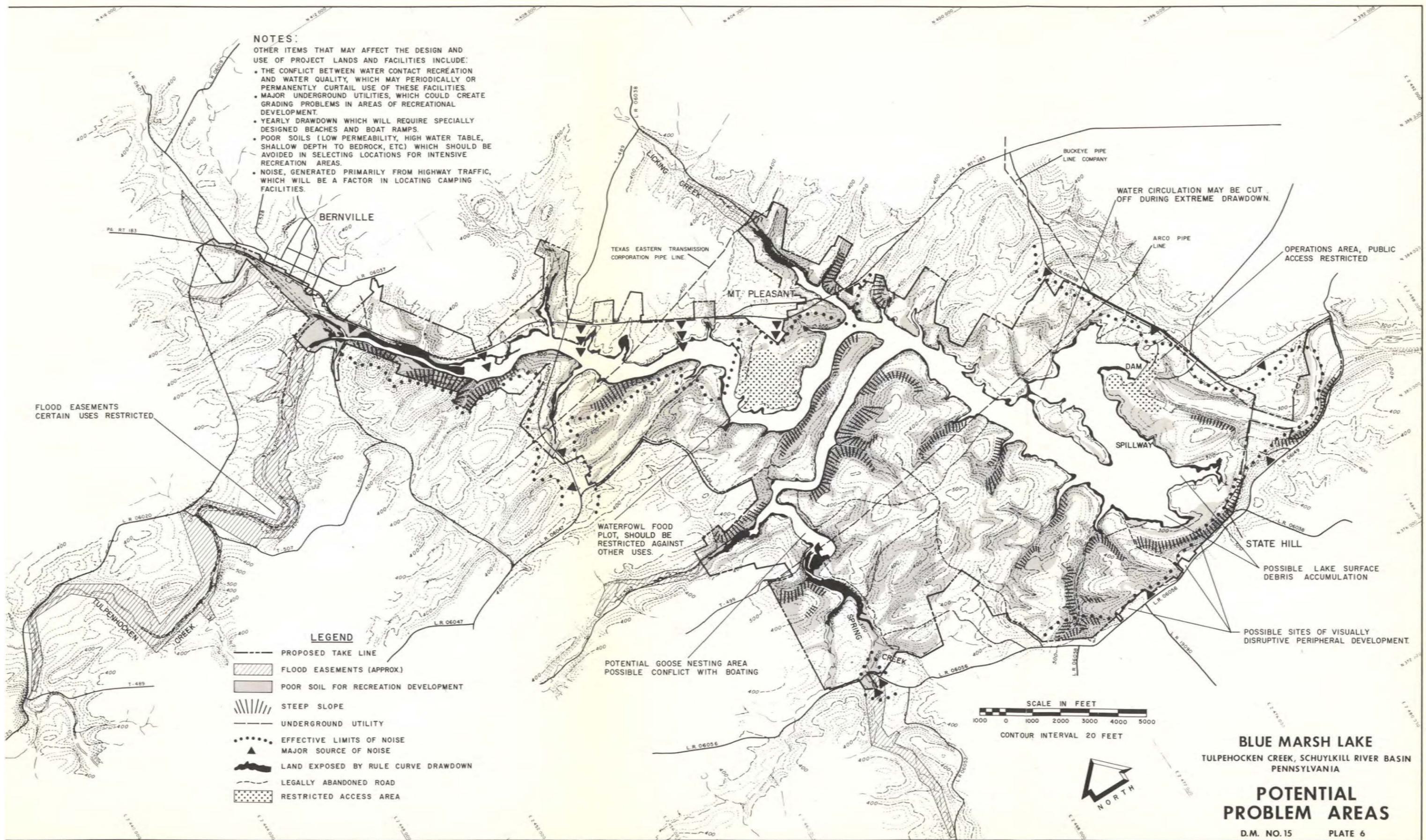


BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA
SOILS SUITABILITY FOR RECREATION DEVELOPMENT
D.M. NO. 15 PLATE 5

NOTE: THE PROPERTY LINE AS SHOWN ON THIS PLATE IS ONLY DIAGRAMMATIC.

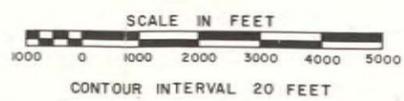
NOTES:

- OTHER ITEMS THAT MAY AFFECT THE DESIGN AND USE OF PROJECT LANDS AND FACILITIES INCLUDE:
- THE CONFLICT BETWEEN WATER CONTACT RECREATION AND WATER QUALITY, WHICH MAY PERIODICALLY OR PERMANENTLY CURTAIL USE OF THESE FACILITIES.
 - MAJOR UNDERGROUND UTILITIES, WHICH COULD CREATE GRADING PROBLEMS IN AREAS OF RECREATIONAL DEVELOPMENT.
 - YEARLY DRAWDOWN WHICH WILL REQUIRE SPECIALLY DESIGNED BEACHES AND BOAT RAMPS.
 - POOR SOILS (LOW PERMEABILITY, HIGH WATER TABLE, SHALLOW DEPTH TO BEDROCK, ETC) WHICH SHOULD BE AVOIDED IN SELECTING LOCATIONS FOR INTENSIVE RECREATION AREAS.
 - NOISE, GENERATED PRIMARILY FROM HIGHWAY TRAFFIC, WHICH WILL BE A FACTOR IN LOCATING CAMPING FACILITIES.



LEGEND

- PROPOSED TAKE LINE
- [Hatched Box] FLOOD EASEMENTS (APPROX.)
- [Solid Grey Box] POOR SOIL FOR RECREATION DEVELOPMENT
- [Diagonal Lines] STEEP SLOPE
- UNDERGROUND UTILITY
- [Dotted Box] EFFECTIVE LIMITS OF NOISE
- [Triangle] MAJOR SOURCE OF NOISE
- [Wavy Line] LAND EXPOSED BY RULE CURVE DRAWDOWN
- LEGALLY ABANDONED ROAD
- [Stippled Box] RESTRICTED ACCESS AREA



BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA

POTENTIAL PROBLEM AREAS

D.M. NO. 15 PLATE 6

FLOOD EASEMENTS CERTAIN USES RESTRICTED

WATERFOWL FOOD PLOT, SHOULD BE RESTRICTED AGAINST OTHER USES.

POTENTIAL GOOSE NESTING AREA POSSIBLE CONFLICT WITH BOATING

WATER CIRCULATION MAY BE CUT OFF DURING EXTREME DRAWDOWN.

OPERATIONS AREA, PUBLIC ACCESS RESTRICTED

STATE HILL
 POSSIBLE LAKE SURFACE DEBRIS ACCUMULATION

POSSIBLE SITES OF VISUALLY DISRUPTIVE PERIPHERAL DEVELOPMENT

LAND-USE CATEGORIES

INTENSIVE RECREATION

-INCLUDES FACILITY-ORIENTED ACTIVITIES, SUCH AS SWIMMING, PICNICKING, CAMPING, BOATING AND FISHING FROM BOATS.

NON-INTENSIVE RECREATION

-INCLUDES ACTIVITIES WHICH REQUIRE LITTLE OR NO FACILITY DEVELOPMENT, SUCH AS SHORE AND STREAM FISHING, HIKING, NATURE STUDY, BICYCLING, HORSEBACK RIDING, HUNTING AND DRIVING FOR PLEASURE.

GAME MANAGEMENT

-INCLUDES PROGRAMS UNDERTAKEN TO ENHANCE HUNTING, SUCH AS CULTIVATION OF FOOD CROPS, PREDATOR CONTROL, DISEASE CONTROL, BROWSE CUTTING, PLANTING OF COVER AND RESEARCH STUDIES.

WILDLIFE CONSERVATION

-INCLUDES LOW-INTENSITY MANAGEMENT PROGRAMS FOR THE ENHANCEMENT AND MAINTENANCE OF NATURAL ECOLOGIC PROCESSES; E.G. DISEASE CONTROL, POPULATION CONTROL AND PRESERVATION OF UNUSUAL, RARE OR ENDANGERED SPECIES.

FOREST MANAGEMENT

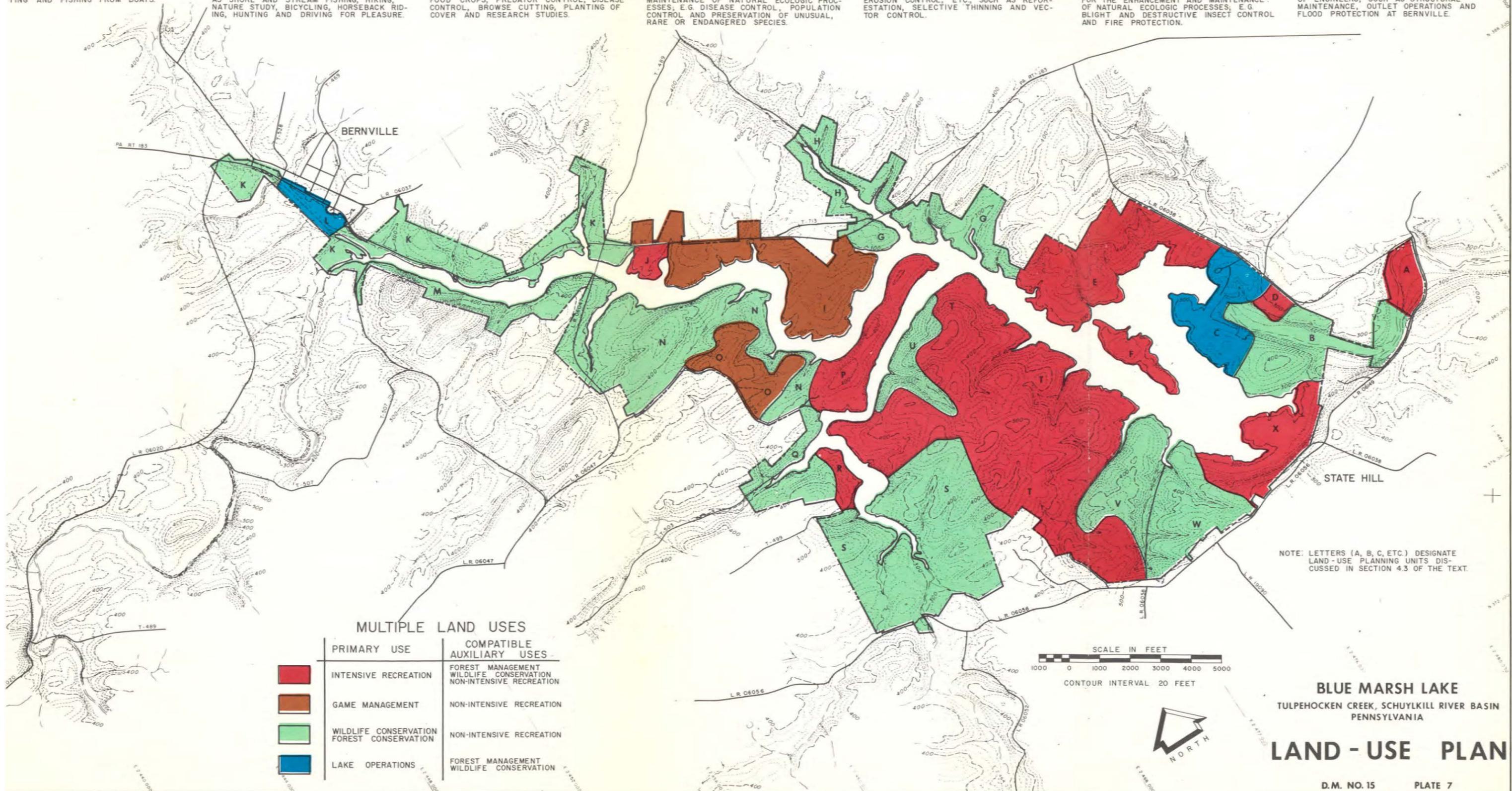
-INCLUDES SILVICULTURAL PROGRAMS FOR PURPOSES OF AESTHETIC ENHANCEMENT, EROSION CONTROL, ETC., SUCH AS REFORESTATION, SELECTIVE THINNING AND VECTOR CONTROL.

FOREST CONSERVATION

-LIKE WILDLIFE CONSERVATION, INCLUDES LOW INTENSITY MANAGEMENT PROGRAMS FOR THE ENHANCEMENT AND MAINTENANCE OF NATURAL ECOLOGIC PROCESSES; E.G. BLIGHT AND DESTRUCTIVE INSECT CONTROL AND FIRE PROTECTION.

LAKE OPERATIONS

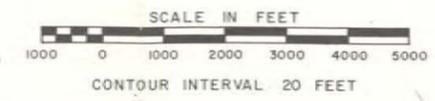
-INCLUDES USES RELATING TO THE OPERATION OF THE LAKE BY THE CORPS OF ENGINEERS, SUCH AS STRUCTURAL MAINTENANCE, OUTLET OPERATIONS AND FLOOD PROTECTION AT BERNVILLE.



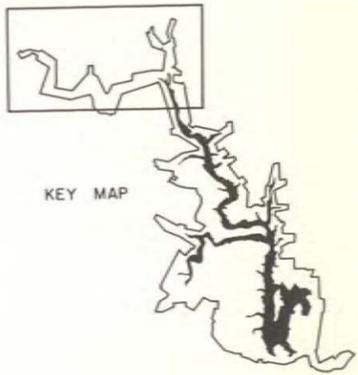
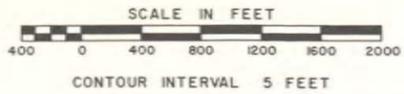
NOTE: LETTERS (A, B, C, ETC.) DESIGNATE LAND-USE PLANNING UNITS DISCUSSED IN SECTION 4.3 OF THE TEXT.

MULTIPLE LAND USES

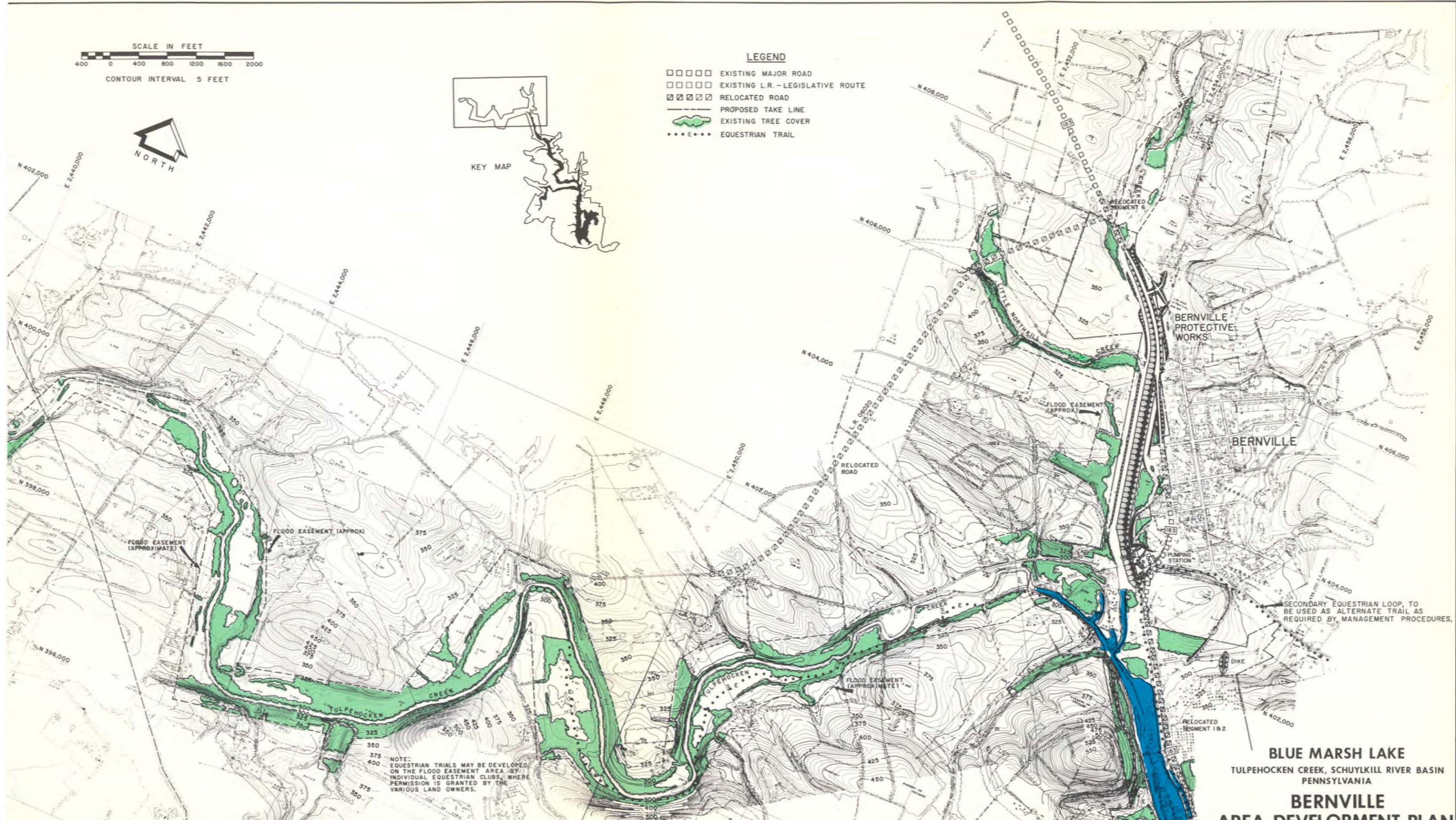
PRIMARY USE	COMPATIBLE AUXILIARY USES
■ INTENSIVE RECREATION	FOREST MANAGEMENT WILDLIFE CONSERVATION NON-INTENSIVE RECREATION
■ GAME MANAGEMENT	NON-INTENSIVE RECREATION
■ WILDLIFE CONSERVATION FOREST CONSERVATION	NON-INTENSIVE RECREATION
■ LAKE OPERATIONS	FOREST MANAGEMENT WILDLIFE CONSERVATION



BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA
LAND - USE PLAN



- LEGEND**
- □ □ □ EXISTING MAJOR ROAD
 - □ □ □ EXISTING L.R. - LEGISLATIVE ROUTE
 - ▣ ▣ ▣ ▣ RELOCATED ROAD
 - - - - PROPOSED TAKE LINE
 - Existing Tree Cover (shaded green)
 - • • • • EQUESTRIAN TRAIL



NOTE:
EQUESTRIAN TRIALS MAY BE DEVELOPED
ON THE FLOOD EASEMENT AREA BY
INDIVIDUAL EQUESTRIAN CLUBS, WHERE
PERMISSION IS GRANTED BY THE
VARIOUS LAND OWNERS.

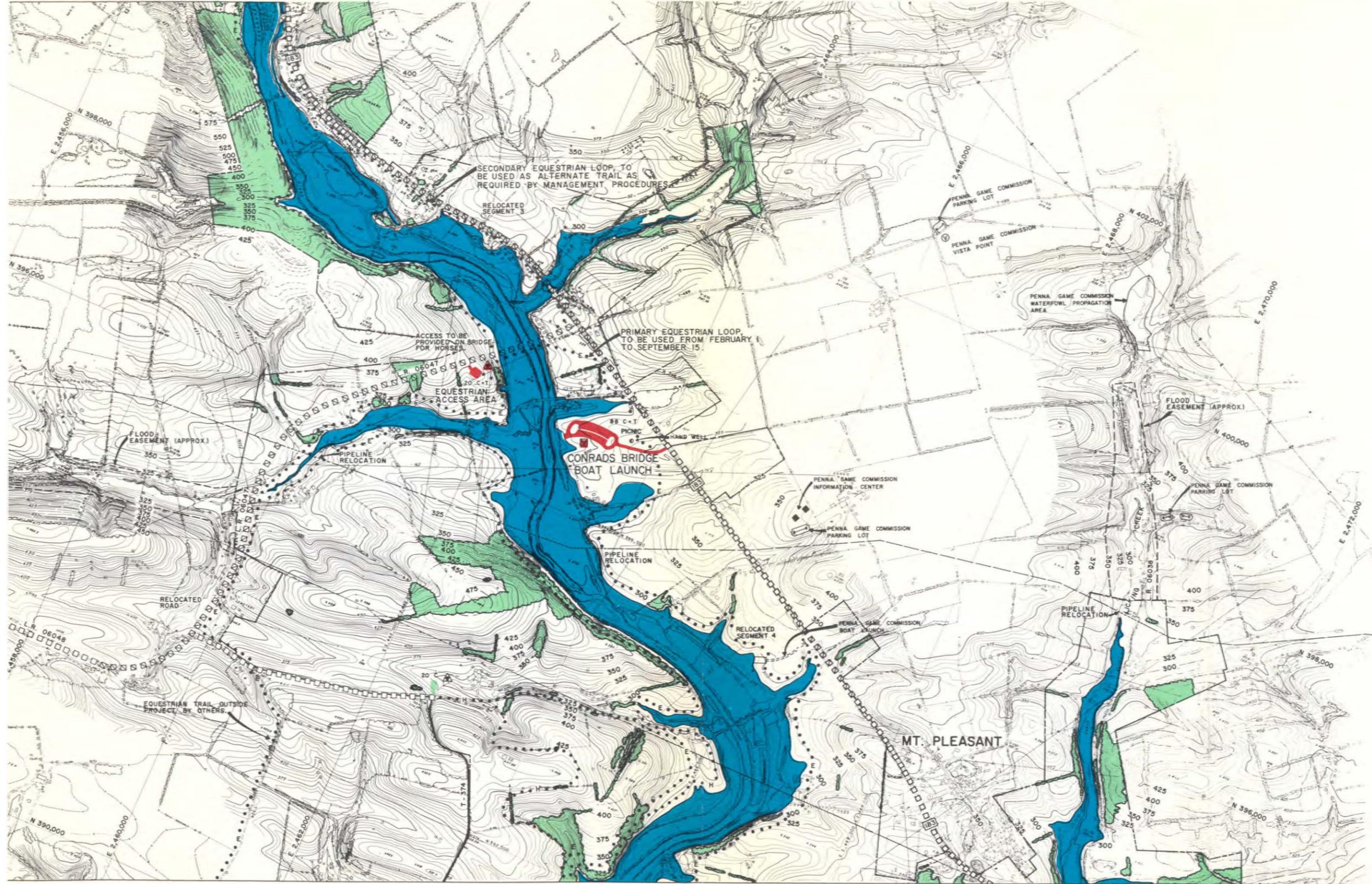
BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

BERNVILLE
AREA DEVELOPMENT PLAN

TEXAS EASTERN TRANSMISSION
CORPORATION PIPE LINE

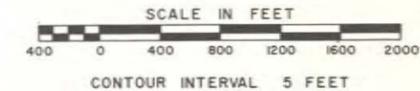
MATCH LINE TO PLATE 9

TCH LINE TO PLATE 8



LEGEND

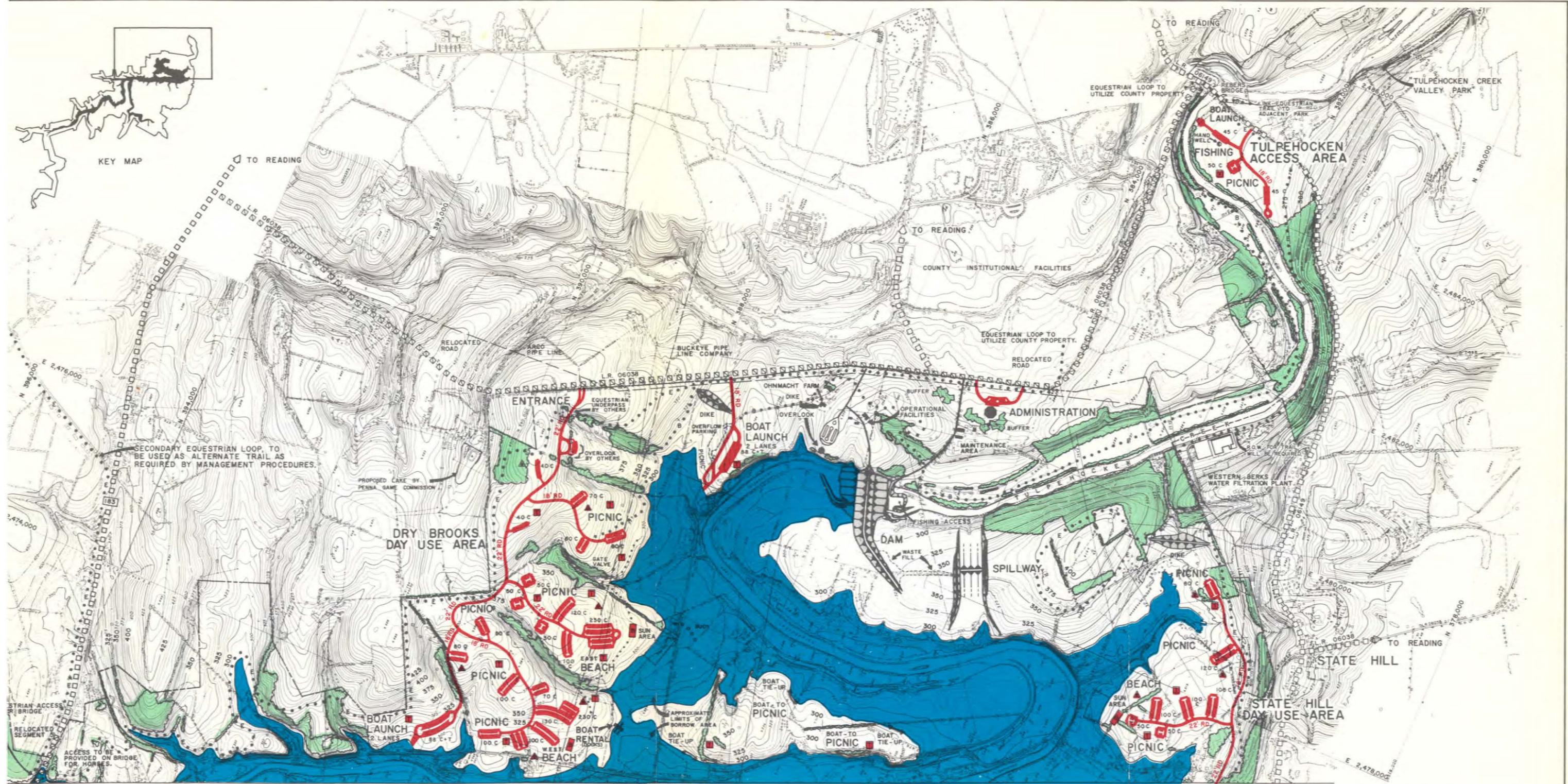
- EXISTING MAJOR ROAD
- EXISTING L.R. - LEGISLATIVE ROUTE
- ▣▣▣▣ RELOCATED ROAD
- — — — EXISTING SERVICE ROAD
- — — — PROPOSED ROAD 18' WIDTH
- — — — PROPOSED TAKE LINE
- ~ ~ ~ ~ U.S.G.S. CONTOURS
- EQUESTRIAN TRAIL
- HIKING TRAIL
- EXISTING TREE COVER
- RESTROOM - VAULT TOILET
- ▲ SHELTER



TEXAS EASTERN TRANSMISSION CORPORATION PIPE LINE



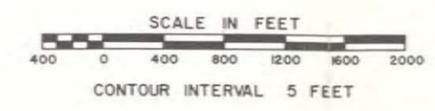
BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA
CONRADS BRIDGE
AREA DEVELOPMENT PLAN



MATCH LINE TO PLATE II

LEGEND

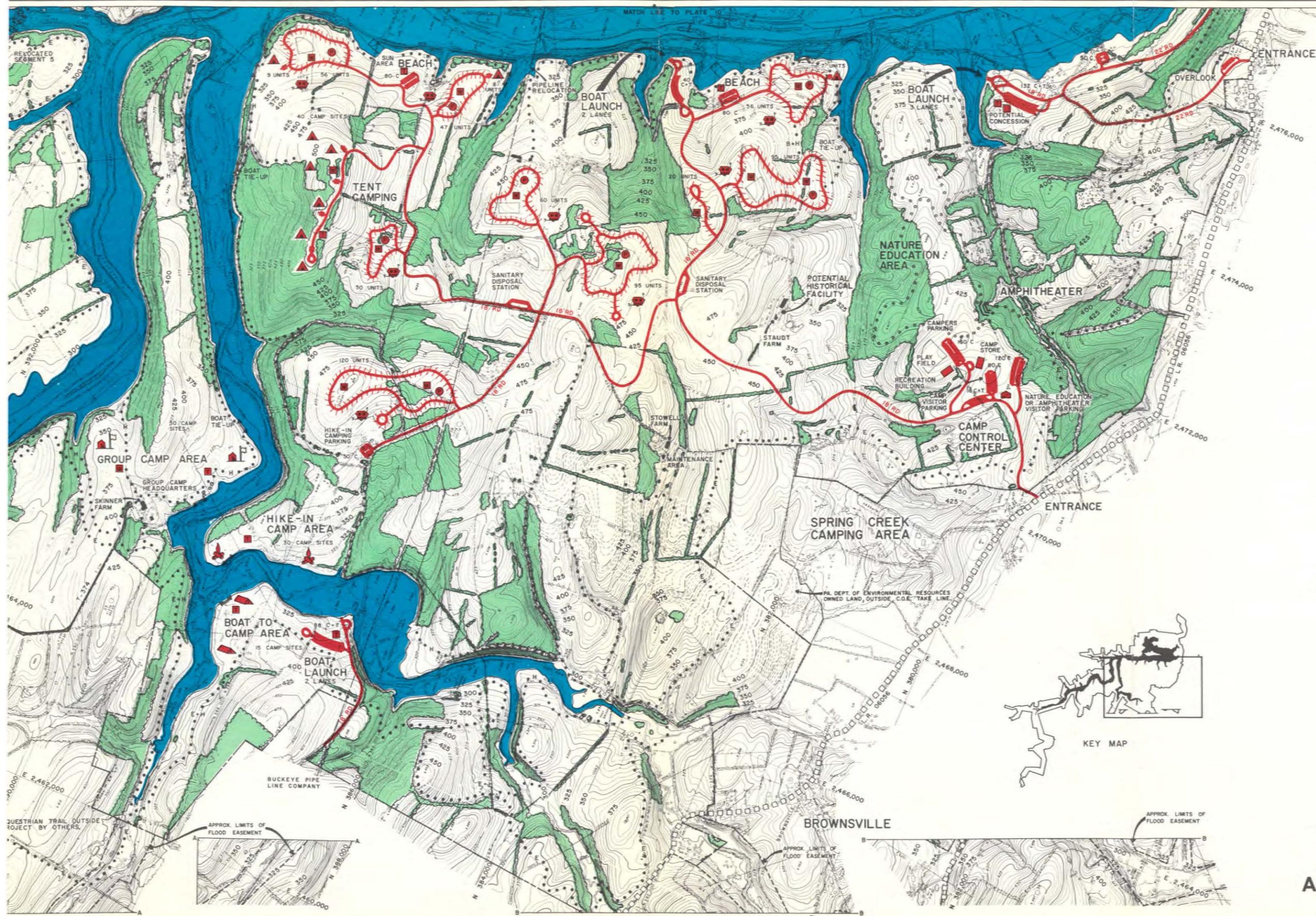
- | | | |
|---------------------------------|---------------------------|-----------------------------------|
| □□□□ EXISTING MAJOR ROAD | EQUESTRIAN TRAIL | ■ EXISTING STRUCTURES TO BE SAVED |
| □□□□ EXISTING LEGISLATIVE ROUTE | BIKE TRAIL | — BOAT TIE-UP |
| ▤▤▤▤ RELOCATED ROAD | ----- PROPOSED TAKE LINE | ▲ PICNIC SHELTER |
| ▬▬▬▬ PROPOSED ROAD 18' WIDTH | ■ EXISTING TREE COVER | ■ BATH HOUSE |
| ▬▬▬▬ PROPOSED ROAD 22' WIDTH | ■ PROPOSED BUFFER | ■ RESTROOM - FLUSH TOILET |
| ▬▬▬▬ EXISTING SERVICE ROAD | ● ADMINISTRATION BUILDING | ■ RESTROOM - VAULT TOILET |
| PATHWAY | ● OVERLOOK | |



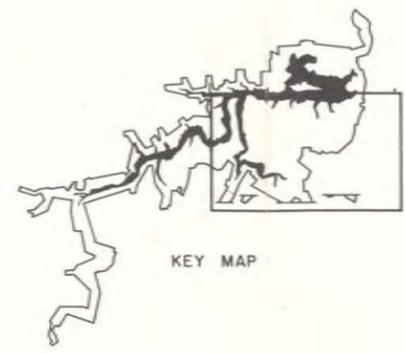
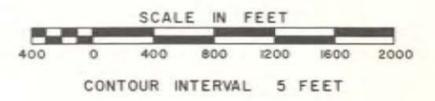
BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA

**DRY BROOKS
 AREA DEVELOPMENT PLAN**

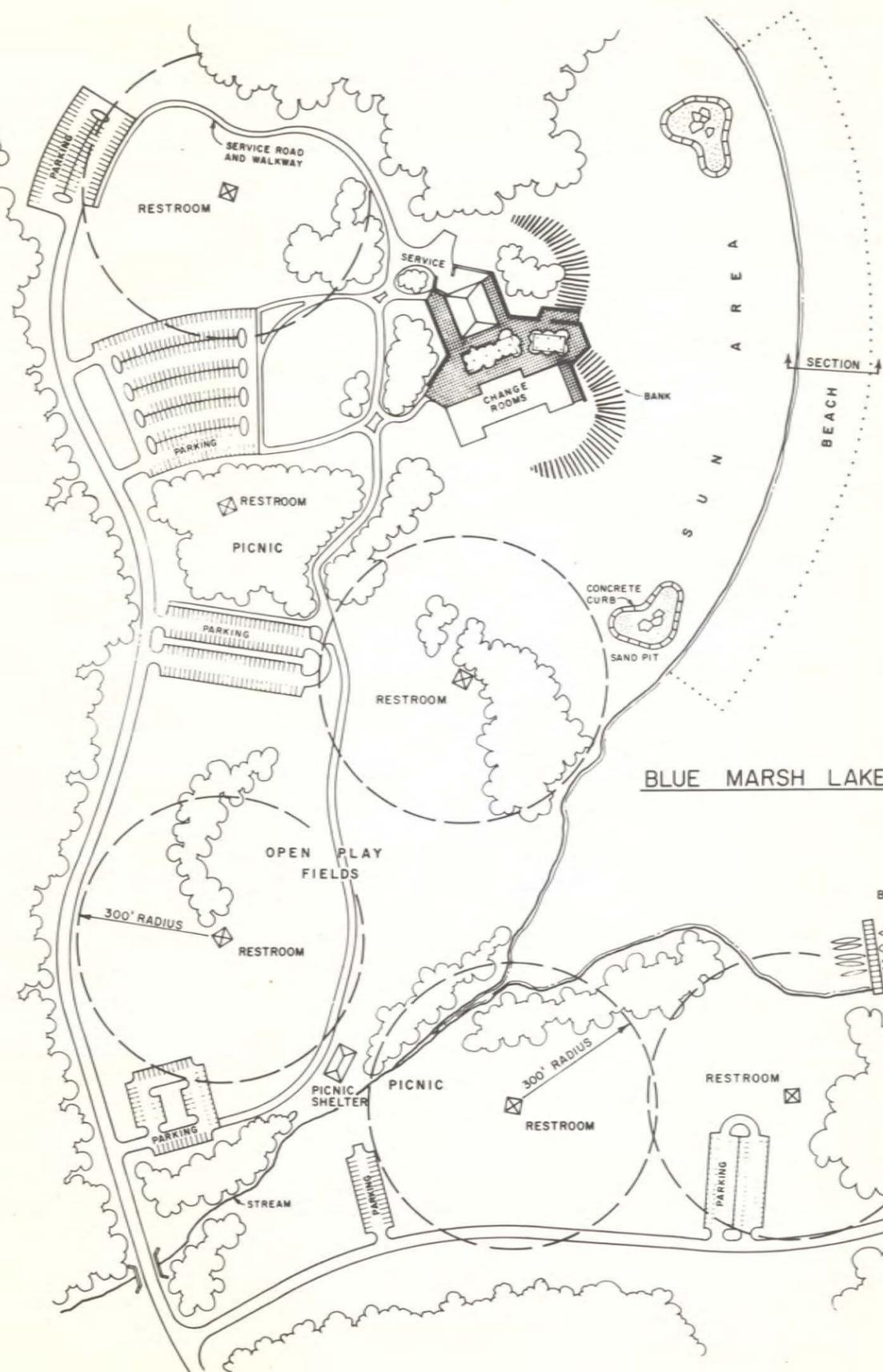
D.M. NO. 15 PLATE 10



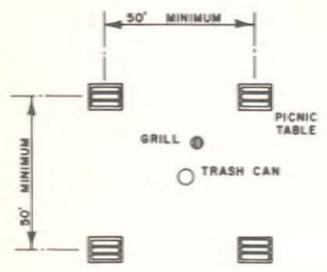
- LEGEND**
- □ □ □ EXISTING MAJOR ROAD
 - □ □ □ EXISTING LEGISLATIVE ROUTE
 - ▣ ▣ ▣ ▣ RELOCATED ROAD
 - — — — EXISTING SERVICE ROAD
 - — — — PROPOSED ROAD 22' WIDTH
 - — — — PROPOSED ROAD 18' WIDTH
 - • • • • EQUESTRIAN TRAIL
 - • • • • HIKING TRAIL
 - • + • • EQUESTRIAN AND HIKING TRAIL
 - • + • • BIKING AND HIKING TRAIL
 - • • • • NATURE EDUCATION TRAIL
 - — — — PROPOSED TAKE LINE
 - — — — PA. DEPT. OF ENVIRONMENTAL RESOURCES PROPERTY LINE.
 - Existing Tree Cover (Green shading)
 - U.S.G.S. CONTOURS
 - CAMP CONTROL BUILDING (Red square with 'C')
 - EXISTING STRUCTURES TO BE SAVED (Red square)
 - AMPHITHEATER (Red trapezoid)
 - TRAILER CAMPING (Red rectangle with 'T')
 - TENT CAMPING (Red triangle)
 - GROUP CAMPING (Red rectangle with 'G')
 - BOAT-TO CAMPING (Red rectangle with 'B')
 - HIKE-IN CAMPING (Red rectangle with 'H')
 - BOAT TIE-UP (Red rectangle with 'B')
 - PLAY FIELD (Red rectangle with 'P')
 - PLAY AREA (Red circle)
 - RESTROOM-WASH HOUSE (Red square with 'R')
 - RESTROOM-FLUSH TOILET (Red square with 'F')



BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA
SPRING CREEK
AREA DEVELOPMENT PLAN

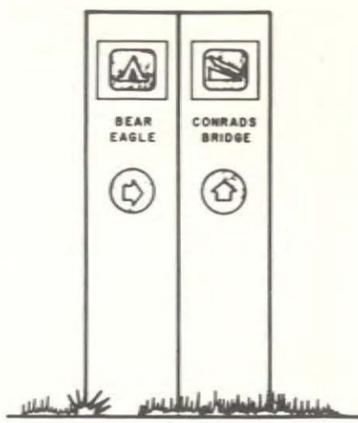


TYPICAL PICNIC UNIT



- DAY USE AREA:**
1. PICNIC TABLES SHALL BE SPACED MINIMUM 50 FEET ON CENTER.
 2. ALL RESTROOMS SHALL BE SPACED SO THAT AN 800 FOOT RADIUS WILL ENCOMPASS 100% OF THE PICNIC SITES.
 3. ALL CAR PARKING SPACES SHALL BE 10'x20' AND 90° ANGLE WITH 25' AISLE WIDTH UNLESS OTHERWISE NOTED.
 4. ALL CAR/TRAILER PARKING SPACES SHALL BE 10'x40' AND 45° ANGLE WITH 25' AISLE WIDTH UNLESS OTHERWISE NOTED.
 5. PARKING AREAS SHALL BE WITHIN 400' FOOT RADIUS OF 90% OF THE PICNIC TABLES.
 6. PARKING AREAS SHOULD BE ARRANGED TO PERMIT PEDESTRIANS TO ENTER THE PICNICKING AREAS WITHOUT CROSSING A MAJOR VEHICULAR ACCESS ROUTE.
 7. PROVIDE MINIMUM ONE PLAY AREA PER DAY USE AREA.
 8. PICNIC TABLES TO BE PLACED THROUGHOUT PICNIC AREA AT RATIO OF 4 TABLES PER 1 GRILL AND 1 TRASH CAN.

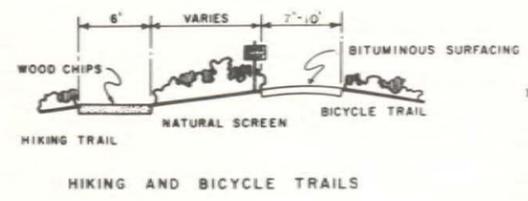
SIGNS



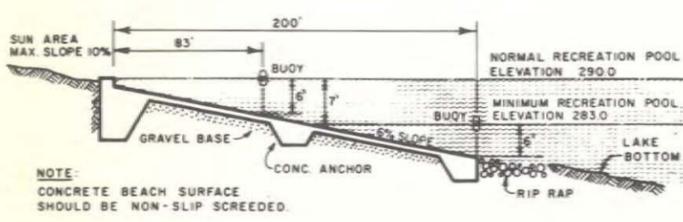
1. GRAPHIC SYMBOLS SHALL BE USED ON ALL SIGNS.
2. SYMBOLS AND IDENTIFYING NAMES OF SPECIFIC AREAS SHOULD BE INCLUDED ON EACH SIGN.
3. SIGNS SHALL BE WOOD AS SHOWN (12"x12") OR STONE, DEPENDING ON SIZE AND LOCATION.



- NOTE:**
1. MINIMIZE DISTURBANCE TO THE AREA.
 2. PROVIDE INTERPRETIVE SIGNS THAT ARE INFORMATIVE TO THE GENERAL PUBLIC.
 3. EXPOSE AS MUCH VARIETY IN THE NATURAL ENVIRONMENT AS POSSIBLE.
 4. ATTEMPT TO MAINTAIN MINIMUM GRADES TO ALLOW FOR MAXIMUM USAGE.
 5. MAXIMUM WIDTH 5'-0"

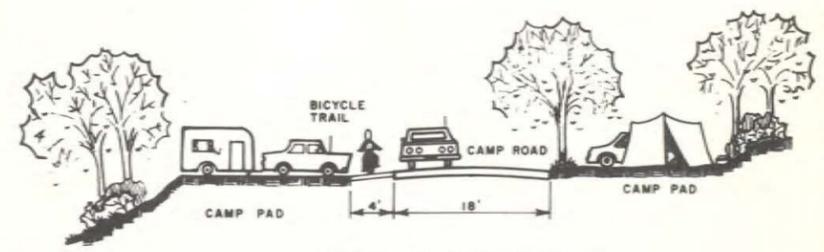


- NOTE:**
1. TRAILS SHOULD CONNECT INTERESTING PHYSICAL FEATURES.
 2. WHERE POSSIBLE, UTILIZE EXISTING ROADS AND TRAILS TO MINIMIZE GRADING.

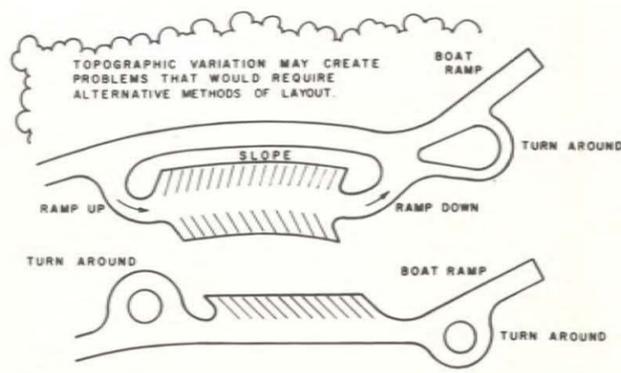


NOTE: CONCRETE BEACH SURFACE SHOULD BE NON-SLIP SCREEDED.

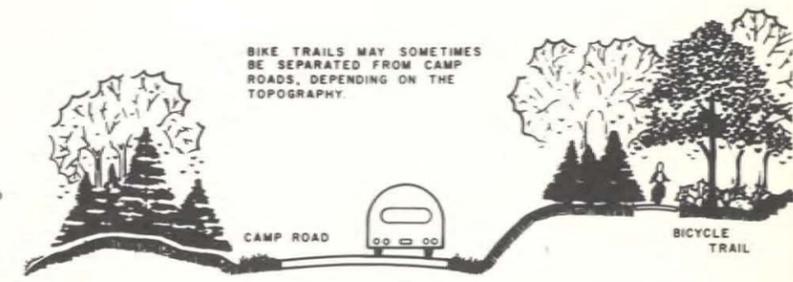
CONCRETE BEACH SECTION



BIKEWAY IN CAMPGROUND SITUATION #1



ALTERNATE ARRANGEMENTS BOAT LAUNCHES

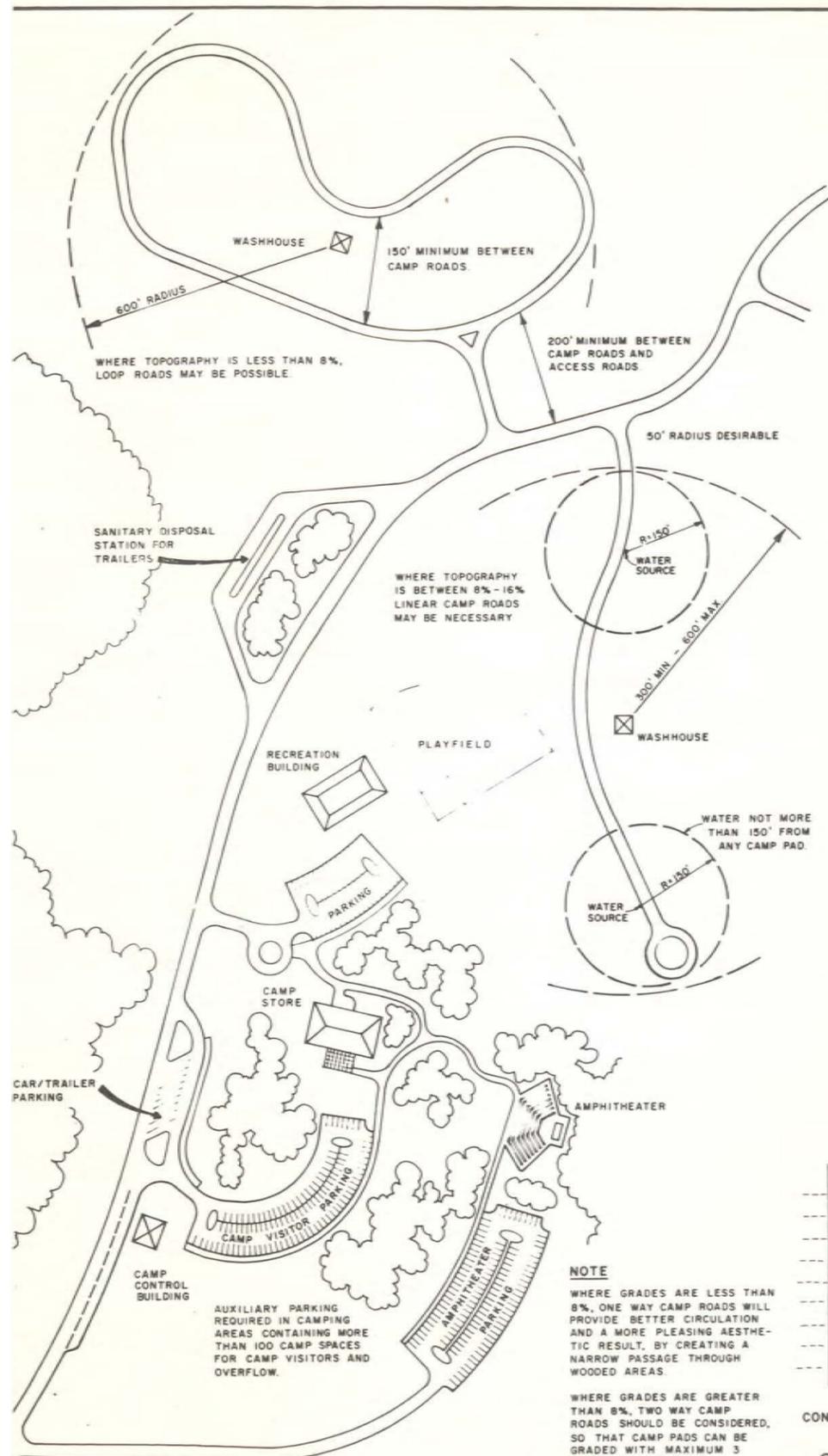


BIKEWAY IN CAMPGROUND SITUATION #2

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

TYPICAL LAYOUTS

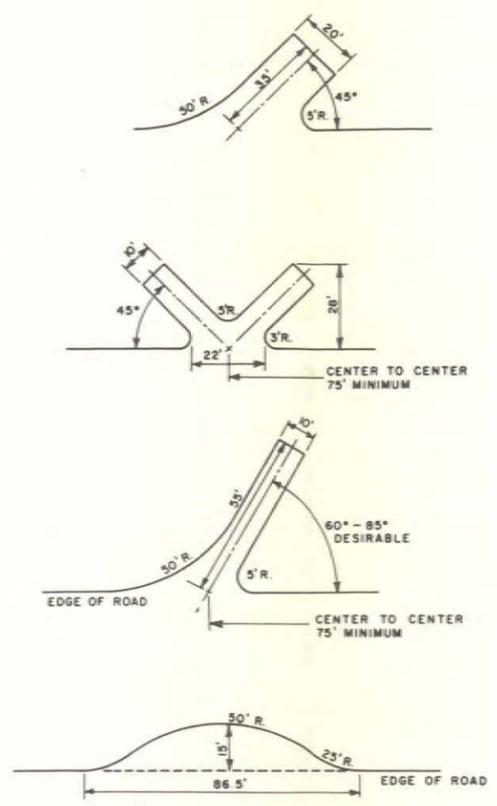
PICNIC AREA - BEACH - BOAT LAUNCH RAMP
D.M. NO. 15 PLATE 12



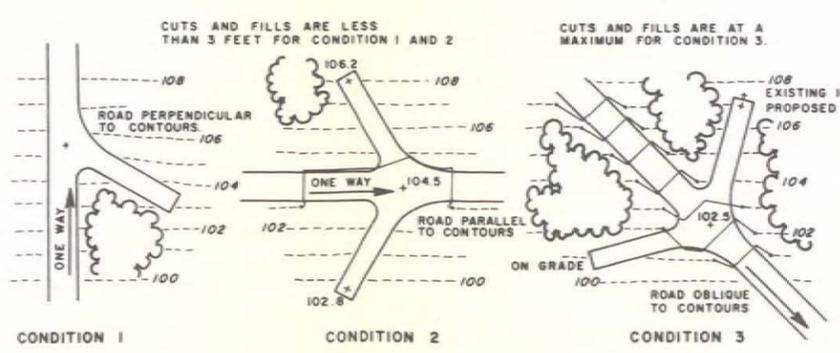
SIDE SLOPES ON PADS:
ON THE DOOR SIDE OF THE CAMP PADS, SLOPES OF 1 ON 4 ARE DESIRABLE. THE REMAINING SIDES ARE RECOMMENDED TO BE GRADED ON SLOPES OF 1 ON 3.

GRADING:
PADS ON GRADE ARE THE MOST DESIRABLE. A 3 FOOT BANK (CUT OR FILL) SHOULD BE MAXIMUM FOR 90% OF THE PADS; 10% OF THE PADS MAY HAVE A BANK GREATER THAN 3 FT.

SLOPES ON CAMP PADS:
UPHILL SLOPED CAMP PADS- 3% MAXIMUM GRADES.
DOWNHILL SLOPED CAMP PADS- 3% MAXIMUM GRADES.



TYPICAL CAMP PADS



ONE WAY CAMP ROADS 8% GRADE OR LESS

NOTE
WHERE GRADES ARE LESS THAN 8%, ONE WAY CAMP ROADS WILL PROVIDE BETTER CIRCULATION AND A MORE PLEASING AESTHETIC RESULT, BY CREATING A NARROW PASSAGE THROUGH WOODED AREAS.

WHERE GRADES ARE GREATER THAN 8%, TWO WAY CAMP ROADS SHOULD BE CONSIDERED, SO THAT CAMP PADS CAN BE GRADED WITH MAXIMUM 3 FOOT CUTS AND FILLS.



TRAILER CAMPING

FOR TRAILERS OR TENTS, AT IMMEDIATE CAMP SITE

- FIRE RING
- TRASH CONTAINER
- PICNIC TABLE
- PARKING SPUR

TENT CAMPING

LIMITED WALKING DISTANCE, 200' MAXIMUM

- FIRE RING
- TRASH CONTAINER
- PICNIC TABLE
- TENT PAD

GROUP CAMPING

FOR ORGANIZED GROUPS, TENTS ONLY

- FIRE RING
- TRASH CONTAINER
- PICNIC TABLES

BOAT-TO CAMPING

LIMITED ACCESS, CAN ONLY BE REACHED BY BOAT

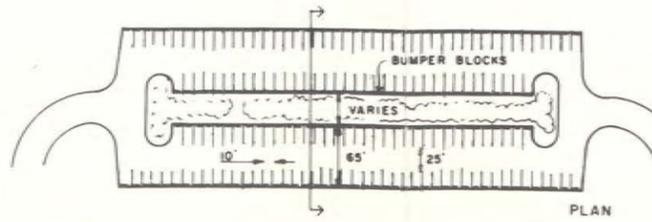
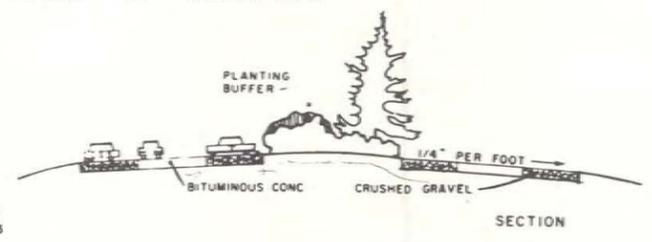
- FIRE RINGS
- TRASH CONTAINER

HIKE-IN CAMPING

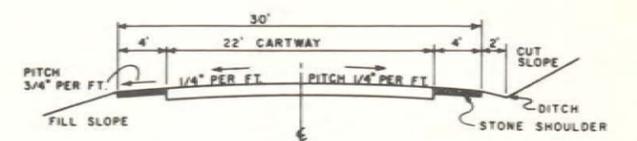
HIKE IN CAMPING, 1/4 MILE OR GREATER

- FIRE RING
- TRASH CONTAINER

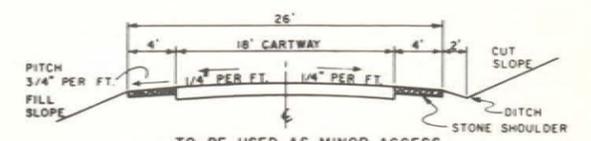
TYPES OF CAMPING



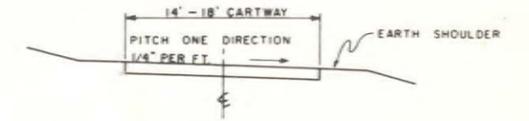
TYPICAL PARKING AREA



TO BE USED AS MAJOR ACCESS ROAD

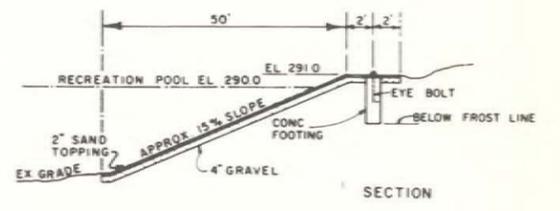
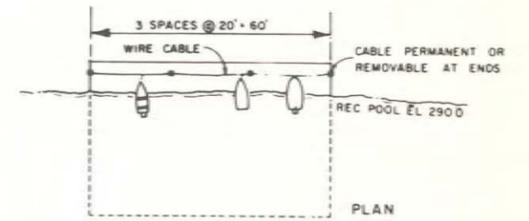


TO BE USED AS MINOR ACCESS ROADS AND CAMP ROADS



TO BE USED AS CAMP ROAD (ONE WAY - 14', TWO WAY - 18') AS TOPOGRAPHY DICTATES

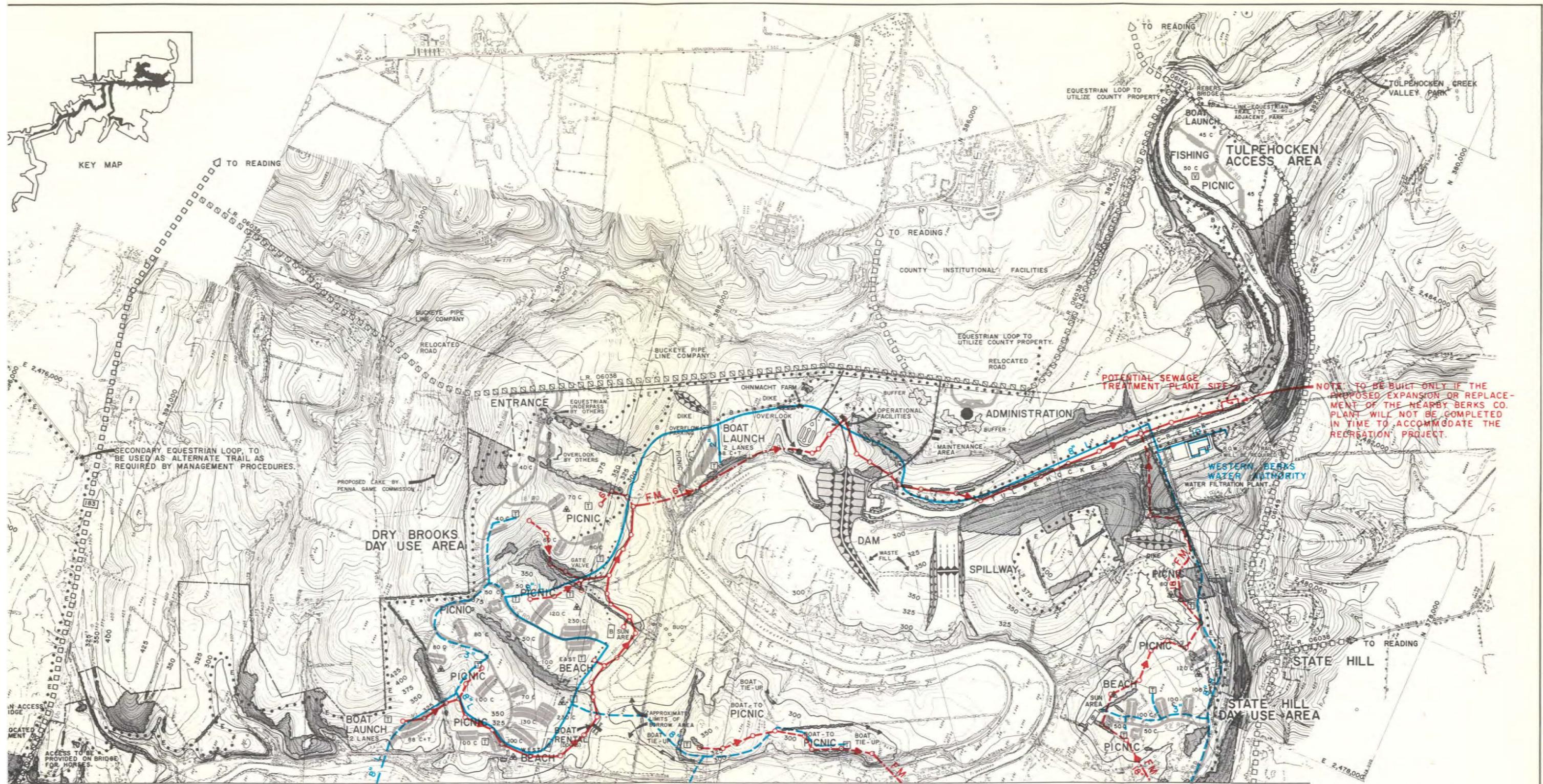
TYPICAL ROAD SECTIONS



BOAT MOORING STATION

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

TYPICAL LAYOUTS
CAMPING AREAS - ROAD SECTIONS



KEY MAP

SECONDARY EQUESTRIAN LOOP, TO BE USED AS ALTERNATE TRAIL AS REQUIRED BY MANAGEMENT PROCEDURES.

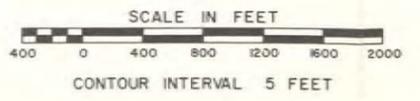
- EXISTING MAJOR ROAD
- L.R. - LEGISLATIVE ROUTE
- ▣▣▣▣ RELOCATED ROAD
- ▬▬▬▬ PROPOSED ROAD 18' WIDTH
- ▬▬▬▬ PROPOSED ROAD 22' WIDTH
- ▬▬▬▬ EXISTING SERVICE ROAD
- PATHWAY

- EQUESTRIAN TRAIL
- BIKE TRAIL
- ▬▬▬▬ PROPOSED TAKE LINE
- ▬▬▬▬ EXISTING TREE COVER
- ▬▬▬▬ PROPOSED BUFFER
- ADMINISTRATION BUILDING
- OVERLOOK

LEGEND

- ▣ EXISTING STRUCTURES TO BE SAVED
- ▬ BOAT TIE-UP
- ▤ PICNIC SHELTER
- ▣ BATH HOUSE
- ▣ RESTROOM - FLUSH TOILET
- ▣ RESTROOM - VAULT TOILET

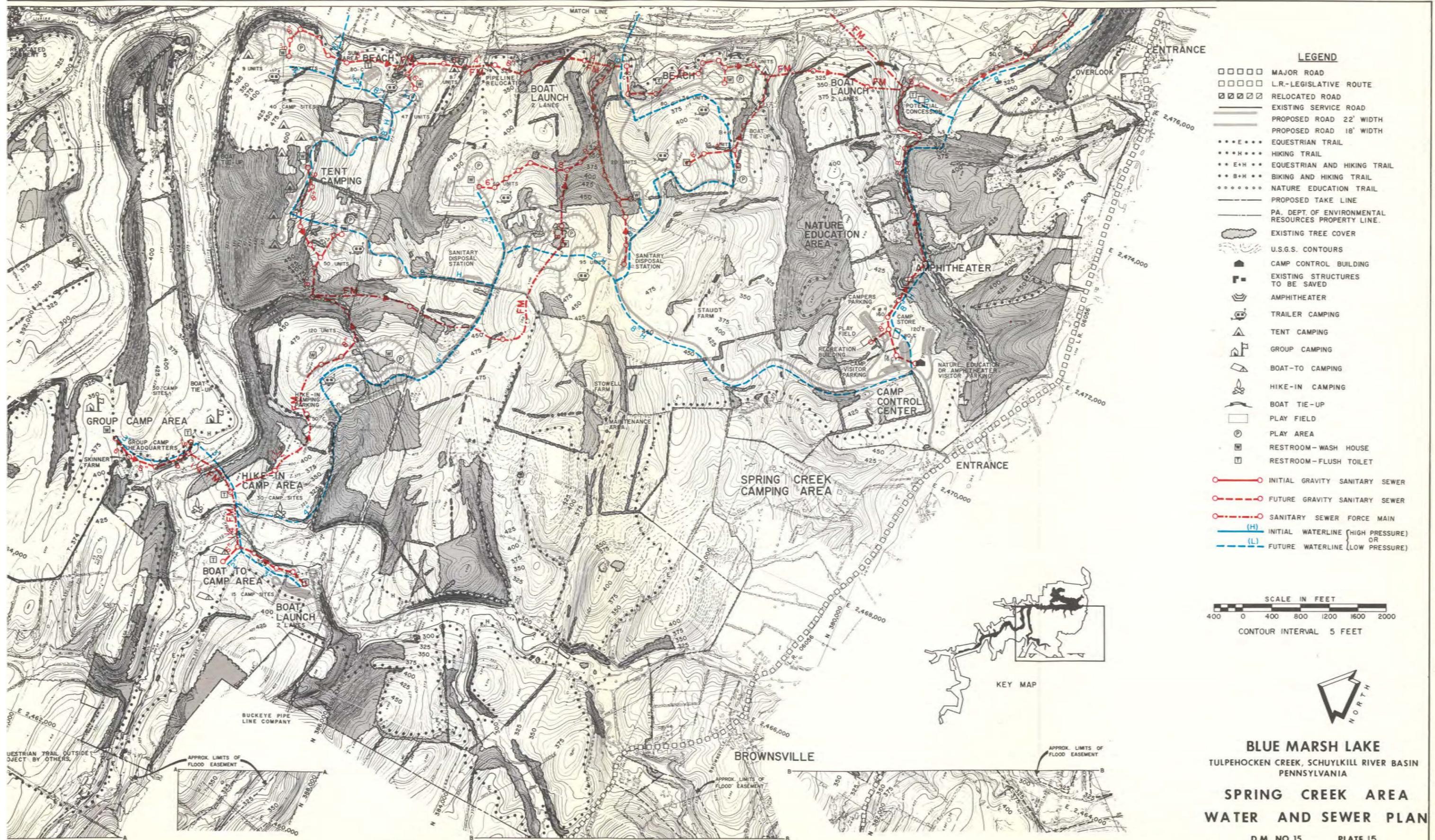
- INITIAL GRAVITY SANITARY SEWER
- - - - FUTURE GRAVITY SANITARY SEWER
- SANITARY SEWER FORCE MAIN
- (H)— INITIAL WATERLINE (HIGH PRESSURE) OR
- (L)— FUTURE WATERLINE (LOW PRESSURE)



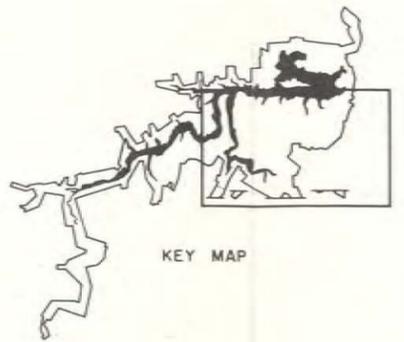
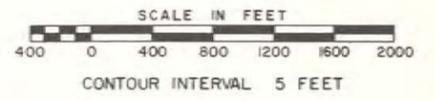
BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA
DRY BROOKS AREA
WATER AND SEWER PLAN
 D.M. NO. 15 PLATE 14

POTENTIAL SEWAGE TREATMENT PLANT SITE

NOTE: TO BE BUILT ONLY IF THE PROPOSED EXPANSION OR REPLACEMENT OF THE NEARBY BERKS CO. PLANT WILL NOT BE COMPLETED IN TIME TO ACCOMMODATE THE RECREATION PROJECT.

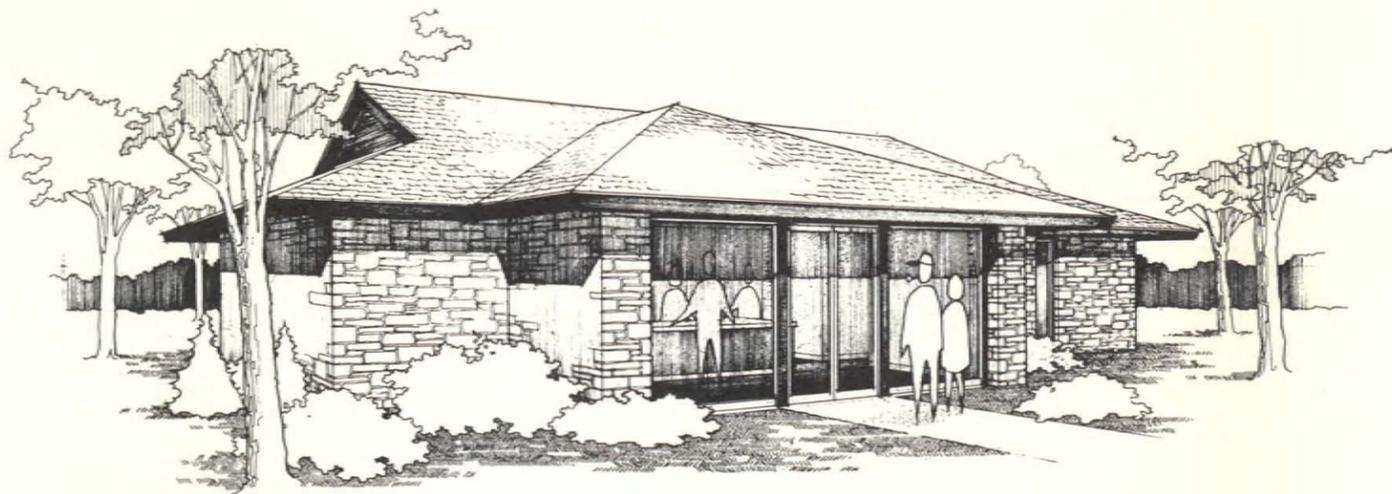


- LEGEND**
- MAJOR ROAD
 - L.R.-LEGISLATIVE ROUTE
 - ▣▣▣▣ RELOCATED ROAD
 - EXISTING SERVICE ROAD
 - PROPOSED ROAD 22' WIDTH
 - PROPOSED ROAD 18' WIDTH
 - EQUESTRIAN TRAIL
 - HIKING TRAIL
 - +•• EQUESTRIAN AND HIKING TRAIL
 - +•• BIKING AND HIKING TRAIL
 - NATURE EDUCATION TRAIL
 - PROPOSED TAKE LINE
 - PA. DEPT. OF ENVIRONMENTAL RESOURCES PROPERTY LINE.
 - Existing tree cover symbol
 - U.S.G.S. CONTOURS
 - CAMP CONTROL BUILDING
 - EXISTING STRUCTURES TO BE SAVED
 - AMPHITHEATER
 - TRAILER CAMPING
 - TENT CAMPING
 - GROUP CAMPING
 - BOAT-TO CAMPING
 - HIKE-IN CAMPING
 - BOAT TIE-UP
 - PLAY FIELD
 - PLAY AREA
 - RESTROOM-WASH HOUSE
 - RESTROOM-FLUSH TOILET
 - INITIAL GRAVITY SANITARY SEWER
 - FUTURE GRAVITY SANITARY SEWER
 - SANITARY SEWER FORCE MAIN
 - (H) INITIAL WATERLINE (HIGH PRESSURE) OR
 - (L) FUTURE WATERLINE (LOW PRESSURE)

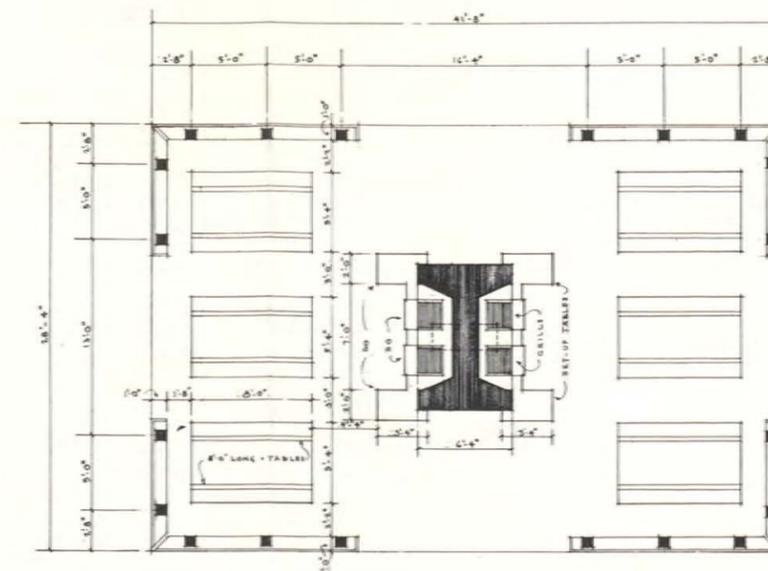


BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA

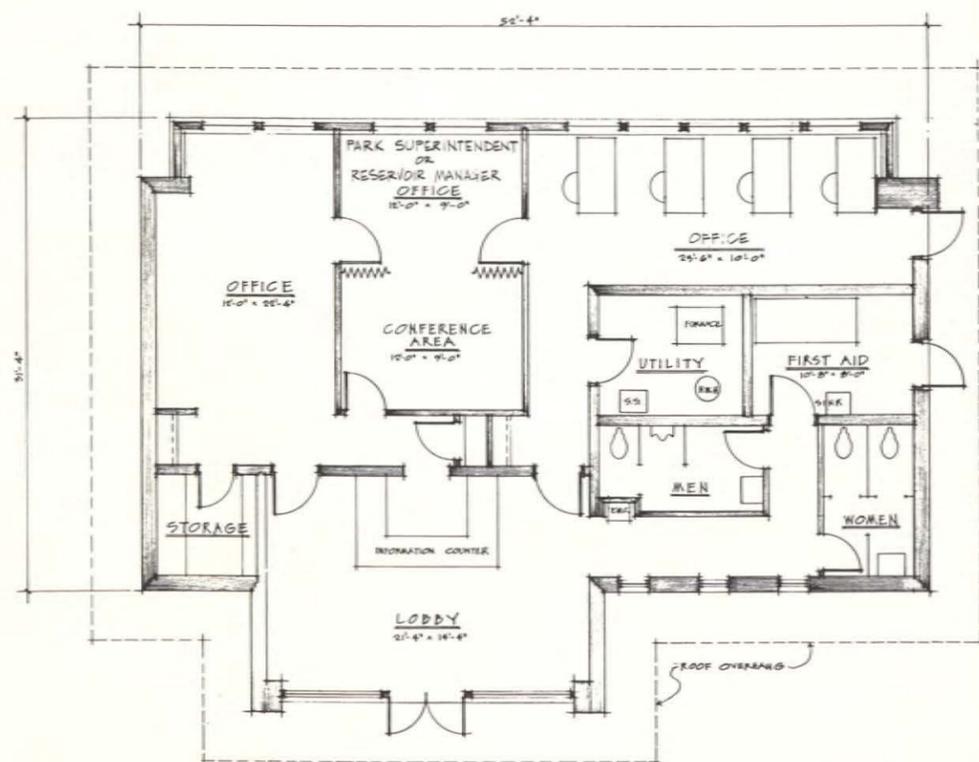
SPRING CREEK AREA
WATER AND SEWER PLAN



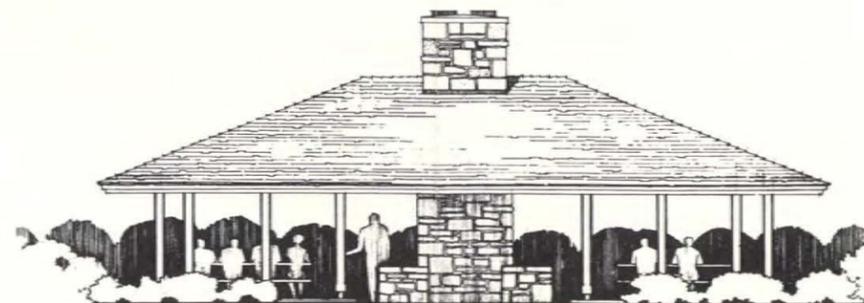
PERSPECTIVE VIEW • ADMINISTRATION BUILDING



PLAN • PICNIC SHELTER
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 6 7 8 9 10



PLAN • ADMINISTRATION BUILDING
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 6 7 8 9 10

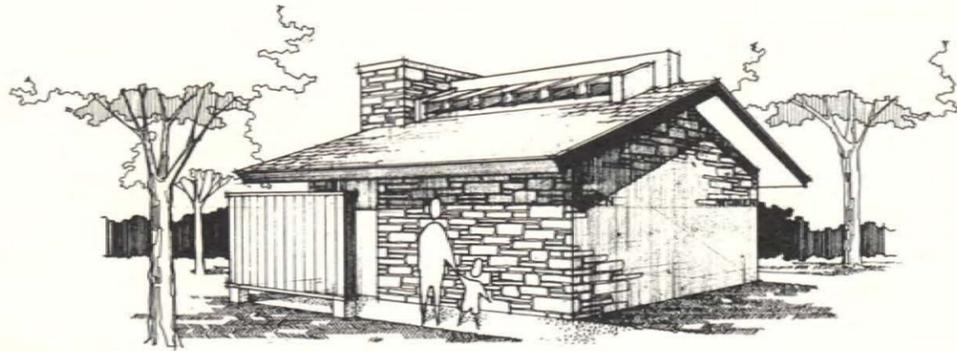


ELEVATION • PICNIC SHELTER
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 6 7 8 9 10

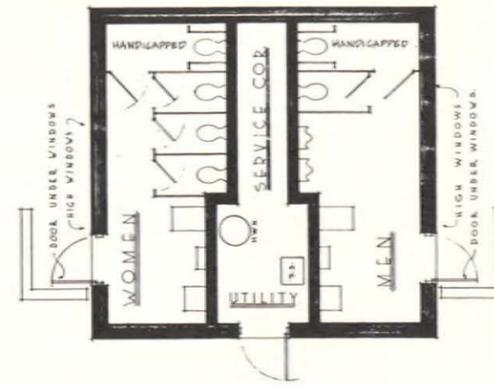
BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

**ADMINISTRATION
PICNIC SHELTER**

ARCHITECTURAL
D.M. NO. 15 PLATE 16

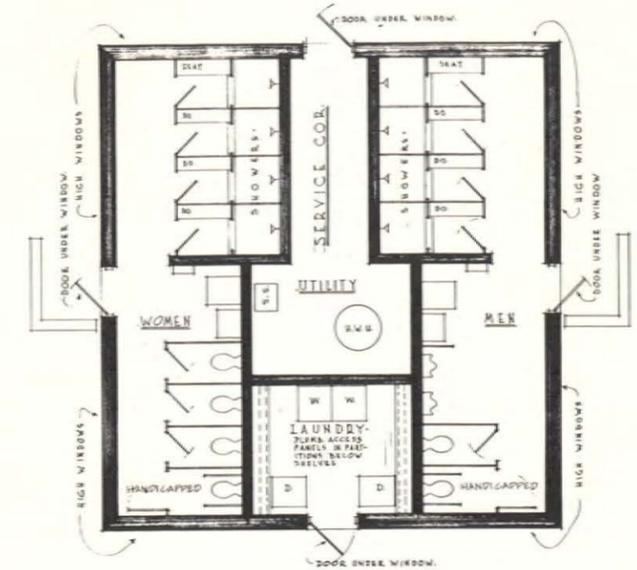
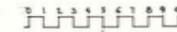


PERSPECTIVE VIEW • VAULT TOILET BUILDING



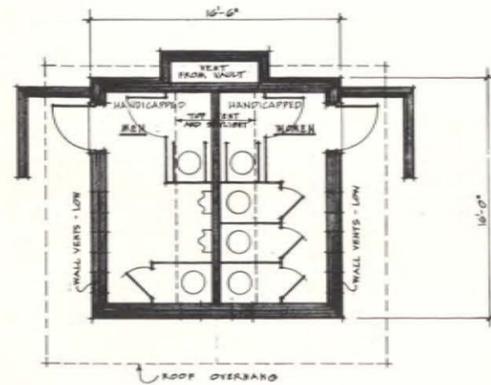
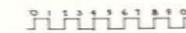
PLAN • FLUSH TOILET

SCALE: 1/4" = 1'-0"



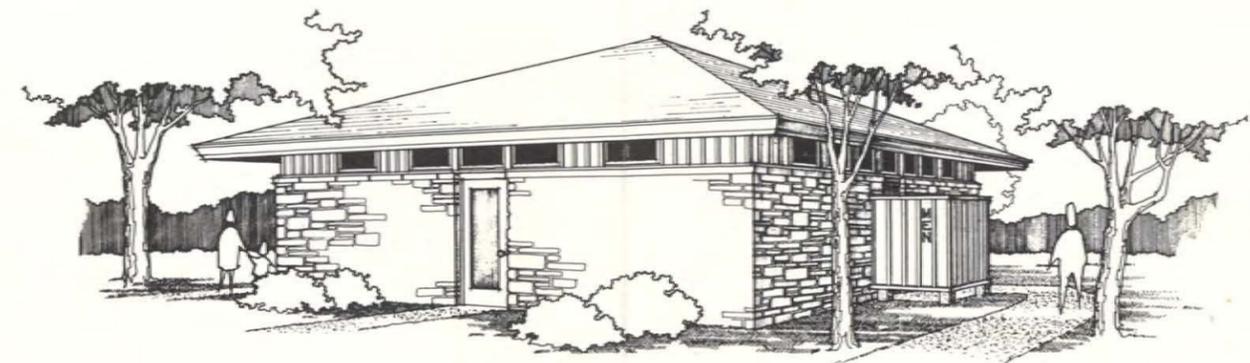
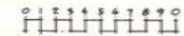
PLAN • WASH HOUSE

SCALE: 1/4" = 1'-0"



PLAN • VAULT TOILET

SCALE: 1/4" = 1'-0"

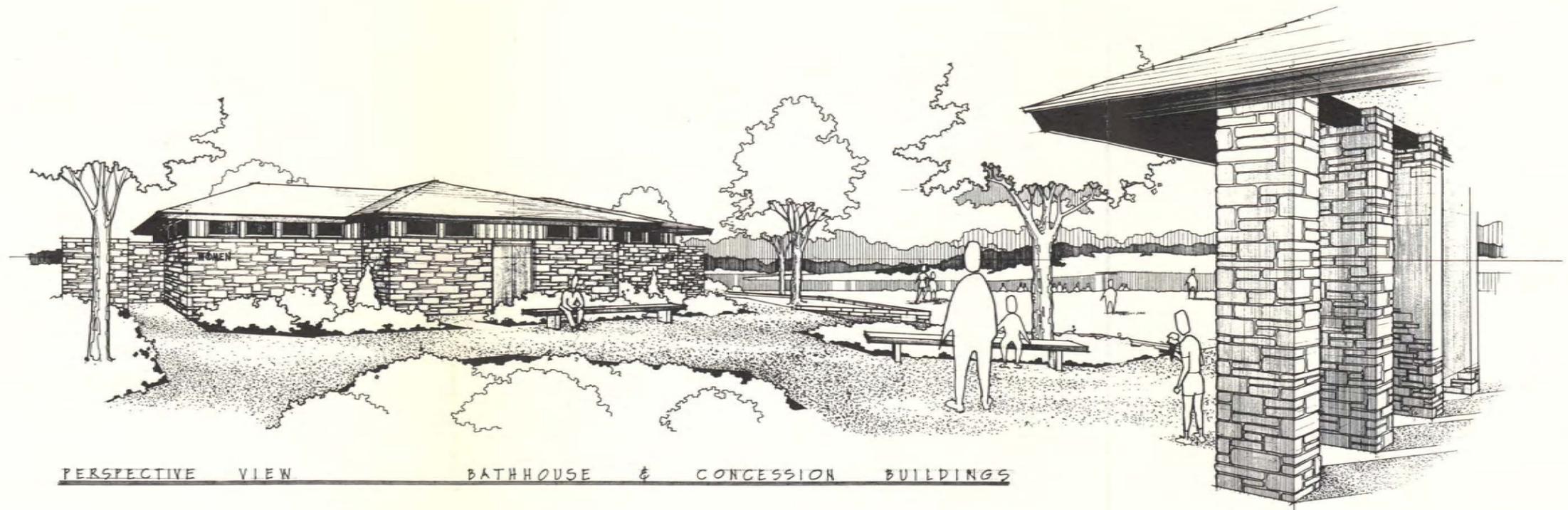


PERSPECTIVE VIEW • TYPICAL TO TOILET BUILDINGS ABOVE

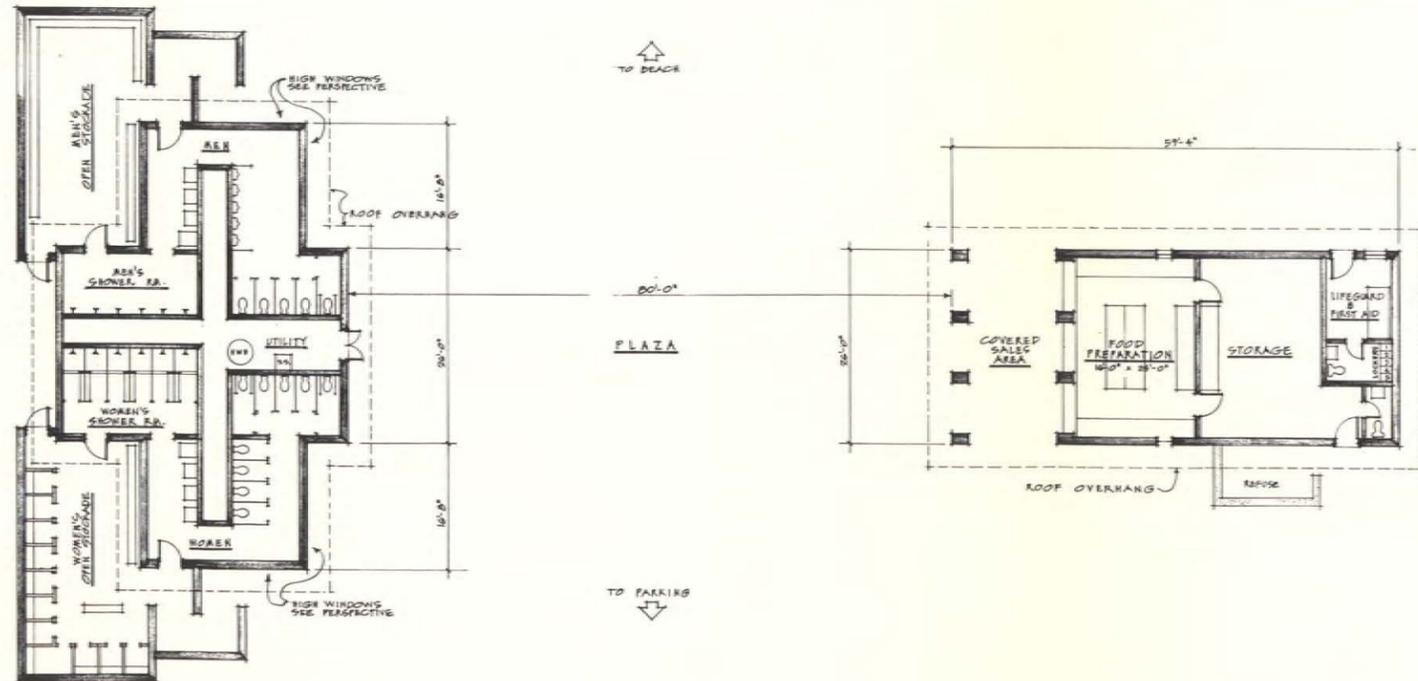
BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

REST ROOMS

ARCHITECTURAL
D.M. NO. 15 PLATE 17



PERSPECTIVE VIEW BATHHOUSE & CONCESSION BUILDINGS

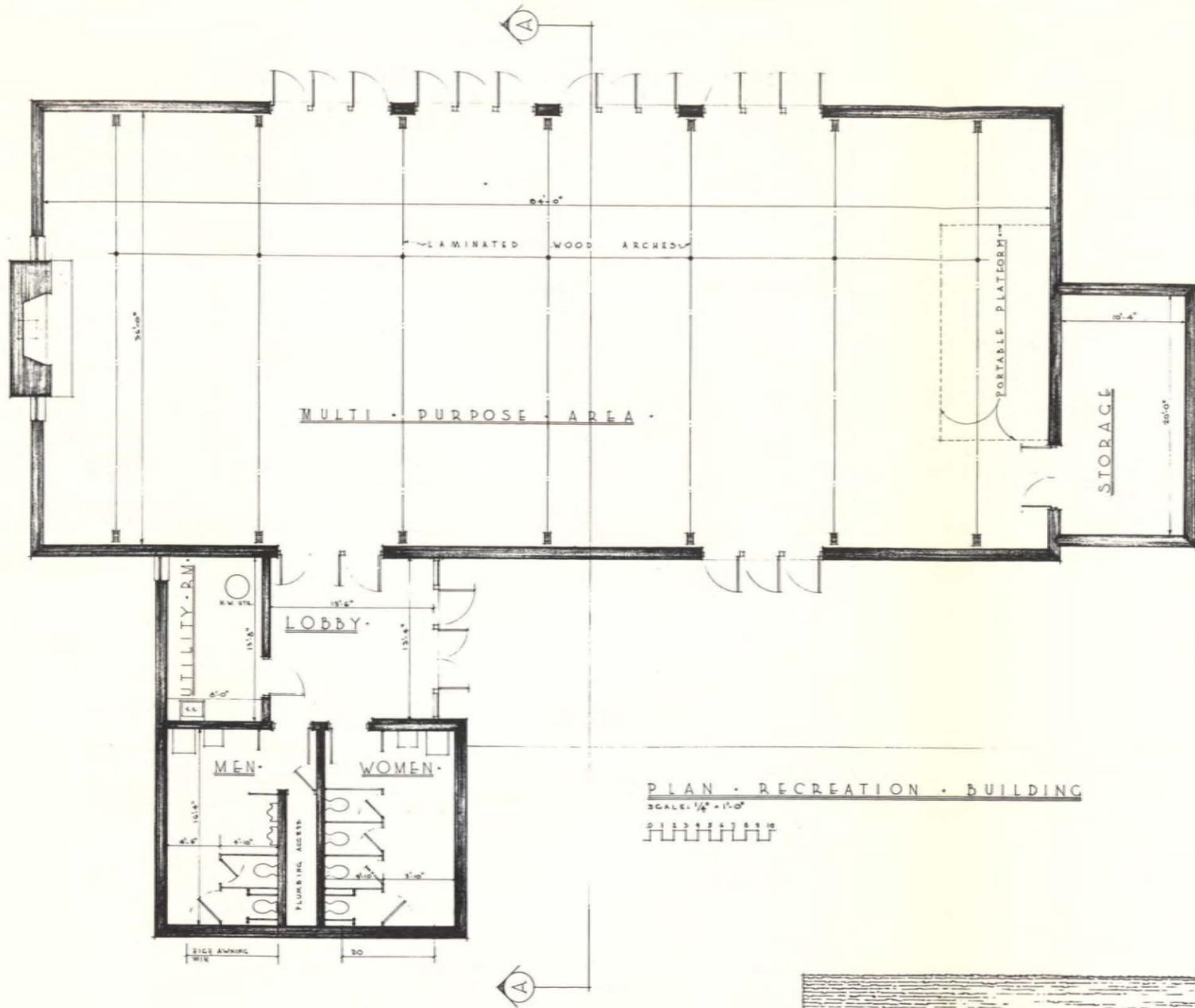


PLAN - BATHHOUSE AND CONCESSION BUILDINGS
 SCALE: 1/8" = 1'-0"
 0 4 8 12 16

BLUE MARSH LAKE
 TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
 PENNSYLVANIA

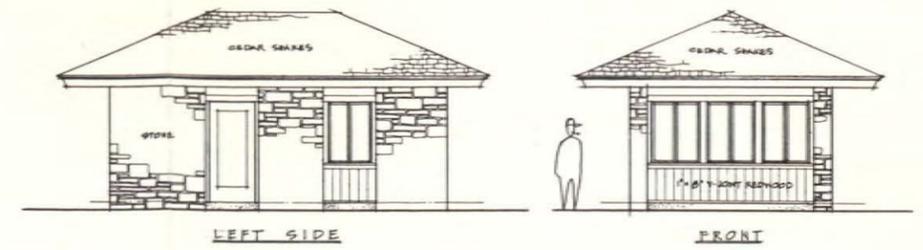
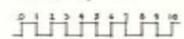
BATHHOUSE

ARCHITECTURAL
 D.M. NO. 15 PLATE 18



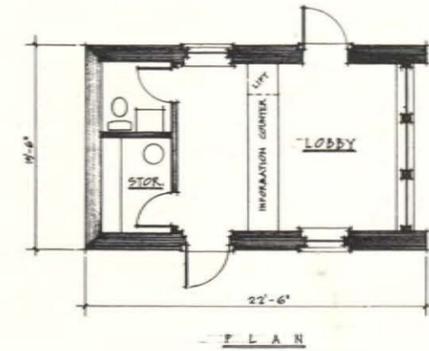
PLAN - RECREATION - BUILDING

SCALE: 1/4" = 1'-0"



LEFT SIDE

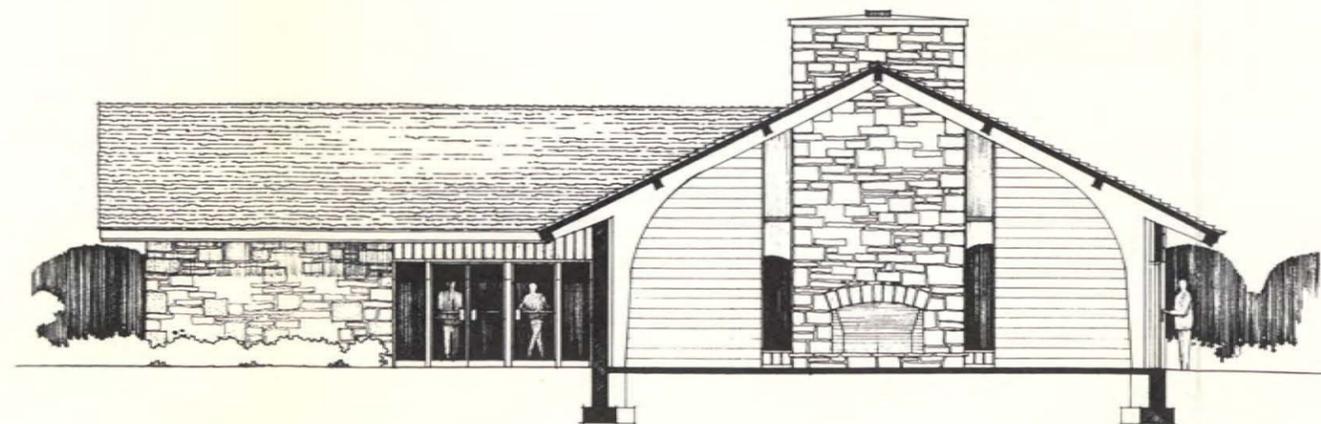
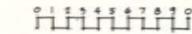
FRONT



PLAN

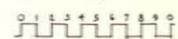
PLAN AND ELEVATIONS
CAMP CONTROL BUILDING

SCALE: 1/4" = 1'-0"



SECTION A-A - RECREATION - BUILDING

SCALE: 3/8" = 1'-0"



BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

RECREATION BUILDING
CAMP CONTROL STATION
ARCHITECTURAL

D.M. NO. 15 PLATE 19

BERNVILLE
PROTECTIVE
WORKS

BERNVILLE

DRY BROOKS
DAY USE AREA

- 956 PICNIC TABLES
- 2 BOAT LAUNCHING LANES
- BOAT RENTAL AREA
- 2 BEACHES

DRY BROOKS
BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

OPERATIONAL
FACILITIES

- OVERLOOK
- RESERVOIR MANAGER

ADMINISTRATION

CONRAD'S BRIDGE
BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

SPRING CREEK
BOAT LAUNCH

- 8 PICNIC TABLES
- 2 BOAT LAUNCHING LANES

STATE HILL
CAMPING AREA

- CAMP CONTROL STATION
- 599 TRAILER OR TENT SITES
- 64 TENT SITES
- 50 GROUP CAMP SITES
- 15 BOAT-TO CAMP SITES
- 30 PRIMITIVE CAMP SITES
- 2 BOAT LAUNCHING LANES
- 2 BEACHES

NATURE
EDUCATION AREA

- AMPHITHEATER
- TRAILS

STATE HILL

TULPEHOCKEN
ACCESS AREA

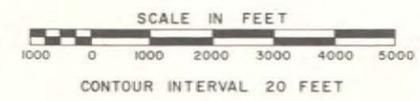
- FISHING ACCESS
- 100 PICNIC TABLES

STATE HILL
DAY USE AREA

- 328 PICNIC TABLES
- 3 BOAT LAUNCHING LANES
- 1 BEACH

BLUE MARSH LAKE
TULPEHOCKEN CREEK, SCHUYLKILL RIVER BASIN
PENNSYLVANIA

PHASING PLAN



LEGEND
 - - - - - PROPOSED TAKE LINE
 - - - - - FLOOD EASEMENTS (APPROX.)
 ■ FIRST PHASE DEVELOPMENT
 ■ ALL OTHER AREAS DEVELOPED
 IN FUTURE PHASES

SCHUYLKILL RIVER BASIN
TULPEHOCKEN CREEK, PENNSYLVANIA
BLUE MARSH LAKE

DESIGN MEMORANDUM NO. 15
MASTER PLAN

EXHIBITS TABLE OF CONTENTS

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15-II LOCAL ASSURANCES	15-II-1
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15-IV-9 Future Phase State Hill Day-Use Area Construction Costs	15-IV-11
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15-III-1 Per Capita Use Rate Curves	15-III-3

EXHIBIT 15-1: COORDINATION DOCUMENTATION

<u>Page</u>	<u>Item</u>
15-1-2	Letter from the Corps of Engineers, North Atlantic Division, Planning Division, informing the Philadelphia District office that <u>Land Requirements Plan/Public Use (Design Memorandum 5)</u> fulfills the requirements for a recreation-resource appendix to the master plan. Dated 9 January 1974.
15-1-3	Letter from the Berks County Planning Commission transmitting information on the traffic network, the recreation plan and the comprehensive plan for Berks County. Dated 14 February 1974.
15-1-4	Letter from the Corps of Engineers, Philadelphia District, Engineering Division, informing the Pennsylvania Fish Commission, Bureau of Waterways, of the plans to widen and deepen the channel between the island and the north shore, and requesting that boating be prohibited through the channel. Dated 13 December 1974.
15-1-6	Letter from the Pennsylvania Fish Commission, Bureau of Waterways, responding to the information on the island-north shore channel transmitted in the above letter. Dated 16 December 1974.
15-1-7	Letter from the Pennsylvania Department of Environmental Resources, Bureau of Resources Programming, approving the revised initial annual attendance estimate for Blue Marsh Lake, which was developed using the Corps of Engineers' "Tech 2" method during the preparation of the master plan. Dated 17 October 1974.
15-1-8	Letter from the Pennsylvania Department of Environmental Resources, Program Services and Operations Division, transmitting information on the anticipated operational budget for the first year of State Park operations at Blue Marsh Lake. Dated 16 May 1975.



DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS
90 CHURCH STREET
NEW YORK, N. Y. 10007

IN REPLY REFER TO

NADPL-R

9 January 1974

SUBJECT: Appendix A to Master Plan, Blue Marsh Lake, Pa.

District Engineer, Philadelphia
Attn: NAPEN-E

1. References:

a. Telephone request, 4 January 1974, from William Hampton, NAPEN-D, subject as above.

b. ER 1130-2-400, 28 May 1971.

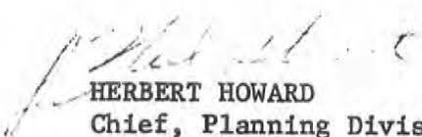
c. ER 1120-2-400, 1 November 1971.

2. In response to the above referenced telephone request, the following is furnished for your guidance.

3. In accordance with paragraph 10, pages 6 and 7 of reference 1c above, the DM No. 5, Land Requirements Plan - Public Use Blue Marsh Dam and Reservoir is now considered as fulfilling the requirement for a Recreation Resource Appendix (GDM) and should be used as part of the Master Plan, particularly section VIII. (See pages C-6, C-7, C-8, Appendix C to the previously referenced 1c.)

4. Appendix A to the Master Plan is covered in paragraph 5 of ER 1130-2-400 and Appendix A to this regulation. It should be prepared in cooperation with the non-Federal agencies that will be operating the recreation facilities and should be completed and submitted to this office for approval by the time the project becomes operational.

FOR THE DIVISION ENGINEER:


HERBERT HOWARD
Chief, Planning Division



PLANNING COMMISSION

Area Code 215
375-6121

Court House, Reading, Pa., 19601

COUNTY OF BERKS

R. Harding Breithaupt
CHAIRMAN

Ferdinand K. Thun
VICE-CHAIRMAN

John M. Darlington
SECRETARY

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Frederick G. McGavin

Charles M. Guthrie, Jr.

SOLICITORS

Scott D. Keefer

DIRECTOR

February 14, 1974

Mr. Dale Earl
Fahringier, McCarty, Grey, Inc.
1620 Golden Mile Highway
Monroeville, Pennsylvania 15146

Dear Mr. Earl:

Enclosed is a copy of our existing Comprehensive Plan, an Information Bulletin summarizing our Open Space and Recreation Plan and some information on the traffic network in the County. The Comprehensive Plan is now being revised, and we no longer have extra copies of the Open Space Plan. When you come to our office, you may use any of our publications here. There is no charge for the enclosed material. If I can be of further assistance, please let me know.

Very truly yours,

Stephen H. Manster
Planner

BERKS COUNTY PLANNING COMMISSION

SHM:dd

Enclosure



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE-2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

RAFEM-E

13 DEC 1974

Captain C. E. Leising
Pennsylvania Fish Commission
Bureau of Waterways
P. O. Box 1673
Harrisburg, PA 17120

Dear Captain Leising:

This is in reference to the comment in your letter of 27 November 1974 to our Contractor, Mr. Fohringer regarding the channel on the west end of the island in Blue Marsh Lake.

At the 290-foot recreation pool elevation the channel between the island and the mainland will be 100-feet wide and one foot deep. Anticipated drawdown to the 285-foot elevation will obviously expose a land connection. Please refer to the inclosed sketch.

This District is considering deepening the channel to elevation 283 and possibly widening it to 200 feet if the material is required for construction of the dam. The purpose for that work is to provide improved circulation and flushing action for the nearby swimming facility. The Pennsylvania Bureau of State Parks is contemplating the feasibility of an overwater service connection for island maintenance.

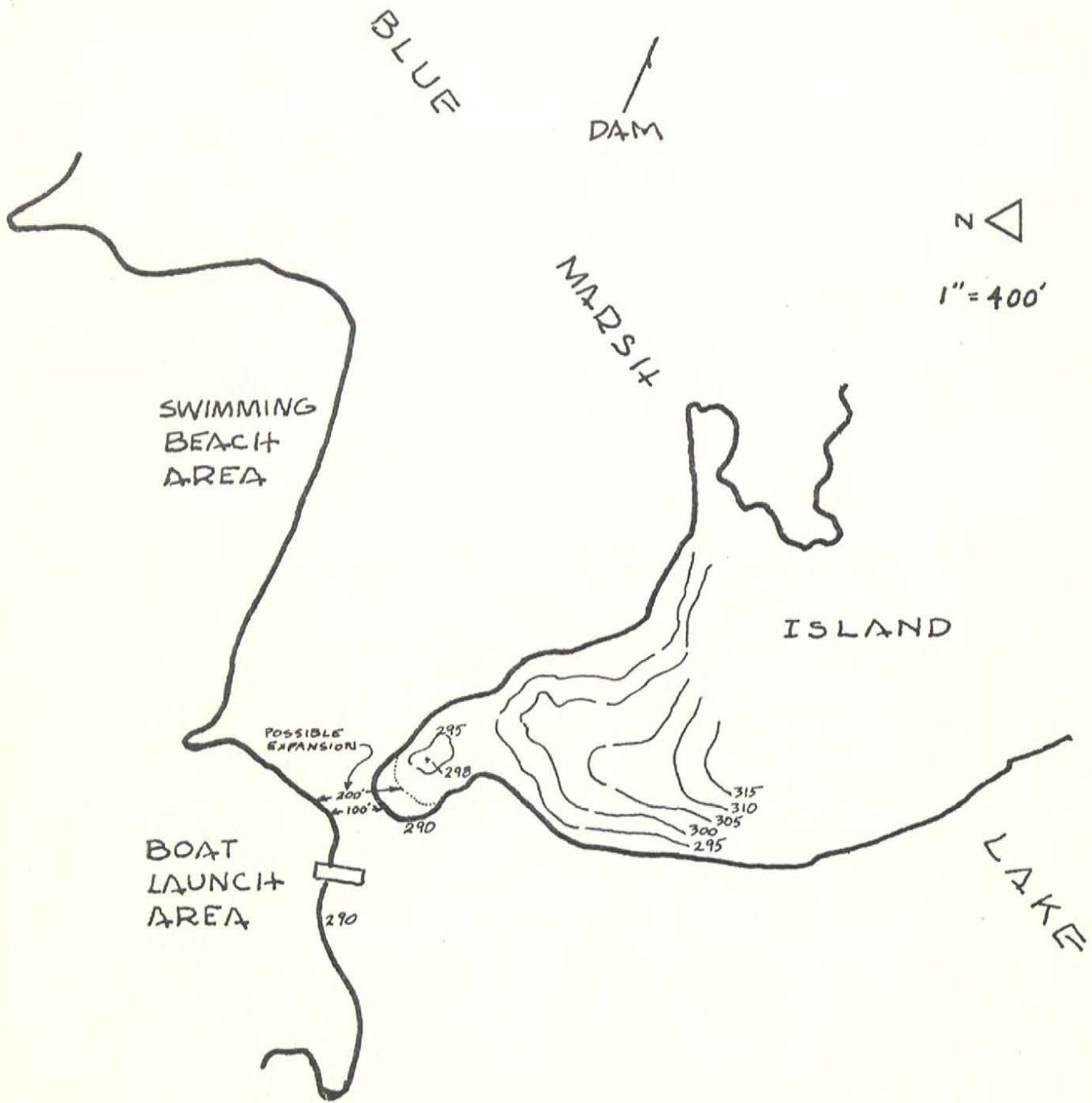
Considering the narrowness of the channel, the proximity to intensive-use public areas on both sides and the possibility of an obstruction to navigation, this District requests that boating be prohibited through the channel.

If there are any questions regarding the above please contact Mr. J. Radley (215)-597-4834 who will be available to assist you.

Sincerely yours,

1 Incl
Sketch

WORTH D. PHILLIPS
Chief, Engineering Division



BLUE MARSH LAKE
Tulpehocken Creek, Pa.

SKETCH

Incl. 1



PENNSYLVANIA FISH COMMISSION
POST OFFICE BOX 1673
HARRISBURG, PA. 17120

Bureau of Waterways

16 December 1974

Department of the Army
Philadelphia District, Corps of Engineers
Custom House, 2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106

Attention: Worth D. Phillips, Chief
Engineering Division

Dear Mr. Phillips:

Thank you for your letter of 13 December regarding the channel on the western end of the island in Blue Marsh Lake. At our meeting on 25 November I don't believe we were aware of the shallow depth of the channel and were hopeful that construction needs at the dam would demand sufficiently enough additional material that widening of the channel would be a logical development.

Our first preference would be, of course, to have the channel sufficiently deep to allow boat passage at no wake speeds since this would help considerably in relieving the congestion to the north of the island. It would seem that such action would assist the circulation and flushing action that is desired. If this cannot be worked into the plans then we would have no alternative but to prohibit boating in the channel as you have requested. I would hope that this would not be necessary.

I am sure that Mr. Radley is aware of our goal to provide as much useable water as possible with our imposing whatever controls might be necessary to make it safe and enjoyable. I am certain that your goals are the same and that your design will be such that this goal can be realized to the greatest extent possible. Thank you.

Sincerely yours,


Charles E. Leising, Capt., USCG (Ret)
Director, Bureau of Waterways

COMMONWEALTH OF PENNSYLVANIA



DEPARTMENT OF ENVIRONMENTAL RESOURCES

P. O. Box 1467
Harrisburg, Pennsylvania 17120

In reply refer to
RM-R

October 17, 1974

Colonel C. A. Selleck, Jr.
District Engineer, Philadelphia
District
Army Corps of Engineers
2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106

SUBJECT: BLUE MARSH LAKE
ESTIMATED VISITATION

Dear Colonel Selleck:

Based on visitation patterns to Pennsylvania State park facilities in Southeastern Pennsylvania, and particularly the park at the existing Corps of Engineers' Beltzville Lake Project in Carbon County, the annual visitation estimate of 263,000 persons (Table 5-3, Pages 5-10 D. M. #5) is very low.

The annual visitation estimate of 1,563,000 as developed in your masterplan D. M., is currently being prepared by using the Tech 2 method referred to in E. R. 1120-2-403 dated March 26, 1970 and is a much more reasonable estimate.

Sincerely yours,

A handwritten signature in cursive script, reading "George E. Fogg".

George E. Fogg, Chief
Division of Outdoor Recreation
Bureau of Resources Programming

COMMONWEALTH OF PENNSYLVANIA



DEPARTMENT OF ENVIRONMENTAL RESOURCES

P. O. BOX 1467

HARRISBURG, PENNSYLVANIA 17120

May 16, 1975

Mr. David Fahringer
 Fahringer, McCarthy & Grey, Inc.
 Landscape Architects and Engineers
 1620 Golden Mile Highway
 Monroeville, Pennsylvania 15146

Dear Mr. Fahringer:

As per the U. S. Army Corps of Engineers recent request for an anticipated operational budget for the first year of operation at the proposed Blue Marsh State Park, I am submitting the following for your information.

<u>Personnel Breakdown</u>	<u>Salary</u>	<u>Wage</u>	<u>Total</u>
1-Park Superintendent II	10,602.00		10,602.00
1-Security Officer (Full-Time)	7,159.00		7,159.00
1-Equipment Operator (" ")	7,159.00		7,159.00
1-Clerk Typist I (Full-Time)	6,592.00	3.66/Hr.	6,592.00
2-Security Officers (Part-Time)		*3,568.50	7,137.00
6-Lifeguards (Part-Time)		3.24/Hr.	
		*3,159.00	18,954.00
4-Laborers (Part-Time)		3.37/Hr.	
		*3,285.75	<u>13,143.00</u>
	Total Salary & Wage		\$70,746.00
	Supplies & Materials		<u>\$25,000.00</u>
	Total Anticipated Budget		<u>\$95,746.00</u>

*Based on 37.5 Hr/week; 26 weeks

Sincerely yours,

Robert E. Klingman
 Robert E. Klingman, Chief
 Program Services & Operations
 Division

EXHIBIT 15-II: LOCAL ASSURANCES

<u>Page</u>	<u>Item</u>
15-II-2	Initial assurances of cooperation by the Commonwealth of Pennsylvania, Department of Environmental Resources (formerly Department of Forests and Waters) in the prevention of downstream channel encroachments and development of recreation facilities. Dated 13 December 1966.
15-II-5	Confirmation of the Commonwealth of Pennsylvania's assurances reproduced above. Dated 6 November 1968.
15-II-6	Assurance that the Commonwealth of Pennsylvania will accept responsibility for operation of the sewage treatment plant to be built to service Blue Marsh Lake project recreation facilities. Dated 8 September 1969.



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS
HARRISBURG
17120

In reply refer to
WCE
F 6:2

P. O. Box 1467

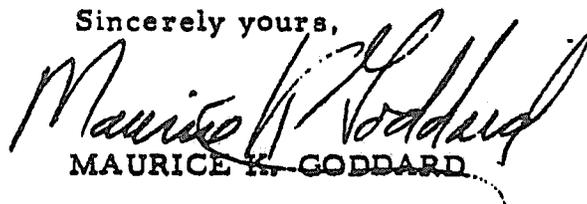
December 13, 1966

Col. William W. Watkin, Jr.
District Engineer
U. S. Army Engineer District, Philadelphia
Corps of Engineers
Custom House - Second & Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Colonel Watkin:

In accordance with prior correspondence, your File
NAPEN-G, Blue Marsh Dam and Reservoir Project, I am
enclosing three (3) copies of the assurances for subject proj-
ect.

Sincerely yours,


MAURICE K. GODDARD

Encls.

December 13, 1966

RESOLUTION

WHEREAS, the Congress of the United States, by Act approved 23 October 1962 (76 Stat. 1173) has authorized the development of the Water Resources of the Delaware River Basin, New York, New Jersey, Pennsylvania and Delaware, substantially in accordance with House Document No. 522, Eighty-seventh Congress, provided that, prior to construction, local interests furnish satisfactory assurances of local cooperation necessary for such construction; and

WHEREAS, final planning is now underway for Blue Marsh Dam and Reservoir, located on Tulpehocken Creek approximately six (6) miles northwest of Reading in Berks County, Pennsylvania; and

WHEREAS, in order that authority may be vested in the United States to proceed with the design of the said reservoir, and to secure the benefits thereof, the Commonwealth of Pennsylvania is willing to furnish the assurances of local cooperation required by the said Act of Congress; and

WHEREAS, the Department of Forests and Waters and/or the Water and Power Resources Board of the Department, acting by and through its Secretary and/or Chairman, respectively, possesses the legal authority to furnish such assurances;

NOW, THEREFORE, be it resolved by the Department of Forests and Waters and/or the Water and Power Resources Board of the Department, that the Commonwealth hereby assures the United States that, at such time as the United States shall undertake to construct the said reservoir, the Commonwealth can and will comply with the following:

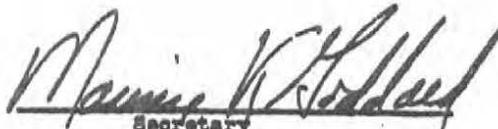
- (a) The Water and Power Resources Board will prevent encroachment on the stream channels downstream from the Blue Marsh Reservoir to the extent needed to provide reasonably efficient reservoir operation.

(Under the Act of June 25, 1913, P.L. 555, as amended by the Act of May 6, 1937, P.L. 599);

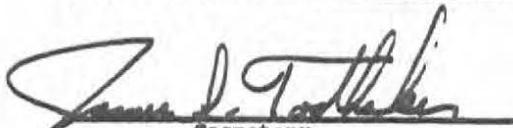
(b) The Commonwealth of Pennsylvania, acting through the Department of Forests and Waters and/or The Pennsylvania Game Commission agrees to undertake establishment and prosecution of a program for the acquisition of lands, and to develop facilities as needed for the recreation developments assigned to the Commonwealth. Such cooperation is contingent upon the appropriation of sufficient funds by the Pennsylvania Legislature (under Act No. 8, Special Session, approved June 22, 1964 and Act No. 195, approved June 5, 1967, P. L. 422, respectively.)

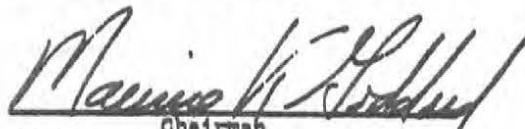
IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the Department of Forests and Waters to be hereunto affixed on the 13th day of December 1966.

(SEAL)


Secretary

I certify that said Resolution was approved by the Water and Power Resources Board on December 13 1966.


Secretary
Water and Power Resources Board


Chairman
Water and Power Resources Board



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS
HARRISBURG
17120

In reply refer to
WCE
F 6:2

P. O. Box 1467

November 6, 1968

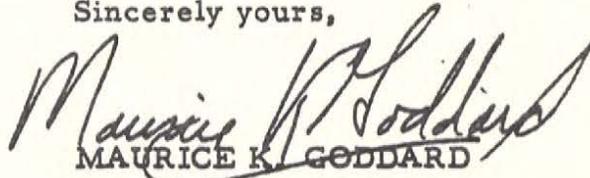
Col. James A. Johnson
District Engineer, U. S. Army Engineer
District, Philadelphia
Corps of Engineers
Custom House - Second & Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Colonel Johnson:

Under letter dated October 24, 1968, I advised that we do not anticipate any uncontrollable pollution problems at Blue Marsh Reservoir resulting from water fowl population. Consequently, we feel that the recreation facilities that are presently envisioned for the site will meet our requirements.

In your letter of September 11, 1968, you requested confirmation of the Commonwealth's assurances contained in the Resolution dated December 13, 1966, which has been previously furnished to your office. This letter will serve to reconfirm the provisions of said Resolution.

Sincerely yours,


MAURICE K. GODDARD



THE SECRETARY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS
HARRISBURG
17120

September 8, 1969

Mr. L. A. Duscha
Chief, Engineering Division
Department of the Army
Philadelphia District, Corps of Engineers
Custom House - 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Mr. Duscha:

The Commonwealth of Pennsylvania, acting through the Department of Forests and Waters, hereby gives assurance that the State is willing to accept responsibility for operation of the sewage treatment plant proposed for installation by the Corps of Engineers to serve recreational facilities proposed for the Blue Marsh Dam and Reservoir area in Berks County, Pennsylvania.

This assurance is in response to your letter of August 26, 1969.

Operation of this facility will be undertaken by the Department of Forests and Waters, Bureau of State Parks' field personnel.

Sincerely yours,


MAURICE K. GODDARD

15-11-6

EXHIBIT 15-III: RECREATION VISITATION METHODOLOGY

The purpose of this exhibit is to review the method of estimating initial annual attendance set forth in the Corps of Engineers' Technical Report No. 2, and to discuss how it was applied to the Blue Marsh Lake project in the preparation of this master plan.

Stated briefly, the "Tech 2" method utilizes a "comparable reservoir" approach to estimating visitation. After several existing lake projects comparable to Blue Marsh Lake were selected from a special list, their known user characteristics were used to extrapolate a per capita use rate applicable to the Blue Marsh Lake market area population.

A. Selecting Comparable Reservoirs. Technical Report No. 2 contains brief descriptions of significant physical features and known user characteristics of 52 existing Corps of Engineers projects. These descriptions were analyzed in order to identify those projects that most closely resemble Blue Marsh Lake. A number of criteria were used to make this comparative analysis including: (1) size of recreation pool and its shoreline length, (2) number of developed public access areas, (3) size and location of nearby population centers, (4) size and location of competing recreation areas, (5) terrain and (6) accessibility. On the basis of this and other pertinent information, four "most similar" projects were chosen. Table 15-III-1 lists the comparable characteristics of these four projects and Blue Marsh Lake.

B. Use-Distance Curves. The per capita use rates for the four "most similar" projects are plotted on figure 15-III-1. A fifth curve, the mathematical average of the other four, represents the projected per capita use rate for the Blue Marsh Lake project.

Per capita use rates are plotted for five concentric zones extending outward from each project in 10 mile increments. These rates are tabulated by project in table 15-III-2.

C. Market Area. The primary day-use market area of the Blue Marsh Lake project is the area within one hour's driving time (explanation on pages 3-25 and 3-26). It is delineated in Design Memorandum 15A, plate A15.

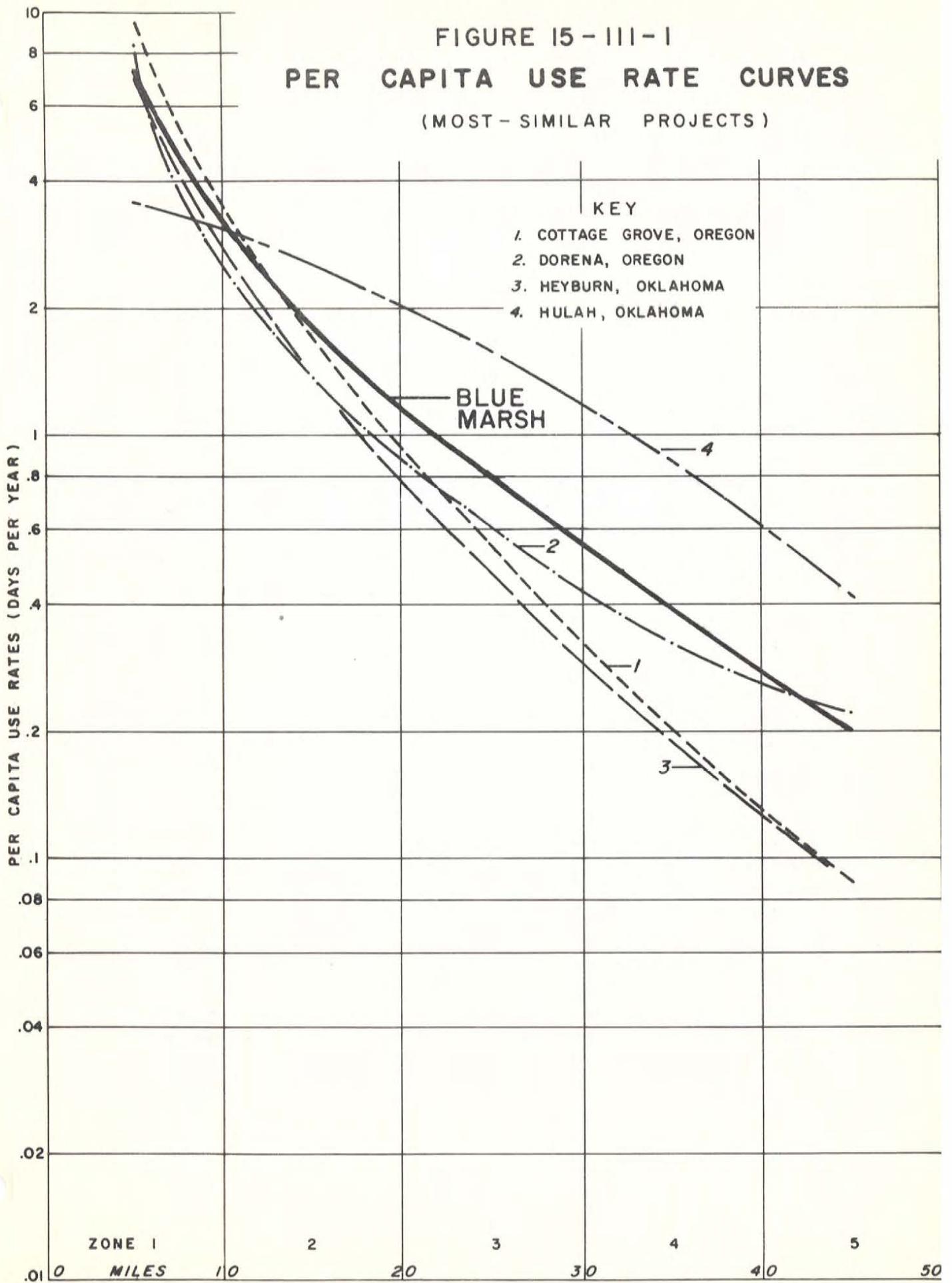
A variance from the "Tech 2" Method was used to calculate the number of residents within this market area. "Tech 2" states, "only those counties with greater than 50 percent of their population and/or area within the market area

TABLE 15 - III - 1

PERTINENT DATA COMPARATIVE TABULATION					
ITEM	BLUE MARSH	COTTAGE GROVE	DORENA	HEYBURN	HULAH
Location (State)	PENNSYLVANIA	OREGON	OREGON	OKLAHOMA	OKLAHOMA
Maximum pool					
Acre - feet	50,010	33,000	77,500	57,300	292,600
Surface acres	2,160	1,251	1,900	3,700	13,000
Average recreation pool					
Surface acres	1,150	1,161	1,750	980	3,600
Shoreline miles	38	9	12	40	62
Number of access areas	6	4	5	5	8
Recreation facilities					
Tent and trailer spaces	758	30	53	200	70
Day-use areas, capacity	(initial phase) 7,500	9,000	2,000	5,570	3,170
Boat launch lanes	11	4	2	6	10
Recreation season	Apr. - Sept.	Apr. - Sept.	Apr. - Sept.	Apr. - Sept.	Apr. - Sept.
Timber cover	Sparse	Moderate	Moderate	Heavy	Sparse
Reservoir terrain	Moderate	Flat to Steep	Flat to Moderate	Moderate to Steep	Moderate
In National Forest	No	No	No	No	No
Access					
Paved road, 1/2 of project	Yes	Yes	Yes	Yes	Yes
Limited, 1/2 of project	No	No	No	No	Yes
Overnight lodging nearby	Yes	Yes	Yes	Yes	No
Competing recreation areas					
0-25 miles - lake (acres)	3,050	1,900	1,158	26,300	3,550
0-25 miles - river (miles)	32	0	0	0	0
25-50 miles - lake (acres)	2,750	0	19,000	5,850	37,400

15-111-2

FIGURE 15-III-1
PER CAPITA USE RATE CURVES
 (MOST-SIMILAR PROJECTS)



should be considered," but leaves it to the discretion of the planner whether or not to adhere strictly to this rule. In the case of Blue Marsh Lake, this rule was modified and only the population of those municipalities within the one-hour driving zone was included.

Population centroids were chosen for each county or portion thereof, and appropriate travel distance zones were also delineated. The projected per capita use rates corresponding to each zone were multiplied by the zonal populations within each county to calculate potential day-use attendance. This information is presented on figure 15-III-1 and table 15-III-2.

Another modification to the rule was made in the case of Berks County and its centroid, the city of Reading. In this instance, Reading was treated separately from the rest of the county due to its close proximity to the project (approximately 6 miles). The county as a unit is centered farther away. People living 20 or 25 miles distant but within Berks County are not going to visit the project as frequently as the people from nearby Reading. Considering the city and county as one unit would result in an unrealistically high visitation projection.

D. Population Projections. The population figures presented on table 15-III-2 are derived from projections made by the Pennsylvania Office of State Planning and Development.* A straight line interpolation was made between the years 1980 and 1985 to obtain projections of the 1981 county populations. Since only portions of several counties are within the primary day-use market area, individual municipalities were broken out and their 1981 populations estimated by increasing their 1970 populations at the same rates as were projected for the parent counties.

E. Visitation. The attendance figures presented in table 15-III-2 have been calculated for the base year of 1981, the third recreation season after the planned opening of the project in 1978. This is the standard year for calculating initial project visitation.

The 1,266,600 day-use visits estimated for 1981 include only those that originate with one hour's driving distance of the project, which according to "Tech 2" represents 80 to 100 percent of the total annual day-use attendance. In the case of Blue Marsh Lake, this figure was assumed

* Pennsylvania Protection Series: Population and Labor Force, Pennsylvania Office of State Planning and Development, November, 1973.

to represent 90 percent (an average between 80 and 100 percent). Thus, 10 percent was added to account for attendance from outside the one-hour driving zone.

In addition to this day-use attendance, it was estimated that approximately 10 percent more people will visit the site to camp. The overnight visitation is therefore estimated at 156,400 visitor-days for the base year.

A total attendance of 1,563,800 is projected for the planned third year of project operation in 1981.

TABLE 15 - III - 2

ZONAL PER CAPITA USE RATES - CALCULATIONS

ITEM	BLUE MARSH	COTTAGE GROVE	DORENA	HEYBURN	HULAH
Zone 1 0 to 10 Miles	7.2235	9.7859	8.4111	8.0418	3.6554
Zone 2 10 to 20 Miles	1.7742	1.7401	1.3761	1.4154	2.5654
Zone 3 20 to 30 Miles	.7856	.5299	.5943	.4690	1.5482
Zone 4 30 to 40 Miles	.3918	.2016	.3415	.1911	.8333
Zone 5 40 to 50 Miles	.2021	.0874	.2258	.0879	.4074

PROPOSED INITIAL ATTENDANCE

County, State, Centroid	Distance (miles)	1981 Population	Per capita use rate	Attendance - day use
Berks, Pennsylvania	15	245,710	1.77	434,900
City of Reading, Pennsylvania	6	83,260	5.70	474,600
Chester, Pennsylvania, Warwick	30	40,470	.55	22,300
Lancaster, Pennsylvania, Brownstown	27	190,220	.74	140,800
Lebanon, Pennsylvania, Lebanon	23	89,200	.78	69,600
Lehigh, Pennsylvania, Cetrionia	32	109,500	.48	52,600
Montgomery, Pennsylvania, Pottstown	36	64,400	.39	25,100
Schuylkill, Pennsylvania, Pottsville	23	59,900	.78	46,800

Attendance (1 hour driving time) 90 % of annual use	1,266,600
Attendance (outside 1 hour zone) 10 % of annual use	140,800
Total annual attendance - day use	1,407,400
10% Overnight use	156,400
TOTAL PROJECT ATTENDANCE	1,563,800

15-111-6

EXHIBIT 15-IV: RECREATION DEVELOPMENT COSTS

Table 15-IV-1:
UNIT CONSTRUCTION COSTS

<u>Item Description</u>	<u>Costs</u>
1. <u>Roadways:</u>	
22 foot width - Day-Use Areas	\$283,000/mi.
18 foot width - Day-Use Areas	214,000/mi.
18 foot width - Camp Areas	99,000/mi.
2. <u>Parking:</u>	
Car	400/stall
Car and Trailer	600/stall
3. <u>Buildings:</u>	
Administration	130,000/ea.
Bathhouse	150,000/ea.
Picnic Shelter	35,000/ea.
Rest Room - Washhouse (W)	85,000/ea.
Rest Room - Flush Toilet (T)	55,000/ea.
Rest Room - Vault Toilet (V)	40,000/ea.
Camp Control	39,000/ea.
Camp Store	75,000/ea.
Recreation	150,000/ea.
4. <u>Boat Launch Ramp:</u>	
Permanent and Floating Dock	109,000/ea.
Boat Ramp (Two Lanes)	14,000/ea.
5. <u>Beach (Concrete)</u>	20/sq. yd.
6. <u>Picnic Unit (4 tables, 1 trash can and 1 grill)</u>	960/ea.

Table 15-IV-1:
UNIT CONSTRUCTION COSTS (cont.)

<u>Item Description</u>	<u>Costs</u>
7. <u>Camping Units:</u>	
Trailer	\$ 730/ea.
Tent	280/ea.
Group	230/ea.
Boat-To	110/ea.
Hike-In	100/ea.
8. <u>Sports Areas:</u>	
Play Area	4,600/ea.
Playfield	1,000/ea.
9. <u>Amphitheater</u>	25,000/ea.
10. <u>Sanitary Disposal Station</u>	5,000/ea.
11. <u>Boat Tie-Up</u>	2,500/ea.
12. <u>Trails:</u>	
Bicycle	32,500/mi.
Hiking	16,000/mi.
Nature Education	21,000/mi.
Equestrian	13,500/mi.
13. <u>Electric Service</u>	11/lin. ft.
14. <u>Signs, Markers, Etc.</u>	approx. 1% of subtotal
15. <u>Contingencies</u>	12% of subtotal
16. <u>Reforestation</u>	100/ac.

Table 15-IV-1:
UNIT CONSTRUCTION COSTS (cont.)

<u>Item Description</u>	<u>Costs</u>
17. <u>Water:</u>	
10" Water Line	\$ 30.00/lin. ft.
8" Water Line	25.00/lin. ft.
4" Water Line	12.00/lin. ft.
3" Water Line	9.50/lin. ft.
2" Water Line	9.50/lin. ft.
1" Water Line	4.00/lin. ft.
18. <u>Sewer:</u>	
18" Sewer Line 10 - 12' deep	22.00/lin. ft.
18" Sewer Line 8 - 10' deep	21.00/lin. ft.
18" Sewer Line 6 - 8' deep	20.00/lin. ft.
15" Sewer Line 10 - 12' deep	17.00/lin. ft.
15" Sewer Line 8 - 10' deep	16.00/lin. ft.
12" Sewer Line 6 - 8' deep	12.00/lin. ft.
10" Sewer Line 6 - 8' deep	9.50/lin. ft.
8" Sewer Line 10 - 12' deep	10.00/lin. ft.
8" Sewer Line 8 - 10' deep	9.00/lin. ft.
8" Sewer Line 6 - 8' deep	8.00/lin. ft.
6" Sewer Line 6 - 8' deep	7.25/lin. ft.
Manholes	800.00/ea.

Table 15-IV-2:
INITIAL PHASE DRY BROOKS DAY-USE AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
22 foot	1.17	\$331,110
18 foot	1.24	265,360
2. <u>Parking:</u>		
Car	750	300,000
Car and Trailer	176	105,600
3. <u>Buildings:</u>		
Bathhouse	1	150,000
Site Development	L.S.	50,000
Rest Rooms - Flush Toilet	2	110,000
Rest Rooms - Flush Toilet Modified* (at boat launch ramps)	2	70,000
4. <u>Boat Launch Ramp:</u>		
Permanent and Floating Dock	2	218,000
Boat Ramp	2	28,000
Site Development	L.S.	70,000
5. <u>Beach:</u>		
Concrete	5,000	100,000
Site Development	L.S.	68,000
6. <u>Picnic Units</u>		
	66	63,360

* A rest room with fewer water closets and lavatories because of limited use (primarily by boaters).

Table 15-IV-2:
 INITIAL PHASE DRY BROOKS DAY-USE AREA
 CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
7. <u>Sports Area:</u>		
Play Area	1	\$ 4,600
Play Field	1	1,000
8. <u>Electric Service</u>	8,640	95,040
9. <u>Planting</u>	L.S.	30,000
10. <u>Signs, Markers, Etc.</u>	L.S.	<u>20,300</u>
Initial Phase Area Total		\$2,080,370
Approximately		<u><u>\$2,080,400</u></u>

Table 15-IV-3:
 INITIAL PHASE DRY BROOKS AREA WATER SUPPLY AND SEWERAGE
 SYSTEMS

	<u>Units</u>	<u>Total</u>
1. <u>Water Supply:</u>		
10" Water Line	1,100	\$ 33,000
8" Water Line	15,770	394,250
3" Water Line	130	1,235
2" Water Line	750	7,125
Valves	L.S.	7,900
Connection to Western Berks Water Authority	L.S.	8,000

Table 15-IV-3:
 INITIAL PHASE DRY BROOKS AREA WATER SUPPLY AND SEWERAGE
 SYSTEMS (cont.)

	<u>Units</u>	<u>Total</u>
1. <u>Water Supply (cont.):</u>		
Connection to Operation Facility	L.S.	\$ 1,000
Miscellaneous		<u>10,550</u>
	Subtotal	\$463,060
2. <u>Sewerage System:</u>		
6" Sewer	370	2,680
8" Sewer	4,730	37,840
10" Sewer	6,540	62,100
Manholes	45	36,000
Sewer Stream Crossings	610	40,800
Pump Station	L.S.	20,000
6" Force Main	2,500	42,500
Special Service to Boat Launch		
Ramp Rest Room	L.S.	12,000
Sewage Treatment Plant	L.S.	400,000
Miscellaneous		<u>6,570</u>
	Subtotal	\$660,490
Initial Phase Area Total		\$1,123,550
Approximately		<u>\$1,123,500</u>

Table 15-IV-4:
 INITIAL PHASE STATE HILL DAY-USE AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
18 foot	0.10	\$ 2,140
2. <u>Parking:</u>		
Car	10	4,000
3. <u>Overlook</u>	L.S.	5,000
4. <u>Planting</u>	L.S.	700
5. <u>Signs, Markers, Etc.</u>	L.S.	<u>120</u>
Initial Phase Area Total		\$11,960
Approximately		<u><u>\$12,000</u></u>

Table 15-IV-5:
 FUTURE PHASE DRY BROOKS DAY-USE AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Parking:</u>		
Car	1,034	\$413,600
Overflow (car and trailer)	40	16,000
2. <u>Buildings:</u>		
Bathhouse	1	150,000
Site Development	L.S.	82,900
Picnic Shelters	6	210,000
Rest Rooms - Flush Toilet	9	495,000
3. <u>Beach:</u>		
Concrete	5,000	100,000
Site Development	L.S.	68,000
4. <u>Picnic Units</u>	184	176,640
5. <u>Sports Area:</u>		
Play Area	2	9,200
Playfield	2	2,000
6. <u>Boat Tie-Up</u>	3	7,500
7. <u>Trails:</u>		
Equestrian Underpass	L.S.	50,000
Pathway (6' width gravel)	0.8	12,400
8. <u>Overlook</u>	L.S.	100,000
9. <u>Electric Service</u>	14,711	161,820

Table 15-IV-5:
 FUTURE PHASE DRY BROOKS DAY-USE AREA
 CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
10. <u>Signs, Markers, Etc.</u>	L.S.	\$ <u>20,550</u>
Future Phase Area Total		\$2,075,610
Approximately		<u>\$2,075,600</u>
<u>Reforestation</u>	107	10,700

Table 15-IV-6:
 FUTURE PHASE DRY BROOKS AREA WATER SUPPLY AND SEWERAGE
 SYSTEMS

	<u>Units</u>	<u>Total</u>
1. <u>Water Supply</u>	L.S.	\$34,700
2. <u>Sewerage System</u>	L.S.	<u>35,558</u>
Future Phase Area Total		\$70,258
Approximately		<u>\$70,255</u>

Table 15-IV-7:
 FUTURE PHASE TULPEHOCKEN ACCESS AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
18 foot	.30	\$ 64,200
Boat Launch Ramp Turnaround	.01	2,140
2. <u>Parking:</u>		
Car	140	56,000
3. <u>Buildings:</u>		
Rest Room - Vault Toilet	1	40,000
4. <u>Boat Launch Ramp (Canoe)</u>	1	1,300
5. <u>Picnic Units</u>	25	24,000
6. <u>Electric Service</u>	1,480	16,280
7. <u>Signs, Markers, Etc.</u>	L.S.	<u>2,040</u>
Future Phase Area Total		\$205,960
Approximately		<u><u>\$206,000</u></u>
<u>Reforestation</u>	29	2,900

Table 15-IV-8:
FUTURE PHASE TULPEHOCKEN ACCESS AREA WATER SUPPLY SYSTEM

	<u>Units</u>	<u>Total</u>
1. <u>Well</u>	1	\$ 1,500
2. <u>Operating System</u>	L.S.	<u>15,000</u>
Future Phase Area Total		\$16,500
Approximately		<u><u>\$16,500</u></u>

Table 15-IV-9:
FUTURE PHASE STATE HILL DAY-USE AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
22 foot	1.22	\$345,260
18 foot	1.03	220,420
2. <u>Parking:</u>		
Car	650	260,000
Car and Trailer	132	79,200
3. <u>Buildings:</u>		
Bathhouse	1	150,000
Site Development	L.S.	82,900
Picnic Shelters	3	105,000
Rest Rooms - Flush Toilet	4	220,000
4. <u>Boat Launch Ramp:</u>		
Permanent and Floating Dock	1	109,000

Table 15-IV-9:
 FUTURE PHASE STATE HILL DAY-USE AREA
 CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
4. <u>Boat Launch Ramp (cont.):</u>		
Boat Ramp (Three Lanes)	1	\$ 21,000
Site Development	L.S.	105,000
5. <u>Beach:</u>		
Concrete	7,800	156,000
Site Development	L.S.	68,000
6. <u>Picnic Units</u>	82	78,720
7. <u>Sports Area:</u>		
Play Area	1	4,600
Playfield	1	1,000
8. <u>Electric Service</u>	12,920	142,120
9. <u>Signs, Markers, Etc.</u>	L.S.	<u>21,480</u>
Future Phase Area Total		\$2,169,700
Approximately		<u>\$2,170,000</u>
<u>Reforestation</u>	180	18,000

Table 15-IV-10:
FUTURE PHASE SPRING CREEK CAMP AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
18 foot	11.59	\$1,147,410
2. <u>Parking:</u>		
Car	640	256,000
Car and Trailer	144	86,400
Group Camping	L.S.	2,900
3. <u>Buildings:</u>		
Rest Rooms - Washhouse	13	1,105,000
Rest Room - Flush Toilet	7	385,000
Camp Control Station	1	39,000
Camp Store	1	75,000
Recreation Building	1	150,000
Group Camp Headquarters (Rehabilitation, Skinner Farm)	2	10,000
Maintenance (Rehabilitation, Stowell Farm)	1	5,000
Camp Control Center Site Develop.	L.S.	41,500
4. <u>Boat Launch Ramp:</u>		
Permanent and Floating Dock	2	218,000
Boat Ramp	2	28,000
Site Development	L.S.	138,000
5. <u>Beach:</u>		
Concrete	4,446	89,000
Site Development	L.S.	30,000
6. <u>Picnic Units</u>	2	1,920

Table 15-IV-10:
 FUTURE PHASE SPRING CREEK CAMP AREA
 CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
7. <u>Camping Units:</u>		
Trailer	599	\$ 437,270
Tent	64	17,920
Group	50	11,500
Boat-To	15	1,650
Hike-In	30	3,000
8. <u>Sports Area:</u>		
Play Area	8	36,800
Playfields	5	5,000
9. <u>Amphitheater</u>	1	25,000
10. <u>Sanitary Disposal Stations</u>	2	10,000
11. <u>Boat Tie-Up</u>	10	25,000
12. <u>Trails:</u>		
Bicycle	4.21	136,825
Nature Education	2.8	58,800
13. <u>Electric Service</u>	37,320	410,520
14. <u>Signs, Markers, Etc.</u>	L.S.	<u>49,875</u>
Future Phase Area Total		\$5,037,290
Approximately		<u>\$5,037,000</u>
<u>Reforestation</u>	980	98,000

Table 15-IV-11:
 FUTURE PHASE SPRING CREEK CAMP AREA AND STATE HILL DAY-
 USE AREA WATER SUPPLY AND SEWERAGE SYSTEMS

	<u>Units</u>	<u>Total</u>
1. <u>Water Supply:</u>		
8" Water Line	36,700	\$ 917,500
4" Water Line	6,650	79,800
3" Water Line	9,000	85,500
2" Water Line	4,920	46,740
1" Water Line	310	1,240
Valves	L.S.	17,740
Pressure Valves	L.S.	<u>17,100</u>
	Subtotal	\$1,165,620
2. <u>Sewerage System:</u>		
6" Sewer Line	3,495	25,340
8" Sewer Line	21,870	174,320
10" Sewer Line	1,280	12,160
12" Sewer Line	980	11,760
15" Sewer Line	1,920	31,740
18" Sewer Line	7,310	151,000
8" C.I. Sewer Line	1,700	49,480
Manholes	139	111,200
Pump Stations	7	99,000
Grinder Pumps	5	11,500
Force Mains	13,980	145,060
Septic Tanks	L.S.	12,000
Inverted Siphons	L.S.	<u>59,000</u>
	Subtotal	\$ 893,560
Future Phase Area Total		<u><u>\$2,059,180</u></u>

Table 15-IV-12:
 FUTURE PHASE CONRADS BRIDGE BOAT LAUNCH RAMP CON-
 STRUCTION COSTS*

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
18 foot	.36	\$ 77,040
2. <u>Parking:</u>		
Car	20	8,000
Car and Trailer	108	64,800
3. <u>Buildings:</u>		
Picnic Shelters	2	70,000
Rest Room - Vault Toilet	1	40,000
4. <u>Boat Launch Ramp:</u>		
Permanent and Floating Dock	1	109,000
Boat Ramp	1	14,000
Site Development	L.S.	69,000
5. <u>Picnic Units</u>	2	1,920
6. <u>Electric Service</u>	3,200	35,200
7. <u>Signs, Markers, Etc.</u>	L.S.	4,890
Future Phase Area Total		\$493,850
Approximately		<u>\$494,000</u>
<u>Reforestation</u>	27	2,700

* Includes equestrian access area and the pedestrian access area for the hiking trails on T-374, both on the south side of the lake.

Table 15-IV-13:
 FUTURE PHASE CONRADS BRIDGE BOAT LAUNCH RAMP WATER
 SUPPLY SYSTEM

	<u>Units</u>	<u>Total</u>
1. <u>Well</u>	1	\$ 1,500
2. <u>Operating System</u>	L.S.	<u>15,000</u>
Future Phase Area Total		\$16,500
Approximately		<u>\$16,500</u>

Table 15-IV-14:
 FUTURE PHASE ADMINISTRATION AREA CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Roadway:</u>		
18 foot	.24	\$ 51,360
2. <u>Parking:</u>		
Car	16	6,400
Car and Trailer	11	6,600
3. <u>Buildings:</u>		
Administration	1	130,000
Site Development	L.S.	51,000
4. <u>Planting and Buffer</u>	L.S.	15,000

Table 15-IV-14:
 FUTURE PHASE ADMINISTRATION AREA
 CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
5. <u>Signs, Markers, Etc.</u>	L.S.	\$ <u>2,605</u>
Future Phase Area Total		\$262,965
Approximately		<u><u>\$263,000</u></u>

Table 15-IV-15:
 FUTURE PHASE ADMINISTRATION AREA WATER SUPPLY AND
 SEWERAGE SYSTEMS

	<u>Units</u>	<u>Total</u>
1. <u>Water Supply:</u>		
3" Water Line	870	\$ 8,265
2" Water Line	400	3,800
Valves	1	<u>180</u>
	Subtotal	\$12,245
2. <u>Sewerage System:</u>		
Septic Tank	1	4,000
Grinder Pump	1	2,000
Force Mains	1,000	<u>4,000</u>
	Subtotal	\$10,000
Future Phase Area Total		<u><u>\$22,245</u></u>

Table 15-IV-16:
FUTURE PHASE MAINTENANCE AREA CONSTRUCTION COSTS*

1. <u>Parking (paved area)</u>	L.S.	\$55,250
2. <u>Buildings (Rehabilitation)</u>	2	10,000
3. <u>Site Development</u>	L.S.	10,000
4. <u>Fence (C.L.F.)</u>	L.S.	6,000
5. <u>Gravel Storage Area</u>	L.S.	<u>7,500</u>
	Future Phase Area Total	\$88,750
	Approximately	<u>\$89,000</u>

* This is the maintenance area located adjacent to the administration building on plate 10: Dry Brooks Area Development Plan.

Table 15-IV-17:
FUTURE PHASE TRAIL CONSTRUCTION COSTS

	<u>Units</u>	<u>Total</u>
1. <u>Bicycle:</u>		
Dry Brooks to Tulpehocken Access Area	3.12	\$101,400
2. <u>Hiking:</u>		
Spring Creek Camp Area	13.09	209,440
Spring Creek to Conrads Bridge Boat Launch Ramp	3.15	50,400

Table 15-IV-17:
 FUTURE PHASE TRAIL CONSTRUCTION COSTS (cont.)

	<u>Units</u>	<u>Total</u>
3. <u>Equestrian:</u>		
Tulpehocken Access Area	1.38	\$ 18,630
State Hill Day-Use Area	2.15	29,025
State Hill to Spring Creek Branch	7.21	97,335
Spring Creek Branch to Bernville via Conrads Bridge (Southwest Side of Lake)	8.03	108,405
Conrads Bridge to Tulpehocken Access Area (Northeast Side of Lake)	6.82	<u>92,070</u>
Future Phase Area Total		\$706,705
Approximately		<u><u>\$707,000</u></u>