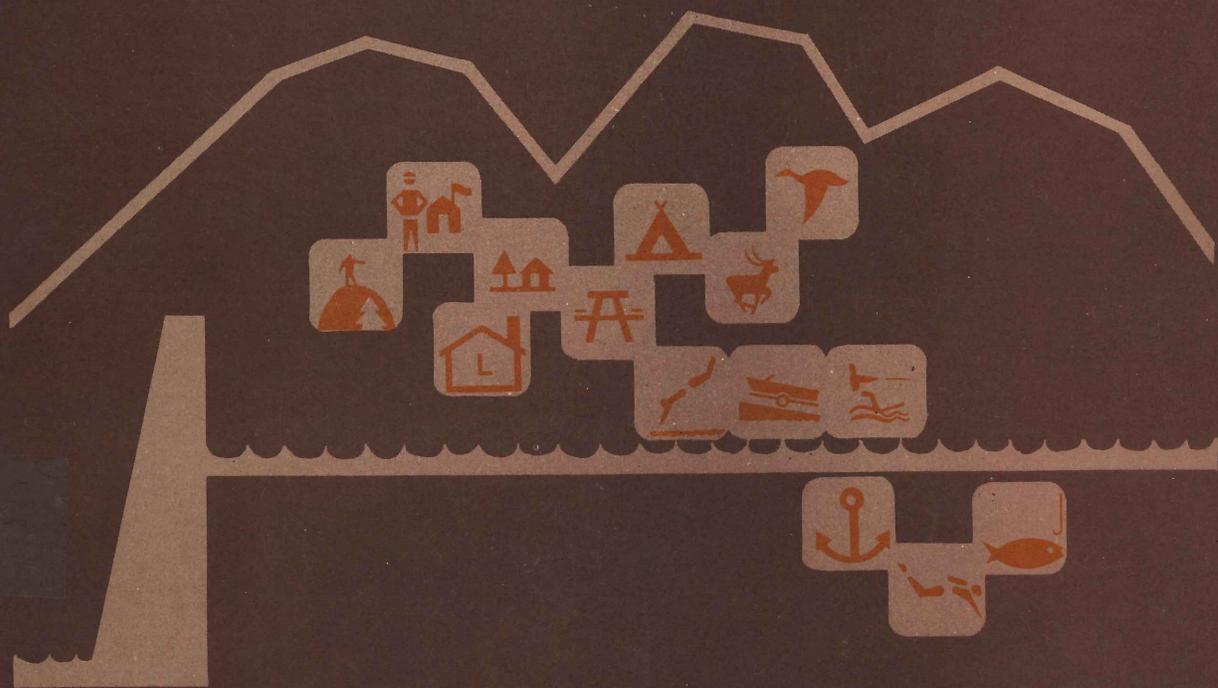


TYGART LAKE

West Virginia

MASTER PLAN

DESIGN MEMORANDUM NO. 1



PITTSBURGH DISTRICT · CORPS OF ENGINEERS · U.S. ARMY

DECEMBER 1976

CEORP-OR-R



DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
FEDERAL BUILDING, 1000 LIBERTY AVENUE
PITTSBURGH, PENNSYLVANIA 15222

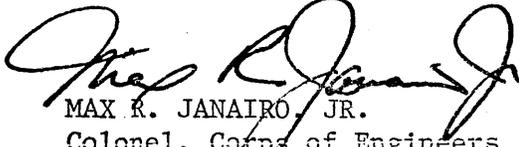
ORPED-PL

3 February 1977

SUBJECT: Updated Master Plan for Tygart Lake, West Virginia

Division Engineer, Ohio River
ATTN: ORDPD-R

Seven (7) copies of the subject Master Plan are submitted for review and approval.


MAX R. JANAIRO, JR.
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated (7 cys)

ORDPD-R (3 Feb 77) 1st Ind

SUBJECT: Updated Master Plan for Tygart Lake, West Virginia

DA, Ohio River Division, Corps of Engineers, P.O. Box 1159, Cincinnati,
OH 45201 22 March 1977

TO: District Engineer, Pittsburgh, ATTN: ORPED-PL

1. Approved subject to the following comments.

2. The concept of sizing the sewage treatment plant for an 18 percent variation over the estimated peak flow (35,000 gallons vs. 29,300 gallons) should be reviewed. The limited experience gained from monitored facilities tends to indicate that current design criteria are overly liberal. It should also be noted that the likelihood of all conditions of the maximum peak flow being met for more than a few minutes is remote. A short term overflow of a few percent should not adversely affect the plant on a long term basis; certainly not to the same degree as the continued gross underloading which will result from sizing a facility for maximum possible loading. The purpose of a sewage treatment plant is to reduce the pollution loading of a waste stream. Plants utilizing biological processes function best when operated near design capacity. The widely fluctuating loads found in recreation areas generally dictate slow equalization. This is a design judgment and specifying the type or size facility in the master plan is not appropriate.

3. The use of grinder pumps in a low pressure system for wastewater should be reexamined in view of a pending legal suit, Julia Clift vs. the United States. This case is a patent infringement case involving the use of these types of pumps at certain Corps facilities.

4. Regarding water supply facilities, ORDR 1110-2-24 requires approval for the use of hand pumps. Paragraph 5d, the same regulation, requires incorporation of suitable flow recording devices on water supply systems.

FOR THE DIVISION ENGINEER:



RICHARD C. ARMSTRONG
Acting Chief, Planning Division

wd encl

CF:

DAEN-CWO-R w 5 cy encl

PITTSBURGH FILE COPY

ORPED-PL (3 Feb 77) 2d Ind

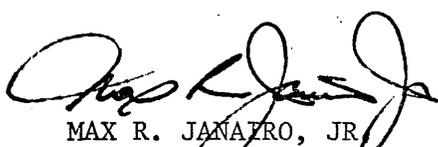
SUBJECT: Updated Master Plan for Tygart Lake, West Virginia

DA, Pittsburgh District, Corps of Engineers, Federal Building, 1000 Liberty Avenue, Pittsburgh, PA 15222 5 April 1977

TO: Division Engineer, Ohio River, ATTN: ORDPD-R

1. The engineering and design concerns raised in paragraphs 2-4 of the 1st Indorsement are noted and will be considered in the preparation of any Feature Design Memorandums and/or plans and specifications for the sewage treatment and water systems at Tygart Lake.

2. The comment in paragraph 2 concerning the level of design detail appropriate for a Master Plan is also noted. The level of design detail to be included in a Master Plan is an area that may require some further clarification since there appears to be some inconsistency between recent guidance and current Engineering Regulations.



MAX R. JANAIRO, JR.
Colonel, Corps of Engineers
District Engineer

ORDPD-R (3 Feb 77) 3d Ind

SUBJECT: Updated Master Plan for Tygart Lake, West Virginia

DA, Ohio River Division, Corps of Engineers, P.O. Box 1159, Cincinnati,
OH 45201 23 May 1977

TO: District Engineer, Pittsburgh, ATTN: ORPED-PL

1. Information contained in the preceding indorsement is satisfactory subject to the following comment.
2. Guidance furnished your office by ORDPD-R letter, 4 April 1977, subject: Master Plan-Scope of Development, is referenced for use to determine the level of design detail appropriate for master plan submittals.

FOR THE DIVISION ENGINEER:

wd all encl



RICHARD C. ARMSTRONG
Acting Chief, Planning Division

TYGART LAKE
WEST VIRGINIA

DESIGN MEMORANDUM NO. 1

MASTER PLAN

Prepared by
GWSM, inc.
1101 Greenfield Avenue
Pittsburgh, Pennsylvania 15217
(Contract No. DACW59-75-C-0049)

Prepared for
U.S. Army Engineer District, Pittsburgh
Corps of Engineers
Pittsburgh, Pennsylvania

December 1976

FOREWORD

The Master Plan for Tygart Lake has been prepared recognizing the currently authorized project purposes of navigation water supply and flood control. The plan of development and management presented in this report assumes the continued operation of the project for these primary purposes.

Concurrent with preparation of the Master Plan, consideration is being given to the feasibility of adding hydroelectric power facilities to the project. An initial phase of study indicates that more detailed engineering and economic investigations are warranted. If it is determined that the addition of hydroelectric power is physically and economically feasible, full consideration will be given to effects on other project purposes, environmental impacts and public opinion prior to formulating more detailed plans and recommendations.

At a minimum, adding hydroelectric power would require construction of power generating facilities and minor modification of project operations. It also could involve adjustments in summer and winter lake levels and the relocation or alteration of existing recreational facilities. Resultant impacts on the project's recreational value would be carefully considered and publicly discussed.

If current studies result in a positive recommendation to add hydropower to Tygart Lake, there will be a need to revise this Master Plan to reflect the impacts of the addition of power production facilities on the land, water and fish and wildlife resources of the project and to develop new plans of recreation development and management to meet any changed conditions.

TYGART LAKE
WEST VIRGINIA

DESIGN MEMORANDUM NO. 1

MASTER PLAN

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<u>Letter</u>	<u>Description</u>
A	LETTER - Letter (August 25, 1975) from Geological and Economic Survey, State of West Virginia, to Project Supervisor, Tygart Dam.
B	LETTER - Letter (September 12, 1975) from Office of Archeology and Historic Preservation, Interagency Archeological Services - Atlanta, U.S. Department of the Interior, National Park Service to A/E.
C	LETTER - Letter (August 18, 1976) from Director, State of West Virginia, Department of Natural Resources, to District Engineer.

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APPENDIXES

<u>Letter</u>	<u>Title</u>
A	Project Resource Management Plan*
B	Forest Management Plan*
C	Fire Protection Plan*
D	Fish and Wildlife Management Plan*
E	Project Safety Plan*
F	Lakeshore Management Plan*
G	Determination of Projected Outdoor Recreation Attendance
H	Estimated Sewage Flows, Proposed Ultimate Development
I	Cost Estimate for Facilities Development

*To be prepared in cooperation with the appropriate agency(ies) subsequent to final issuance of this Master Plan.

TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1
MASTER PLAN

SECTION 1.0 INTRODUCTION

1.1 AUTHORIZATION. The Tygart Lake project was initially authorized by the Public Works Administration, 11 January 1934, and was adopted by the River and Harbor Act of 30 August 1935.

1.2 PROJECT PURPOSE. Tygart Lake is operated as a unit of a coordinated reservoir system for flood protection in the Tygart, Monongahela and Ohio River valleys. In addition to flood control, the reservoir provides for navigation water supply through storage of 100,000 acre-feet (A-F) of annual spring inflow from a tributary drainage area of 1,184 square miles. This water creates a summer pool which is gradually reduced during the summer-fall period in accordance with navigation water supply requirements. The project also provides for industrial and domestic water supply and low flow augmentation. Other extrinsic uses which are considered in this memorandum include recreation, land conservation, and fish and wildlife preservation and enhancement.

1.3 PURPOSE AND SCOPE OF MASTER PLAN. This updated Master Plan has been prepared in accordance with the applicable provisions of Corps of Engineers Regulations and appropriate

Engineering Manuals; more specifically, with the provisions of ER 1120-2-400, "Recreation Resources Planning", dated 1 November 1971. This study presents a complete re-evaluation of the assets, needs and potentials of the Tygart Lake area and proposes an updated plan which takes into account all changes that have occurred since initial development and which reflects projected recreation user demand in terms of attendance, preferred activities, new types of equipment, access routes and new highways, and other factors not anticipated in the Master Land Use Plan dated December 1954. The updated plan will serve as a guide for the future development, management and use of the land and water resources of Tygart Lake for optimum public benefit throughout the remaining project life. The general scope of work covered by this memorandum includes but is not limited to: a narrative and technical report, field studies, development plans, architectural designs, cost estimates and coordination with appropriate State and other Federal agencies.

1.4 PRIOR REPORTS. A Master Land Use Plan for the Tygart River Reservoir Area, dated December 1954, was prepared jointly by the Division of Parks, Conservation Commission, State of West Virginia (now West Virginia Department of Natural Resources) and the Corps of Engineers, U. S. Army,

Pittsburgh District. This updated Master Plan will supersede that report.

1.5 APPLICATION OF PUBLIC LAWS. The following Federal statutes govern administration and development of Tygart Lake.

1.5.1 Section 4, Public Law 534 - Flood Control Act of 1944, as amended by the Flood Control Act, approved 24 July 1946 (Public Law 526, 79th Congress, 2nd Session, H.R. 6597), provides for the development of reservoir areas under the control of the Department of the Army for recreational purposes. This law establishes the basic authority for the development of the Tygart Lake project area for recreation purposes.

1.5.2 Public Law 85-624 - Fish and Wildlife Coordination Act of 1958, states the general policy that fish and wildlife conservation shall receive equal consideration with other project purposes and be coordinated with other features of water resources development projects. Early and continuing coordination is encouraged to fulfill the spirit and intent of the law and administrative policy. This law establishes the bases for detailed consideration of fish and wildlife values in formulating future development plans for Tygart Lake.

1.5.3 Public Law 89-72, Federal Water Project Recreation Act of 1965, imposes requirements of non-Federal cooperation and cost-sharing participation in recreation financing and administration. These requirements have been applied administratively to projects authorized before 1965. Therefore, any Corps of Engineers participation in future recreation development at Tygart Lake is subject to the requirements of P.L. 89-72.

SECTION 2.0 PROJECT DESCRIPTION

2.1 LOCATION. Tygart Lake is a Corps of Engineers impoundment located on the Tygart River in Taylor and Barbour Counties, north-central West Virginia. The Lake is approximately 26 road miles due east of Clarksburg, West Virginia and 30 road miles south of Morgantown. The dam is situated 22.7 river miles above the mouth of the Tygart River at Fairmont, or 2.25 miles upstream from Grafton, West Virginia. See PLATE 1 for the regional map.

2.2 PROJECT DATA

2.2.1 The Dam, Spillway and Outlet Works. The dam is a concrete, gravity-type structure with an uncontrolled spillway located in the line of the stream approximate to the middle of the dam. Abutment sections flanking the spillway on either side extend 23-feet above the spillway crest. The total width of the spillway opening is 489-feet. The overall length of the dam at the top is 1,921-feet. The maximum base width is 207-feet. The crest of the spillway is 207-feet above the river bed, or at elevation 1167 which corresponds to the reservoir full pool elevation. The spillway permits the passing of large quantities of water when the reservoir is full, thus preventing overtopping and possible destruction of the dam should an unprecedented run-off occur in the tributary

basin of the reservoir. Water is released from the reservoir through the dam by means of eight main sluices and two low flow circular conduits. The eight main sluices are each controlled by two hydraulically-operated, vertical-lift gates, one for regular service and the other for emergency use. The two low flow conduits are controlled by large needle valves. The gates and valves are controlled from the operation gallery within the dam. The entrances to the sluices are protected by trash racks which prevent clogging by submerged drift. A floating trash boom, which extends across the reservoir pool above the dam is provided to catch surface drift. The stilling basin, immediately downstream from the spillway section, absorbs the energy produced by the discharge of water over the spillway or through the sluices. The small concrete weir which forms the stilling basin is 26-feet high and 488-feet long and is located 223-feet downstream from the toe of the dam near the end of the training walls. The City of Grafton Water Works, located on the right bank of the Tygart River immediately below the stilling basin, is supplied with raw water through a special intake from the dam.

2.2.2 Reservoir Description and Project Operation. The reservoir contains a gross storage capacity of 289,600 acre-feet (A-F) at the full pool elevation (1167, spillway elevation) creating a water surface area of 3,440

acres extending 13.1 miles above the dam along the main stream of the Tygart River. Several tributary stream valleys provide inlets from the main body of water, forming a lake of high scenic quality. The gross storage is generally divided between the prime purposes of navigation water supply and flood control as follows: Approximately 11,200 A-F of storage is reserved for sedimentation and intake protection. This minimum sedimentation pool has a surface elevation of 1010, a length of 6.4 river miles above the dam, and it encompasses 660 surface acres. Above elevation 1010, a net usable capacity of 100,000 A-F, as referred to in paragraph 1.2, is reserved for storage of excess run-off during the spring months which is released during low-rainfall periods occurring in the summer and fall to assure a flow of 340 cubic feet per second at the Opekiska Lock and Dam located downstream on the Monongahela River. This low-flow regulation pool has a surface area of 1,750 acres at elevation 1094, a length of 10.1 miles above the dam, a nominal width of 0.3 miles, and it is considered to form the lake which is best suited for recreational purposes. Toward the close of the recreation season in the fall, the normal pool elevation has dropped to approximately 1075. TABLE 1 delineates the expected drawdown during the recreation season for wet, average and dry years. To accommodate the flood control purposes of the project, an additional

178,400 A-F of storage is possible throughout the summer, capable of absorbing 2.8 inches of run-off. At full winter release of the low-flow regulation pool, flood control storage increases to 278,400 A-F, equivalent to 4.4 inches of run-off. TABLE 2 shows the expected storage frequencies for Tygart Lake. The maximum recorded pool elevation attained during the peak recreation period was 1155.2 in June 1972, at the time of Tropical Storm Agnes. The normal pool configurations referred to above are shown on PLATE 2, as well as the maximum pool elevation of 1190.9.

TABLE 1
TYGART LAKE
RESERVOIR DRAWDOWN

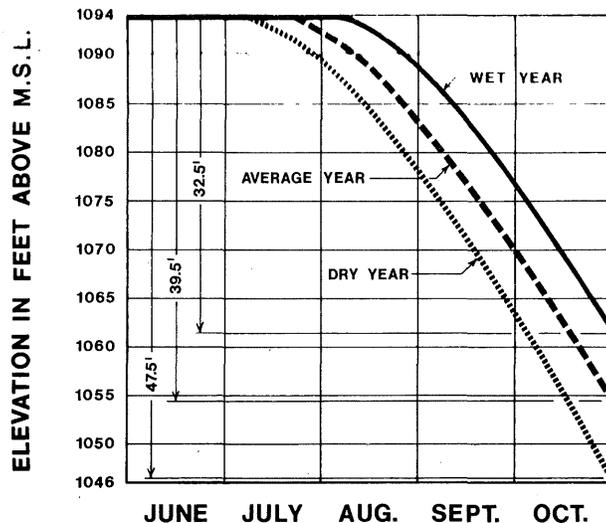
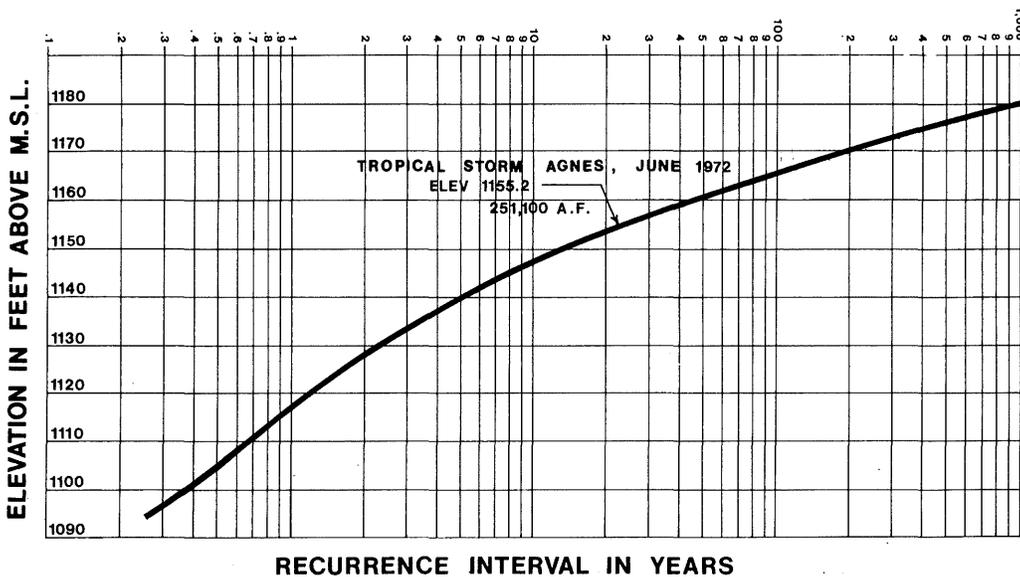


TABLE 2
TYGART LAKE
RESERVOIR STORAGE FREQUENCY



2.2.3 Climate. The climate in the vicinity of Tygart Lake is characterized by cold winters and moderate summers. The average annual temperature is 52 degrees Fahrenheit (°F) and the annual rainfall is 45 inches.

1972-1975		1972-1975	
Average		Average	
<u>Temperature (°F)</u>		<u>Precipitation (inches)</u>	
January	34.6		4.06
February	32.3		3.00
March	43.4		3.53
April	49.3		5.19
May	60.8		4.66
June	67.7		5.06
July	72.0		2.65
August	72.3		5.44
September	64.7		3.55
October	53.2		2.79
November	43.8		3.44
December	36.5		4.28
4 year		4 year	
average		average	
mean		annual	
temperature	52.55°	precip.	47.65 inches

Tygart Lake is located west of the Allegheny Mountains and is exposed to the invasion of cold, dry air from the north and masses of warm air from the Gulf of Mexico. The prevailing wind is westerly most of the year but is southerly or southwesterly some of the time in the summer and fall, although the high side slopes of the valleys and the hills diminish wind effects. Precipitation is generally uniform throughout the year with October being the driest month.

2.2.4 Reservoir Shoreline. The lake which has been formed in the valley of the Tygart River is surrounded by high, rounded hills and steep slopes which are covered with timber and undergrowth. The highest nearby hilltop elevation is 1627-feet, 533-feet above the summer pool shoreline at elevation 1094-feet. Because of the rugged terrain and the many tributary valleys, the reservoir has an irregular and interesting shoreline approximately 31 miles in length. The generally dense vegetation which exists above elevation 1094 inhibits erosion into the reservoir.



Photo No. 1 Western Shoreline at Summer Pool



Photo No. 2 Eastern Shoreline During Drawdown

SECTION 3.0 RESOURCE INVENTORY

3.1 INTRODUCTION. The previous section deals with rather specific physical characteristics of Tygart Reservoir and its hydrological functions. In this section, consideration is given to an inventory of other resources, both natural and cultural. These resources of geology, ecology, vegetation, fish and wildlife, the existing park facilities, along with historical and archeological factors, comprise the remaining general base upon which fundamental planning decisions rest. Certain of these factors have more influence than others, as explained under sub-headings contained in this Section. Further, in Section 5, specific influences are discussed in light of detailed planning of park and public hunting and fishing facilities.

3.2 GEOLOGY. Tygart Lake is situated in a steep-sided valley that exposes the sedimentary rock strata of three Pennsylvanian age formations. The hilltops and most of the valley walls are formed by the Conemaugh Formation. The Conemaugh Formation is approximately 400-feet thick and contains strata ranging from sandstones to red claystones. The relatively thin (150-feet) Allegheny Formation occurs in the lower valley walls and consists of shale

and sandstone with coal seams. The thick sandstones of the New River Formation are exposed near the valley floor in the southern half of the reservoir area. The dominant geologic structure of the area is the Hiram Anticline. The axis of this anticline, although somewhat irregular, trends N30°E, plunges northeast at approximately 1° and crosses the Tygart River Valley just south of Sandy Creek. The rock strata on either side of this axis strike parallel to it and dip away from it. To the north, the beds dip approximately 2° to the northwest while to the south, the dip is 1° to the southeast.

3.2.1 Natural Resources. Although a few wells have been drilled along the Hiram Anticline, no great quantities of oil or gas were discovered. It is not likely that oil and gas will play a significant role in any future development of the reservoir area. Except for coal, there are no other known natural resources (clay, sand, gravel, etc.) in the area.

3.2.1.1 Coal. A Study was conducted to delineate the coal seams that exist in and around Tygart Lake and to determine their present status and potential for mining. Contacts were made with various coal companies and governmental agencies to determine ownership of potentially mineable coal seams and the regulations

and policies of the State of West Virginia regarding deep and strip mining in state-owned land. A brief description is presented for each coal seam, and its areas of occurrence relative to Tygart Lake are given. An analysis of the data indicates that although two coal seams at Tygart Lake are potentially mineable, a timetable for their exploitation can not be established. Any mining conducted in the future would be subject to state and Federal regulations in existence at that time. Due to the uncertainty of when or if mining of these coals will occur, no special considerations have been made relating to mining in the preparation of this Master Plan. A review of geologic literature indicates the principal coals of mineable thickness in the Tygart Lake area are the Upper and Lower Kittanning seams. Based on selected cross sections and borings, the Upper Kittanning coal varies in elevation from about 850 in the vicinity of the Tygart Lake Dam (ground surface elevation + 1100) to roughly 1150 near the Taylor-Barbour County Border. In the vicinity of Moatsville in the southeastern reaches of the reservoir, the Upper Kittanning seam has an elevation of about 1275. Maximum reservoir level in this area is approximately 1175. The Upper Kittanning (locally called the four-foot seam) averages 3-4-feet in thickness. The Lower Kittanning coal occurs 40-60-feet below the Upper Kittanning and has elevations corresponding to the above locations of approximately 800 (at the Dam), 1100 (at the

County line), and around 1250 in the Moatsville area. The Lower Kittanning (locally called the five-foot seam) averages 4-6-feet. Other coal seams in the region in and around Tygart Lake are the Pittsburgh, Elk Lick, Bakers-town, Upper Freeport, Clarion, and Upper Mercer. Preliminarily, these coals appear to have limited importance relative to Tygart Lake and the proposed development. The Pittsburgh coal occurs generally west and northwest of Tygart Lake where it has been extensively stripped and deep mined. The coal has elevations ranging from approximately 1300 to 1400 in these areas which are principally south and west of Pruntytown. Its thickness varies from 5-to 9-feet. At its closest point to Tygart Lake, it has been stripped from the hills northwest of the lake's southwest flowage easement along Pleasant Creek in Barbour County. The coal has been largely eroded from the study area. Based on regional structure, the coal had an elevation of about 1500 at the town of Webster, west of Tygart Lake, and approximately 1800 at Millertown to the east. Elk Lick Coal occurs about 265-feet stratigraphically below the Pittsburgh seam. Where mineable, it is generally east of Tygart Lake and has an average thickness of 2-to 3-feet. Outcrops are high on the hills and mineable tracts are, consequently, rather small.

The closest outcrops to Tygart Lake are east of the Moatsville area at about elevation 1700. The Bakerstown Coal occurs about 425-feet stratigraphically below the Pittsburgh coal. Generally found east of Tygart Lake, it averages 2-3-feet in thickness where mineable. A few strip mines were noted on the west side of Tygart Lake in the Moatsville area where the coal has an elevation between 1675-1715. The Upper Freeport Coal occurs about 550-600-feet below the Pittsburgh coal. It is generally of mineable thickness in both Taylor and Barbour Counties east of the town of Hiram. Thickness varies from 2-to 6-feet. Occurrence of this coal is frequently variable and patchy. A measured thickness of 4-feet was noted southwest of Moatsville. An isolated reference about one mile southeast of the mouth of Lick Run was also found for this seam where it has a thickness of four feet at about elevation 1535. The Clarion and Upper Mercer Coals occur roughly 725-to 775-feet below the Pittsburgh coal. Although these coals outcrop at locations in the Cove Run to Moatsville area, their occurrence is patchy and they are generally slaty. Both these coals appear to have little or no commercial importance near Tygart Lake. Due to the variable and patchy occurrence of the Elk Lick, Bakerstown, and Upper Freeport Coals, the prospects for commercial mining near the project area are small. As was noted in the descriptions for each of these coals,

locations for these coals found in the literature indicate the best outcrops are east of Tygart Lake. The above information is somewhat general in nature, and it is likely, in some areas, that changes will have occurred in the descriptions of past mining. Such additional activity, however, has had little effect, if any, on operations of the reservoir or on operations of the State Park. Several contacts were made during the course of this study to determine present ownerships of coal in the vicinity of the Tygart Lake and throughout the watershed upstream. Those contacted included representatives of the West Virginia Bureau of Mines offices in Morgantown and Charleston, West Virginia, and the West Virginia Department of Natural Resources in Charleston. Private firms contacted were: Consolidation Coal Company (offices in Pittsburgh and Library, Pennsylvania) and their Mountaineer Coal Division in Fairmont, West Virginia; Badger Coal Company in Philippi; Dean Engineering in Buckhannon; Horner Brothers Engineering in Clarksburg; Southern Ohio Coal Company in Fairmont; and Hillman Coal and Coke in Pittsburgh, Pennsylvania. There is no record of any Federal ownership of coal in the area; it was learned, however, that Hillman Coal and Coke Company owns the majority of coal rights beneath properties near the Tygart Lake Dam and several other areas within Tygart Lake State Park. Hillman is now in the process of acquiring addi-

tional properties in the area. Apparently, most of the tracts are rather small, and purchasing them is a time-consuming process. Hillman has been concentrating their efforts on obtaining mineral rights to the Kittanning Coals, although they have no plans to undertake mining in the near future, nor are they able to estimate when the coals might be mined. Often, when the mining rights are not separable, Hillman purchases the land in fee title. The West Virginia Department of Natural Resources knew of no extraordinary legal restrictions governing mining beneath state-owned land. It was said that some mining is presently taking place beneath some state parks, although they stated all entries to the mines must be outside park boundaries. It was not known if any mining had been done or was currently being done below reservoirs in any of the state parks. Any plan to mine beneath a state park reservoir likely would be carefully scrutinized by the Department of Natural Resources. It is generally accepted in the industry that over 50% of the coal in such circumstances must remain as support against subsidence of any body of water. On the basis of these findings, it appears safe to conclude that, despite predominant private ownership, coal seams with the highest mining potential in the reservoir area (Upper and Lower Kittanning) are not likely to be exploited in the near future. This is especially true where the coals occur below the reservoir (from the dam to approximately the County line). In addition to the

obvious environmental considerations and easier access to other coals in nearby areas, mining of the coals is likely to be very difficult beneath the reservoir. This, of course, is wholly dependent on future economy and energy-demand factors which might possibly combine to make such now extraordinarily difficult and costly retrieval more economically feasible. For very obvious reasons, these future circumstances defy prediction and are not regarded as valid constraints on the preparation of this Master Plan. Nonetheless, it must be considered prudent, at such time as any of the proposed developments are being considered for construction, that an assessment be made of the then current mining situation, in precise detail. Finally, it seems most unlikely that mining would be conducted in any manner which would jeopardize the dam/reservoir. As a consequence, as long as the lake continues to serve its primary purposes in storing water for navigation, flood control and water supply, its secondary purpose for recreation will remain secure. Should mining continue beneath the land areas of Tygart Lake, even to the extent of 100% retrieval, the prospect of ordinary subsidence is not considered to be a barrier to continued operation and development of the Tygart Lake project. Through contact with the Reclamation Division of the West Virginia Department of Natural Resources, it has been learned that Section II, Article 6, Chapter 20 of the State Mining

Code as it related to strip-mining prohibits such activity within 100-feet of park land. Further, the Code requires screening of the operation from view. If acid drainage and/or stream siltation appear as likely problems in any watershed (not alone one which encompasses park lands) permits may be and have been denied. A representative of the Law Enforcement Division of the Department of Natural Resources confirmed that denial of permits based on esthetic considerations have been upheld in a court of law.

3.2.2 Features. Dominant, massive sandstone outcrops frequently appear along the shoreline at about elevation 1075. This New River Formation seems stable and is clearly visible at several locations around the lake, especially during drawdown periods. Henderson's Rocks, located on the west bank about 3 miles from the Dam, is an outstanding grouping of such outcrops which is quite popular among divers. Organizations of divers have been permitted to set this area aside and mark it with buoys to reserve its use for skin diving during periods of inundation.

3.3 ARCHEOLOGY. Tygart Lake is among the least known archeological areas in the State. A survey of archeological resources has been contracted to the West Virginia

Geological and Economic Survey by the United States Department of Interior, as explained in more detail in EXHIBITS A and B of this Master Plan. The survey, scheduled for completion by June 1976, was concentrated at Doe Run although other sites are to be explored.

3.3.1 Doe Run Archeological Site. Located on the west shore at the mouth of Doe Run, this area is inundated when the summer pool reaches elevation 1094. Salvage excavations were conducted by a Geologic and Economic Survey team from West Virginia during the 1975-76 winter low level pool. There is reason to believe that an Indian village site existed in this location, possibly of the Monongahela culture of the Late Pre-historic Period.

3.3.2 Tygart Lake Shoreline. An intensive search for other possible archeological resources of pre-historic significance within shoreline areas affected by fluctuations in water level will be made during this same period by the West Virginia archeologists.

3.4 HISTORICAL SITES. The best available information reveals that, as of 1975, no thorough survey of historic sites has been made within land areas of the project or its immediate environs. It is assumed, therefore, that there are no compelling reasons to emphasize the history

of the area in planning any park facility or in suggesting any amendment of the interpretive program. There is a remote possibility that some attention might be given to the history of the rise and decline of the railroads in the vicinity, but this is considered to be of such minimal importance that, again, no change in planning would occur. Should the archeological investigations, mentioned above, produce items of interest, it is expected that such findings would be reflected in Department of Natural Resources literature.

3.5 ECOLOGY. Tygart Lake and the park lands which surround it can be regarded in a very broad sense as containing a series of altered ecosystems. After approximately four decades of impoundment, the lake itself has, of course, become more or less stabilized despite extreme seasonal fluctuations of water level throughout each year. The "bottom" areas which are exposed at periods of low pool are devoid of vegetation because low pool occurs well beyond the growing season. As spring flows increase, the reservoir fills quite rapidly; yet there is still insufficient time for aquatic plants to develop in this strip because of the continuation of occasional periods of draw-down. Thus, the exposed "bottom" areas are considered to be "lifeless", characterized by stumps of trees which

once stood in the valley, by erosion-prone subsoils, and by occasionally exposed rocks. Below water level, at low pool, one might expect to find customary associations of plant and fish life. Above normal recreation pool, there have been some substantial alterations to natural systems, notably a raising of ground water levels. This condition, too, is stabilized to some extent although seasonal variations are often radical. Vegetation and wildlife have adapted to the changes and are described in brief in the sections immediately following. The most important influence on ecological systems is, however, the existence of a functioning recreational area, fairly intensely developed. The presence of man, his interventions into the wooded areas, his roadways, and his other impositions on the land have performed the most severe alterations. The greatest changes have occurred on the right bank and in the boat club areas; these places can no longer be considered "natural". This Master Plan envisions no radical departures from established patterns, and so it must be expected that the existing, altered, and adaptive ecosystems will remain essentially as they've developed during the past 40 years.

3.6 VEGETATION. In general, the vegetation of the Tygart area is of the mixed mesophytic forest association.

(Acer-Fagus-Liriodendron-Quercus-Tilia). Almost the entire drainage area of the Buckhannon River and the Tygart River above the reservoir (the main feeder streams) are located within the mixed mesophytic forest association. The extreme upper reaches of the feeder streams of the Tygart River are located in the northern hardwood classification (Acer-Betula-Fagus-Tsuga) which fall outside of the study area. In the area immediately adjacent to the reservoir, both the mixed mesophytic and northern hardwood forest associations were observed. The mixed mesophytic was characteristically found in the more moist soils and on the lower slopes or in valleys protected from the drying actions of the winds. The northern hardwoods were characteristically found on the upland slopes and in the drier soils.

3.7 FISH AND WILDLIFE. The Corps of Engineers has granted a license to the West Virginia Department of Natural Resources authorizing fish and wildlife management within the Tygart Lake project. This license expires on 23 March 1997. A comprehensive Fish and Wildlife Management Plan is contained in APPENDIX D of this Master Plan.

3.7.1 Fish. Recent improvements in water quality have had a significant impact on the fishery resources of Tygart Lake. Although there is little variety of habitat in the main body of the lake, due to fluctuation in pool level which prevents weed beds, there is a considerable variety in species of fish. Largemouth bass, walleye pike, crappies, and sunfish make up the bulk of sport fishes. Other species in descending order of population as observed in the past include bullhead, pumpkinseed, bluegill, white sucker, channel catfish, occasional rock bass, and very minimal counts of musk-elunge, brown trout, smallmouth bass, and brook trout. The Doe Run impoundment provides a relatively constant pool wherein weed beds furnish cover for eggs and fry of many species and any similar tributary impoundment would offer the same benefits. Walleye and bass do not require such cover and this accounts, in part, for their successful adaptation to the lake. The largemouth bass population is expanding and the Central West Virginia B.A.S.S. Club has held several successful tournaments at the project. They feel it is now one of the best bass waters in the state. Because of the improved water quality, Tygart Lake now also provides an excellent walleye habitat. Walleye eggs and fry, introduced in 1973, have shown excellent growth rates. In addition to the walleyes, 140,000 largemouth bass fingerlings,

and large numbers of northern pike eggs, rainbow trout fingerlings and spottail and silver shiners were stocked in 1973.

Walleye eggs and fry have been stocked annually since 1973, as follows:

1973 - 450,000

1974 - 1,500,000

1975 - 1,100,000

1976 - 2,000,000

It is evident that the walleye stockings have resulted in a high population of that species, because only walleyes were recovered in later gill net and rotenone samplings, although northern pike and musky observations were reported by anglers. The trout have not yet appeared in the anglers' creel above the dam, although fingerling stockings in the tailwaters have been successful. In view of the excellent growth rates and increasing angler success with largemouth bass and walleyes, stockings of northern pike, trout and musky are being discontinued to reduce forage competition. Stockings of walleye fry will be continued, and annual stockings of spotted shiners will be made to supplement bluegills,

crayfish and bullheads as the forage base. A dominant forage species is needed, according to fishery biologists of the West Virginia Department of Natural Resources, and threadfin shad were first introduced in 1975; annual stockings and observations will be continued to determine whether or not this objective has been achieved. Earlier (1972) gill net reports indicated that 65 percent of the fish sampled had full stomachs, with bluegills and crappies then being the predominant forage, along with a lesser proportion of crayfish. The effects of water level fluctuation on fish populations are currently under study by the fishery biologists and it is generally believed that large fluctuations of the reservoir pool, especially during spawning periods, may severely affect fish populations. It is also believed by the biologists that increasing the level of the winter pool and thus increasing winter fish habitat areas would increase fish populations. While there is a direct relationship between the available acreage and the number of fish which can be sustained in a given body of water, it is acknowledged that the primary hydrological functions of the reservoir must prevail and that the fish population, ultimately, might continue to be limited by the extent of the normal winter pool.

To enhance use of the lake by fishermen, boating no-wake zones were established in 1975. However, angler use of the lake remains somewhat limited because the boat launching ramps do not provide access to the low winter pool. In brief summary, Tygart Lake is highly regarded as a source of fishing recreation despite the imposition of conditions described above which relate to the primary functions of the project and which serve to reduce fishing below absolute optimum levels. Considering all the other uses of the lake, however, the fishery is quite good.

3.7.2 Wildlife. Wildlife, indigenous to the region, abounds in the Tygart Lake area and is especially prevalent in the Pleasant Creek Public Hunting and Fishing Area. Pleasant Creek provides excellent hunting for game including whitetail deer, ruffed grouse, squirrel, cottontail rabbit, raccoon, and woodchuck. Wild turkey populations are low but increasing. Approximately 1,900 acres are open to public hunting, and it is widely regarded as being a good and diversified hunting area. The West Virginia Division of Wildlife Resources maintains 18 wildlife management clearings in Pleasant Creek consisting of patches of land planted in grasses and clover which provide forage and habitat for grouse, deer,

turkeys and rabbits as well as many other small mammals and birds. The hilly to mountainous wooded portions of Pleasant Creek support good populations of deer, grouse, squirrel and raccoon. Quail hunting exists to a limited degree in the few open, grassed areas. Local and migratory waterfowl populations have improved with the construction of the Doe Run impoundment which provides waterfowl food and nesting areas. Waterfowl hunting, however, is essentially limited to the sub-impoundment and beaver marshes on Pleasant Creek because of the low winter pool level of the remainder of the lake and the difficulty of boat access to it.

3.8 RECREATION. In the vicinity of the dam, the Corps of Engineers has provided and maintains a parking area, a public sanitary and concession building, overlook area, and limited picnic facilities. Except for this area, the development of recreational facilities and the management of the fish and game resources in the Federally-owned portion of the Tygart Lake area are the responsibility of the State of West Virginia under a long-term lease for parks and recreation purposes and license for fish and wildlife management with the Department of the Army. The leased land, together with the various parcels of the State-owned land adjoining the lake, have become known as Tygart Lake State Park, on the right bank, and Pleasant Creek Public

Hunting and Fishing Area, on the left bank. PLATE 3 shows the overall disposition of the land as to ownerships and principal uses. The state has constructed and maintains approximately five miles of park road along the eastern shore of the lake. A marina offering storage and rental services and nearby launching ramps, (under the terms of a concession agreement from the West Virginia Department of Natural Resources, terminating 31 December 1982) a bathhouse and paved bathing area, a tent and trailer camping area, three picnic areas, ten rental cabins and a lodge with twenty living units, have been provided by the State of West Virginia and are available to the public. Additionally, the State has provided an administration/recreation building, residences for the park superintendent and caretaker, a service garage, and a maintenance area. Physical developments in the Pleasant Creek Area amount to a residence shop and office and an implement shed. There is also a new 31-unit campground with two vault restrooms and a sanitary disposal station. The area has 2.3 miles of bituminous surfaced road that is owned and controlled by the Department of Highways. There are 11.8 miles of rock-based road and, of this, 6.5 miles are maintained by the Department of Highways and the remainder by the West Virginia Department of

Natural Resources. There is also a 200-yard rifle range with two bench rests in the Pleasant Creek Hunting Area. Five boat clubs, operated by local organizations under concession agreements entered into by such organizations or their representatives with the West Virginia Department of Natural Resources, are located along the south shoreline generally east of the mouth of Pleasant Creek. These concessions are granted on the basis that water-oriented recreational activity is to be offered by the concessionaire to the general public, without discrimination, including temporary docking and camping facilities. The clubs occupy areas under several ownerships, including portions of State-owned land (Public Hunting and Fishing Area) as well as adjoining private lands. Access to the shore is gained by crossing Federal land which has been leased to the State, corresponding for the most part to the maximum pool elevation of 1190 feet. The concession agreements permit only very limited constructions, such as tent platforms, and the operators of the clubs are under obligation to comply with all applicable health and safety standards. There are several private launching and docking facilities along the shore, some jointly serving a number of properties, and they are subject to regulation under the terms of the Lakeshore Management Plan which is prepared and administered by the Corps of Engineers.

SECTION 4.0 COORDINATION

4.1 INTRODUCTION. Since the major portion of the Federal land has been long committed to specific uses, during the preparation of this Master Plan continual contact was maintained with the West Virginia Department of Natural Resources due to their prime role as administrators of the recreation and wildlife resources. In addition, coordination was maintained with the West Virginia Office of Federal-State Relations and two Regional Planning and Development Councils which serve as state and local planning clearinghouses. Correspondence was also initiated with various Federal agencies soliciting their interest and participation in this effort, and although each Federal agency acknowledged the inquiry, they indicated their participation would be limited. Prior reports and findings such as the "Monongahela-Youghiogheny Basin Study", dated 15 April 1974, prepared by the BOR's Northeast regional office, and "Soil Survey of Barbour County", dated April 1968, prepared by the SCS, provide excellent background material. The Taylor County SCS agent furnished a report of soil characteristics within the Tygart Lake Zone in Taylor County.

4.2 STATE OF WEST VIRGINIA. The State of West Virginia has been involved in the development and management of Tygart Lake land and water areas beginning shortly after completion of construction of the dam in February 1938. In 1945, 1,732 acres of Federally owned property at Tygart were transferred to the West Virginia Conservation Commission (now the West Virginia Department of Natural Resources) in settlement of a claim for damages to West Virginia highways. This became the nucleus of the State Park and the first license for recreational development and fish and wildlife management of remaining project lands was granted to the West Virginia Conservation Commission in 1947. Currently, aside from the limited Corps facility in the immediate vicinity of the dam, project lands continue to be administered by the West Virginia Department of Natural Resources. A total of 1,453 acres of land and water is under lease for parks and recreation purposes, and 2,217 acres of land and water are licensed for fish and wildlife management. This updated Master Plan represents another step in the continued joint effort of the Corps of Engineers and the West Virginia Department of Natural Resources in the development, operation and management of Tygart Lake and has been thoroughly coordinated with the Divisions of the Department as outlined below.

4.2.1 Division of Parks and Recreation. This Division is responsible for the operation of Tygart Lake State Park. Continuing day to day coordination is maintained between Corps personnel and the State Park staff, and a joint meeting is held at least annually to discuss matters of mutual concern. The Division of Parks and Recreation has been actively involved in providing input toward preparation of this Master Plan through meetings held in the Departmental and Division offices in Charleston, field coordination meetings at Tygart Lake with the park superintendent and other Division representatives, and through correspondence and telephone contacts. In the course of these meetings and communications, comments and advice have been solicited and received.

4.2.2 Division of Wildlife Resources. Management of the fish and wildlife resources of the project falls under this Division along with day to day operation of the public use facilities within the Pleasant Creek Public Hunting and Fishing Area. The Division representative has been included in all significant field reviews and coordination meetings and has supplied vital input for this Master Plan not only during those meetings, but through several telephone contacts.

4.2.3 Division of Planning and Development. The majority of the existing recreation facilities at Tygart Lake have been planned, designed, and constructed under the direction of this Division. They have been the primary working contact during preparation of this Master Plan over a period of several months and have furnished very helpful counsel as well as many documents reflecting existing conditions and proposed improvements prepared by the Division staff and by consultants. Therefore, the plan of future development presented herein has been subjected to periodic reviews conducted throughout the study, and it represents a joint planning effort between the Corps and the West Virginia Department of Natural Resources (DNR). A letter concurring in the concepts of the Master Plan, from the Director of DNR to the District Engineer, is attached as EXHIBIT C. Also, a letter to the District Engineer indicating compliance with the Statewide Comprehensive Outdoor Recreation Plan, from the Director of the Outdoor Recreation Division (Office of the Governor, Federal State Relations), is attached as EXHIBIT D.

4.3 FEDERAL AGENCIES

4.3.1 National Park Service (NPS). The NPS has participated in prior reviews of project lands. This

agency joined with the Corps of Engineers and the earlier West Virginia Conservation Commission in making the first evaluation of the project area which led to the initial recommendations for enhancement of recreation resources. The NPS is currently administering a contract for an archeological survey within the project area as referred to in paragraph 3.3 and as detailed in EXHIBITS A and B of this Master Plan.

4.3.2 Bureau of Outdoor Recreation (BOR). This agency of the U.S. Department of the Interior responded by letter (EXHIBIT E of this report) in which they outlined their Cooperative Management Program. The letter made reference, also, to the matter of controlled releases from the reservoir for downstream recreation. Contrary to BOR understanding, there are no difficulties in making releases from Tygart because, as referred to in Section 2 of this Master Plan, precise releases are made throughout low rainfall periods to assure a minimum flow for navigation purposes. These releases have an incidental benefit for downstream recreation although there have been no specific requests for releases for activities such as canoeing. The Pittsburgh District, Corps of Engineers, makes such releases at the Youghiogheny River Lake for special events such as canoe races providing there is no effect on the primary hydrological function.

As to the BOR Cooperative Management Program, it is to be noted that the majority of project lands and water area has been transferred to the State of West Virginia, commencing in 1945, and that significant areas of land and water are under lease to the State, commencing in 1947, for recreation and fish and wildlife purposes.

4.3.3 U.S. Department of Agriculture, Soil Conservation Service (SCS). The SCS furnished soil survey data and general soil maps for Taylor and Barbour Counties in which Tygart Lake is located. Although proposed additions to or modifications of existing facilities, as set forth later in this Plan, do not require extensive new development over lands not previously used for recreation or for fish and wildlife purposes, the SCS information was thoroughly reviewed. It was determined that the nature and condition of the soils prevalent in all areas of proposed new development were not unfavorable for such development, including the proposed major acquisition of land for wildlife management and a smaller area for boat launching facilities.

4.3.4 U.S. Environmental Protection Agency (EPA). In a letter of 19 September 1975, the EPA furnished two reports of the chemical and biological survey conducted in 1968. No additional information has been recorded

pertinent to the lake, and no new surveys have been scheduled.

4.3.5 U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service, in conjunction with the West Virginia Department of Natural Resources Wildlife Resources Division, has made studies to determine the capacities of the lake and the project lands for the propagation of fish and game. At a meeting held in their regional office, a 1973 gill net report was reviewed. Among the suggestions contained in that report was one which called for increasing the length of launching ramps or raising the winter pool level, either of which would enhance winter pool access. However, this Master Plan proposes two means of gaining extended fishing opportunity, one involving lengthening the ramp at Scab Run to elevation 1070 which would provide access through mid-September of an average year (See TABLE 1 and PLATE 9). The other proposal, at West Hill (See PLATE 24), would furnish boat launching facilities throughout the year including access to the minimum conservation and sedimentation pool, elevation 1010 (See PLATE 2). Winter pool levels are determined by the primary purpose of the reservoir operation and, therefore, cannot be programmed to benefit incidental

uses such as extending fishing use. The U.S. Fish and Wildlife Service has recognized the Corps' efforts in the past years in retaining the summer pool as long as possible consistent with other project requirements.

SECTION 5.0 INFLUENCING AND CONSTRAINING FACTORS

5.1 GENERAL. Secondary uses, such as recreation and fish and wildlife management, have been important at Tygart Lake since completion of the impoundment in 1938. Topography and geology have continued to be primary factors in dictating the patterns of land use and recreation development for the project. Hydrology, climate and ecology have also exerted an influence on the overall project development and on the characteristics of its separate areas. To assure the capability of the project to safely accommodate visitors throughout its anticipated life, all of the above-mentioned factors, plus current social/cultural and economic factors, have been reexamined in preparation of this updated Master Plan.

5.2 DEMOGRAPHIC PROFILE. It is estimated and surveys have verified that approximately 80% of the day-use visitation originates within a 50 road mile radius of Tygart Lake. This area basically includes 11 West Virginia counties; specifically, those listed in TABLES 3 and 4 and shown on PLATE 1. For the purpose of further reference in this Master Plan the 11-county area will be designated as the Tygart Lake area. Within these 11 counties there are relatively few urbanized areas, the major population centers being Morgantown in Monongalia County, Clarksburg

TABLE 3
DEMOGRAPHIC CHARACTERISTICS OF THE DAY-USE MARKET AREA

	SOCIAL/CULTURAL FACTORS						ECONOMIC FACTORS (1970)		
	POPULATION		AGE		EDUCATION		Percent of civilian labor force unemployed	Median family income	Percent of families less than poverty level income
	Total 1970 Population	Percent change, (1960-1970)	Percent urban population (1970)	Percent 65 years old and over (1970)	Median age, years	Median number of school years completed (25 years old and over)			
WEST VIRGINIA	1,744,237	- 6.2%	39%	11.1%	30.0	10.6	5.1%	\$7,415	18.0%
<u>COUNTIES</u>									
BARBOUR	14,030	- 9.3	21.4	14.4	31.6	8.9	7.0	5,324	25.9
DODDRIDGE	6,389	- 8.3	0.0	16.5	33.3	8.8	6.9	5,896	23.4
HARRISON	73,028	- 6.2	47.7	13.1	30.1	12.0	4.8	7,717	13.2
LEWIS	17,847	- 9.5	41.1	16.6	30.7	8.9	5.0	5,919	22.4
MARION	61,356	- 3.7	46.7	13.1	30.7	11.7	3.7	7,807	12.6
MONONGALIA	63,714	+14.6	54.1	9.3	26.3	12.1	4.2	7,758	13.1
PRESTON	25,455	- 6.5	10.0	12.5	29.0	9.1	4.8	5,626	26.8
RANDOLPH	24,596	- 6.7	33.7	12.4	28.4	10.0	5.6	5,870	24.0
TAYLOR	13,878	- 7.5	47.5	15.0	28.9	10.2	6.1	6,644	18.9
TUCKER	7,447	- 3.9	0.0	14.4	30.2	9.6	4.2	5,243	24.9
UPSHUR	19,092	+ 4.4	37.9	12.9	29.4	10.0	5.8	6,228	23.8
TYGART LAKE AREA	326,832	-2.14	40.7	12.6	29.9	10.1	4.8	6,366	17.2

in Harrison County, and Fairmont in Marion County, as shown on PLATE 1. These three centers account for 25% of the total population of the Tygart Lake area. Urban population percentiles for all eleven counties are shown in TABLE 3. The Pittsburgh region is the only major urban population center which would exert any significant influence on project visitation. Although Pittsburgh lies outside the immediate Tygart Lake area, completion of Interstate 79 has reduced travel time from Pittsburgh to Tygart Lake and will contribute to some increase in overnight and weekend use by residents of that metropolitan region.

5.2.1 Social/Cultural Factors. Population in the Tygart Lake area decreased during the period between 1960 and 1970 by 2.14%. Monongalia and Upshur counties are the only counties which have recorded any growth in this period. An increase of 14.6% in Monongalia County is mainly attributed to Morgantown and the expansion of the nearby University of West Virginia. It is expected that Monongalia County will continue to grow at this rate through the year 2020. In Upshur County, which has grown by 4.4%, the increase is attributable to the recent amplification of coal mining activities and to the presence of West Virginia Wesleyan College. It is expected that Upshur County will also grow at a similar rate to the year 2020. Barbour, Doddridge, Lewis, Marion, Preston, Taylor and Tucker

TABLE 4

COUNTY POPULATIONS: HISTORICAL AND PROJECTED

COUNTY (W.VA.)	HISTORICAL		PROJECTED*				
	1960	1970	1980	1990	2000	2010	2020
BARBOUR	15,474	14,030	14,500	13,700	13,000	12,300	11,900
DODDRIDGE	6,970	6,389	6,300	5,700	4,900	4,600	4,400
HARRISON	77,856	73,028	78,800	81,300	80,400	80,600	80,400
LEWIS	19,711	17,847	18,700	18,600	17,900	17,500	17,400
MARION	63,717	61,356	66,300	68,000	67,700	67,700	67,600
MONONGALIA	55,617	63,714	74,300	81,900	87,900	90,600	92,700
PRESTON	27,233	25,455	27,100	27,100	26,400	26,300	26,200
RANDOLPH	26,349	24,596	26,200	26,300	26,000	25,600	25,300
TAYLOR	15,010	13,878	13,900	13,100	12,200	11,700	11,300
TUCKER	7,750	7,447	7,400	6,800	6,300	5,700	5,400
UPSHUR	18,292	19,092	21,500	22,900	23,800	24,300	24,700
TOTALS	333,979	326,832	355,000	365,400	366,500	366,900	367,300

*Source: Office of Business Economics and the Economic Research Service (OBERS)

counties are all projected to experience gradual decline in population through the year 2020 while Harrison County will increase in population to the year 2010 then slightly decline during the following ten years. Randolph County will tend to increase to 1990 and then will also fall into a pattern of decline through 2020. Overall, the Tygart Lake area is projected to increase in population from 326,832 in 1970 to 357,300 in 2020 for a net increase of 12.4%. There is no predicted change in the relative proportion of visitors who come to Tygart Lake from various localities within the 11 county area. Existing patterns of use are likely to remain quite steady although, should plans be adopted for the construction of the Stonewall Jackson or Rowlesburg Lakes, the Tygart Lake market area may be significantly affected. Historical and projected county population statistics are shown in TABLE 4.

TABLE 3 shows also that the median age is significantly lower in those counties with a higher percentage of urban population. This inherent characteristic of urbanization, due to the greater opportunities for employment and economic advancement available to youth is readily apparent in the Tygart Lake area. Opportunity for education is also enhanced in urban areas and this is reflected by the median number of school years completed by those over 25. The U.S. Bureau of Outdoor Recreation has found in past studies that a higher

rate of participation in outdoor recreation exists where 1) there is a greater degree of urbanization; 2) the age of the individual recreator is lower; and 3) there is a higher level of education. Of the three major urban centers, Morgantown, Fairmont and Clarksburg, which are in close proximity to Tygart Lake, only Morgantown has shown any significant growth in the last ten years. The median age of residents in the Tygart Lake area (29.9) is higher than the national median age (28.1), and the median number of school years completed (10.1) is lower than the national figure (10.9). Again, Morgantown in Monongalia County is exceptional in that the median age for that vicinity is 26.3, well below the national average, while education levels exceed normal secondary school years. The existence of the University contributes, of course, to both these statistics and although the student community cannot be regarded as permanently settled in Morgantown, as individuals, it is, nonetheless, a constant factor which remains much the same year after year. The above social and cultural profiles, combined with the projected modest increase in population, indicate that only slight adjustments for growth must be considered in future planning for Tygart Lake.

5.2.2 Economy. The primary area of influence, forming the basis of an economic structure in the Tygart Lake area,

is synonymous with the Upper Monongahela River Basin. Industries which have developed in the area tend toward heavy, primary industries associated with relatively easy river transportation for ores and other bulk material, such as coal. Initially, the mining industry demanded little skill and, therefore, afforded very low pay. However, unionization resulted in higher wages which, in turn, made mechanization more attractive and strip mining more prolific. Other industries having some bearing on the economic structure are agriculture and restrictive logging where the generally rugged topography and poor soils are not a prohibitive factor. Mountainside orchards and dairy farming utilize areas of lesser fertility. Customarily diverse business and professional interests prevail in urban centers. Refer to TABLE 3: Residents of the Tygart Lake area tend to fare better than residents of other parts of West Virginia in terms of unemployment and the percentage of families earning less than poverty level incomes. However, they are less well off when comparing median family incomes. Further comparison shows they have not experienced the same economic growth as neighboring Pennsylvania or the rest of the nation. In 1970, 17.2% of the families within this area were below the poverty level compared with a State average of 18.0%, a Pennsylvania average of 7.9%, and a national average of 10.7%. The unemployment rate for this area in 1970 was 4.8% compared to 5.1% for all of West Virginia, 3.7% for

Pennsylvania, and 4.4% for the nation. The median family income for this area was lower in all comparisons at \$6,366 per year versus \$7,415 for all of West Virginia, \$9,558 for Pennsylvania, and \$9,590 for the nation. Although family income levels are not on par with other areas there has been a continual growth in visitation to the Tygart Lake project since the Master Land Use Plan was prepared in 1954. Annual usage of the recreational facilities has increased 156% since that time, and took a great jump in 1975 over levels recorded in 1974. While possible reasons for this are somewhat speculative, it seems likely that due to higher unemployment more free time was available to nearby residents and, in light of generally poor economic conditions and concurrent inflation, "stay at home" vacations become more popular. Visitation is discussed in greater detail in the next paragraph of this section. The use of current trends, as a basis for planning, will remain valid as long as the future does not show any abrupt deviation. Since there are no indications that the socio-economic characteristics depicting the Tygart Lake area will be altered to any degree in the future, it is anticipated that the entire region will continue to grow at the same relative rate as the nation.

5.3 VISITATION.

5.3.1 Recent Attendance. Visitation for the year 1975 amounted to approximately 910,630 recreation days, an increase of 17% above the 1974 attendance. In 1974 an increase of only 3% above 1973 was experienced, more nearly reflecting patterns of the past several years, and, as discussed in the preceeding paragraph, 1975 seems to have been an unusual year. The monthly attendance percentages for the period of peak use during 1974 are as follows:

Mar.	Apr.	May	June	July	Aug.	Sept.	Total
3.2%	7.3%	12.8%	14.5%	19.9%	17.8%	7.2%	82.7%

5.3.2 Activity Participation. Sightseeing continues to be the top activity of the users of the project, attracting nearly three times the people who come to the park for picnics, which is the next highest use.

In descending order, comparing 1974 and 1975 records, the figures below are the percentages of participation in recreational activities afforded by Tygart Lake Park and the Pleasant Creek Public Hunting and Fishing Area.

Although overall attendance in 1975 is considered to be extraordinary by comparison with any previous year, usage of the various facilities remained remarkably constant.

Yet, in support of the "stay at home" vacation trend which is accountable to generally depressed economic conditions, certain low-cost uses are up in 1975 while those requiring slightly higher costs were less popular. As examples, sightseeing climbed by 3% or over 25,000 recreation days while boating and water-skiing dropped over 15,000 recreation days, collectively. Tent camping jumped 10,000 recreation days but cabin use showed a slight decline. Swimming use increased.

	<u>1974</u>	<u>1975</u>
Sightseeing	53%	56%
Picnicking	20.2%	20.7%
Swimming	14.6%	16.7%
Boating	12.8%	12.2%
Fishing	5.3%	6.0%
Water-skiing	5.3%	4.2%
Tent Camping	5.1%	6.2%
Hunting	3.4%	3.4%
Cabin Guests	1.8%	1.7%

5.3.3 Projected Attendance. An annual use of 920,000 recreation days is projected for 1980. This calculation is based on using ER 1120-2-403 Procedures for estimating recreation use. An expanded analysis of attendance is included in APPENDIX 'G' of this Master Plan. It is noteworthy to mention that the attendance is predicted to peak

in the year 1980 with a slight decline thereafter. This projection is based on the anticipated general decline in population of the market area (the 11 counties) excepting Monongalia, and a modest increase in Upshur.

5.4 TOPOGRAPHY. The most difficult obstacle to overcome in developing recreation facilities is the steepness of the side slopes of the valley that surround the lake. Tygart Valley is classified as being hilly to mountainous. Circulation roads follow curvilinear alignments reflecting the undulating character of the terrain. Recreational development generally occupies natural land benches sloping less than 15% due to the fact that in areas with a greater degree of slope, special design and construction techniques, frequently expensive, are required. As a result, facilities are spread over a wider stretch of the land and such physical separation tends to benefit activities which might otherwise conflict if they were in close proximity. As a consequence, the overall character of Tygart Lake suggests a spacious remoteness which enhances each facility and yet the immediate surroundings of any facility afford an excellent sense of human scale. The Park and the Public Hunting and Fishing Area offer splendid views which are encountered as visitors move along the roadways. The scenery is constantly changing and facilities are approached often by surprise, creating high interest. In this sense, the "obstacle" of

terrain becomes the key asset of the project and while it imposes some very real constraints on development of fully



Photo No. 3 General Topography Along Shore

adequate parking areas and "flat" recreation spaces; for example, the terrain accounts for the popularity of sightseeing and other uses. The cabin area affords vistas of the water and surrounding hills with only a hint of other structures and activity. The lodge commands a sweeping view as does the beach area. Separation, however, also requires longer stretches of roadway and imposes problems of utility distribution on the right bank. Traffic which must penetrate well into the Park and into the Pleasant Creek area is sometimes heavy but this and other minor negative impacts are more than offset by the natural beauty.



Photo No. 4 Severity of Access

Many of the slopes immediately adjacent to the shore are inaccessible and remain in their natural state, enhancing the rugged character of the Park, although significantly limiting the quantity of land available for intensive recreation. Few buildable "flat" areas remain within the State-leased or owned property, particularly along the right bank, and creation of any major new facilities would require acquisition of buildable land. The only such land in the vicinity of the project is far removed from the water and, thus, would not serve to increase the recreation potential for water-oriented programs. Indeed, it would be difficult, if not impossible, even to see the lake from some of these hilltops.

5.5 SOILS. Thin residual or colluvial soils lie within the lake shore and surrounding valley slopes although

some deposits of alluvial soil have been reported in the river bottom. The residual soils are normally thin but their thickness varies in areas where the underlying bedrock is easily decomposed and where chemical and mechanical weathering agents have ready and constant access to the rock strata. The colluvial soils generally occur on the steeper slopes. These soils tend to move downhill under the influence of gravity and/or flowing water, and commonly occur as wedges at the bases of the slopes. These slopes are potentially unstable if changes occur in the ground water system or the slope is disturbed. Overlying the sandstone bedrock, soils tend to be sandy with sandstone fragments occurring throughout and scattered over the surface. Where the bedrock is shale and claystone, the soils are clayey silts and silty clays with rock fragments. The soils which develop on the weak red claystones of the Conemaugh Formation are frequently subject to soil creep and slumps. These claystones erode easily and tend to become waterlogged because of low permeability which inhibits drainage. The rocks generally contain a plastic clay which, when saturated, makes these materials subject to sliding movements.

Data from publications of the Soil Conservation Service indicate the Dekalb very stoney loam and Gilpin-Dekalb very stoney complex are typical of the soils blanketing the upland areas, while the Holston silt loam and

Huntington silt loam are characteristic of the terraces and bottomland. These soils normally have low to moderate sensitivity to erosion. However, slope length, slope gradient and vegetative cover are other factors which affect a soils resistance to erosion. Care should be taken during any construction activity to prevent disturbance of natural slopes to minimize the possibility of landslides.

For example, when access roads are constructed in mountainous land where the stability of existing soils is questionable two diverse methods of design can be examined. The first method is to design the road with a minimum of soil testing and engineering and to use the least cost methods of construction. This produces a low initial cost road that will undoubtedly require maintenance and rebuilding because of subgrade disintegration and adverse drainage problems. The second method is to obtain extensive soils and drainage information and to design a roadway of high durability with extensive drainage provisions. This will result in a high initial cost but low maintenance cost. In many instances, the actual method of design may be somewhere between these two extremes.

Access roadways should be classified as to importance. Primary access roads should be designed for low risk and low maintenance because of the impact they have on the area

and facilities when they are out of service. Secondary access roads to lower use areas or personal use areas can be considered with a higher risk factor because of their minor impact on use when out of service.

Where access roads pass through areas designated as slide-prone, the design of the road must be engineered on a case-by-case basis. For the case where a proposed road passes below a potential slide, grading must be designed to prevent aggravation of the unstable slope above the road. The uphill slope can be improved by the installation of subsurface drains. Where a primary access road passes directly through a slide area, material must be removed down to firm, stable material and replaced with suitable backfill along with adequate drainage. Secondary access roads may sometimes be placed directly on the unstable area with the attendant maintenance being an acceptable alternative to achieve low initial cost. In all cases where underground drainage or seeps are uncovered, controlled positive drainage paths must be established.

5.5.1 Subsurface Phenomena. The ground conditions encountered in the field are the direct result of geologic and hydrologic processes operating on and within the earth. One of these processes related to impoundments is that of "bank storage" water which builds up during prolonged flood

periods. Overstressing of the soil occurs when the water recedes and the pressure of the stored water encourages slides in slide-prone areas. There are many methods and techniques for correcting and controlling land movement, but because no one method is universally applicable, each slide must be considered on the basis of its own individual character. Removal of stabilizing vegetative cover in and around observably slide-prone areas must be avoided. Manmade fills below flood pool are also susceptible to slumping or sliding if hydrostatic pressure is allowed to build up. Constructed fills, when unavoidable, must be held to a minimum and then sufficiently anchored and drained.

5.5.2 Permeability. Data from the Soil Conservation Service indicates that the Dekalb soils have a moderate to fast permeability while the Gilpin, Holston and Huntington soils are slow to moderate. Field studies and interviews at Tygart have shown that sewage leaching beds have not provided satisfactory service in many instances. This is attributed to one or more of three possible factors: 1) overloaded septic systems; 2) improperly constructed septic systems and; 3) local occurrences of fine-graded impermeable soils in the area. While there is a full range of soils surrounding Tygart Lake, the predominant condition is that of slow permeability which is the overriding cause of malfunctioning leaching beds. (See paragraph 7.8.1.)

5.5.3 Woodland Suitability. Dekalb, Culleoka and Gilpin soils are classified for woodland suitability groups 4 and 6. These soils are fair to excellent sites for hardwoods, but their productivity is strongly affected by aspect. North facing slopes have good potential, while slopes having a south aspect are only fairly productive. Potential for lumbering operations is severely limited due to the stoney character of the soil and the rugged terrain which restricts access for logging equipment but, in any case, this is not a factor in determination of land use at Tygart Lake. It is important to note that the steep slopes support very fine woodlands which must be regarded as high on the list of the natural characteristics which make the recreational facilities so attractive.

5.5.4 Soil Capability. The characteristics of soils found at Tygart Lake, as detailed in the preceding paragraphs, are such that the area lends itself more readily to wildlife management than to intensive recreational use. Even so, wildlife management is best accomplished by methods which do not require extensive cultivation of the stoney fields for crops or pasture. The open areas which do exist in the Pleasant Creek Public Hunting and Fishing Area will support shrub plantings to provide both cover and food for wildlife. Aside from the topographical constraints

mentioned in paragraph 5.4, the Dekalb and Gilpin soils themselves are not conducive to development of such facilities as athletic fields, heavily used trails and roads, high density camping, or any other intensive use. The limited depth to bedrock, coupled with the severity of the terrain and all the other soil factors, combine to render the entire Tygart Lake project somewhat fragile in nature, thus inhibiting expansion of recreation intensive facilities.

5.6 ACCESSIBILITY. A network of roads, including Interstate Highway I-79, U.S. Routes, State Highways, Local Roadways and Park Roads serves Tygart Lake. PLATES 1 and 4 show both regional and local routes which provide access for visitors from within the Tygart Lake Area and beyond. PLATE 1 extends well into the neighboring states of Ohio, Pennsylvania, Maryland, and Virginia and, at a smaller scale, shows the location of Tygart Lake in relation to the bordering state of Kentucky and the more remote states of Tennessee and North Carolina. This Master Plan addresses the key study element of accessibility from the immediate region and, of course, from the locality of the Lake.

5.6.1 Regional Access. Tygart Lake is located immediately south of Grafton, West Virginia which, in turn, is located at the Junction of U.S. 50, an east-west highway,

and U.S. 250, a northwest-southeast highway. Primary access to Grafton from the north or south is by Interstate 79, which recently has been completed between Pittsburgh, Pennsylvania and the Charleston, West Virginia area. The Interstate can be reached by U.S. 250 from Grafton to Fairmont for north-bound trips and from Grafton to Clarksburg on U.S. 50 for south-bound trips. The recent opening of Interstate 79 from Waynesburg, Pennsylvania to Morgantown, West Virginia and the proposed four-lane U.S. 48 from Cumberland, Maryland to Morgantown, West Virginia will make traveling to Tygart Lake from the north and east more desirable. Regional access including travel time from surrounding towns is summarized in TABLE 5, and somewhat more detailed, local mileages are presented in TABLE 6. In general, highway improvements are already completed and projected for the future which offer better access to Tygart Lake from more distant centers of population (Charleston and Morgantown in West Virginia; Cumberland, Maryland, and Pittsburgh, Pennsylvania) than in the past. While this might cause some slight increase in visitation to Tygart Lake by residents of these cities, the fact remains that these same highways serve, in a general sense, to open up access to a wide range of recreational opportunities for those persons, Tygart being only one. Local access is discussed in full detail in paragraph 5.6.3.

TABLE 5
HIGHWAY ACCESS TO TYGART LAKE

Origin City	Routes	Mileage	Average Speed (MPH)	Travel Time (Hr.)
CHARLESTON, W.VA. via Clarksburg	I-79	143	50	2.9
	U.S.50	26	30	.9
		169		3.8
PITTSBURGH, PA. via Fairmont	I-79	100	50	2.0
	U.S.50	25	30	.8
		125		2.8
PARKERSBURG, W.VA. via Clarksburg	U.S.50	81	50	1.6
	U.S.50	26	30	0.9
		107		2.5
CUMBERLAND, MD. (present)	U.S.220/U.S.50	101	30	3.4
CUMBERLAND, MD. (future)	U.S.48	70	50	1.4
	I-79	20	50	.4
	U.S.250	25	30	.8
		115		2.6
CUMBERLAND, MD. (future)	U.S.48	70	50	1.4
	U.S.119	30	30	1.0
		100		2.4
WHEELING, W.VA. via Fairmont	U.S.250	78	40	2.0
	U.S.250	25	30	.8
		103		2.8

5.6.2 Inventory of Road Conditions. The roads in the Tygart Lake Area have been classified according to surface type, pavement width, and average travel speed. Based on these classification parameters, each road was designated as either a principal highway, a local paved road, or a local unpaved road. TABLE 6 outlines all pertinent existing conditions which are shown, graphically, on PLATE 4.

TABLE 6
INVENTORY OF ROAD CONDITIONS, FEBRUARY 1975
TYGART LAKE AREA

ROUTE NO.	LENGTH OF SEGMENT	FEDERAL AID	SURFACE TYPE	SURFACE CONDITION	ROADWAY WIDTH	TRAVEL SPEED
PRINCIPAL HIGHWAYS						
U.S. 250	2.4 mi.	FAP (T)	Bituminous	Good	2-lane	30 MPH
U.S. 119	2.7 mi.	FAS (T)	Bituminous	Excellent	2-lane	45 MPH
U.S. 250-119	12.6 mi.	FAP (T)	Bituminous	Good	2-lane	40 MPH
U.S. 50	14.8 mi.	FAP (T)	Bituminous	Good	2-lane	40 MPH
W. Va. 92	13.2 mi.	FAS (F)	Bituminous	Good	2-lane	40 MPH
W. Va. 38	6.6 mi.	FAS (F)	Bituminous	Good	2-lane	40 MPH
LOCAL ROADS - TAYLOR COUNTY						
44	2.3 mi.	FAS	Bituminous	Fair	20 ft.	25 MPH
9/7 & 9/13 (Park Roads)	5.8 mi.		Bituminous	Excellent	20 ft.	25 MPH
9 from Grafton to Scab Run Rd.	3.1 mi.	FAS	Bituminous	Fair	20 ft.	30 MPH
9/7 Scab Run Rd.	1.1 mi.		Bituminous	Good	20 ft.	25 MPH
9 Scab Run Rd. to Knottsville	1.8 mi.	FAS	Bituminous	Fair	20 ft.	25 MPH
9 Knottsville to Rt. 52	1.6 mi.		Tar & Chips	Fair	16 ft.	20 MPH
9/1 from Lucretia to Park	1.8 mi.		Tar & Chips	Poor	16 ft.	20-10 MPH
9/8	1.7 mi.		Stone & Mud	Poor	14 ft.	15-10 MPH
48/1 from Rt. 48 to Rt. 9/8	0.9 mi.		Stone & Mud	Poor	14 ft.	15-10 MPH
48/1 from Rt. 9/8 to Lake	0.7 mi.		None	(Trail)	-	15-Walk
48, 46/5, 46	4.2 mi.		Some Bituminous, Some Gravel	Fair	16-20 ft.	20-25 MPH
48 from 46/5 to Lake	0.8 mi.		Mud	Poor	15 ft.	15 MPH
8 Delta Route	0.9 mi.		Stone & Mud	Poor	15 ft.	15 MPH
46/6	0.5 mi.		Mud	Poor	15 ft.	10 MPH
119/35	0.5 mi.		Some Gravel, Some Grass	Fair	16 ft.	15 MPH
10/12 (Barbour County) and 119/25 (Pleasant Creek Rd.)	2.0 mi.		Mud	Poor	16 ft.	15 MPH
42 (West Hill Rd.)	1.3 mi.		Gravel	Fair	16 ft.	15 MPH
42/2 (West Hill Rd.)	0.7 mi.		Mud	Poor	14 ft.	15 MPH
9 Delta Route (Pleasant Creek Area Campground Rd.)	0.4 mi.		Bituminous	Fair	18 ft.	15 MPH
LOCAL ROADS - BARBOUR COUNTY						
119/32 (Taylor County) and 10 (Pleasant Creek Rd.)	1.8 mi.	FAS	Tar & Chips	Fair	16 ft.	20 MPH
10 from Pleasant Creek Rd. to Clemtown	3.3 mi.		Mud, Some Gravel	Poor	16 ft.	15 MPH
10 from Clemtown to Moatsville	3.2 mi.		Tar & Chips	Fair	16 ft.	20 MPH
10 from Moatsville to W. Va. 92	1.1 mi.		Bituminous	Excellent	14 ft.	25 MPH
10/8 and 44/5 (Taylor County)	1.7 mi.		Mud	Poor	16 ft.	15 MPH
8	3.3 mi.		Mud	Poor	16 ft.	15 MPH
10/9	1.0 mi.		Mud	Poor	16 ft.	15 MPH
6 from 119-250 to Clemtown	5.7 mi.	FAS	Bituminous	Fair	16 ft.	25 MPH
6 North of Clemtown	0.9 mi.		Gravel, Mud	Poor	15 ft.	15 MPH
2 from W. Va. 92 to 2/3	1.8 mi.		Gravel	Fair	16 ft.	15 MPH
2 from 2/3 to Big Cove	1.4 mi.		Mud	Poor	16 ft.	10 MPH

KEY

FAP = Federal Aid Primary (T) = Trunk
FAS = Federal Aid Secondary (F) = Feeder

Principal highways are defined as roads with two full lanes of pavement separated by a painted divider. Their condition is rated either "good" or "excellent". Such roads can be travelled at 30 miles per hour or faster. Local paved roads are defined as roads 16-feet in width constructed of low content bituminous "tar and chips" pavement or, in some instances, of gravel. They are in "fair" to "good" condition and can be travelled at 20 to 30 miles per hour. Local unpaved roads are roads that have been graded to a width of 16-feet or less. Most of these roads were in a mud condition at the time of the survey in February. These roads may be described as "seasonal" roads because they can be used only when the weather is dry. Their condition in the winter is rated "poor" to "very poor", and the travel speed is less than 15 miles per hour.

5.6.3 Local Access. Most road alignment patterns around the Tygart Lake vicinity had been established prior to the construction of the impoundment. Road relocation in areas where inundation occurs was accomplished through damage settlement claims agreed to by the Corps of Engineers and the State of West Virginia. Succeeding years brought general upgrading of certain roads by county and state agencies based on the need determined by intercommunity travel rather than for providing improvements of access to

the project. The project will continue to have a limited influence on future operation and development of this network. The incidental use of the road system for recreation access is not a critical element. On the other hand, lack of ideally adequate circulation reduces the number of visits and use of the project facilities. It is impossible to travel from one bank to another without having to drive a great distance around or through Grafton and other communities. Since the major, intensive recreation facilities are established on the right bank, in the State Park, visitors coming from the west have to endure less desirable access than those approaching from the east.

5.6.3.1 Main Park Entry. The present public facilities on the right bank are accessible from Grafton by two routes. County Route 44 parallels the Tygart Valley River to the dam site. This road is paved with a twenty-foot wide bituminous surface. The segment of the road just south of Grafton is not suitable for two-way traffic flow, especially cars towing boats or other trailers or for recreation vehicles because, normally, automobiles are parked on the roadway, reducing traffic to one very narrow lane. This condition is apparent in Photo No. 5.



Photo No. 5 Route 44

The better access road for recreational vehicles is County Route 9 and Scab Run Road. Even though Route 9 provides better road conditions, it still is desirable to maintain the identity of Route 44 as the main entrance due to its direct relationship to the Federal Area. First-time visitors gain a much better introduction to the entire project at this location than can be had anywhere else on the right bank. The view of the dam and lake which is seen from this vantage point is far superior as an introduction to Tygart Lake than any view found at other access points. The Federal Area, being at the extreme north end of the project, affords the best overall orientation for the greatest number of visitors.

5.6.3.2 Secondary Access. Alternate access route 9/1, 48/1, Delta 8, and 46/6, although not part of the interior park road circulation, do permit access to the shoreline and recreation facilities of the right bank. These routes are considered seasonal. Road surfaces are usually 14-to 16-feet wide, mud and gravel, and normally are unused during the winter.

5.6.3.3 Left Bank Access. The County access roads on the left bank leading to the area between Lick Run and Pleasant Creek, used primarily by the boat clubs, are in very poor condition. Routes 8, 6 and 10-8 from Cunningham Run Road are less than 16-feet wide, are gravel or unpaved roads, have no shoulders, and are on generally steep grades. These roads are passable during the summer as evidenced by the presence of a number of small to medium-sized house trailers perched upon the hillsides which are used as vacation or hunting cabins. One spur terminates as a boat launch to Shaw Run, as seen in Photo No. 6. Parking is haphazard, causing degradation of the surrounding soil by compaction, resulting in some minor siltation problems.



Photo No. 6 Shaw Run Launch Ramp

5.6.3.4 Pleasant Creek Road. This affords the best access to public hunting and fishing area facilities on the left bank and consists of County Route 10, leading off Route 119-250, plus a stretch of park road extending to the water. Up to the point where Route 10 veers sharply to the right and heads toward Clemtown it is paved to a 16-foot width with "tar and chips" and is regarded as being fair to good in quality. The park road, up to the entrance to the camping area, is similarly paved. There is a short, wooden, one-lane bridge on Pleasant Creek Road which, due to the relatively low traffic volume which is expected, is not considered a severe bottleneck. On occasion, however, Pleasant Creek road is inundated; a water-level of approximately elevation 1120 (26-feet above summer pool) places the park road under water just beyond where it ties with Route 10.

Such an interruption of access, which can occur quite suddenly, has a potentially serious effect on the use of camping facilities in the Public Hunting and Fishing area. Besides prohibiting uses which might continue even during short periods of high water, the closing of access might have severe consequences should any health emergency arise. This Master Plan addresses the need for alternative access to the area in Section 7.

5.6.3.5 West Hill Road. An access road extending from Routes 119-250 known as Route 52 and 42/2 is presently being used for several private houses. The road is a 16-foot wide gravel cartway turning into a 14-foot wide unpaved surface that extends to the water edge and to an unpaved launch area. A view of the area is shown below.

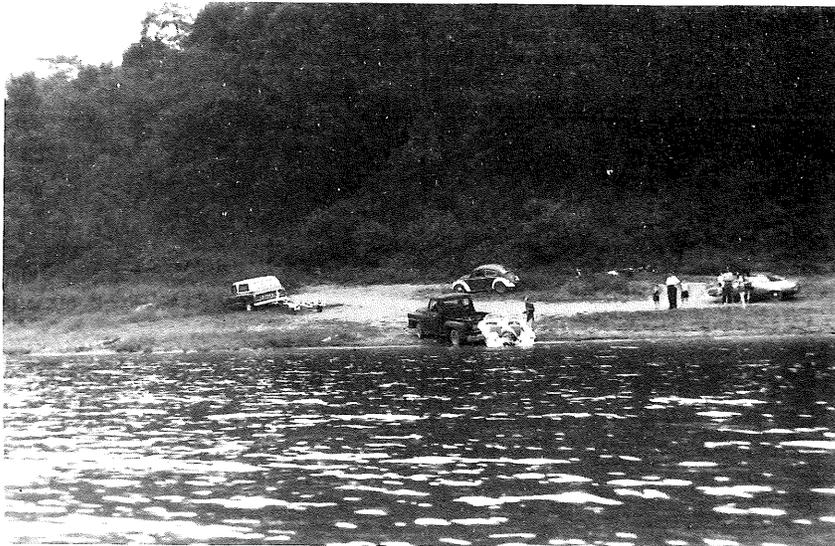


Photo No. 7 West Hill Launch Ramp

5.6.3.6 County Road 119-35. An access road extending from Routes 119-250, known as County Road 119-35, is presently used as access for several private houses. The road is a 16-foot wide gravel surface terminating at the shore with a small concrete launch ramp. There is very little parking space available at this area.

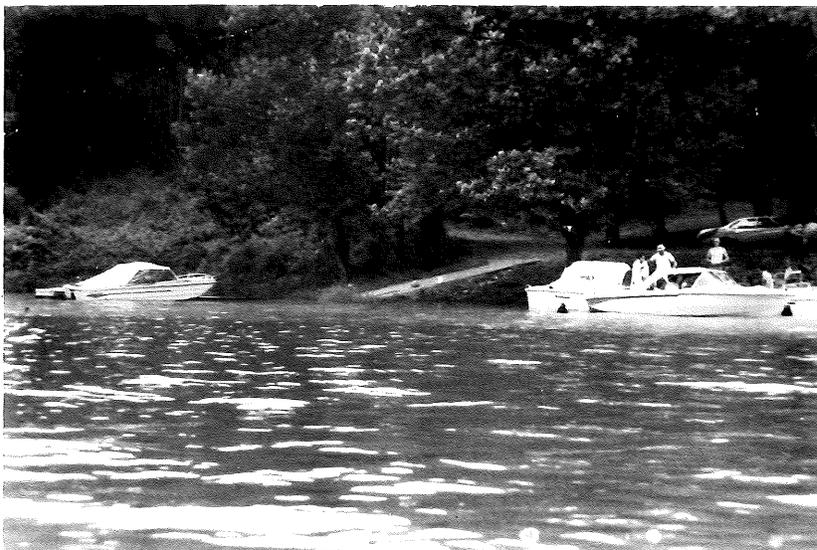


Photo No. 8 Private Launch Ramp at Route 119-35

5.6.4 Interior Roads. The road system within Tygart Lake State Park, Routes 9/7 and 9/13, is generally in excellent condition and well maintained. These roads are not meant for high-speed travel (over 25 m.p.h.) and there are several locations which are outstanding for sightseeing and photography. Gravel pull-off places are provided for

those purposes and the berms, shoulders, swales and ditches are generally acceptable, considering the rough terrain. Although there is occasional minor erosion, none of these problems are considered grave enough to warrant more than normal maintenance procedures and, therefore, they are not specifically addressed in this Master Plan. The entrance road from Route 44 is bordered on both sides by private land just outside the park boundary. In consideration of its prominent location, it is recommended that this roadside be acquired by the State of West Virginia and set aside as a buffer to preserve the integrity of the adjacent recreation area. The land in question is considered to be capable of supporting private development, although it is steeply sloping.

5.7 RESERVOIR OPERATIONS. Reservoir operations are conducted to provide optimum enhancement of recreation and fish and wildlife uses of the project consistent with the authorized project purposes; however, recreation and fish and wildlife development have been planned within the constraints imposed by normal reservoir operations.

5.7.1 Storage Depletion. Rapid depletion of usable storage in the lake is a dominant factor in recreation planning. Drawdown during the peak recreation season is

dependent on the demand for release of storage for low-flow augmentation relative to the amount of run-off experienced in the basin. Drawdown curves, shown in TABLE 1, indicate that during a normal year the summer pool elevation of 1094 can be maintained past mid-July. Toward the end of August, approximately 10-feet of pool elevation is lost, moderately reducing the usable water surface. However, during a dry year, increased demand for water releases to provide minimum flow in the rivers does accelerate drawdown and this severely affects recreational activities, commencing early in September. By the end of October, even in a wet year, the water level has dropped over 30-feet reducing use of the lake to almost zero. During the 1972, 1973, and 1974 Memorial Day to Labor Day seasons, usable storage was maintained near the normal recreation pool level which resulted in a favorable increase in water-oriented recreational opportunities. Monitoring agencies also noted modest increases in fish population and waterfowl activity during these seasons. Onshore recreation facilities experience sometimes troublesome problems related to pool fluctuations. Storage depletion, as discussed above, creates mud flats which detract from the aesthetics of the shore and reduce recreation potential. On the other hand, flood control storage can inundate access routes and, sometimes, facilities themselves. There are no remedies for these situations, given the continued operation of the project for its authorized purposes.

5.8 WATER QUALITY

5.8.1 Acidity. Studies indicate that water quality has improved and acid levels have decreased in Tygart Lake during the preceeding ten year period. An August 1968 chemical survey of the lake by the Federal Water Pollution Control Administration noted pH values ranging from approximately 4.0 in the epilimnion to 5.5 in the hypolimnion and average lake effluent values of pH 5.0. August 1974 Pittsburgh District Field Data indicated average pH values at six sampling sites ranged from 6.4 in the epilimnion to 6.1 in the hypolimnion and a lake effluent value of pH 6.4. During the entire monitoring period in the summer of 1975, pH values at the lake sampling sites averaged 6.4 in the epilimnion and 6.2 in the hypolimnion. The water quality of Tygart Lake is affected primarily by incoming acid mine drainage originating from tributary streams along the upper Tygart River, yet, pH in the lake is lower than might be expected due to the natural alkalinity of those same streams despite the fact that soils in much of the drainage basin are lacking in alkaline material. However, a delicate balance prevails. Only a small amount of acidity can be added to the very soft water in this area before the natural chemical balance of these streams is upset. During the period 1970-75 the pH at the outflow ranged from a low of 4.4 on 25 January 1971 to a high of

7.7 on 27 August 1973 (Pittsburgh District Field Data).

During the spring and summer months, operation of the sluice gates at the dam draws water from the more dilute, cooler waters of the deep strata hypolimnion which have remained relatively constant in character since the spring runoff period. For this reason, water quality downstream from the lake is improved and less subject to periodic severe stress from high concentrations of pollutants, due to the moderating or diluting effect of the lake. The waters of the lake are moderately soft as a result of sulfate rather than carbonate hardness. In the past, acid mine wastes have somewhat restricted the recreational use of the lake, limiting the fishery to some extent and making primary contact recreation such as swimming and water skiing less desirable than in lakes with higher pH levels. However, water quality improvements over the last ten years have enhanced the recreational and fishery use of the lake. EPA Region III, Wheeling Field Office, Work Document No. 48 predicts that water quality in the initial 69 mile reach of the Tygart Valley River which includes Tygart Lake, will meet all the required standards for secondary recreation and warm water fishery by 1983. Current water quality trends in Tygart Lake indicate that most of these standards have already been achieved and that standards approaching primary recreation and warm water fishery are likely in the future.

5.8.2 Erosion and Siltation. These factors are not considered overriding problems. Organic enrichment and siltation of the lake bottom is due, in part, to an influx of organic materials from the upper basin, carried into the lake by influent streams. These materials, transported by stream currents, deposit on the lake bottom as the velocity of the current is reduced. The fluctuations in velocity and flow rates of the incoming streams causes a differential in penetration distance of deposition. The character of the lake bottom and manipulation of the water levels cause the deposition of organic materials and other suspended matter to be greatest in the deeper parts of the lake. When water levels are dropped for flood control and low flow augmentation, the shallow portions of the lake bed are exposed and subsequent runoff tends to flush accumulated sediment into the deeper pools. The former relatively low pH levels in Tygart Lake suppressed microbial degradation of organic materials and inhibited organic breakdown, thus causing a higher rate of organically enriched sediment accumulation in the past than would have normally occurred in a lake with higher pH levels. The current decreasing acidity levels in the lake will permit increased degradation of organic materials in the upper strata sediments, a lower rate of organically enriched sediment accumulation, and a probable resultant increase in lake nutrient levels.

5.8.3 Biological Considerations. The biological community of the lake reflects the water quality improvements which have occurred during the preceding ten-year period. Findings of an August 1968 Biological Survey of Tygart Lake by the Federal Water Pollution Control Administration revealed that the phytoplankton community in the lake was limited to 12 acid tolerant species in low numbers. The sparse phytoplankton community in conjunction with the high acid levels in the lake in turn limited the dependent populations of zooplankton and other aquatic organisms. A noted improvement and increase in the phytoplankton community is reflected in 1973 and 1974 Corps of Engineers field data. Phytoplankton taxa observed in Tygart Lake during this period included over 80 species of which several are acid intolerant indicators of moderately good water quality. This improved phytoplankton community has, in turn, increased the productivity of the lake as well as greatly increasing the base of the food web of the aquatic community.

5.8.4 Summary. The implementation of the proposed updated master land use plan will have little, if any, impact on the water quality of the lake. Increased usage of the area for recreation, accompanied by improvements in sewage collection and tertiary treatment, will not substantially increase nutrient levels in the lake. Replacement

of the larger septic sewage systems with a tertiary treatment plant will, in fact, reduce the present direct nutrient loading of the lake. Continued mitigation of upstream acid mine drainage inflow would, of course, further enhance the fisheries and wildlife aspect and further increase the contact recreational and boating value of Tygart Lake.

5.9 EXISTING DEVELOPMENT. As mentioned in paragraph 5.1, secondary project uses for recreational purposes have been key factors in development of Tygart Lake from the very beginning. Early decisions as to what kind of facilities should be included were obviously well founded, as evidenced by the popularity of both the State Park and the Pleasant Creek Public Hunting and Fishing Area. Decisions as to size and location of the facilities have been proven equally well founded in light of projections made at the time, and in consideration of the physical constraints which applied then, as well as now. In only one or two instances, not warranting specific mention, there is some evidence of a slight compromise in the siting of a facility. Overall, little fault can be found with the existing development and, certainly, this Master Plan suggests no significant alteration of established land uses or management practices. Concurrently with this study, the West Virginia Department of Natural Resources is in process of making improvements at Tygart Lake State Park and at the Pleasant Creek Public Hunting and Fishing Area. Those additions

include restrooms in both areas, a launch ramp at the Marina, expansion of camping facilities at Pleasant Creek, a proposed enlargement of the Lodge and the building of more cabins. This Master Plan endorses the additions and reflects them in its conclusions. Certain administrative and management procedures were in transition at the time this study was undertaken. Enforcement of provisions contained in concession agreements was being renewed. These cooperative measures by the Corps of Engineers and the West Virginia Department of Natural Resources have had a very positive influence on this Master Plan. The net result of holding to established patterns of land use and recreational zoning, as discussed in somewhat greater detail in Section 7, and as shown on PLATE 3, is that of providing orderly means of accommodating modest increases in demand. Only two exceptions are taken to present uses; relocation of right bank camping in favor of expansion of the cabin complex, and ultimate reallocation of lands now occupied by the boat clubs concessions. Both these matters are discussed in this Master Plan.

SECTION 6.0 PLANNING CONSIDERATIONS

6.1 GENERAL. The recreational resources of Tygart Lake serve a wide range of public needs: vacation cabins and the lodge, camping, hunting, fishing, boating, swimming, picnicking, and just sightseeing. There are opportunities for hiking, birdwatching, nature study, and all forms of passive recreation as well. Each facility of the project is used extensively and, except for the marina area and some parts of the boat club concession areas, is generally well maintained. As a consequence of several influences, there has been a progressively increasing demand for recreational facilities and to satisfy these needs, further development must be undertaken. Such development is proposed by this Master Plan founded on the premise that upgrading and expansion of existing facilities, based on demand, is the best method of meeting demand. Lastly, certain strategic locations are suggested for acquisition by the State of West Virginia to provide better access and to furnish buffers for specific areas.

6.2 ACTIVITIES. Prior to this section, the Master Plan has presented a general inventory of planning considerations which have influenced the overall development of the Tygart Lake project. This section will deal with a more

specific and detailed presentation of activities provided for by this Master Plan. Future development of proposed and existing areas is based on an estimate of annual capacity, weekend peaking, and the expected distribution of use of the several recreational activities offered in the State Park area and in the Pleasant Creek Public Hunting and Fishing Area. It has also been recognized that certain use patterns are well established and to a great extent they have influenced proposed land use. Activities considered for future development are, for the most part, activities which have been determined to be in demand for the project area.

6.2.1 Boating. Based on present use, power boating on Tygart Lake has become a major recreation function. However, it has been determined that boating must be constrained by applying a ratio of acres per boat in order that a practical capacity will not be exceeded. (See Upper Bound on Boaters calculation, APPENDIX G, p. G-15.) Boating activities are further constrained by the master zoning plan (see PLATE 3). This is not meant to deter boating, but to reorganize it in relationship to other water-oriented activities. As part of this reorganization it is proposed that present and future demands be met by the construction of certain auxiliary supportive facilities.

This would include launch areas, parking areas for cars and cars with trailers, a marina, concession building, and restrooms, all intended to furnish improved facilities while at the same time providing somewhat increased capacities.

6.2.2 Swimming. A beach, sunning area, and a bath-house with restrooms and facilities for dressing has been in operation at Tygart Lake since 1954. The facility is capable of accommodating 1,400 people at one time although the anticipated peak use demand is only 1,280 (see APPENDIX G, p. G-18). By virtue of its projected adequacy, improvements or expansions are not recommended for this facility.

6.2.3 Camping, Cabin. Ten cabins, operated by the State, now provide visitors the opportunity for extended vacation use. A total of 26 units is provided by the proposed plan, 20 short of projected demand. (See APPENDIX G, p. G-17.) However, the high cost of development of an additional cabin area at any other location, especially in proportion to the overall number of people that would be served, rules out additional cabin development beyond the proposed 16 units. (Refer to paragraph 7.4.6.) The existing lodge and its proposed additions, as discussed in paragraph 7.4.1, may be considered as fulfilling the remaining deficit of projected demand for overnight use.

6.2.4 Camping, Tent/Trailer. At present, there are 65 tent/trailer sites located throughout the Tygart Lake project area. Ultimately, it is planned that all tent/trailer sites be relocated to the Pleasant Creek area and increased to 137 sites just short of demand. (See APPENDIX G, p. G-17.) Auxiliary facilities to be included in the camping areas are restrooms, sanitary disposal station and hand pump water wells.

6.2.5 Picnicking. Of the 192 picnic tables projected to satisfy user demand (see APPENDIX G, p. G-18), 14 are provided in the Federal Area and 78 in the three State Park picnic areas. A deficit of 100 tables indicates that some consideration should be given toward the expansion of this very popular activity. Picnic shelters, lawn picnicking, play fields, or major parking areas should not be considered due to the severe terrain and adverse soil conditions.

6.2.6 Hunting. This activity is very compatible with the less refined rugged and "remote" character of the Pleasant Creek area of the project. Improved access and parking facilities for hunters have been included as part of this plan.

6.2.7 Fishing. Fishing is an extremely popular activity at Tygart Lake and it promises to improve in the years ahead. Additional boat and shoreline access for fishermen has been considered as well as extension of a launching ramp to provide access to the winter pool.

6.2.8 Sightseeing. A review of activity participation at Tygart Lake during 1975 shows that 56% of the total visitation was considered to be made up of sightseers. However, a large portion of sightseers also participate in one or more other day-use activities such as picnicking and swimming. The only formally developed area for sightseeing is at the overlook above the dam, where facilities such as parking and a concession are specifically provided by the Corps of Engineers for sightseers. Other than this area, no special provisions have been or need be made for sightseers who will generally benefit from the facilities provided for other activities.

6.3 DESIGN CRITERIA. Proposed recreational facilities within the Tygart Lake project have been planned in conformance with accepted Recreation Planning and Design Criteria as provided by Appendix A of Engineer Manual 1110-2-400. All criteria used have been abstracted from that reference, unless deviations have been warranted, in which case explanation is presented. The design criteria presented

relates to boating, swimming, camping (both cabin and tent/trailer), picnicking and supplemental facilities.

6.3.1 Boating. The extent and number of facilities to be developed for boating activities are directly related to the Design Day Load, as detailed in APPENDIX G of this Master Plan.

6.3.1.1 Marina. A marina will be developed to provide an adequate, safe and dependable boat basin for access and moorage space. Floating boat dockage and a marine service station will be constructed under an approved development and operation plan. Boat dockage systems will be a combination of metal frame and concrete decking with styrofoam or polyurethane flotation, or equal. Otherwise, the design and construction of the marina and its associated lighting system will be as specified in the National Fire Protection Association (NFPA) Code 303.

6.3.1.2 Concession Complex. A concession area will be provided as a contiguous backup to the marina. In order to achieve a close relationship to the normal water level, structures will be constructed of materials capable of inundation in event flood storage becomes necessary. The food service trailer, located below possible flood levels, will be

mobile and capable of removal to safe storage above the maximum flood pool at elevation 1190. The complex will thus provide the concessionaire with control and will allow service to boat dockage users as well as to sightseers.

6.3.1.3 Fuel Dispensing System. Fuel dispensing units shall in all cases be at least 25 feet from any activity not associated with fuel handling and as otherwise specified in the National Fire Protection Association (NEPA) Code 303. The fuel storage tank is proposed for location at the upper parking lot, near elevation 1175 which is above the reservoir full pool elevation. The pipe line is to be buried between the tank and the abutment of the dock access ramp at which point it couples securely to a flexible line out to the service building. No fuel leakage should occur in event of inundation of the marina complex.

6.3.1.4 Restrooms. The restroom structure in the marina area will be designed to withstand inundation without damage. Since the expected level of use is more than 50,000 recreation days annually, waterborne (men-women) restrooms will be provided.

6.3.1.5 Water Supply at Marina. The amount of water to be provided where flush-type restrooms are used is 1.5 gallons per day per expected user.

6.3.1.6 Parking. Parking areas at the marina will be surfaced with bituminous pavement. Car-trailer spaces will be 10-foot by 35-foot for 45 degree angle parking with 25-foot width aisles or access lanes, provided at the rate of 25 spaces per ramp having 40 boat launchings per normal summer weekend day. Car parking spaces will be 10-foot by 20-foot with 20-foot width aisles, at the rate of one per boat slip.

6.3.1.7 Boat Launching Ramps. Boat launching ramps will be provided in accordance with facility computations based on the Design Day Load. The ramps will consist of reinforced concrete with a minimum 12% slope and a maximum 16% slope. The width of lanes will be 12- to 14-feet or multiples thereof. Where boat channel dredging is required, a minimum bottom surface width of 24-feet will be maintained. Ramp lengths will vary as required.

6.3.1.8 Courtesy Piers. A courtesy pier will be provided at all boat launching ramps. Courtesy piers should be constructed so that adjustments can be made as required by water fluctuation. Shown on PLATE 24 is a self-adjusting pier suggested for use at Tygart Lake.

6.3.2 Swimming. The extent to which the elements of a swimming complex are to be developed are contingent upon the Design Day Load. It is assumed that 60% of the total number

of bathers at any given moment will be on the beach at one time, 30% in the water, and 10% elsewhere. The turnover factor is 2.

6.3.2.1 Beach Area. Fifty square feet of sand or turf, singly or combined, will be provided per person for sunbathing. The beach area will be separated from parking areas with a vegetative buffer.

6.3.2.2 Water Area. Thirty square feet of swimming area inside a buoyed safety zone will be provided per person. Underwater areas are to be graded to a maximum four to five percent slope.

6.3.2.3 Bathhouse. A bathhouse will be provided for each swimming area with an expected peak attendance of more than 600 swimmers on a normal summer weekend day. Clothes basket storage and concession services may be provided and operated by other than Corps of Engineers personnel. Showers, water closets and urinals may be installed.

6.3.2.4 Water Supply. A well or other water supply system must be provided to supply 13 gallons per user per day where waterborne restrooms and showers are part of development. The facility is to be constructed in accordance with State public health regulations.

6.3.2.5 Restrooms. Waterborne restrooms will be provided at each beach area with an expected attendance of 600 or more swimmers per peak visitor day-use. The facility is to be constructed in accordance with State public health regulations.

6.3.2.6 Parking. Parking areas will be required within walking distance of the beach (500-feet maximum). The amount of parking to be provided will be determined by applying a car load factor of 3.4 persons to the number of swimmers expected on a peak visitor day. Car parking spaces will be 10-foot by 20-foot with 20-foot width aisles.

6.3.3 Camping/Tent/Trailer. Tent/trailer camping spaces will be provided at the rate of one per four individual campers expected on the design day. The density of spaces should not exceed 5 per acre. Clear, grade, reseed and provide an appropriately paved parking surface, and place a sign clearly showing a number for each campsite as required. A campsite, approximately 15-feet by 15-feet (nominal size), should be a complete unit to accommodate one family, including a picnic table, a charcoal grill, refuse container, parking pad for vehicle and trailer and landscaping. Preferable distance between campsites is 75-feet center to center, adjusted to fit the terrain and to cause a minimum

amount of disturbance to forest and other vegetative cover.

6.3.3.1 Water Supply. A minimum of one well with hand pump for each 25 campsites will be furnished. A hand pump will be placed within 50-feet of the nearest campsite and not more than 300-feet from the farthest, where practical. An alternative central water supply system will be evaluated during the detailed design stage. This system will consist of a centralized well or wells and a pressure distribution system. A minimum of one self-closing tap and spigot will be furnished for each eight camping spaces. Where practical, spigots will be placed not more than 150-feet from the farthest space. Five gallons of water per user per day will be provided under either system. Water supply will be provided in accordance with State public health regulations.

6.3.3.2 Restrooms. Chemical vault-type restrooms will be provided for reasons of economical development in areas where water supply and central sanitary systems would be costly. One double chemical vault-type restroom will be provided for each five to ten camping spaces. Where practical, facilities will be sited not more than 300-feet from the farthest campsite. All facilities will be constructed in accordance with State public health regulations.

6.3.3.3 Sanitary Disposal Station. For each camping area of 50-200 spaces, one sanitary disposal station will be provided, constructed to conform with public health laws, including a water flushing device.

6.3.3.4 Parking. Each camping space will be provided with one car or one car and trailer parking space 10-foot x 20-foot or 20-foot x 20-foot or 10-foot x 40-foot minimum, with a 10-foot wide road turn-in or loop road.

6.3.4 Picnicking. The amount of picnicking to be provided will be based on the Design Day Load. Each picnic area is to include 10 or more tables with fireplaces or adjustable charcoal grills and refuse containers. The maximum slope for picnic areas should not exceed 10 percent.

6.3.4.1 Tables. Tables may be of masonry, wood, metal or a combination of these materials, preferably on a concrete wearing pad. A density of not more than 12 tables per acre will be used. It should also be considered that a group of picnickers may require more than one table. To accommodate such a group, two tables or more may be placed together where site conditions permit.

6.3.4.2 Fireplaces. Fireplaces or adjustable charcoal grills will be furnished at a ratio of 1 per 2 picnic tables.

6.3.4.3 Refuse Containers. One container will be furnished for each two to five tables or as may be deemed sufficient for normal summer weekend day use.

6.3.4.4 Water Supply. Each picnic area will be furnished with one well or other water supply with one tap or spigot or multiple spigot. Two gallons of water per user per day will be furnished where waterborne restrooms are not part of the development. Water tap unit or well spacing will be 400-feet minimum unless restricted by terrain. Spigots and wells will be constructed in accordance with State public health regulations.

6.3.4.5 Restrooms. Waterborne (men-women) restrooms will be provided in picnic areas with an expected annual use of 50,000 or greater recreation days. Each such restroom will contain four water closets and two lavatories for women; two water closets, two urinals and two lavatories for men. Restrooms will be sited at 100-feet minimum distance from the nearest table and not farther than an approximate radius of 600-feet of picnic units. Facilities shall be constructed in accordance with State public health regulations.

6.3.4.6 Parking. A minimum of one parking space (10-foot x 20-foot) will be provided for each picnic table. Parking areas will be surfaced with bituminous pavement at permanent picnic areas.

6.3.5 Roads. Roads will be provided for access to, and circulation or service within, developed areas. The degree of steepness of cut and filled slopes shall be varied in relation to the depth of the cut and the stability of the soil in any given location. Tops and bottoms of cuts and fills should be rounded with short radius curves and attention will be required to assure minimum clearing and maximum preservation of vegetation. Following are the standards for determining recreation roadway design throughout the Tygart Lake project:

Road Type	Pavement Width	Maximum Grade (%)	Design Speed (MPH)	Minimum Shoulder Width (Ft.)	Minimum Radius (Ft.)
Circulation	18	12	30	2	150
Camp Area	10	12	20	2	50

Typical road sections are shown on PLATE 25.

6.3.5.1 Pavements. All roads and parking areas on the Right Bank will be constructed of 6-inches of crushed aggregate or gravel base material, 4-inches of bituminous concrete and a 1-1/2-inch layer of bituminous wearing course. All roads and parking areas on the Left Bank will be constructed of 4-inches of crushed aggregate and a 2-1/2-inch layer of a tar and chip wearing course.

6.3.6 Architecture. Future development planning requires that certain structural elements must be considered and the following discussion outlines criteria to be applied to the design of proposed project buildings to assure consistency of character.

6.3.6.1 Design Criteria. The design of future project structures should show a relationship to their functions, reflecting a meaningful and logical concept based upon the environment of the area being developed. Structures should also show a relationship to other existing and proposed facilities as suggested by the Master Plan and should be constructed in such a manner as to withstand public use and vandalism and to be maintenance free to the extent feasible. Structures that are similar in nature should be standardized in design by detail and materials and should provide for use by the handicapped where possible.

6.3.6.2 Building Types. Several building types have been proposed for future construction by this Master Plan. Following is a brief description of each structure.

6.3.6.2.1 Lodge. The present facility offers 20 rooms for overnight or extended vacationing guests and includes a restaurant. This Master Plan proposes the

addition of six rooms, three to each wing, which may be accomplished without altering the overall esthetics and functioning of the lodge complex. The style of the existing architecture and materials are to be duplicated. Expanding the complex beyond this limit would require a major restructuring of the building, parking, topography and service components and, therefore, it is recommended that 26 rooms be considered maximum. Shown on PLATES 7 and 8 are site and architectural plans of the existing lodge and proposed additions.

6.3.6.2.2 Marina Concession. The concession area is planned to contain two separate shelters. One structure is designated for use as a covered snack area, while the other would accommodate a portable food preparation unit contained in a trailer having water and electrical connections. PLATES 9 through 14 illustrate the proposed layout and design. After seasonal use or in the event of potential inundation, the trailer could be moved for safe storage above the maximum flood pool. Since there is the possibility of inundation under conditions of flood storage concrete is to be used for the two shelters.

6.3.6.2.3 Marina Restrooms. The restroom facility proposed as part of the marina complex should take

on the same design characteristics as the concession shelters. The exterior walls are to be cast-in-place concrete, internal walls concrete block, and the roof system is to consist of concrete and precast concrete louvers. The facility would provide three urinals, two toilets, and three lavatories for men and five toilets and three lavatories for women. The building is designed to create an open air atmosphere and is self-ventilating. See PLATE 15.

6.3.6.2.4 Flush-Type Restrooms. There are two restrooms being constructed by the West Virginia Department of Natural Resources in conjunction with Picnic Areas 1 and 2. They are being built in accordance with drawings and specifications developed by the Department, as diagrammatically shown in plan, section and elevations on PLATE 17. Materials being used are concrete block, wood siding and asphalt shingles with concrete floors. This type of restroom will have running water, flush-type sanitary units and electrical service. Refer to Section 7 for a discussion of the recommended adaptation of these two restrooms to a low pressure collection system.

6.3.6.2.5 Chemical-Type Restrooms. There are presently two (2) restroom buildings under construction in the Pleasant Creek Camping Area at which conversion from

ordinary vault-type facilities to chemical operation is recommended, as shown on PLATE 17. There are also five restrooms proposed for the expanded Pleasant Creek Camping Area and one at the West Hills Launch Ramp which will be erected as chemical-type restrooms. Their construction is in general accordance with plans and details provided by the West Virginia Department of Natural Resources embracing wood frame with concrete flooring and with somewhat smaller vaults than in those presently being built. Two single unit chemical restrooms, one each for men and women, are to be located at the rifle range detailed on PLATE 22.

6.3.6.2.6 Cabins. It is proposed that the new cabins reflect the architectural character of the existing buildings. Exterior materials are to be duplicated insofar as possible at the time of construction. PLATE 21 illustrates the architecture and interior arrangement of these units.

6.3.7 Signs/Markers. Orientation for visitors in the form of signs, either directing or identifying, should be provided throughout the project area. At least one display board, such as a map of the project showing significant resources, should be strategically located to orient visitors. Identification markers should be provided as needed to identify visitor facilities, natural features and other items set out for public use or viewing. Directional signs should be

provided as needed to direct visitors to the dam and other public access sites and areas. All signs should be provided and constructed in conformance with criteria outlined in Engineer Regulations 1130-2-400, "Project Operation" and the West Virginia Department of Natural Resources sign manual.

6.3.8 Electric Power and Telephone Service. These utilities should be provided for all major recreation site development and all overnight areas, except primitive areas. Installation should be in accordance with criteria outlined in Engineer Manual 1110-2-400.

6.3.8.1 Night Lighting. Night lighting should be provided as required for safe utilization of facilities. Lighting intensities should conform to EM 385-1-1 or to American National Standards Institute Standard A 85.1, Practice For Protective Lighting.

6.3.8.2 Low Level Lighting. Low level lighting should be provided at the washhouse and restrooms, where practical, to furnish continuous illumination throughout the night for safety and to discourage vandalism.

SECTION 7.0 EXISTING FACILITIES AND PROPOSED DEVELOPMENT

7.1 GENERAL. In order to provide a comprehensive plan for facility development at the Tygart Lake project, it was first necessary to determine recreation demand, evaluate the adequacy of existing facilities, and then, to formulate a progressive program of augmentation. Following are specific discussions dealing with those evaluations and proposals deemed necessary for updating the Tygart Lake project.

7.2 ZONING PLAN. In order to insure logical and efficient utilization of the various resources of the project, all land as well as water areas have been zoned. The Zoning Plan shown on PLATE 3 has been, to some degree, influenced by existing use patterns. Careful consideration was given to each area based on planning criteria discussed in previous sections and it was determined that activities were, for the most part, appropriately located. Topographic as well as geologic constraints were also major factors in allocating land use. The irregular shoreline and the potential resource of fish and wildlife played an important role in the formulation of boating regulations set forth by the West Virginia Department of Natural Resources which, in turn, essentially dictates the zoning plan for the lake.

7.2.1 Land Use Allocations. All project lands owned or leased out by the Federal Government, owned by the State of West Virginia, or under concession agreements issued by the State of West Virginia to private concerns, have been allocated in accordance with land use categories outlined in ER 1120-2-400. This provides for sound development and resource management practices consistent with authorized project purposes and is based on the highest and best use possible for these lands. There are four classifications of land ownership shown on PLATE 3; Federally Owned and Managed Land, Federal Land Leased to State, State Owned Land and privately owned land within the Flowage Easement. These subdivisions of land ownership are further defined by land use allocations. Following is a brief discussion of all applicable categories of land use allocations as shown on PLATE 3.

7.2.1.1 Recreation - Intensive Use. These are lands acquired for project operations or specifically for recreation purposes and allocated for use as developed public use areas for intensive recreational activities by the visiting public, including areas for concessions and quasi-public development.

7.2.1.2 Recreation - Low Density Use. These are lands acquired for project operations or specifically for recreation purposes and allocated for low density recreation activities by the visiting public, as required for open space between intensive recreational developments or as a buffer between an intensive recreational development and land which, by virtue of use, is incompatible with the recreational development and would detract from the quality of the public use. Project lands in this category at Tygart Lake are generally inaccessible except by foot travel and are used as buffer areas between activities and other privately owned land.

7.2.1.3 Wildlife Management. These are lands acquired for project operations or specifically for recreation purposes and generally allocated as habitat for fish and wildlife or for propagation of such species. This includes all lands not specifically zoned for recreation but considered instead as part of game management areas.

7.2.1.4 Fish and Wildlife Lands. All lands acquired for the project or specifically for fish and wildlife mitigation and enhancement purposes, and definitely

allocated for the respective use are included in this category. As shown on PLATE 3, these areas are, specifically, the Doe Run Impoundment and the proposed waterfowl impoundment at Pleasant Creek.

7.2.2 Water Use Allocations. The boating regulations as promulgated by the Director of the Department of Natural Resources of the State of West Virginia are generally reflected in the water zoning shown on PLATE 3. However, some changes to the existing regulations are reflected on PLATE 3 to provide tighter restrictions in areas that require greater protection such as the Pleasant Creek area. Water area is zoned according to one of three categories:

7.2.2.1 Boating Prohibited. There are two areas where boating is prohibited. A buffer area of approximately 400-feet has been proposed immediately south of the trash boom above the dam for safety reasons. The other area of prohibited boating is in the vicinity of Henderson Rocks. This area, because of its unique characteristics, provides a great amount of interest to scuba divers. While such divers are required to set out special buoys to mark their locations and are under constraint to surface within a strictly limited distance of that buoy, additional protection in the form of a restricted zone is considered desirable.

7.2.2.2 Unlimited Speed Zone. This zone accounts for the greatest portion of the lake's surface area. Water skiing is permitted in this zone only.

7.2.2.3 Idling "No Wake" Speed Zone. This zone, in most areas, is defined as the area of water extending from the shore outward for 200-feet. Exceptions to this are at the beach facility where warning buoys should be placed parallel to and 300-feet beyond the buoyed safety line defining the swimming area, at Pleasant Creek, at all natural coves, and at the Marina.

7.3 FEDERAL ADMINISTRATIVE AREA. In the vicinity of the dam, the Corps of Engineers has provided and maintains a 100-car bituminous paved parking area, a public restroom and concession building, an overlook area, and approximately 14 picnic sites with refuse containers, grills and potable water outlets. The facilities shown on PLATE 6 are adequate to meet the needs of visitors to the dam, except as noted below, and are more than adequately maintained.

7.3.1 Considerations. The Federal area, as the initial point of visitor contact, has failed to provide wholly adequate project information in terms of directional signs and general guidance. This shortcoming should be

corrected in accordance with Signs/Markers criteria noted in Section 6, paragraph 6.3.7. An overlook deck oriented to view from above the front face of the dam and the spectacular water discharge was also considered as a desirable addition, yet access to such an observation point is quite difficult. Topography and soil conditions impose severe limitations all along the crest and the only available land is taken up by the reservoir manager's residence yard space and the service road to the dam. It was, therefore, determined that such a facility was economically and practically unfeasible and did not warrant any consideration as a proposal of this Master Plan.

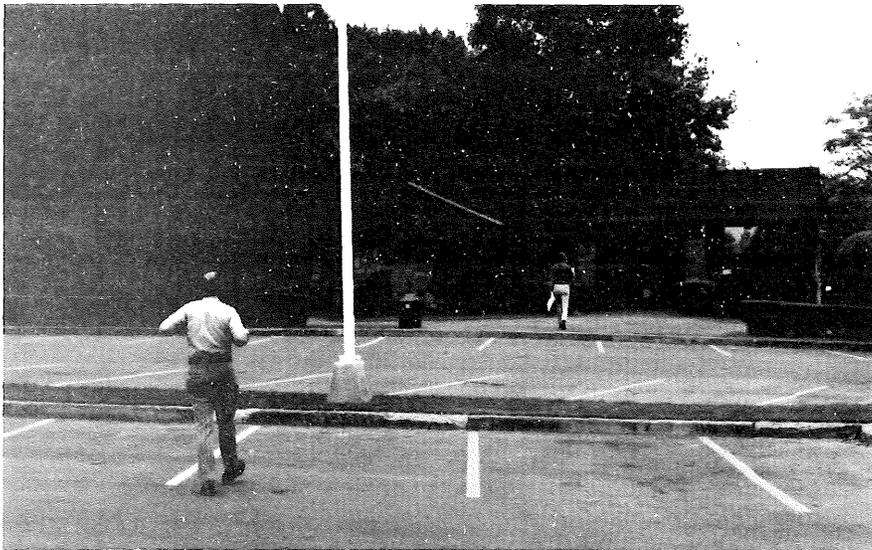


Photo No. 9 Federal Overlook Concession



Photo No. 10 View From Overlook

7.4 TYGART LAKE STATE PARK. The State Park area consists of lands on the right bank extending from the Tygart River Dam upriver to Flag Run. These lands have been developed as the main day-use recreation area at Tygart Lake. Following is a brief description of each facility along with a discussion of possible considerations followed by applicable proposals for development.

7.4.1 Lodge. The State of West Virginia operates the lodge under a concession agreement. The present facility



Photo No. 11 Lodge

has 20 rooms, a restaurant, and parking for approximately 60 cars. It is an excellent accommodation, attractively oriented to a view of the lake and the marina. Site and architectural plans of the lodge are shown on PLATES 7 and 8.

7.4.1.1 Proposed Development. Coupled with the proposed expansion of six rooms, as described in paragraph 6.3.6.2.1, several other improvements have been considered. The view from the lodge may be enhanced by the selective removal of several trees on the slope below the lobby and dining area. A terrace across the front of the main element of the building would furnish a new opportunity for passive recreation outdoors. Vehicular access to the lodge is basically adequate; however, the parking area should be expanded by six spaces in conjunction with the proposed additional rooms. It also appears likely that the retaining wall, in the parking area, will need attention at some future time and a full investigation of the slide-prone soils in the vicinity is recommended prior to specific design studies for wall and drainage revisions. Pedestrian access to the shoreline would be improved significantly by the construction of a stabilized gravel walk, 5-feet wide, commencing at the front walkway and extending down the slope.

7.4.2 Scab Run Launch Ramp. The existing Scab Run Launch Area affords perhaps the best site for improvement

of day-use boat launching opportunities due to its relatively gradual slope. It is located approximately one mile from the dam at the mouth of Scab Run which enters the lake from the east. Car/trailer access is made available by a spur road branching off the main interior circulation road and the ramp enables launching at a minimum water elevation of 1090. Car/trailer parking is limited to approximately 10 spaces.



Photo No. 12 Scab Run Launch Ramp (Summer Pool)



Photo No. 13 Scab Run Launch Ramp (Winter Pool)

7.4.2.1 Considerations. Among the present shortcomings of the Scab Run Launch Ramp is its ineffectiveness during drawdown periods and throughout the months of winter pool. The lower edge of the bituminous ramp has eroded creating a hazardous condition. Such deterioration, lack of sufficient parking and general topographic limitations reduce its effective use. Boaters are more apt to use the marina boat launching ramp, which often creates severe overcrowding of that facility.

7.4.2.2 Proposed Development. It is recommended that Scab Run be upgraded to a major water access point to supplement facilities provided at the marina. The launching facility is proposed as a 28-foot wide curbed concrete ramp at a slope of 16% to an elevation of 1070. Dredging a channel from the end of this ramp 30-foot wide and 400-foot long would permit extended access to the water. It is not considered feasible to construct access to the winter pool from this point and, thus, there will remain a shortcoming in terms of use by fishermen, although the recommended improvements will serve to prolong the season beyond what is now possible. Circulation to, and alignment of, the proposed ramp would remain quite the same as now exists. Parking would be expanded to 35 car/trailer spaces plus 20 cars. A turn-around at each end of the parking area would also ease trailer maneuverability. Road and parking pavements

should be constructed in accordance with criteria outlined in paragraph 7.4.5.1. The Scab Run launch ramp is shown on PLATE 9.

7.4.3 Marina. The existing marina is located on the right bank of the lake approximately one and one-half miles above the dam and is situated on the moderately steep slope south of Scab Run as shown on PLATE 9 and following Plates. The marina is accessible by a spur road which follows the lake shore for nearly 2,500-feet, again rejoining the interior road. The spur road remains fairly constant in elevation and follows a contour approximately 15-feet above the summer recreation pool with moderately steep slopes occurring on both sides. Vegetation is sparse along the road due to lack of topsoil; pool fluctuation also inhibits establishment of vegetative cover. The existing marina complex shown in Photos No. 14 through 20 includes, in addition to dock facilities, a concession building with restrooms all operated under a licensing agreement between the State of West Virginia and a private concessionaire.

7.4.3.1 Considerations. Over a period of time, the complex has deteriorated to a point where the entire system is now decrepit and beyond salvage. At the time these studies were commenced there were, in many instances,

extraordinary hazards, as exemplified by Photos No. 18 through 20. The electrical system along the line of docks was well below standards and was regarded as critically unsafe. Parking was insufficient and its layout inhibited maneuverability. Storm drainage was regarded as being ineffective. Pedestrian and vehicular circulation were barely functional and the concession building and restrooms were in deplorable condition. The most critical health and safety hazards involving the docks, electrical and lighting system and the restroom were corrected for the 1976 recreation season. However, there is general agreement that the basic proposal to abandon the structural elements of the existing marina is the only long-term solution to the problem. In evaluating alternative locations for a marina no benefit could be seen in relocation of this facility to a new site. Prevalent topographical and soil limitations would require specialized and costly engineering procedures. A new access route would entail a large expenditure. It was determined that several improvements could be incorporated into the existing site to relieve undesirable conflicts of circulation, to provide better parking, and to restore an optimum mix of diverse facilities.

Photo No. 14
Pedestrian Walk
to Docks



Photo No. 15 Marina Parking

The entire marina complex begged for improvement.

Food service concession is abandoned and comfort facilities were in deplorable condition.



Photo No. 16 Entrance to Women's Restroom



Photo No. 17 Entrance to Food Concession

Minimum health and safety standards required by regulatory agencies seemed to have been ignored.

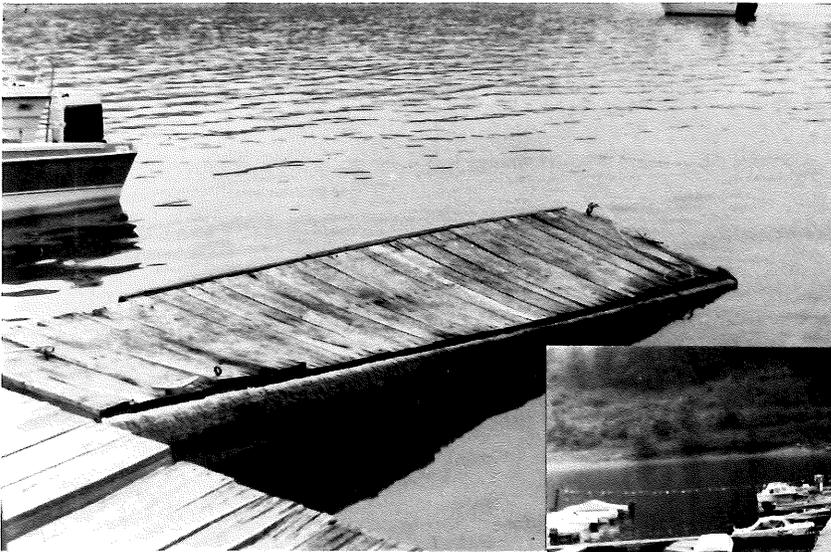


Photo No. 18 Finger Dock



Photo No. 19
Dock Approach



Photo No. 20 Main Dock Access

7.4.3.2 Proposed Development. Of all the existing park facilities, the marina in its present condition is least able to properly accommodate public use. Its replacement, therefore, warrants highest priority. Following are proposals for development of a new marina and support facilities. PLATES 9, 10, 11, 12, 13, 14 and 15 illustrate the proposed development of the marina.

7.4.3.2.1 Dock System. There are proposed 200 slips to provide the majority of the projected demand for dockage. This amounts to 48% of the lake-wide demand which has been determined at 418. Boat clubs, private docks, and additional docking facilities at Pleasant Creek are expected to supply the remaining portion of the total demand. Considering that the rapid water fluctuation and winter drawdown impose severe strain on the docks, a metal frame has been recommended which would withstand these stresses more effectively than wood. Wooden units have short durability (five to ten years), while the metal frame could be expected to last 25 years or more. PLATE 12 illustrates the metal frame system with removable, precast concrete surface panels which permits easy access to utility lines and flotation components for repair or replacement. The concrete surface is coarse textured to prevent slipping accidents and the mass of the system provides better overall stabilization,

reducing the "bounce" action caused by mild wakes and wind and wave action, thus minimizing the "working" of the system and tending to reduce wear. Access to the docks would be from one main point at the concession area. Lightweight metal ramps, illustrated on PLATE 13, are hinged and interconnected to adjust to pool elevations as conditions change, with flotation units resting on concrete pedestals at periods of low water. Handrails and a non-skid wearing surface on the ramp deck provide safe walkway access. Although capital improvement costs for such a system are understandably higher than for other alternative systems, the predictably longer life and relatively limited maintenance and repair costs, expected to continue escalating in the years ahead, point to a long-range cost benefit. Marina operation is labor intensive and if dockage rates are to be held as low as possible it means that manpower needs must be minimized.

7.4.3.2.2 Concession Area. The proposed concession area would consist of two concrete shelter-type structures as shown on PLATE 14 and described in Section 6, paragraph 6.3.6.2.2. The structures have been located well within the range of possible flooding for the convenience of boaters. However, the combination of using concrete materials and the flexibility of a portable food preparation unit would help to minimize the effects of inundation.

A new "loop" road which spurs off of the access road through the marina complex facilitates servicing operations. The "loop" road which would not ordinarily be open to the public becomes an overlook deck in front of the concession area and at the same elevation, providing pedestrian circulation and access to the docks.

7.4.3.2.3 Marina Restrooms. The restrooms shown on PLATE 15 have been designed to withstand inundation without damage to the structure. Again, the use of concrete materials and the creation of an "open air" atmosphere without any unnecessary appurtenances will minimize replacement or maintenance of facilities. Besides the recommended fixture provisions outlined in Section 6, paragraph 6.3.6.2.3, a small area for changing clothes would be available for scuba divers, water skiers and boaters. It is recommended that this building be constructed, operated and maintained by the Division of Parks, West Virginia Department of Natural Resources, and that the facility remain open even after the marina concession is closed for the season. This would provide a continued convenience for sightseers and day-use boaters whose needs will be served by the Scab Run Launch Ramp.

7.4.3.2.4 Fuel System. Included in the existing concession agreement is the requirement that the

concessionaire provide fuel service and the vending of incidental supplies. PLATE 12 shows a floating service building, 9 x 12-feet, fabricated of aluminum structural members and aluminum panels. Fuel service would originate at a storage tank located near the overflow parking area above the Comfort Station. The tank would be accessible from the main circulation road, well above flood pool. The service line would be carried underground to the dock access ramp abutment and from this point a flexible fuel line would be suspended beneath the ramps and would be conducted through the interior of the dock system to the outermost dock, to standard electrically-operated pumps at the service building.

7.4.3.2.5 Slope Protection. Periodic inundation, the effects of past marina construction during which the virgin surface was disturbed, and apparent overuse of the slopes near the summer pool in the immediate vicinity of the marina create difficult growing conditions. Very little vegetation is in evidence below an approximate elevation of 1108 in this area. Some scrub growth is seen in scattered clumps. Extensive planting of slopes, which will be formed by construction of the proposed marina and associated roadways, is not recommended although some key planting is warranted. Below elevation 1112, slopes formed by construction would be covered with stone rip-rap to control erosion.

Above 1112, raw slopes would be topsoiled and seeded and small deciduous trees planted. After the rough grasses have become established, tree seeds may be scattered in an attempt toward reforestation.

7.4.3.2.6 Parking. As indicated on PLATE 9, a major "car only" parking area accommodating 163 vehicles would be established in the immediate vicinity to serve marina patrons and sightseers. Closer to the launch ramp, a 34 car/trailer parking lot would be provided for day-use boaters. An auxiliary parking lot, now located above the marina along the interior road, would be expanded to 37 cars to accommodate overflow parking and long-term storage of trailers. Total marina parking would amount to approximately one car per slip.

7.4.3.2.7 Access. The general alignment of the road is to be maintained and slopes would be adjusted to gain width in the parking area. The existing one-way system would be discarded and two-way traffic would be established. The new launch ramp completed in the spring of 1975 is recommended for retention as a day-use facility and as a convenient boat access to the docks. A turn-around located midway between the existing launch ramp and the marina complex would facilitate free movement of cars and trailers so they need not travel the entire "loop" of the spur road.

7.4.4 State Operated Picnic Areas. Three major picnic areas, located above the circulation road on the right bank just beyond the marina (see PLATES 9 and 16), serve all but the maximum peak picnicking loads on summer holidays. Presently there are 78 tables distributed throughout the three State picnic areas. Several tables have been added from time to time in response to previous increases in demand. It should be noted that picnic tables also have been provided in the cabin area, and in the tent camping areas both on the right bank and at Pleasant Creek. These tables have not been considered as fulfilling any part of the projected demand because of their exclusive use by visitors engaged in tent or cabin camping.

7.4.4.1 Picnic Area No. 1. Presently, Picnic Area No. 1 contains 16 tables within an approximate area of 1.7 acres. There are 5 fireplaces and 11 refuse containers dispersed throughout the entire area. Restrooms previously had consisted of pit-type structures situated 150-feet east of the picnic area but these have been replaced by a new restroom recently constructed in the overflow parking area above the marina. This restroom, shown on PLATES 9 and 16 and detailed on PLATE 17, is further discussed in Section 7.8 of this Master Plan. A level play area approximately 80-feet x 40-feet is located just above the picnic area.

7.4.4.1.1 Considerations. Picnic sites in this area are generally undefined. Many of the tables are well worn as are the fireplaces which, in most cases, amount to a pile of rubble stone. The existing unpaved parking facility provides space for 16 cars.



Photo No. 21 Typical, Picnic Area No. 1

7.4.4.1.2 Proposed Development. In order to establish a degree of standardization regarding picnic areas, it is recommended that Picnic Area No. 1 be reorganized in accordance with criteria outlined in Section 6, paragraph 6.3.4. Because of the relatively less severe topographic condition, picnic sites in the existing area would be increased to 20 or 12 sites per acre. A minimum of one refuse container would be provided for every two

tables and one adjustable charcoal grill for every two tables. The existing parking area would be expanded to provide a minimum of one space per table. Since it has been determined that currently there exists a deficiency of 100 picnic tables (see APPENDIX G, p. G-21) it is recommended that Picnic Area No. 1 be expanded to the north along the interior circulation road. Such expansion would amount to approximately 10 acres or an area approximately 2,200-feet long by 200-feet wide which would accommodate 83 of the needed tables. This area would be characteristically similar to the existing picnic area and would be developed in accordance with previously prescribed criteria. The proposed expansion of Picnic Area No. 1 is shown on PLATE No. 9. Water for picnickers should be provided by a potable water outlet in the vicinity of the new restrooms. Parking would be distributed along the expansion in locations affording the most favorable topography and would consist of single bay lots to minimize width, an essential planning constraint due to the relatively severe slope. Extension of Picnic Area No. 1 in this manner allows more favorable relationships to the newly constructed restrooms above the marina location. Furthermore, the northernmost reaches of the picnic facility would bear a considerably closer relationship to the marina itself, raising the possibility of some interplay.

7.4.4.2 Picnic Area No. 2. Picnic Area No. 2 presently covers a larger area of the park and is similar in character to Picnic Area No. 1. The 31 tables existing in this facility are generously spaced over 5.5 acres and while there are no grills or fireplaces provided in this area, refuse containers have been placed at the rate of one per table. A recently constructed restroom (as in Picnic Area No. 1) provides sanitary facilities for this area. For the most part, tables have been located in a 100-foot strip along both sides of a 0.5 mile long "loop" road which intersects the interior circulation road approximately 600-feet south of the entrance to the marina boat launching area, parallels the interior road on the inland side for 0.5 miles and again rejoins the interior road. Parking is adequately provided for by cleared areas along the berm of the road.



Photo No. 22 Typical, Picnic Area No. 2

7.4.4.2.1 Considerations. Picnic tables in this area are spaced too far apart in terms of specified criteria. Closer spacing, especially in the predominant form of the development where tables are located in the 100-foot wide strip along the "loop" road, would facilitate a better relationship between jointly shared amenities such as grills and refuse containers.

7.4.4.2.2 Proposed Development. Picnic tables along the "loop" road should be spaced approximately 60-feet on center with one grill and one refuse container for each two tables. This would increase the number of tables in this area to 44 creating a density of 8 tables per acre. This density is recommended because of the restrictive topography. Parking would be continued along the berm of the road and although it is attenuated it would be adequate. Water for picnickers should be provided by an outdoor potable water outlet in the vicinity of the new restroom.

7.4.4.3 Picnic Area No. 3. Picnic Area No. 3, located adjoining the Recreation Building, is 1.8 acres in size and contains 31 picnic tables, a density much higher than normally used. Restroom facilities for this area are

located within the Recreation Building, which also contains the Park Superintendent's office and visitor service desk. Maps, copies of regulations governing park use and other information of general and specific interest to boaters, campers, day-users, and the public in general are dispensed at this location. An existing play area approximately 120 feet by 50 feet with swings and a slide offers active recreation for the younger age groups. A paved parking area provides space for approximately 35 cars with a smaller lot at the rear of the building, recommended for staff parking. Other amenities include 6 fireplaces, 14 refuse containers and a facility for water located in the center of the area.



Photo No. 23 Recreation Building/Park Office
at Picnic Area No. 3

7.4.4.3.1 Considerations. Picnic Area No. 3 is somewhat different than the other two State Park picnicking areas, in that topography is less severe and lends itself to group picnicking. This characteristic is further enhanced by the proximity of the Recreation Building and its inherent facilities. The Recreation Building is prominently located, very agreeable in appearance, and there are no amendments recommended. The existing play area is poorly located and ill defined. It is in the course of the main pedestrian thoroughfare between the picnic sites and the Recreation Building. The fireplaces have deteriorated to an almost inoperable state. Parking is more than adequate to serve the present demand for picnicking.

7.4.4.3.2 Proposed Development. It is proposed that Picnic Area No. 3 be reorganized in accordance with the picnic area criteria described in Section 6, paragraph 6.3.4. The recommended criteria of a maximum 12 tables per acre would decrease picnicking activity in this area by 10 tables to 21 total. These 10 tables would then be relocated to the expanded area of Picnic Area No. 1. Group picnicking should be further encouraged in this area because of the close proximity of restroom and other facilities provided by the Recreation Building and because of the favorable topographic conditions, although while more than one table could be provided per site, the sites

themselves should be dispersed. The existing play equipment should be relocated so as not to interfere with pedestrian movements. Refuse containers and grills would be provided at the rate of one each for every two tables. No improvements are recommended for the parking area. Water would be provided by the existing water outlet in the area and at the Recreation Building.

7.4.5 Beach Access and Bathhouse. The bathing facility attracted 152,460 swimmers and bathers in 1975. The 20,000 square foot concrete beach is in satisfactory condition, along with walkways, steps, grass areas, and planting. The hillside just behind the open lawn is filled with large trees, creating a very attractive natural setting. Views

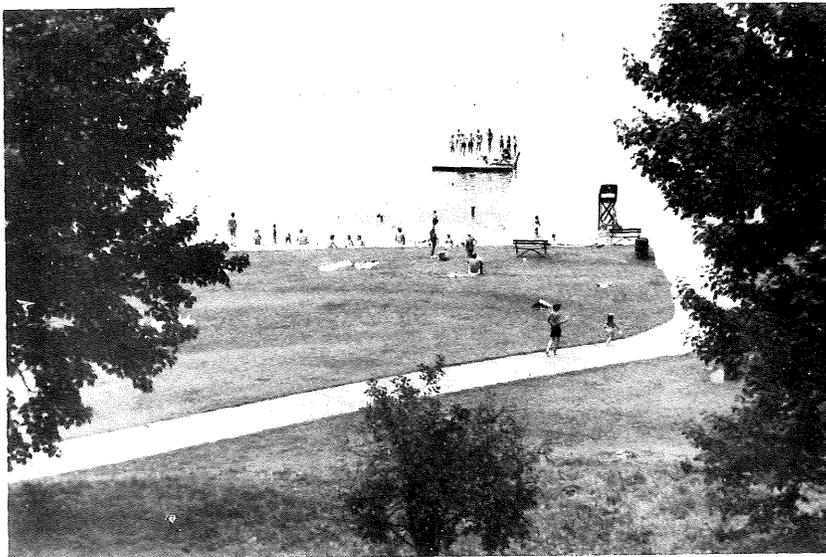


Photo No. 24 Walk From Bathhouse To Beach

from this area are directed toward sweeping expanses of water. The bathhouse is located above the maximum flood pool, thus quite a difference in elevation exists between the beach itself and the dressing facilities. While this might be regarded as a somewhat detrimental feature, it is made more acceptable by the pleasant aspect of the hillside area through which bathers pass on the way to and from the beach. Site and architectural drawings of the beach and bathhouse are shown on PLATES 18 and 19.

7.4.5.1 Considerations. This facility is presently capable of accommodating 1400 people per day or 120 more persons than the projected demand. Interviews with operating personnel and lifeguards revealed no functional problems. Maintenance has been of the highest order. The bituminous parking area was resurfaced in the spring of 1975 and appears to be in very good condition. The State Park Superintendent indicated that vehicular access, service, and parking were adequate for present normal demand. By field measurement, it appears that the existing parking areas readily can accommodate approximately 150 cars. To satisfy the projected peak demand, parking areas would require expansion to accommodate an additional 236 cars. However, because of the limitations

imposed by topography and the impracticality of planning for such occasional peak use, it is recommended that parking expansion not be considered. On occasions when additional parking is necessary for certain peak days, ample space has been provided in the past by permitting berm parking along the interior circulation road. Similarly, because of their projected adequacy, improvements or expansions to the present bathhouse or beach area are not recommended.

7.4.6 Cabins. These are superb structures, widely spaced, beautifully situated, and their popularity is quite evident. A site plan of the cabin complex is shown on PLATE 20. Rental rates for the 10 existing cabins are very reasonable considering the splendid furnishings and equipment. Stone fireplaces, excellent wood finishes throughout the interior, and the quality of kitchen and bathroom fixtures and fittings, combine to create an aura of rustic elegance. Access to the cabins is gained along a stretch of the general main road within the park, which then extends slightly beyond the cluster of cabins to the present camping area. Gravel pull-off parking is provided adjacent to each cabin and this and other site facilities and plantings are as well maintained as the cabins. Utilities include potable water from the central system, overhead electrical service, and sewage which is presently carried by gravity flow through a system of pipes leading

to a central septic tank and tile field. The cabins are available through reservation for periods not exceeding two weeks; past records indicate that reservations for the full season are customarily completely filled by the end of April. The projected demand indicated in APPENDIX G is for a total of 46 cabins resulting in a calculated current deficiency of 36 cabins.

7.4.6.1 Considerations: To accommodate 36 additional units, under area standards not directly applicable to Tygart Lake, a total of over 12 acres of land would be required. On the other hand, five new cabins can be interspersed among the existing 10 cabins without undue crowding. Additional land which would be required for the remaining units would have to be purchased or, alternatively, the facility may be extended into the existing tent/trailer camping area immediately beyond the cabins necessitating relocation of camping.

7.4.6.2 Proposed Development. The West Virginia Department of Natural Resources accepted two fundamental recommendations during meetings held near the outset of this study aimed at updating the Master Plan for Tygart Lake. First, it was agreed that no additional land would be purchased to expand the cabins. In actuality,

no suitable contiguous, privately-owned land exists over the rugged terrain near the cabin area. Topographic and geologic constraints occur throughout this portion of the project and into adjoining land. While land might be available at higher elevations, remote from the other cabins and from the all-important lake, this alternative was rejected out of hand. Secondly, it was agreed in principle that the existing 34 tent/trailer sites presently located on the right bank eventually would be abandoned when the Pleasant Creek camping area is completed, thus meeting that total demand. By using the right bank camping area for cabin expansion, access roads, new utilities and site work are kept to a minimum. Consolidation of cabins in a single area provides obvious management advantages in both "housekeeping" and security. Even though this area affords sufficient acreage by gross standards, on-site exploration and map studies reveal that only 11 cabins may be suitably placed in the area now occupied by tent/trailer camping because of the limitations imposed by the topography of that site. PLATE 20 illustrates the suggested approximate locations of the proposed new cabins. It is recommended that the five cabins proposed for construction amid the existing ones be built by 1990. The remaining eleven cannot be considered until the Pleasant Creek Camping Area is completed. The existing camping area Contact Station and Washhouse facilities would be retained to serve the cabin complex. Access

to the new cabins is provided by the existing road passing through the camping area, with only modest alteration. Small gravel pull-offs, similar to parking areas at the existing cabins, are the only new paved surfaces required. The construction of future cabins should be in accordance with drawings provided by the West Virginia Department of Natural Resources, as outlined on PLATE 21, using materials and techniques which are essentially as those applied to the original cabin development. Any radical departure from these standards would cause operational and overall management problems and more than likely would be reflected in variable preferences by users. Without overall consistency of design within the complex, a "system" is non-existent. While these recommendations result in a total of only 26 units, 20 short of the calculated projected demand, the high cost of development of an additional cabin area at any other location, especially in proportion to the numbers of people that would be served, rules out additional cabin development beyond the proposed 16 new units. Furthermore, as touched on elsewhere in this Master Plan, the existence of Tygart Lake Lodge is a factor which certainly exerts influence on the computation of demand for overnight accommodations within the State Park. The Lodge does not figure directly in evaluating overall need since it is not precisely equatable to the cabins, yet it does tend to mitigate the deficiency in cabin units by providing a very agreeable substitute.

7.4.7 Tent/Trailer Camping Area. Although this facility is recommended for eventual relocation to the Pleasant Creek Area, it will remain in service for at least 25 to 35 years. At present, it is agreeably developed and well-maintained, with no apparent overextensions of environmental capacity. The Contact Station is regarded as being adequate for its purpose but it is recommended that the washhouse, which underwent structural repair during 1975, be supplemented by the addition of two clothes washers and two electric dryers. Other than these, no modifications to this facility are recommended by this Master Plan. With normal care, the camping area on the right bank will serve throughout its useful life.

7.4.8 Park Superintendent's Residence/Maintenance Area. No major changes are proposed in these facilities in light of the fact that there are no recommended major extensions of park area or recreational uses. While it is apparent that no significant additions will be required to the present maintenance complex, the needs expressed by the Park Superintendent are in terms of equipment which can be sheltered or otherwise accommodated by existing structure and grounds. The general condition of all State Park areas reflects a well planned maintenance program without any major shortcomings and, with continued application of high level management

and manpower, the condition will not change nor be affected by new development.

7.5 PLEASANT CREEK PUBLIC HUNTING AND FISHING AREA. This portion of the Tygart Lake project furnishes the vast majority of recreational opportunities available to the general public on the left bank. Only one other consequential public facility exists on this side of the lake, the West Hill Launch Ramp which is described in Section 7.5.6. There are, however, a number of private docks permitted along the shore and, as discussed in paragraph 7.5.7, concessions have been granted to several boat clubs. By comparison with the right bank, facilities in Pleasant Creek are less refined and better suited to the rugged and "remote" character of the wildlife area. In addition to hunting, fishing and wildlife management, several areas have been set aside for relatively primitive camping, although this use will be terminated upon completion of Phase I of the new campground.

7.5.1 Access. As previously discussed in paragraph 5.6.3.4, p. 5-27, access to these recreation facilities via Pleasant Creek Road is interrupted by high water from time to time. PLATES 3 and 5 indicate an area of land approximately 800 acres in size which is recommended for acquisition by the State of West Virginia to enable development of an alternate vehicular route to the interior of the camping area. The land is contiguous on the east with

State-owned property and is bounded by Doe Run to the north and Pleasant Creek to the south. The primary soils in the area are of the Gilpin complex with a predominance of Gilpin channery silt loam. Slopes are moderate to steep. The land is well suited for a hardwood plant association and for consequent woodland wildlife and, therefore, this acreage is appropriate for acquisition as an extension to the areas embraced under the wildlife management program. The alternate route would consist of a single lane, stabilized gravel road, 10-feet wide. Pull-offs would be provided approximately each quarter-mile to enable vehicle passing. The road would be used primarily for access to the added land for wildlife management purposes and secondarily as an alternate means of access to the camping area during periods of high water. As indicated on PLATE 3, the roadway would begin just east of the B&O Railroad bridge at Route 10 and wind along the interconnected hilltops, eventually joining the road near the camping area entrance. The total length of the proposed alignment of the road is 2.55 miles.

7.5.2 Pleasant Creek Rifle Range. This form of recreation is considered to be an important adjunct to hunting activity. The existing rifle range, opposite Pleasant Creek, is located approximately one-quarter mile to the west of the wildlife manager's office. A gravel spur

road, 12-feet wide and approximately 600-feet in length, originates from Route 10 and winds to the top of the hill on which the range is placed. The existing facility consists of a parking area, firing line and a vault restroom.

7.5.2.1 Proposed Development. The access road alignment and grade could remain intact from Pleasant Creek road to a point near grade elevation 1210. A new road alignment is recommended above elevation 1210, leading to a 20-car gravel-surfaced parking area. A gravel walk is proposed to serve as a connection between the parking lot, two firing shelters, and two chemical restrooms. The firing shelters and chemical restroom buildings are to be constructed of wood. PLATE 22 illustrates the recommended general arrangement and detailing of these elements. An elevation difference occurs between the firing line and the target area and, therefore, excavation of the "backstop" is recommended rather than mounding. A four-position 100 yard and four-position 200 yard firing line would be oriented north/south to take advantage of an existing steep sloped hill as a secondary backstop.

7.5.3 Pleasant Creek Camping Area. Previous to 1975, the Dadisman's Rocks camping area and Pleasant Creek camping area consisted of 24 scattered primitive campsites which

were reached by narrow one-lane earth roads. The rugged character of the area lent itself to wildlife habitat. Food plots for game were and are cultivated and undergrowth is retained. Several pit-type restroom facilities were provided. An adirondack building is available for group camping or for hunting shelters although inconvenient access and service difficulties have lessened the attractiveness of this structure. Birdwatching and nature study events have been scheduled from time to time by private organizations. The growing popularity of these camp areas has prompted a land use modification to the extent that non-wildlife recreation use is now more prevalent than that which is associated strictly with wildlife management activities. As a consequence, the West Virginia Department of Natural Resources has recently completed development of a section of a more-refined campground containing 31 tent/trailer sites, two vault restrooms and a trailer sanitary disposal station. The water system for the area has not been constructed.

7.5.3.1 Access. Access to the camping site is gained via Route 10 and an extension of the park road. The present surfacing is rated fair; however, some periods of inundation have restricted passage to and from this area and paragraph 7.5.1 explains an alternative when flooding occurs.

7.5.3.2 Proposed Development. The West Virginia Department of Natural Resources planned an ultimate development containing a total of 95 tent/trailer sites. It is recommended that the capacity be increased, ultimately, to 137 to approach projected demand, including replacement of the camping sites which are recommended for relocation away from the right bank. (See paragraph 7.4.7.) PLATE 23 illustrates a plan which would accommodate this number and which reflects the character of the recently completed portion. Construction material and architectural style are to be consistent with the established development. Completion of this facility will be accomplished in two phases; Phase One is recommended by 1990 and Phase Two by the year 2010.

7.5.3.2.1 Phase 1. Extension of one mile of "tar and chip" road with stone base would accommodate 55 tent/trailer sites. Serving these units, two restrooms, two wells, and a 100-foot x 100-foot bituminous surfaced multi-purpose recreation court are proposed. Concurrently with the development of this phase, the access road for the Doe Run Impoundment is recommended for improvement (refer to paragraph 7.5.4.1.)

7.5.3.2.2 Phase 2. The addition of another mile of "tar and chip" road would allow development of 51 new sites. Three restrooms and three wells are recommended

to serve this area and a boat launch and parking lot are also proposed along the shore at Pleasant Creek. A "tar and chip" branch road, 0.2 mile long, is recommended for construction between the campground access road and a proposed "tar and chip" parking area which would accommodate 40 cars and 11 cars with trailers. Twenty-eight slip docks, similar to those designed for the marina, are proposed for this location and in addition to a fee it is suggested that a maximum time limit of two weeks be imposed on rental of dock space. The launch ramp is recommended at a width of 28-feet, with concrete paving curbed at both sides with a courtesy pier for the convenience of boaters.

7.5.4 Doe Run Impoundment. Doe Run was initially impounded to provide a waterfowl food and nesting area. Various species of fish, such as black bass and crappies, were introduced and now provide an attractive fishery which has resulted in this area being identified as the most productive fishing area within the project. Furthermore, because reservoir drawdown exerts no influence on this small impoundment, fishing activity is spread over an extended use period.

7.5.4.1 Improvements. The single access is now in the form of a 10-foot wide mud land road originating

near the campground entrance and terminating at the small dam.



Photo No. 25 Doe Run Impoundment at Summer Pool



Photo No. 26 Dam at Doe Run (Winter Drawdown)

This access is impassable in early spring to all except four-wheel drive vehicles. It is recommended that the existing lane be upgraded along its present alignment and that a 20-car parking area be provided near the dam. The proposed new roadway would follow present grades, requiring only minor shaping of berms and side drainage ditches. The parking area would serve fishermen, campers with "car-top" boats, scuba divers wishing to explore the area of Henderson's Rocks, as well as general shoreline activities. The road would be 18-feet wide and the parking area would be "tar and chip" surface on a stone base. The improvement is recommended for inclusion in Phase 1 of the Pleasant Creek Camping Area development.

7.5.5 Waterfowl Impoundment. The Division of Wildlife Resources of the West Virginia Department of Natural Resources, in 1964, conceived an additional impoundment similar to that at Doe Run, the location of which is shown on PLATES 3 and 5. It was proposed as a 9-foot to 12-foot high earth dam with a concrete spillway, located about three-quarters of a mile below the wildlife manager's headquarters on the north side of Route 10. When completed, the dam would cause inundation of about 11 acres of land along Pleasant Creek. Depending on the final location and elevation of the dam, a portion of Route 10 immediately below the headquarters might have to be relocated to a higher elevation roughly paralleling

the existing road alignment, rejoining the campground access road just above the dam. The improvement of fish and wild-life habitat by implementation of this impoundment is consistent with the proposed use of the land; therefore, the impoundment planned by the West Virginia Department of Natural Resources is included in this Master Plan.

7.5.6 West Hill Launch Ramp. An area now being used by the public as a launching site is located where a lane off the end of Route 42/2 reaches the shoreline adjacent to the Doe Run Impoundment (see PLATE 24). Photo No. 7, p. 5-28, indicates the day-use potential and clearly shows a need to improve this facility which developed over the years through unplanned use as a means of access to the lake from private properties on the left bank. All the land flanking the road and along the lake shore presently is in private ownership. The Corps of Engineers holds flowage easement to elevation 1190. It is recommended that the State of West Virginia consider the purchase of approximately 13 acres of property(ies) for development of a public day-use boat launch/parking facility. Access to the lake from the west would be greatly enhanced by the addition of an improved facility in this key location, intended to serve a larger number of users than is now possible and, furthermore, providing the shortest possible access to the winter pool.

7.5.6.1 Proposed Development.

7.5.6.1.1 Access. Access to the site would be over an extension of Taylor County Route 42/2, requiring resurfacing of 0.5 mile of the present roadway with "tar and chips" and the construction of a new stone road base with identical surfacing, 18-feet in width, extending from the present end of the paved road for a distance of 0.28 mile and ending in the proposed parking area.

7.5.6.1.2 Parking and Launching. The recommended 21 car/trailer "tar and chip" parking lot, two turnarounds, a curbed concrete launch ramp with a courtesy pier, and a 17-car stabilized gravel pull-off for overflow parking are illustrated on PLATE 24.

7.5.6.1.3 Amenities. Included among the facilities of the launching area is a restroom situated at elevation 1168, served by a 10-foot wide stabilized gravel service road. This restroom should be built in accordance with drawings prepared by the West Virginia Department of Natural Resources (see PLATE 17). Potable water would be provided by the installation of a well located along the proposed gravel path from the parking area to the restroom.

7.5.7 Boat Clubs. There are currently several boat clubs located on lands adjoining the lake and one other which occupies privately-owned land, all in the vicinity of Pleasant Creek. Paragraph 3.8, p. 3-20, explains in somewhat greater detail the concession arrangements under which the public land is occupied for this purpose. The clubs have expanded over the years without benefit of planning and have often encroached beyond private and State-owned land. The tendency seems to be to creep closer and closer to the water's edge and, on occasion, some installations have floated away when there was a need to store run-off, a function of reservoir operation. Dock facilities for the most part are primitive and employ steel drums for flotation, a practice which is contrary to current regulations because such drums are easily separated from the docks they support and, loose, clutter the exposed lake bottom after fall draw-down starts. Individual club members have also erected facilities which, frequently, are more elaborate than the simple tent platforms permitted by the concession agreements. Trailers, in somewhat permanent settings, pit-type restrooms, wells, electric service by both public utility lines and private generation equipment, are typical of the facilities which abound in the area. Tent platforms and "out buildings" are substandard and the areas tend to be littered with debris. Electrical installations are frequently exposed; wires have been nailed to

trees without insulators and, in general, do not comply with minimum standards of the National Electric Code (NFPA-70) or Fire Protection Standards for Marinas (NFPA-303). Some clubs are more successful than others in maintaining their areas with respect for the natural environment, although by and large the developments and their management are helter-skelter.

7.5.7.1 Recommendations. The concession agreements should be enforced by the State throughout their present terms, in every respect, including the removal of non-conforming installations of whatever nature and extent and the dissemination of clear rules about use of the premises. The concessionaires should be required to limit construction and adhere to all applicable health and safety laws and take whatever steps are essential to compliance. For example, if restrooms are to be provided they should be chemical type; wells should be cased as needed and subjected to customary testing; electrical installations must meet all governmental codes. Not later than two years before the existing concession agreements expire the need for these facilities should be reevaluated. If demand then warrants, the State should undertake the planning and construction of a boat launching and docking facility along with wholly upgraded access and all other auxiliary land facilities

such as interior roads, parking, restrooms and water supply similar to those recommended in other left bank areas. Lands in excess of these requirements should be restored to public hunting and fishing purposes. It is also recommended that the principle parcel of private land adjoining the flowage easement then be acquired for addition to the public hunting preserve.

7.6 WATER SUPPLY AND DISTRIBUTION.

7.6.1 Right Bank. Potable water for the right bank development is presently supplied by the City of Grafton from the municipal water system located immediately below the dam, adjoining the Federal area. The main 6-inch transite distribution line is installed beside the main access road through the State Park. The 6-inch main enters the park along the road, provides a service connection to the dam, overlook, and the Project Supervisor's residence, and then continues along the road to the Tygart Lake Lodge. At this point, there is a 1-inch service line which runs from the lodge to the Park Superintendent's residence. The 6-inch line then reduces to a 4-inch line which crosses Scab Run to the marina and continues along the access road to the recreation building. The 4-inch line extends for a short distance beyond the recreation building and then reduces to

a 2-inch line which provides service to the bathhouse, a 40,000 gallon storage tank situated on the knob above the bathhouse, and finally to the cabin area. Potable city water service terminates at this point. The primary purpose of the tank is to provide pressured service to the cabins and, secondarily, to serve as a reserve tank. Its condition, according to the City of Grafton and the Park Superintendent, is good. Potable water service is provided free of charge to all Federal facilities. State-owned facilities are metered and charged conventional water rates. As reported by the City of Grafton, the volume of water supplied to the State Park facilities during peak operational months, July and August, amounts to 225,000 gallons per month, with the bulk of the water, 150,000 gallons, being consumed by the camping and cabin facilities. The second highest user is the lodge with a peak month usage of 58,000 gallons. The present maximum monthly flow of 225,000 gallons was analyzed to determine the average and maximum daily peak flows. Peak flows were examined due to the disproportionate use of the park on weekends. The average peak flow was found to be 14,000 gallons per day, which is based on a 50 percent usage (APPENDIX G, p. G-10) over a four weekend (8-day) period. The maximum peak flow was then established as 35,000 gallons per day based on a maximum flow factor of 2.5 times the average daily flow. The maximum flow factor of 2.5 is a generally

accepted factor relating the average and maximum water demand, or flow, of a water system. The 225,000 gallon monthly flow was used as the design flow due to the minimal usage increase expected (Section 5.3, pp. 5-9 and 5-10) and the fact that the water distribution system is not appreciably altered or extended under this master plan. The justification of this flow is that the proposed changes to the park are not expected to increase the water demand to any significant degree since the changes are for the most part rehabilitations of existing facilities, and the proposed additions do not have large water demands. For example, the demand for potable water at the proposed expanded portion of the cabin complex will be only very slightly increased above that now required by the existing cabin/campground area. This results from a net decrease of total users although there will be an increase in unit usage. Presently, slightly over 5,000 gallons per day of potable water is used throughout the combined cabin/campground area during peak usage. The estimated demand from the 26 proposed cabins is 6,300 gallons per day. In summary, usage experience at Tygart Lake indicates that there are no problems with city water supply. The proposed additions to the park facilities do not require any changes or additions to the existing water system other than adding lines to service the marina (see PLATE 27) and the new cabins (see PLATE 28).

7.6.2 Left Bank. The left bank facilities consist of the Pleasant Creek camping area, the West Hill launch ramp, and the rifle range. The water system for the initial phase of the Pleasant Creek camping area has not been constructed. The development plan and cost estimate presented herein proposes a system of wells and hand pumps located adjoining the proposed restrooms in the camping area. An additional well and hand pump is proposed for the West Hill launch ramp. However, depending on the results from test wells, detailed planning and design studies and the availability of funds, an alternative system could be construed consisting of a well or wells and a pressurized distribution system. Reference is made to the description of the sanitary system (Section 6.6) in which the recommendation is made that all restrooms on the left bank be of the chemical type, not requiring high capacity water service for their operation.

7.7 ELECTRIC POWER DISTRIBUTION.

7.7.1 General. The electric power distribution system, served by the Monongahela Power Company, was investigated in light of the additional demand for power resulting from improving or replacing existing facilities and from installation of proposed facilities. On the right bank, electrical needs of the modified lodge, marina, Picnic

Areas No. 1 and No. 2, the proposed sewage treatment plant, and the cabin complex are discussed. The remaining right bank facilities require no alterations. On the left bank there are no additional electrical needs presently estimated. However, if a centralized water system is selected for the Pleasant Creek camping area, there would be a need to extend power distribution into that area. TABLE 7 summarizes the investigations and recommendations contained in this Section. The estimated costs, under this same heading in APPENDIX I, are for basic distribution only; electrical costs other than for basic distribution are included in estimates for individual facilities.

7.7.2 Lodge. The lodge is presently served by a three-phase 12 KV (Kilovolt) underground electrical service terminating at a pad-mounted 500 KVA (Kilovolt Ampere) transformer. There is sufficient capacity supplied by this transformer to serve the minor additional demand created by the proposed new six rooms.

7.7.3 Marina. The marina area has obtained power from a 7.2 KV overhead service, presently terminating at the existing concrete block structure in the parking area. Electrical service is required for the proposed restroom, concession building, snack area, dock lighting, fuel pumps,

TABLE 7

ELECTRIC POWER DISTRIBUTION

Area Served	Existing Electric Power Service	Proposed Facilities Additional Electrical Demand	Estimated Additional Electrical Service Required	Required Electrical Material
1) Lodge	Three-Phase - 12 KV to a 500 KVA Transformer	Six Rooms	Minimal	None
2) Marina	Single-Phase - 7.2 KV Overhead	Concession Stand, Snack Area, Restroom, Area Lighting, Dock Lighting	400 Ampere Service	(1) 75 KVA pole-mounted Transformer, Single-Phase (2) Electrical Wiring in conduit for: 400, 100 and 60 Ampere Underground Service, waterproofed
3) Picnic Areas	None	Two Restrooms	60 Ampere Service Each Restroom	(1) Two 10 KVA pole-mounted Transformers (2) Overhead Primary Service from Marina (Single-Phase) (3) Electrical Wiring in Conduit for 60 Ampere Underground Services
4) Sewage Treatment Plant	None	Sewage Treatment Plant	400 Ampere	(1) 75 KVA pole-mounted Transformer, Single-Phase (2) Overhead Primary Service from Bathhouse
5) Cabin Complex	Single-Phase - 7.2 KV Overhead to Two 50 KVA and One 10 KVA Transformers	Sixteen New Cabins Existing Washhouse	100 Ampere Per Cabin and 100 Ampere for Washhouse	(1) Three 25 KVA and Five 10 KVA pole-mounted Transformers (2) Primary Overhead Wiring, 7.2 KV

and area lighting (see PLATE 27). It is proposed that a 75 KVA transformer be pole-mounted near the overflow parking area feeding a 400 ampere underground line running from the transformer to the restroom. At that point, services would be subdivided as follows: restroom, 60 amperes; concession, 100 amperes; snack area, 60 amperes; area lighting, 100 amperes; and dock lighting including fuel pumps, 100 amperes. (Usage is not expected at 100% of design load at any given time.) The dock and area lighting would be low level and low intensity. All electrical facilities must be designed to withstand inundation as the marina facilities would be subject to this periodically.

7.7.4 Picnic Areas No. 1 and No. 2. There is presently no electric power available in the picnic area. Electric service would be required for the proposed grinder pumps and minimal lighting at the two restrooms being constructed by the State of West Virginia. Overhead single-phase 7.2 KV service is proposed to run from the marina to the restrooms. It is recommended that there be a pole-mounted 10 KVA transformer adjacent to each building with 60 ampere underground service to the restrooms.

7.7.5 Sewage Treatment Plant. Electric service does not now reach the proposed sewage treatment plant location.

The existing 7.2 KV single-phase service at the bathhouse is recommended for overhead extension to the plant area. A 75 KVA pole-mounted transformer is proposed with a 400 ampere underground service to the plant. The proposed sewage treatment plant is shown on PLATE 29.

7.7.6 Cabin Area. The ten existing cabins, along with the registration/check-in building and the washhouse at the present camping area, are presently served by two 50 KVA and one 10 KVA transformers (see PLATE 28). The existing cabins contain an electric range, refrigerator and water heater along with baseboard heaters. Due to high operating costs the baseboard heaters presently are not being used. With the construction of 16 more cabins, the additional load should result in a more equitable rate and a net reduction in unit operating cost although, of course, increasing overall costs. The proposed electric distribution system must be adequate for the appliances listed above, the baseboard heating, and the lighting needs of the proposed 16 new cabins. It would also provide additional power to the washhouse to accommodate anticipated future installation of washers and dryers. Electrical service to the registration/check-in building and the ten existing cabins will remain unchanged. The proposed system consists of primary 7.2 KV overhead service from the existing power supply leading to a combination of 3-25 KVA and 5-10 KVA pole-mounted transformers located within the expansion area to

serve the new cabins and the existing washhouse. Each cabin and the washhouse will receive 100 ampere overhead service.

7.7.7 Telephone Service. There is a public telephone located at the registration/check-in building at the right bank camping area. No added service is proposed in this location. Similarly, telephone service exists at the lodge, the bathhouse, and at the recreation building; no further installations are required. It is proposed that there be no service to any of the facilities on the left bank.

7.8 SANITARY SEWER SYSTEMS.

7.8.1 General. The existing sanitary sewer facilities at Tygart Lake, shown in TABLES 8 and 9 on pp. 7-57 and 7-58, are primarily septic systems. Only the lodge is being served by a sewage treatment plant which was recently constructed to replace a former septic system. In general, the present septic systems are inadequate, and in some instances (the marina, the cabin complex, and the right bank camping area), the existing sanitary facilities are in need of immediate attention. This is due to septic system overloading and soil conditions near the shoreline which are not conducive to septic systems. Refer to paragraph 5.5.2, p. 5-17 for more detailed discussion. At other locations (the bathhouse

and the recreation building which adjoins Picnic Area No. 3), the septic systems do not present any immediate problems although they are considered to be undesirable from a long-range viewpoint. Effluent from septic systems lying close to the lake can contribute to deterioration of water quality in the impoundment. For example, should there be leachate flowing from the septic system at the bathhouse to the lake, a health hazard might occur. Presently, two restrooms are being constructed by the West Virginia Department of Natural Resources to serve Picnic Areas No. 1 and No. 2. These restrooms have flush-type units which had been planned for connection to a proposed sewage treatment plant. That plant had been designed by the State of West Virginia to accept sanitary waste from Picnic Areas No. 1 and No. 2 and the marina by means of a lift station. Although the structures have been built this proposed system has not been constructed. The left bank sanitary facilities consist, at present, of two vault-type restrooms and one trailer sanitary disposal station under construction in the Pleasant Creek camping area and a single vault-type unit at the rifle range. The existing facilities have been individually examined and evaluated during the preparation of this Master Plan, with recommendations for basic improvements shown in TABLES 8 and 9. The few septic systems which are suggested for continuation of service are those which are characterized by low flow and

TABLE 8

SANITARY SEWER FACILITIES - RIGHT BANK

Facility	Present System: Condition/Problems	Recommendations	Remarks
Overlook area including residence	ST(S) OK-normal maintenance	No change	Adequate for continued service of public restrooms at concession shelter and for residence. Expense to connect to proposed STP prohibitive.
Lodge	STP OK- normal maintenance	No change	Adequate for load from 6 additional rooms (proposed)
Park superintendent's residence	ST(S) OK- normal maintenance	No change	See text.
Marina, land facilities	ST(L) Inadequate; too close to lake; effluent problems	Restroom served by GPS to new STP near beach area	See text.
Marina, boat sanitary disposal station	None - No problems as result of <u>not</u> having such facility	No facility proposed	Boats on Tygart generally are without restroom facilities.
Picnic areas No. 1 and No. 2	VRW- New facilities being built; anticipating future STP	GPS to new STP near beach	See text.
Recreation Building and Picnic Area No. 3	ST(S) - OK- normal maintenance	GPS to new STP near beach	See text.
Beach area bathhouse	ST(L) - Inadequate	PS to new STP near beach	See text.
Cabin area	ST(S) - 10 individual tanks - inadequate	GPS to new STP near beach	Individual GPS for cabins. See text.
Camping	ST(L) - Inadequate	Abandoned camping to be replaced by cabins	See above.

SEE TABLE 9 FOR CODE

TABLE 9

SANITARY SEWER FACILITIES - LEFT BANK

Facility	Present System: Condition/Problems	Recommendations	Remarks
<u>Pleasant Creek</u>			
<u>Area</u>			
Camping	PR - Primitive, inadequate; three VR's and trailer sanitary disposal station now under construction	CR's conveniently located to serve existing and proposed camping. Three existing VR's to be converted to CR's	See text.
Trailer sanitary disposal station	Vault - Adequate for expected use	No change	See text.
Boat cleanout	None - no problem	None proposed	See comments; Marina.
Rifle range	PR - (proposed) Primitive	CR, 2 units	See text.
West Hill Launch Ramp	None - Proposed facility	CR	See text.

CODE:

ST Septic Tank; (S) Small; (L) Large
 CR Chemical Restroom, Flush Type
 PR Pit Restroom
 STP Sewage Treatment Plant
 GPS Grinder Pump System, Low Pressure
 VR Vault Restroom
 PS Pump Station
 W Waterborne

which are remote from the lake. The final selection of a proposed system resulted from thorough consideration of location, use, terrain, geology, and economics.

7.8.2 Alternatives. The following alternate methods of sewage collection were addressed in the selection of the proposed sewage system. Combinations of these methods were also considered.

	<u>Alternative</u>	<u>Comments</u>
1.	Renovate existing septic systems	Not acceptable for high usage, although acceptable for low usage situations.
2.	Conventional gravity collection system	Generally amenable to the site if augmented by some lift stations, requires water supply, electric service and high capital cost.
3.	Low pressure collection system	Low capital cost, relatively higher operation and maintenance cost, requires water supply and electric service.

Alternative	Comments
4. Vacuum collection system	Inapplicable to site with widely dispersed facilities.
5. Chemical units	Applicable to initial or to low usage installations; requires neither water nor electric services.

Alternatives 2 and 3, both waterborne systems, and Alternative 5 are the most amenable to the site in general. However, each has certain disadvantages. Alternative 2, a conventional gravity collection system, requires high initial capital cost, is less amenable to repair in the case of earth slides or settlement and would require pump stations which need regular attention. Alternative 2, however, has the lowest overall operation and maintenance costs. Alternative 3, a low pressure collection system, requires only low initial capital cost and is easily repaired in the case of slides or settlement. Alternative 3, however, has highest operation and maintenance costs, of the systems considered, which includes replacement of grinder pumps. Alternative 5, chemical units, calls for the lowest capital costs but requires normal sewage collection by tank truck, replacement of chemicals and replacement of mechanical portions of the toilets.

Alternative 5 does not, of course, allow for lavatory facilities in conjunction with restrooms and must, therefore, be considered more primitive but not as primitive as ordinary vault-type facilities.

7.8.3 Constraining Factors Influencing Choices. Facility dispersal, terrain, geology and usage at Tygart Lake are such that any sewage collection system will involve difficulties in construction and maintenance.

7.8.3.1 Terrain. The rocky terrain, especially in the Pleasant Creek area, increases the costs of laying deep pipe lines and building manholes.

7.8.3.2 Slide-Prone Areas. Slide-prone areas are abundant and deep trenches could create underground waterways which have the capability of saturating surrounding soils, triggering failures.

7.8.4 Options. To formulate a proposed sewage collection system, many conceptual designs were made so that the optimal system would be recommended. Six of those designs are presented in this section in brief form with comparative associated costs given. The recommended design is discussed in detail in the next paragraph and the costs are included in APPENDIX I, broken down into individual facilities and appropriate overall system costs.

		Operation and Maintenance Cost
Option	Capital	(annual)
A	Conventional gravity collection system, serving entire park; force main from left bank to a single sewage treatment plant on right bank; plant capacity of 40,000 gallons per day	\$15,000
	\$661,000	
B	Conventional Gravity Collection System, separated; sewage treatment plant on right bank with capacity of 35,000 gallons per day; plant on left bank with capacity of 7,000 gallons per day	\$17,000
	\$616,000	
C	Low Pressure Collection System, serving entire park (treatment plants as in A)	\$18,000
	\$411,000	
D	Low Pressure System, separated (treatment plants as in B)	\$17,000
	\$335,000	

Operation and
Maintenance Cost

Option	Capital	(annual)
E Conventional Gravity Col- lection serving right bank; sewage treatment plant with capacity of 35,000 gallons per day; chemical units serving left bank (plus existing Trailer Sanitary Disposal Station)	\$454,000	\$17,000
F Pressure Collection Sys- tem serving right bank; sewage treatment plant with capacity of 35,000 gallons per day; chemical units serving left bank (plus existing Trailer Sanitary Disposal Station)	\$294,000	\$18,000

Note: The above costs do not include estimates for water or electric service for the left bank facilities that would be required for Options A, B, C and D.

The operation and maintenance costs used above include the replacement of certain mechanical items based on normal (and

variable) estimated operating lives. These include grinder pumps, pumps and motors for the pump stations, pumps and blowers in the sewage treatment plant and other miscellaneous mechanical items. The costs for capital improvement and operation and maintenance were based on January 1976 costs. For simplicity, costs were analyzed over a twenty-five year period without inclusion of discount rates, interest, or any other factors and, thus, the figures must be regarded comparatively, only.

7.8.5 Recommendations - Proposed Sanitary Sewer System, Option F. Based on all the factors discussed above, it is recommended that a major system be developed on the right bank of Tygart Lake utilizing a low pressure collection system. While remnants of the present systems are recommended to remain (at the Federal Overlook Area, the Lodge, and the Superintendent's Residence), the proposed low pressure collection system would serve the Marina, Picnic Areas No. 1 and No. 2, Bathhouse, Recreation Building (Picnic Area No. 3), and the expanded Cabin Area. Due to the high flow between the Bathhouse and proposed treatment plant, a pump station is recommended at the Bathhouse. This collection system would be served by a 35,000 gallon per day sewage treatment plant located near the Bathhouse (see PLATES 26 and 29 and APPENDIX H, for flow calculations) which would have sufficient capacity to accommodate the Lodge should that connection become advisable in the future. The increase of the total estimated peak

sewage flow (29,300 gallons per day) to the design peak flow (35,000 gallons per day) results from the state of the art of sewage flow calculations and normal sizing practice for sewage treatment plants. Variability of sewage flows is accountable to presently unknown or unresolvable factors and under such circumstances it is prudent to provide some excess capacity. Sizing the sewage treatment plant at 30,000 gallons per day allows only a 2 percent variation in the estimated peak sewage flow which is considered insufficient for the above reasons. A 35,000 gallon per day sewage treatment plant allows an 18 percent variation in the estimated peak sewage flow which is commensurate with the flow calculations and would provide treatment capacity that would certainly be equal to or greater than the anticipated maximum sewage flow to the plant. It was also taken into account that gaining long range assurance of adequate capacity requires only a 5 percent increase above the cost of a 30,000 gallon per day plant, at current levels. In light of the recent installation of the sewage treatment plant at the Lodge, it is recommended that it remain in service as long as it continues to function properly; the plant's capacity is adequate for the additional six rooms being proposed. The proposed sewage treatment plant as shown on PLATE 29 would be augmented by both secondary and tertiary treatment (sand filters) with disinfection. The effluent will be pumped to a point below

low pool elevation downstream of the beach area. The cost estimate for the sewage treatment plant was based on January 1976 prices for an installed "package plant" that complies with current West Virginia regulations. To comply with Federal Regulations, an Operations Building (includes blowers, flow recorder, electrical equipment, etc.) and laboratory have been provided. The plant has reserve capability to accommodate the expected peak flow from the park facilities when operating at maximum anticipated attendance. During final design of the treatment plant, it may be determined that it is more economical to construct a smaller plant with surge capacity or to compartmentalize the aeration volume of the 35,000 gallon per day plant to handle both high and low flows. In either case, the estimated costs for the sewage treatment plant will not vary appreciably. Restrooms on the left bank are recommended to be chemical-type installations which minimize the liquid waste volume and require recirculating a formaldehyde based chemical to retard biologic growth. The recirculating chemical-type restrooms would overflow to a central holding tank and be pumped out periodically and trucked to the sewage treatment plant. Three restrooms under construction are convertible from ordinary vault-type facilities to chemical operation by using the vault to house or to serve directly as the holding tank. Five proposed restrooms in the Pleasant Creek

camping area and one restroom at the proposed West Hill launch ramp are recommended to be constructed with chemical units. PLATE 17 shows their detail to be similar to the two (2) restrooms being erected at Pleasant Creek. It is further recommended that the rifle range be served by two separate chemical restroom units, placed side by side. Peak flows from the ultimate left bank installations, including the existing trailer sanitary disposal station, are estimated at 1,500 gallons per day (see APPENDIX H). This volume can be introduced readily into the right bank sewage treatment plant. It is recommended that hauling be by outside contract and that such costs be accounted under normal operation and maintenance expenses.

7.8.6 Holding Tanks. Trailer holding tanks are sometimes treated with a formaldehyde based compound, similar to that used in the chemical restrooms, which have in a few instances been reported to affect sewage treatment plants. Toward the close of the camping season (end of August, early September) tanks are sometimes flushed with such materials to provide thorough cleaning. The presence and concentration of formaldehyde is as difficult to predict, as is its effect on the treatment plant. Under normal or peak loading, however, the expectation of a problem due to formaldehyde is very low since it would be amply diluted. It is recommended when formaldehyde concentration from chemical restrooms or

from the sanitary disposal station is suspected to present a problem, that contact be made with the municipality of Grafton and an arrangement be made to haul such wastes to the larger community treatment facility.

7.8.6.1 Piping. The low pressure system consists of 1-1/4-inch to 3-inch diameter PVC pressure pipe, with certain main runs of 4-inch diameter PVC pressure pipe. The necessary valves, air release lines and other appurtenances are included in the estimated cost per linear foot. Where lines pass through the lake, construction could be accomplished during high water by "sinking" the lines and then burying them during low water. Trenches, throughout, would be relatively shallow.

7.8.6.2 Grinder Pumps. Depending on the precise sewer system layout and the selection of grinder pump connections, the sizes of the pumps may vary. In general, the smallest pump available would serve one cabin and the largest (a duplex or double unit) the equivalent of six cabins. The present cost of these units vary depending on size, quantity, and ancillary equipment. There is low cost normal maintenance of the grinder pumps due to their design; however, the piping system, air release valves, etc., must be inspected on a periodic basis. The normal

life expectancy of the grinder pumps is approximately 10 years. At that time, the grinder pump could be rebuilt or replaced depending on the economics at the time.

7.8.6.3 Low Pressure Collection System. When the facilities are closed at the end of the recreation season it is necessary to flush the collection system with potable water. This procedure prevents anerobic sewage from being pumped to the treatment plant when the facilities are reopened. Small portions of the system being out of operation for short periods of time are not a problem, as the anerobic sewage pumped upon reopening will be amply diluted and will not create problems at the treatment plant.

7.9 TYPICAL DETAILS OF CONSTRUCTION. This Master Plan makes no attempt to define the exact nature of each and every component of the recommended installations; to do so without precise information concerning highly localized soils and all other influencing factors would not be possible. However, PLATE 25 suggests certain basic dimensions and primary characteristics of major elements of site construction without intending to conflict with any other standards set forth by the West Virginia Department of Natural Resources.

7.10 PHASED DEVELOPMENT. Responsibility for the development of Tygart Lake State Park and the Pleasant Creek public

hunting and fishing area lies with the State of West Virginia. Action on recommendations set forth in this Master Plan remains dependent upon appropriation of funds by the West Virginia Legislature and, to a degree, on the status of Federal cost-sharing programs in the future. Nevertheless, to provide guidelines for funding, a time frame is proposed, ordering priorities which will enable a logical progression toward achievement of the overall development.

CONSTRUCTION TIME FRAME

<u>Facility</u>	<u>Priority</u>	<u>Projected Completion</u>
Lodge	2	1990
Scab Run Launch Ramp	1	1980
Marina	1	1980
Cabins (Phase 1)	2	1990
Cabins (Phase 2)	4	2010
Pleasant Creek Rifle Range	1	1980
Pleasant Creek Waterfowl Impoundment	2	1990
Pleasant Creek Camping Area (Phase 1)	2	1990
Pleasant Creek Camping Area (Phase 2)	4	2010
Pleasant Creek Alternate Access Route	5	2020

<u>Facility</u>	<u>Priority</u>	<u>Projected Completion</u>
West Hill Launch Ramp	3	2000
Route 44 Land Buffer		
Acquisition	1	1980
Pleasant Creek Land		
Acquisition	3	2000
West Hill Launch Ramp		
Land Acquisition	2	1990
Sewage System	1	1980

7.11 MANAGEMENT. Tygart Lake is under the multiple management of the Pittsburgh District and the West Virginia Department of Natural Resources Division of State Parks and Division of Wildlife Resources. The Corps is responsible for operation of the project for its primary purpose and for defining general administrative policy for management of its land and water resources. The actual management of land and water areas is accomplished by the West Virginia Department of Natural Resources under a lease for recreation purposes and a license for fish and wildlife management. It is apparent that over the years such cooperative control has been largely successful and this Master Plan recommends continuance of past practices. The license and lease agreements under which the State uses Federal land, require the State

to submit annual Management Plans. These reports should continue and should be supplemented by joint inspections of all recreational facilities at frequent intervals, increasing during periods of high usage. Cooperative efforts are required in all specific areas, notably those associated with erosion control, policing, and public safety. For example, particular attention is required for the enforcement of boating and fishing regulations. A Lakeshore Management Plan is being undertaken and will be included as APPENDIX F to this Master Plan. It will result in the promulgation of regulations governing the location and type of private installations to be permitted along the shore and will define areas along which shoreline development is to be prohibited. Permits for such developments will be issued by the Corps of Engineers. State activities related to fish and game management and the associated endeavors such as the planting of game food crops, wildlife "cover" and stocking of fish must be coordinated with the Corps of Engineers. The objective of such diverse management plans at Tygart is the provision of safe public access to both land and water areas and the affording of continuity in recreational opportunity, year after year, in all of its many variations. The appendixes to this Master Plan, as listed in the Table of Contents, include details of Project Resource Management,

Forest Management, Fish and Wildlife Management, Lakeshore Management (as noted above), and further include a Fire Protection Plan and Project Safety Plan. All will be prepared in accordance with ER 1130-2-400. Each of these embraces a certain joint responsibility of the Federal and State agencies toward public information and education. In contrast to the management of newly constructed impoundments and adjacent developments, management at Tygart Lake is primarily concerned with preservation of existing values and the established land and water environmental resources. Achieving this requires constant vigilance and constraints to avoid over-use. New developments often require restrictions during early periods of stabilization, a relatively easy function to comprehend. In older, so-called "stable" areas the effects of mismanagement can be even more devastating than at newer facilities because results of mis-use or over-use are often not immediately evident.

7.11.1 Project Resource Management Plan. This plan will be prepared by the Pittsburgh District office and will accompany this Master Plan as APPENDIX A. It will restate the authorized purposes of the project and will delineate the influence of those operational procedures on the recreational potential in both the State Park area and the Pleasant Creek Public Hunting and Fishing Area. It will

deal with the land acquisitions recommended by this Master Plan for current and future purposes, specifically as a buffer along the principal entrance at the Federal area, for construction of the proposed West Hills launch ramp, and well into the future for the enlargement of the wildlife areas now partly occupied by private concessionaires in the general vicinity of Pleasant Creek, and also for similar expansion adjoining the Pleasant Creek camping area. The Resources Management Plan will serve as a guide to the West Virginia Department of Natural Resources and, in light of the fact that actual day-to-day management of the recreational resources falls to the State agencies under that Department, their suggestions and reviews will be sought in setting forth management policies affecting all public use areas, maintenance facilities, and the full range of matters having to do with staffing and administration.

7.11.1.1 Local Considerations. The Corps of Engineers and the West Virginia Department of Natural Resources have maintained liaison with organizations and individuals in the Grafton area and throughout the 11-County Tygart Lake area. It is proposed that such contact be continued in the future as a management function relating to formulation of policies affecting use of the recreational resources afforded by the project, and especially

those offered by the water area. Cooperation by these local entities is essential to the preservation of the recreational values at Tygart Lake. Of particular importance is the cooperation of all concessionaires.

7.11.2 Forest Management Plan. The prime purpose of this plan, APPENDIX B, is to assure preservation and enhancement of the recreational facilities in the State Park and in the Pleasant Creek Public Hunting and Fishing Area. In the former, it is desirable for many reasons, such as provision of shade, a sense of "isolation" and beauty, to maintain the lush vegetation which characterizes the surroundings of each of the recreational facilities at Tygart Lake. In the latter, it is necessary to provide appropriate environments for wildlife purposes and for camping, in accordance with the various animal habitats in existing areas and those recommended for acquisition, such as low-lying lands subject to occasional inundation, slopes, and the broad tops of ridges which are characteristic of the proposed major acquisition in the Pleasant Creek area. Any plan for preservation of the forest areas, essential to conservation of the land through prevention of erosion, must necessarily include a public education program and include provisions for enforcement of specific regulations governing protection of trees and other forest vegetation. Since direct management of the public facilities falls

within the responsibilities of the West Virginia Department of Natural Resources, their suggestions must be considered in preparing the Forest Management Plan.

7.11.3 Fire Protection Plan. Closely following the Forest Management Plan, it is necessary to set forth guidelines for prevention of grass and forest fires throughout the project. Furthermore, in event fires do occur, well-defined means of fighting and bringing them under control are essential. Such a plan is presented in APPENDIX C of this Master Plan and it requires very close cooperation of the Corps of Engineers and the West Virginia Department of Natural Resources for its enforcement. The plan examines the special fire hazards at Tygart Lake, suggests means of their minimization through clean-up, public education and information, employee awareness, signage, and enforcement of specific regulations. Additionally, emergency procedures are included in the plan such as the closing of areas in case of predetermined danger of fires due to prolonged dry weather.

7.11.3.1 Local Considerations. Because fire-fighting can require the services of a vast range of personnel, the Plan must establish procedures and agreements under which contact is made with the State Division of Forestry, Philippi, West Virginia office, which maintains

relationships with volunteer fire wardens and with local fire departments. While the Park Superintendent has responsibility for initial action in case of fire and is equipped with hand tools for that purpose, he must also be familiar with the ways in which emergency assistance can be obtained. The Grafton City Fire Department is on call. Similarly, the wildlife manager has primary responsibility for fire suppression in the Pleasant Creek Public Hunting and Fishing Area and calls on the Philippi Fire Department. If still additional help becomes needed, the municipal Fire Chiefs from these two nearby communities have the responsibility to call for such assistance.

7.11.4 Fish and Wildlife Management Plan. The water and land resources devoted to these particular forms of recreation require very specific management functions which demand a high level of attention to scientific principles. Improvements in fishery which have been brought about by steadily improving water quality in the lake call for ever-increasing attention to the aquatic populations and to the need for maintaining the delicate ecological balances which produce good forage for the game fish. To very much the same extent, establishment of attractive habitats for the various species of game depends upon close observation and monitoring of trends. APPENDIX D of this Master Plan will

describe management procedures related to improved fisherman access and a slightly extended season which results from the proposed launching ramps which stretch to lower water levels. It will deal, also, with the prospect for still further improvements in water quality and the likelihood of some modest reduction of inflow of nutrients when certain proposed improvements are made in the right bank sanitary system. The past management of public hunting lands has not involved any measures at Tygart Lake such as the extensive planting of food crops or the thinning of forests to produce floor vegetation to serve as browse. There seems to be no need of introducing such measures although there will occur a major change in management needs when the proposed waterfowl impoundment is undertaken (refer to paragraph 7.5.5) and when additional highlands are acquired, as proposed.

7.11.5 Project Safety Plan. APPENDIX E of this Master Plan will deal with specific safety hazards and will establish preventive measures, cooperatively with the West Virginia Department of Natural Resources. Boating regulations, use of swimming facilities, scuba diving, and all related functions such as boat launching and use of the marina facilities, will be coordinated by the Project Safety Plan. When completed, this plan will prescribe first aid training for all personnel including those concerned with reservoir operation as well as all State Park and public hunting and fishing

area employees. Safety measures will be defined for the protection of both employees and visitors in all areas of the project, particularly in the use of tools and equipment and all public facilities. All pertinent regulations of the Occupational Safety and Health Act (OSHA) will apply. Traffic control, warning systems for severe weather, fire prevention (related to APPENDIX C), and crowd control are among the concerns addressed by the Project Safety Plan.

7.11.5.1 Local Considerations. In event of emergency, the police departments of surrounding municipalities are available and the Project Safety Plan will establish the conditions under which they may be called and by whom. Emergency equipment available at the project will be listed, along with outside facilities "on call".

7.11.6 Lakeshore Management Plan. The Corps of Engineers has a primary responsibility for overseeing the use of the water area and of the immediate shoreline because of the potential for interference of such uses with the primary purposes of the project. Fluctuations in water level for low flow augmentation or flood control have a great influence on shoreline installations such as docks, piers, and so forth. Also, there exists a definite relationship between such installations and other recreational facilities such as beaches, marinas to serve the public, nearby

picnic areas, and camping areas. In the latter concern there is the need to provide separation of functions and minimize potentially dangerous water traffic which could conflict with other uses. In the former concern a need exists to regulate the methods of construction and the type of components to be permitted. For example, flotation systems must be secured so they withstand fluctuations in water level without becoming disengaged. There has been a persistent problem at Tygart Lake resulting from the breaking loose of oil drums used to support docks. Accordingly, the Lakeshore Management Plan, APPENDIX F, will prescribe special zoning and permitted uses along the shore as well as define areas in which no construction will be allowed.

SECTION 8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS. The study of existing facilities at Tygart Lake and long-range projections of future demand as related to the adequacy or inadequacy of those facilities leads to certain conclusions which are covered in detail in the preceding Section of this Master Plan. Those conclusions are summarized in brief, as follows:

8.1.1 Modest extensions of present recreational facilities at Tygart Lake, an extraordinarily attractive recreation area despite the fact that the water level is sometimes subject to severe fluctuation, will enhance its use by the residents of the north-central counties in West Virginia. Some slight increases in visitation by people from greater distances, extending into southwestern Pennsylvania, is expected upon full completion of Interstate Route 79.

8.1.2 Utilization of both land and water areas must be somewhat more attuned to environmental capacities than in the past. Rigid enforcement is needed of regulations designed to preserve the benefit of safe, healthful recreational opportunities for the majority of users. Continued cooperation between the Pittsburgh District and the West

Virginia Department of Natural Resources is essential to such preservation.

8.1.3 Since the right bank of the lake has been more intensely developed than the left bank and is more readily accessible to larger numbers of people for day-use, concentration and improvement of such facilities at or near their present locations would best meet expected needs. The major improvement called for is at the existing marina concession which should be continued as the best means of providing such a facility.

8.1.4 The left bank, more natural in character than the right, lends itself to less intense uses and becomes the center for camping, hunting, fishing, etc., with only such added facilities as are thought necessary to round out minimal needs for family use, and to absorb camping which is recommended for discontinuance on the right bank.

8.1.5 While not of absolute necessity, State acquisition of certain non-owned parcels in the Pleasant Creek area would provide more assured access to those facilities during periods of high water. At the same time, such land acquisitions would allow some additions to be made in wildlife-related facilities, and in access to the lake.

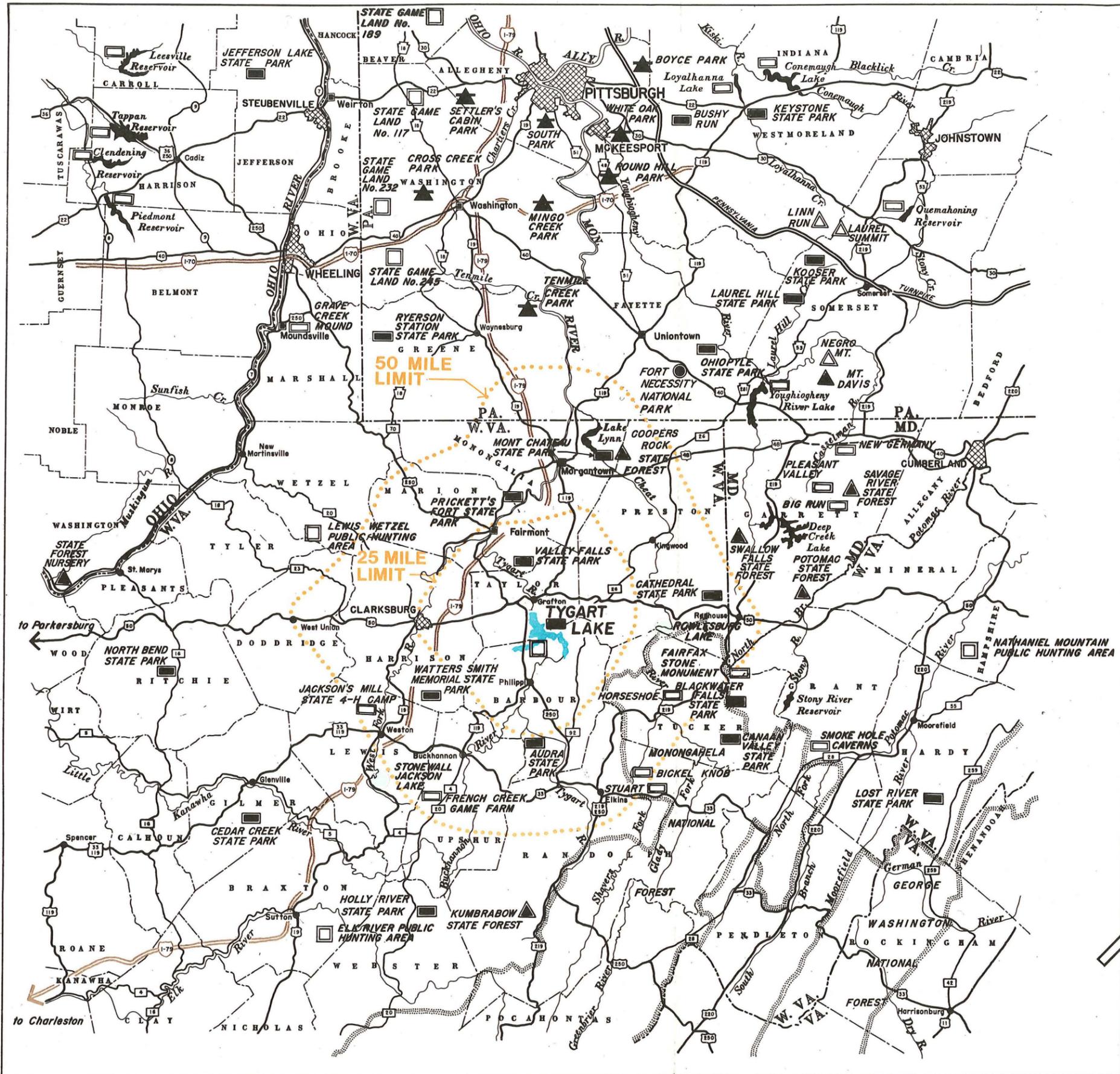
8.1.6 Other acquisitions are highly desirable nearby existing park facilities on the right bank, particularly those which front on the existing entrance roadway. While no extensions of uses are proposed, these properties, if publically owned, would protect the Park against incompatible development by private interests.

8.1.7 Reliance must be placed on continuation of existing codes and regulations with respect to surface and subsurface mining, as protections for water quality and land stability. Acquisition of mineral right is not now warranted.

8.1.8 The concession agreements covering the boat clubs which operate in the Pleasant Creek vicinity require closer monitoring for the duration of those agreements. Without improved enforcement of existing provisions of the agreements and of governmental health and safety regulations further environmental degradation and resource management problems will ensue. This Master Plan concludes that, upon termination of the present concessions, these areas should revert to wildlife management purposes.

8.2 RECOMMENDATIONS. It is recommended that this updated Master Plan be approved as a guide for continued development and management of Tygart Lake.

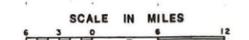
MAX R. JANAIRO, JR.
Colonel, Corps of Engineers
District Engineer



LEGEND

- NATIONAL PARK
- EXISTING RESERVOIR
- STATE PARK
- STATE FOREST PARK
- STATE FOREST PICNIC AREA
- RECREATION AREA
- NATIONAL FOREST BOUNDARY
- COUNTY PARK
- POTENTIAL LAKE
- PUBLIC HUNTING AND FISHING AREA

**MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
REGIONAL INFLUENCE**



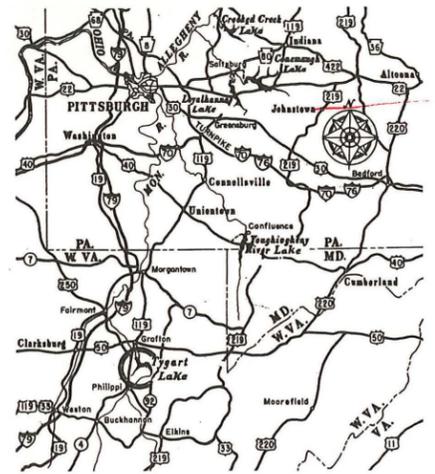
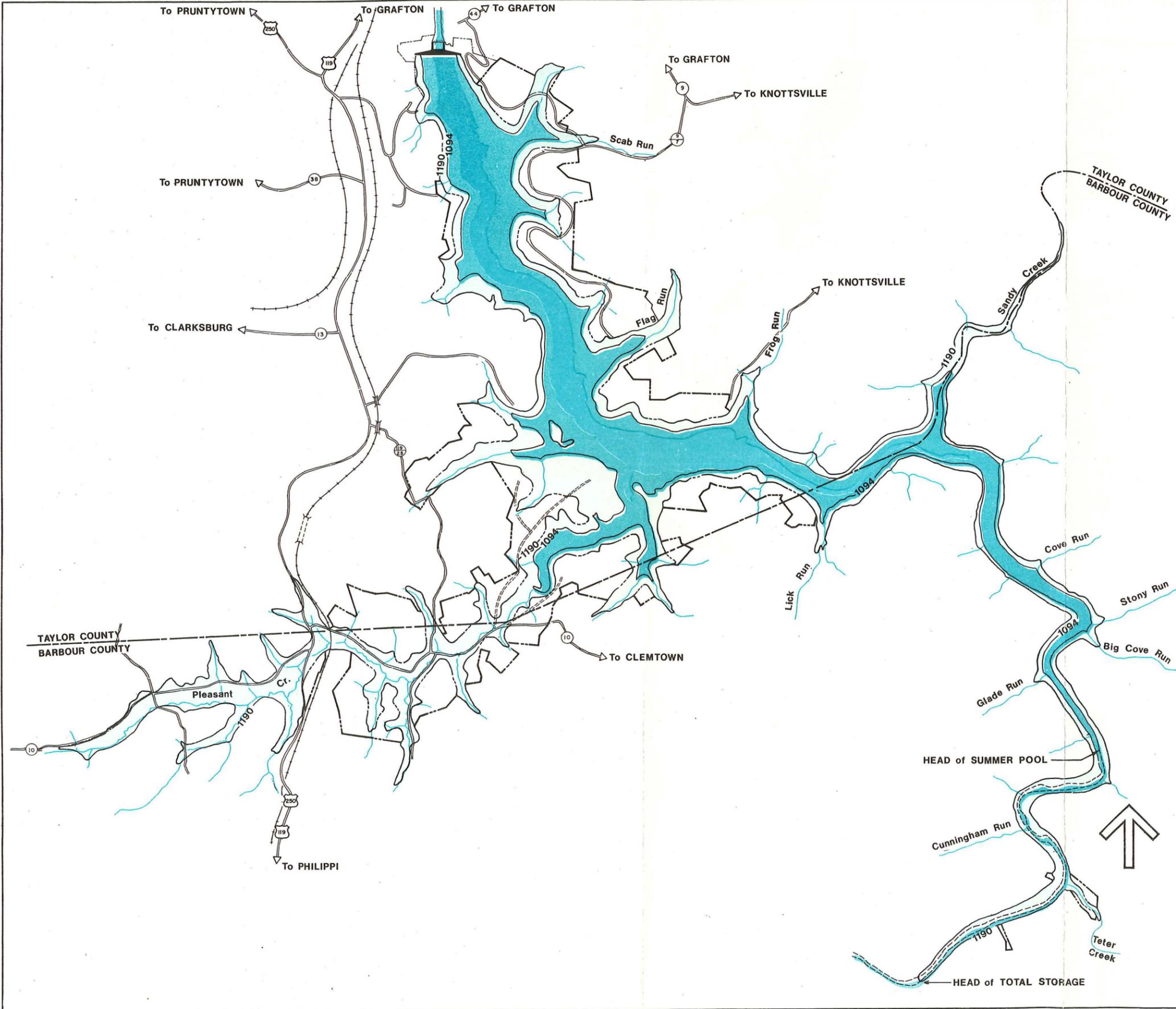
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: APPROVAL RECOMMENDED: APPROVED:

GW&S, Inc. / Landscape Architects
CHIEF ENGINEERING DIVISION
PREPARED BY: D.L.M.
DRAWN BY: D.L.M.
CHECKED BY: W.M.G., W.G.S.

037-R3-12/1

PLATE 1



LOCATION MAP
Scale of Miles
0 25 50

LEGEND

- MINIMUM CONSERVATION AND SEDIMENTATION POOL - EL. 1010
- SUMMER POOL - EL. 1094

**MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
PROJECT POOL LEVELS**

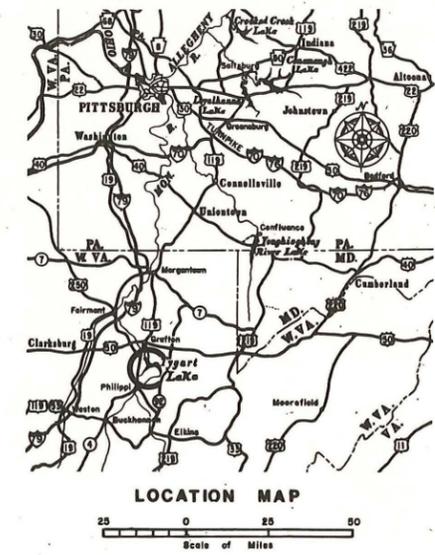
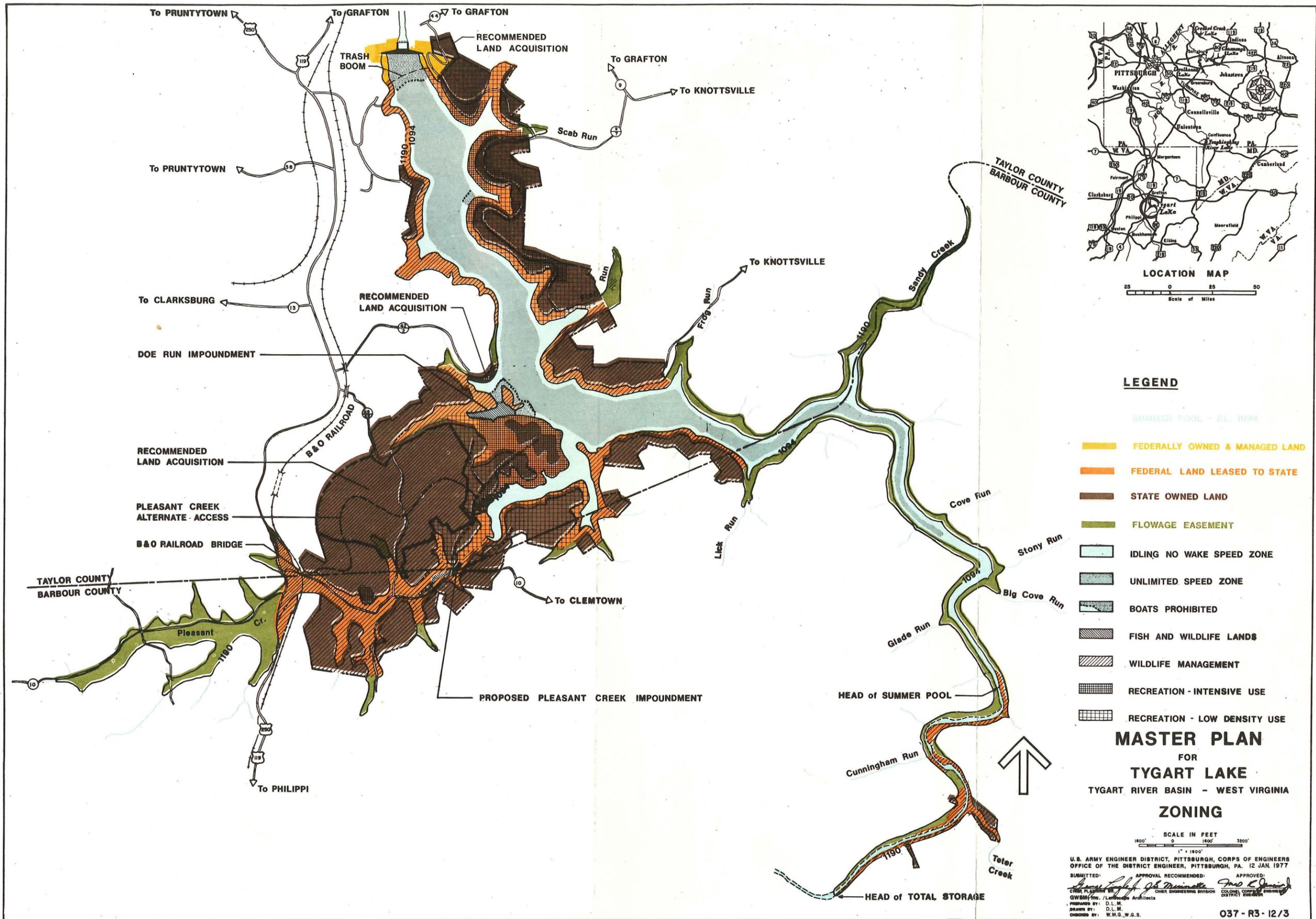
SCALE IN FEET
1" = 1600'
0 1600' 3200'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]*
 CHIEF, PLANNING BR. CHIEF, ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS
 DISTRICT ENGINEER

GWSM, Inc. / Landscape Architects
 PREPARED BY: D.L.M.
 DRAWN BY: D.L.M.
 CHECKED BY: W.M.G., W.G.S.

037 - R3 - 12/2



- LEGEND**
- SUMMER POOL - EL. 1094
 - FEDERALLY OWNED & MANAGED LAND
 - FEDERAL LAND LEASED TO STATE
 - STATE OWNED LAND
 - FLOWAGE EASEMENT
 - IDLING NO WAKE SPEED ZONE
 - UNLIMITED SPEED ZONE
 - BOATS PROHIBITED
 - FISH AND WILDLIFE LANDS
 - WILDLIFE MANAGEMENT
 - RECREATION - INTENSIVE USE
 - RECREATION - LOW DENSITY USE

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
ZONING

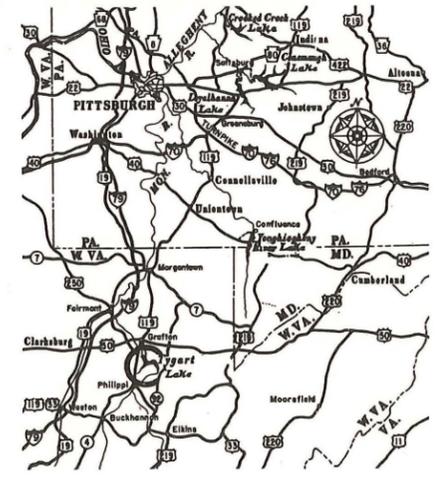
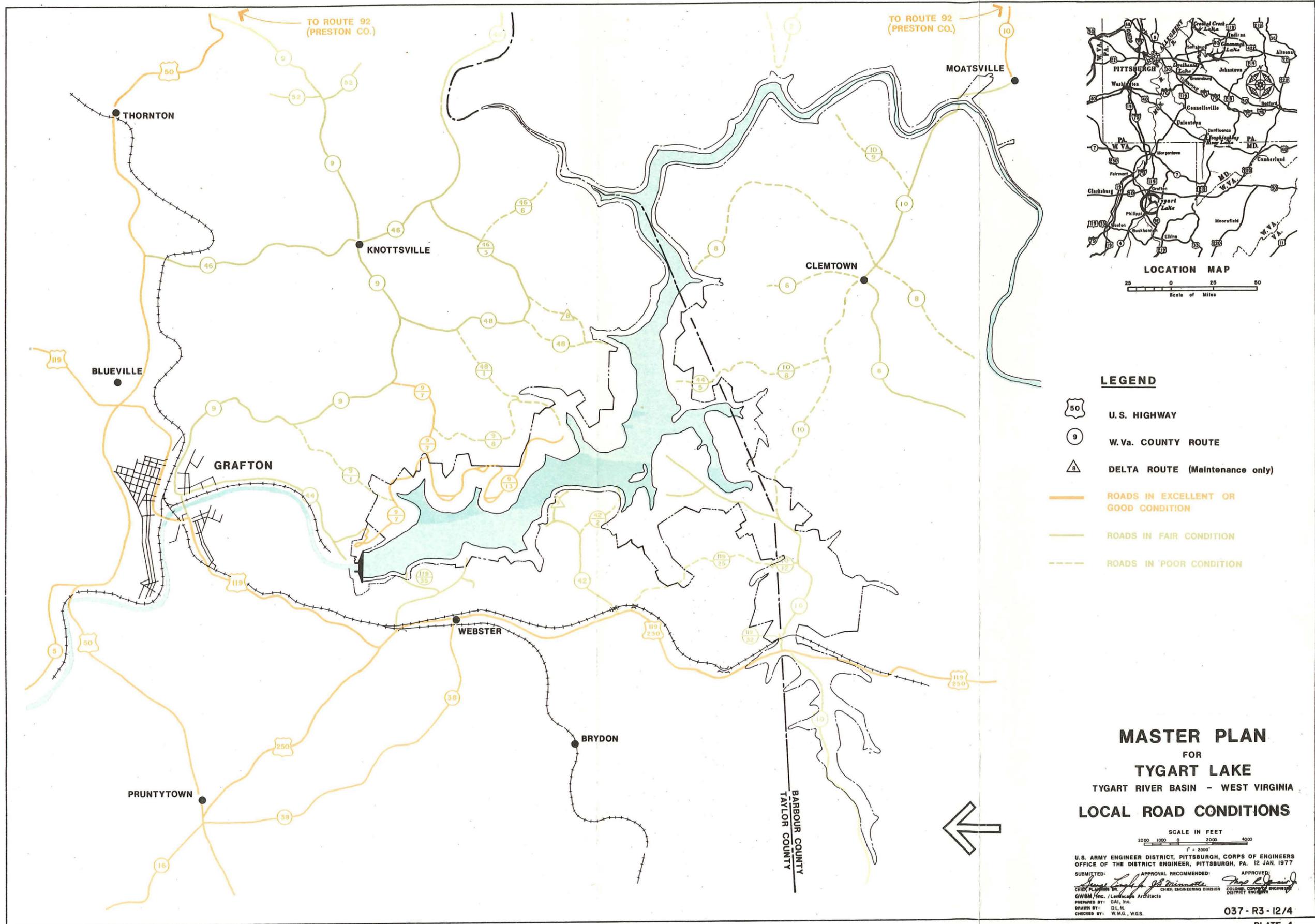
SCALE IN FEET
1" = 1800'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: [Signature]
APPROVAL RECOMMENDED: [Signature]
APPROVED: [Signature]

PREPARED BY: D.L.M.
DRAWN BY: D.L.M.
CHECKED BY: W.M.O., W.G.S.

037 - R3 - 12/3
PLATE 3



LEGEND

- U.S. HIGHWAY
- W.Va. COUNTY ROUTE
- DELTA ROUTE (Maintenance only)
- ROADS IN EXCELLENT OR GOOD CONDITION
- ROADS IN FAIR CONDITION
- ROADS IN POOR CONDITION

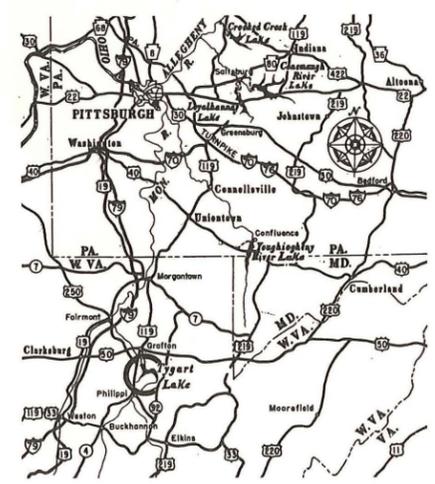
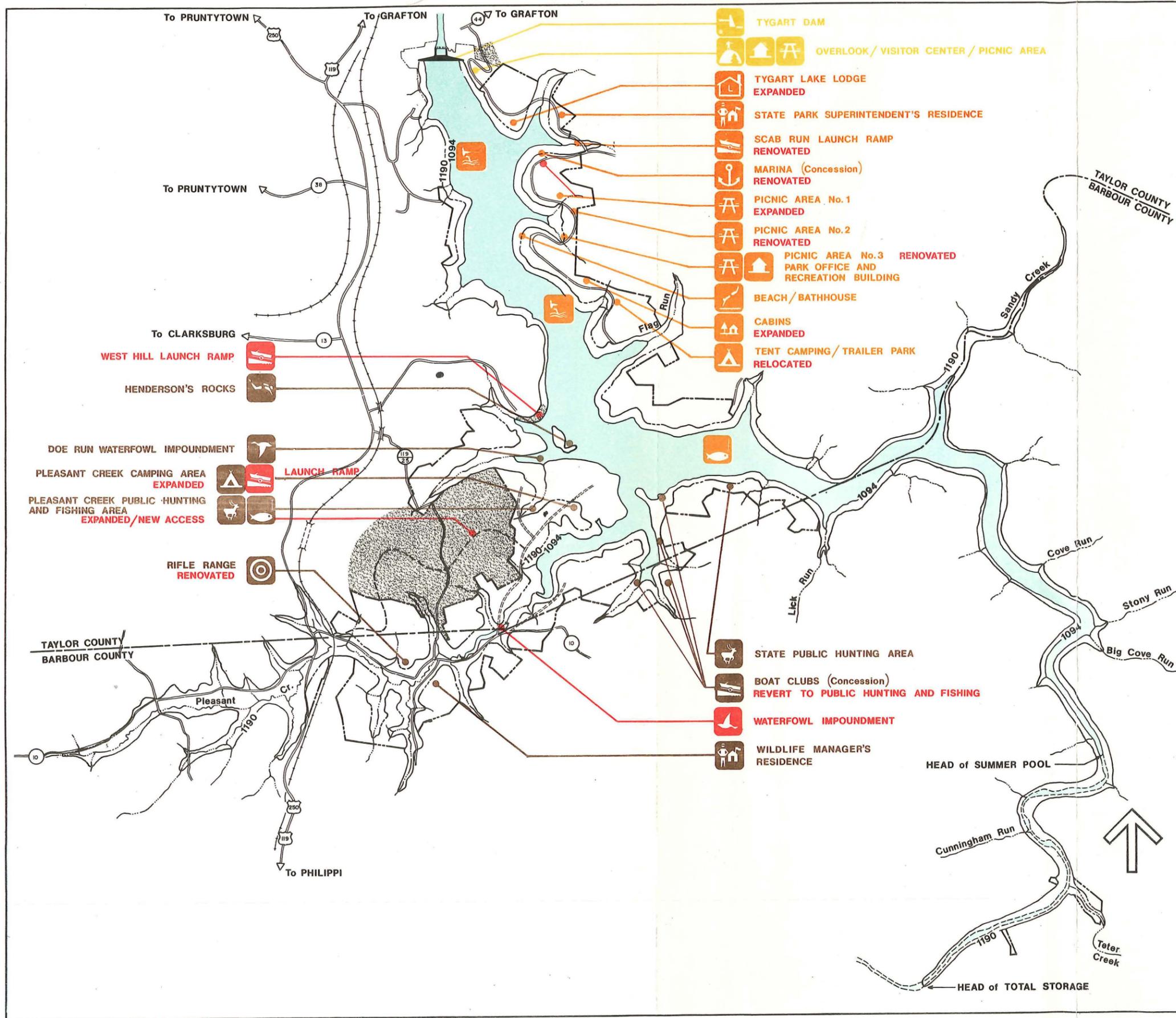
**MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
LOCAL ROAD CONDITIONS**

SCALE IN FEET
2000 1000 0 2000 4000
1" = 2000'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]* APPROVED: *[Signature]*
CHIEF PLANNING ENGINEER CHIEF ENGINEERING DIVISION COLONEL CORPUS ENGINEER DISTRICT ENGINEER

GW&M, Inc. / Landscape Architects
PREPARED BY: GAI, Inc. DRAWN BY: D.L.M. CHECKED BY: W.M.G., W.G.S.



LEGEND

- EXISTING FEDERAL FACILITIES - CORPS OF ENGINEERS
- EXISTING STATE PARK FACILITIES
- EXISTING PUBLIC HUNTING AND FISHING FACILITIES
- PROPOSED FACILITIES/ EXPANSION OF EXISTING FACILITIES
- ▨ RECOMMENDED LAND ACQUISITION

- TYGART DAM
- OVERLOOK/ VISITOR CENTER/ PICNIC AREA
- TYGART LAKE LODGE EXPANDED
- STATE PARK SUPERINTENDENT'S RESIDENCE
- SCAB RUN LAUNCH RAMP RENOVATED
- MARINA (Concession) RENOVATED
- PICNIC AREA No.1 EXPANDED
- PICNIC AREA No.2 RENOVATED
- PICNIC AREA No.3 RENOVATED
- PARK OFFICE AND RECREATION BUILDING
- BEACH/BATHHOUSE
- CABINS EXPANDED
- TENT CAMPING/ TRAILER PARK RELOCATED
- STATE PUBLIC HUNTING AREA
- BOAT CLUBS (Concession) REVERT TO PUBLIC HUNTING AND FISHING
- WATERFOWL IMPOUNDMENT
- WILDLIFE MANAGER'S RESIDENCE

- WEST HILL LAUNCH RAMP
- HENDERSON'S ROCKS
- DOE RUN WATERFOWL IMPOUNDMENT
- PLEASANT CREEK CAMPING AREA EXPANDED
- PLEASANT CREEK PUBLIC HUNTING AND FISHING AREA EXPANDED/NEW ACCESS
- RIFLE RANGE RENOVATED

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
LAND UTILIZATION
(EXISTING AND PROPOSED)

SCALE IN FEET
1600' 0 1600' 3200'
1" = 1600'

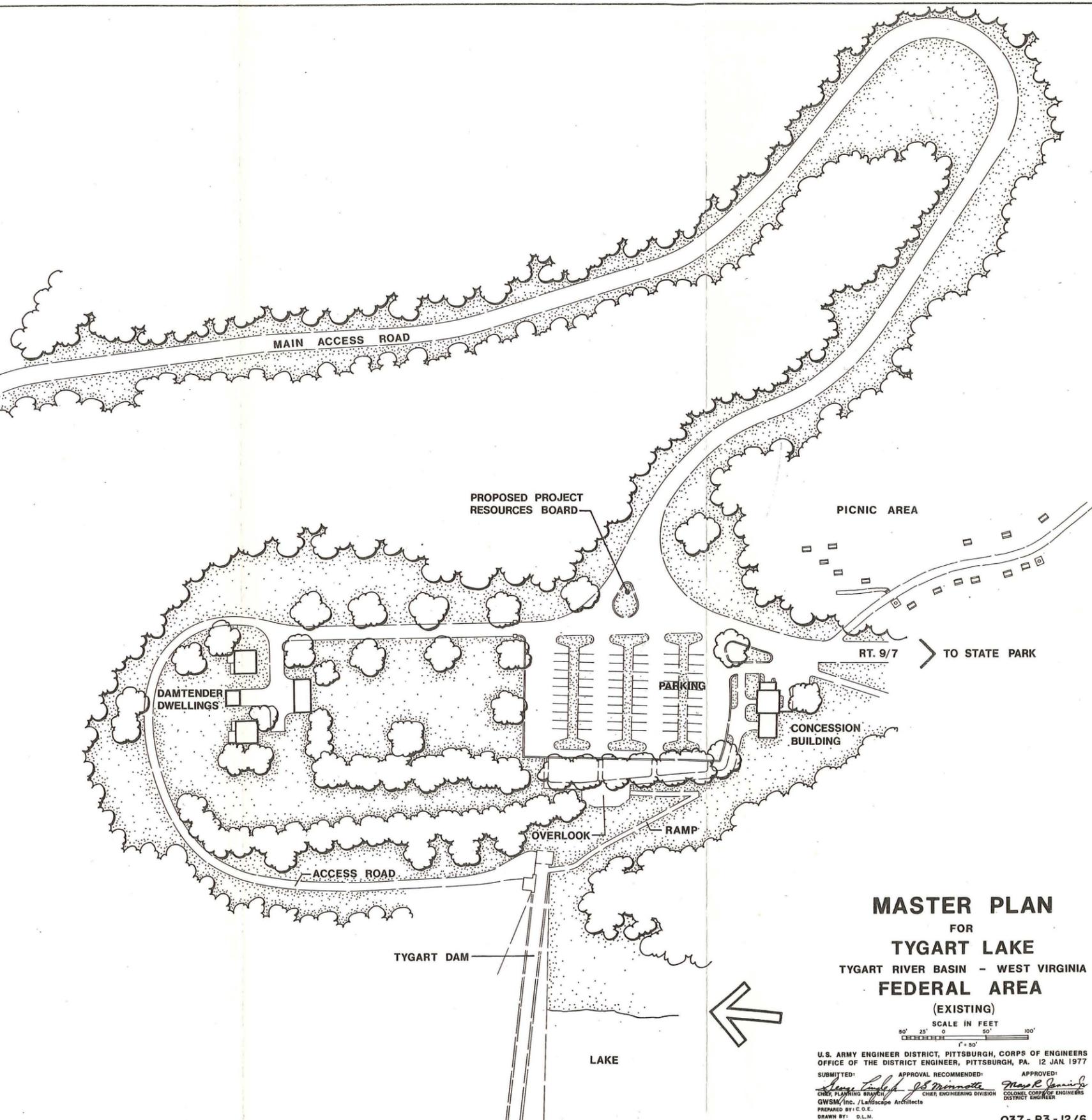
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
[Signatures]

CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
GWSM, Inc. / Landscape Architects
PREPARED BY: D.L.M., G.J.G.
DRAWN BY: D.L.M.
CHECKED BY: W.G.S.

SEE PLATE 3 FOR EXTENT OF RIGHT BANK PROPERTY AND RECOMMENDED ACQUISITION.

TO GRAFTON
W.V. SECONDARY ROUTE 4A
TO GRAFTON WATER WORKS



MASTER PLAN FOR TYGART LAKE TYGART RIVER BASIN - WEST VIRGINIA FEDERAL AREA (EXISTING)

SCALE IN FEET
1" = 50'

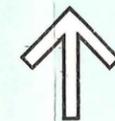
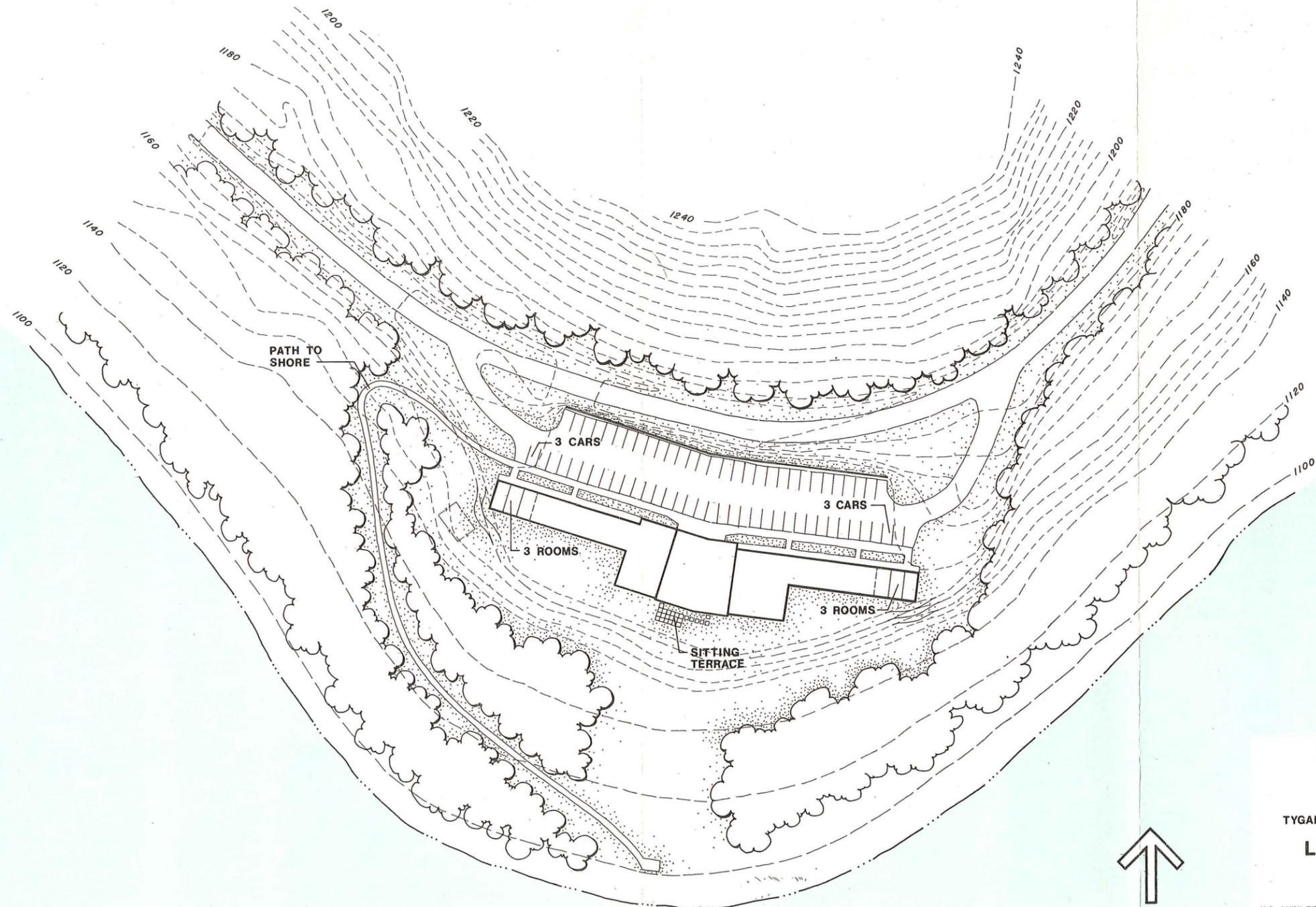
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]* APPROVED: *[Signature]*
CHIEF PLANNING BRANCH CHIEF ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

GWSM/Inc./Landscape Architects
DRAWN BY: D.L.M.
CHECKED BY: W.G.S.

037-R3-12/6

ALL NOTED ITEMS ARE PROPOSED ADDITIONS TO EXISTING STRUCTURE AND GROUNDS.



**MASTER PLAN
FOR
TYGART LAKE**
TYGART RIVER BASIN - WEST VIRGINIA
LODGE - SITE PLAN

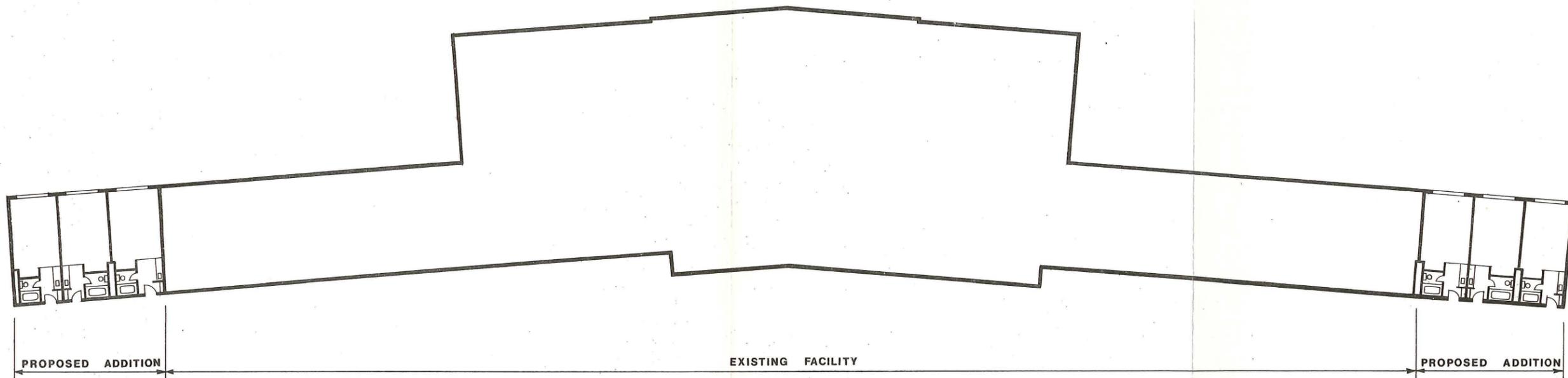
SCALE IN FEET
0 20 40 80
1" = 40'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
James L. ... *J. S. Minnesota* *Max K. ...*
CHIEF PLANNING BR. CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
GWSM, Inc. / Landscape Architects DISTRICT ENGINEER
PREPARED BY: W.M.G.
DRAWN BY: D.L.M.
CHECKED BY: W.M.G., W.G.S.

037 - R3 - 12/7



SOUTH ELEVATION



PLAN



SIDE ELEVATION



SIDE ELEVATION

PLANS AND DETAILS OF EXISTING FACILITIES OBTAINED FROM WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES DRAWINGS

**MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA**

LODGE

SCALE IN FEET
1" = 10' 0" 3/32" = 1'-0"

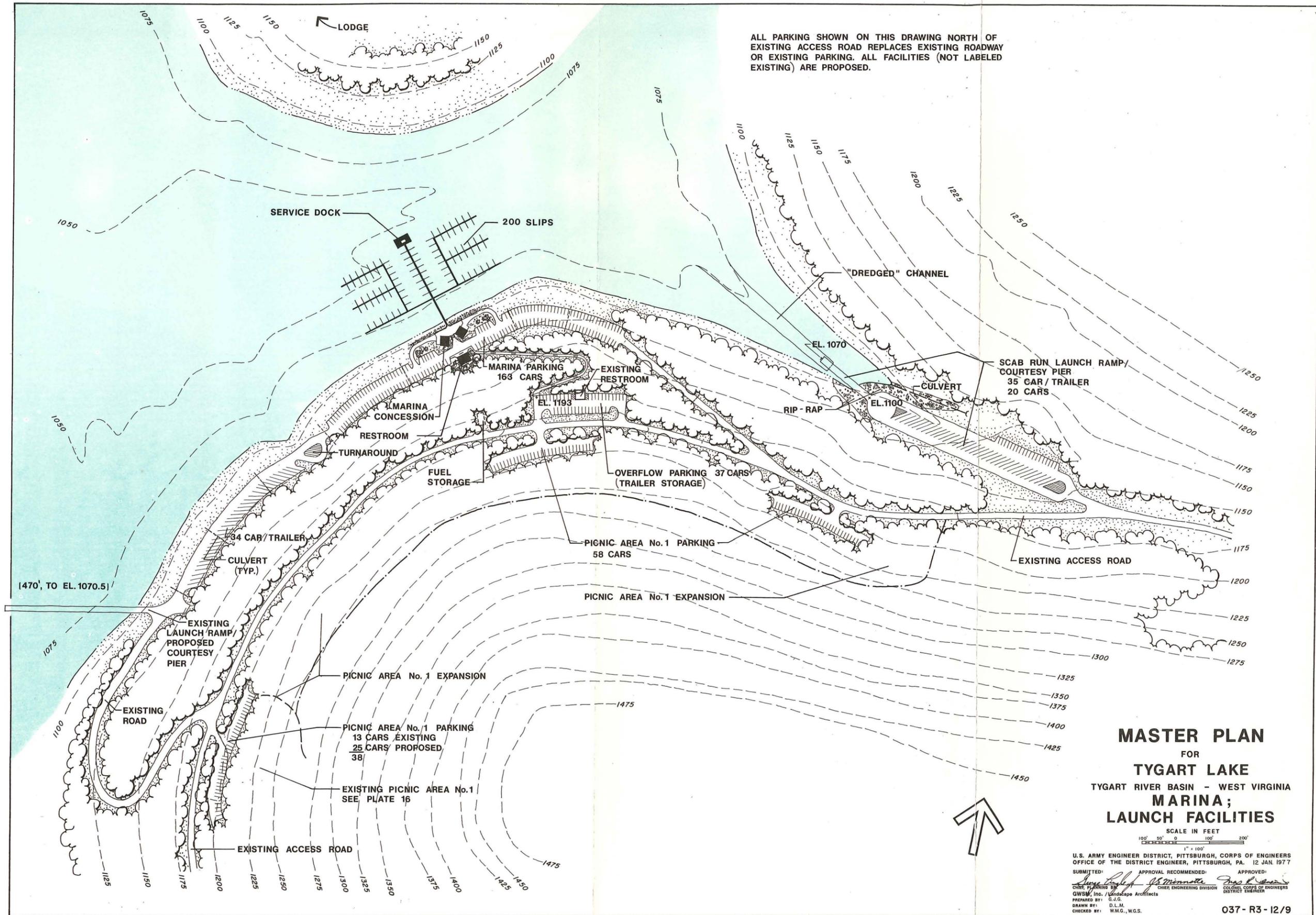
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]* APPROVED: *[Signature]*
CHIEF ENGINEERING DIVISION CHIEF ENGINEERING DIVISION DISTRICT ENGINEER

GWSM, Inc. / Landscape Architects
 PREPARED BY: WEST VIRGINIA D.N.R.
 DRAWN BY: J.C.S.
 CHECKED BY: D.L.M., W.G.S.

037-R3-12/8

ALL PARKING SHOWN ON THIS DRAWING NORTH OF EXISTING ACCESS ROAD REPLACES EXISTING ROADWAY OR EXISTING PARKING. ALL FACILITIES (NOT LABELED EXISTING) ARE PROPOSED.



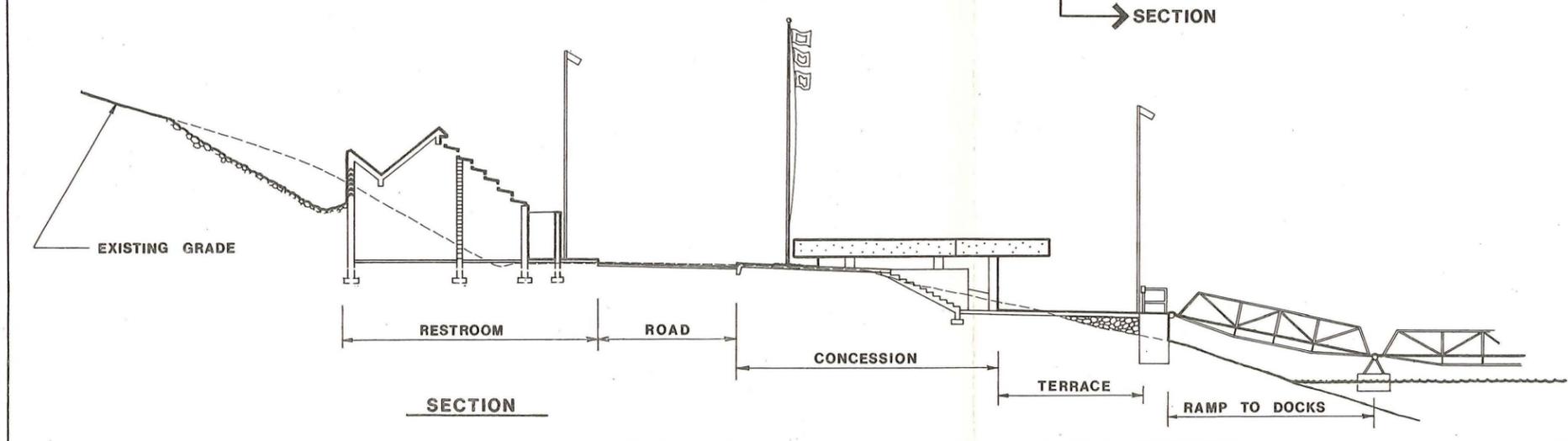
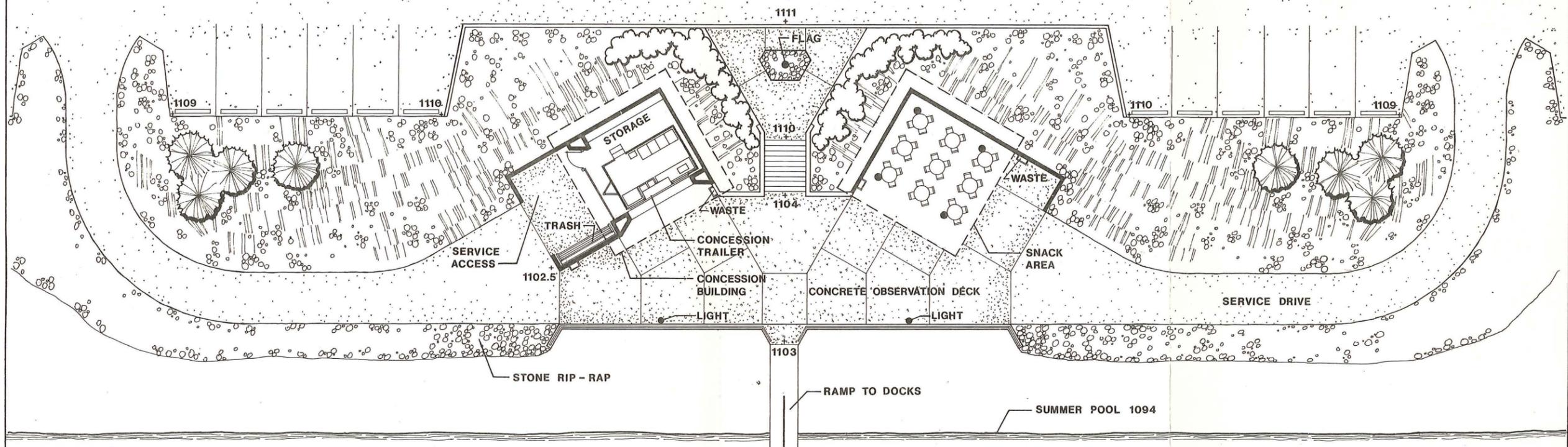
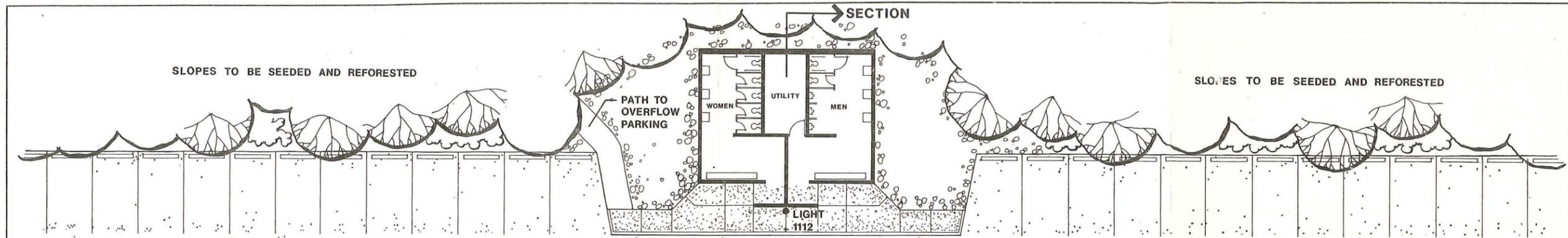
MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
MARINA;
LAUNCH FACILITIES

SCALE IN FEET
1" = 100'
100' 50' 0' 100' 200'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]
CHIEF PLANNING BY: [Signature] CHIEF ENGINEERING DIVISION: [Signature] COLONEL CORPS OF ENGINEERS
GWSM, Inc. / Landscape Architects
PREPARED BY: G.J.G.
DRAWN BY: D.L.M.
CHECKED BY: W.M.G., W.G.S.

037-R3-12/9



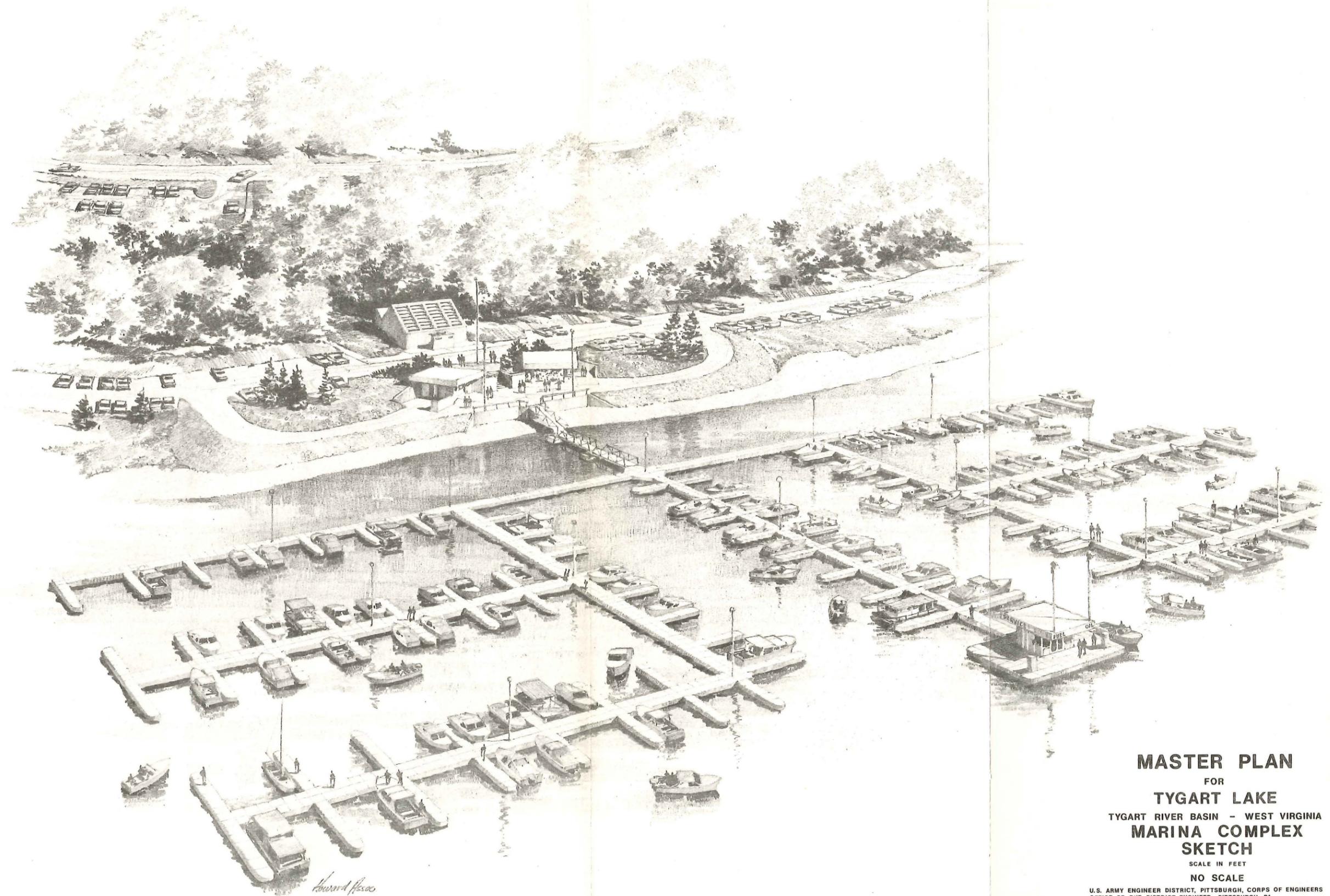
MASTER PLAN
 FOR
TYGART LAKE
 TYGART RIVER BASIN - WEST VIRGINIA
MARINA COMPLEX

SCALE IN FEET
 12" 0' 5' 10' 15' 20'
 1/8" = 1' - 0"

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
 OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]
 CHIEF, PLANNING DIVISION CHIEF, ENGINEERING DIVISION DISTRICT ENGINEER
 GWSM, Inc. / Landscape Architects
 PREPARED BY: G.J.G.
 DRAWN BY: D.L.M., J.C.S.
 CHECKED BY: W.M.G., W.G.S.

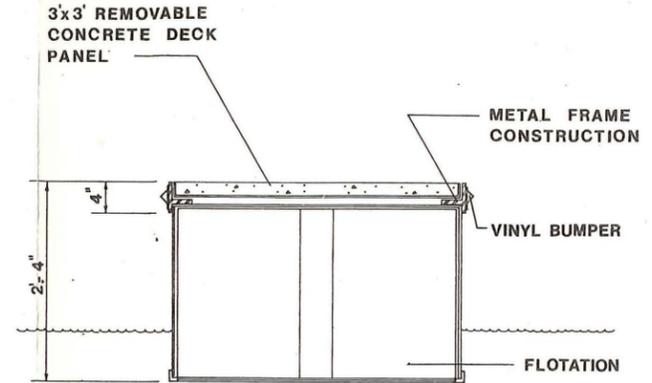
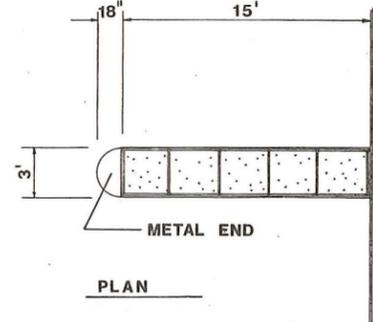
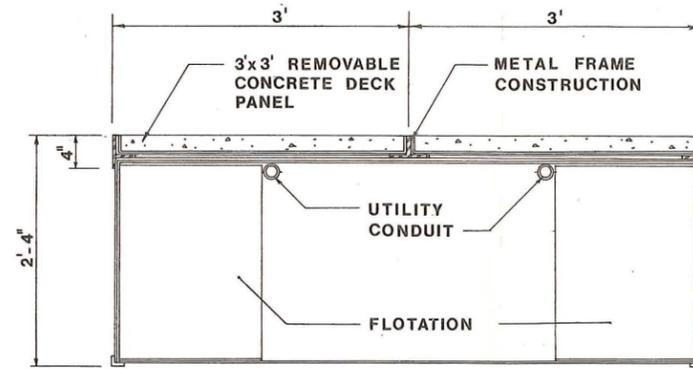
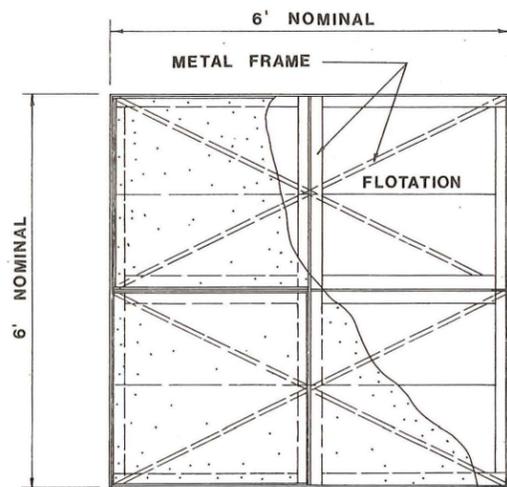
037 - R3 - 12/10



MASTER PLAN
 FOR
TYGART LAKE
 TYGART RIVER BASIN - WEST VIRGINIA
MARINA COMPLEX
SKETCH
 SCALE IN FEET
 NO SCALE

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
 OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA.
 SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
 CHIEF, PLANNING BR. CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
 GWSM, Inc. /Landscape Architects DISTRICT ENGINEER
 PREPARED BY: HOWARD ASSO.
 DRAWN BY: HOWARD ASSO.
 CHECKED BY: W.G.S.

037 - R3 - 12/11
 PLATE 11

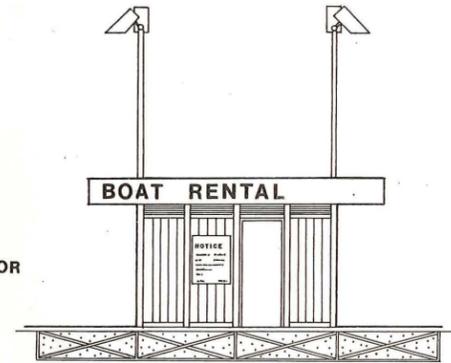
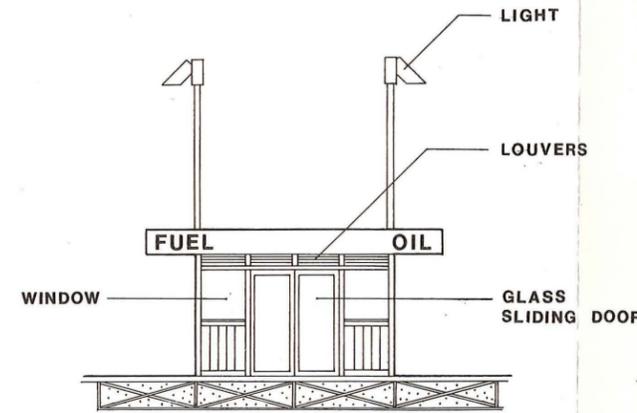
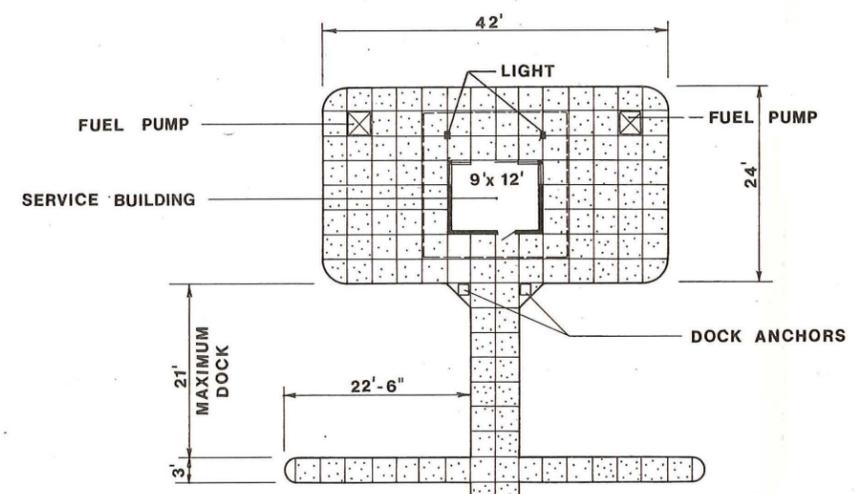


SECTION

FINGER DOCK
NO SCALE

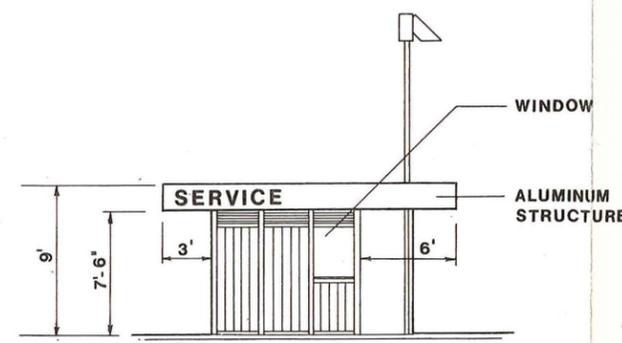
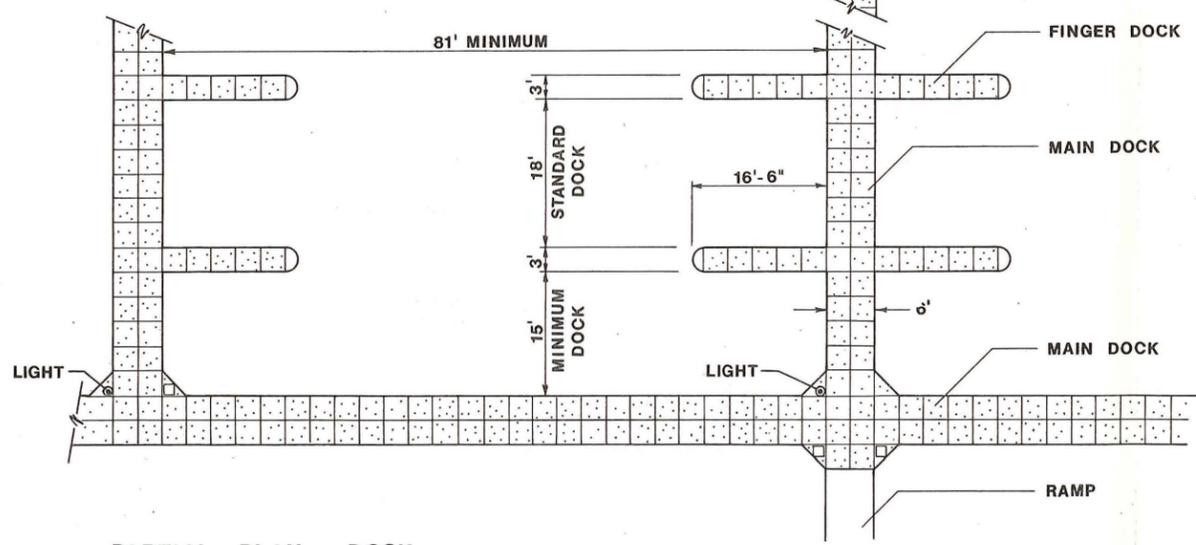
SECTION

PLAN



FRONT ELEVATION

REAR ELEVATION



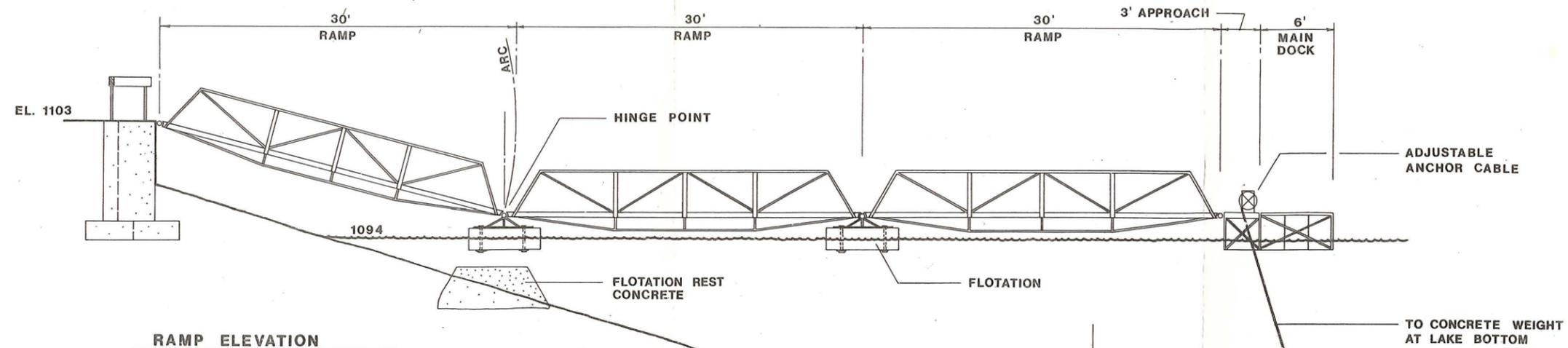
SERVICE BUILDING
SIDE ELEVATION - 1/4" = 1'-0"

PARTIAL PLAN - DOCK
1/8" = 1'-0"

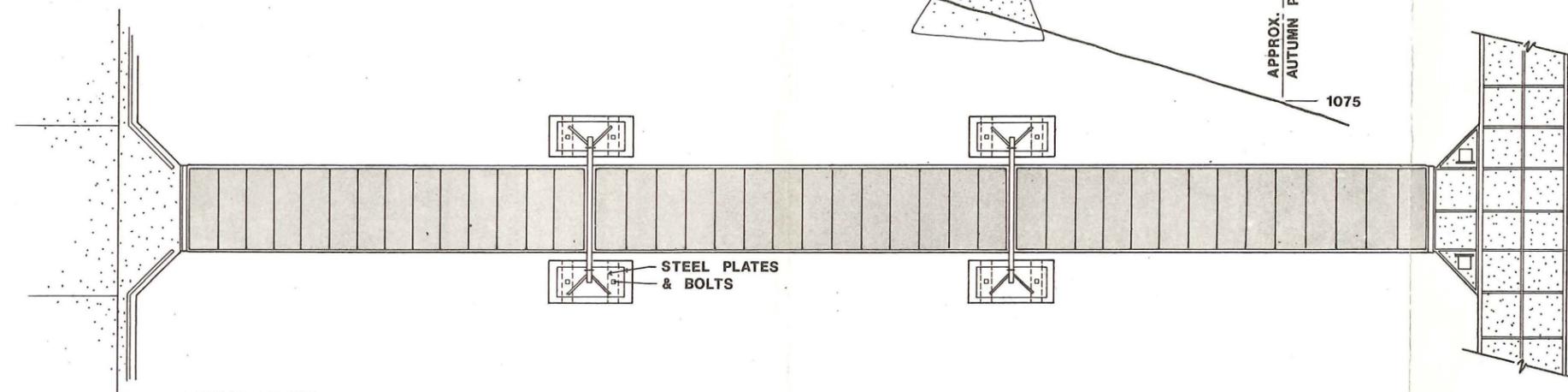
MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
MARINA DETAILS

SCALE IN FEET
12" 0 5' 10' 15' 20'
1/4" = 1'-0"
1/8" = 1'-0"
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
CHIEF PLANNING BY: CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
GW&M, Inc. / Landscape Architects DISTRICT ENGINEER
PREPARED BY: W.M.G.
DRAWN BY: J.C.S.
CHECKED BY: W.M.G., W.G.S.

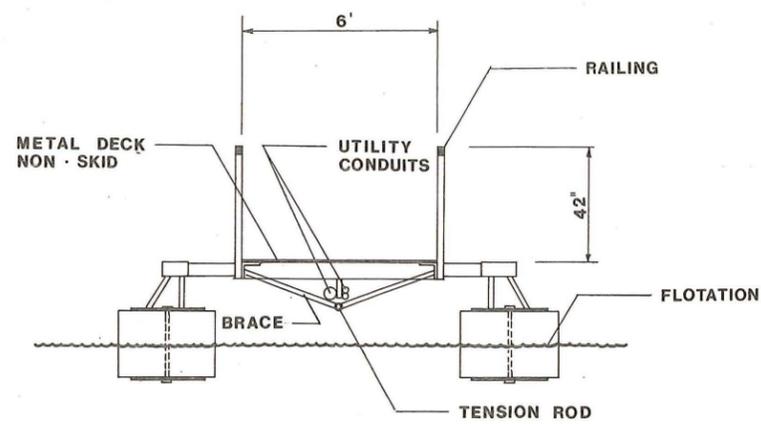
037 - R3 - 12/12
PLATE 12



RAMP ELEVATION
1/4" = 1'-0"



RAMP PLAN
1/4" = 1'-0"



RAMP SECTION
1/2" = 1'-0"

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
DOCK ACCESS
DETAILS

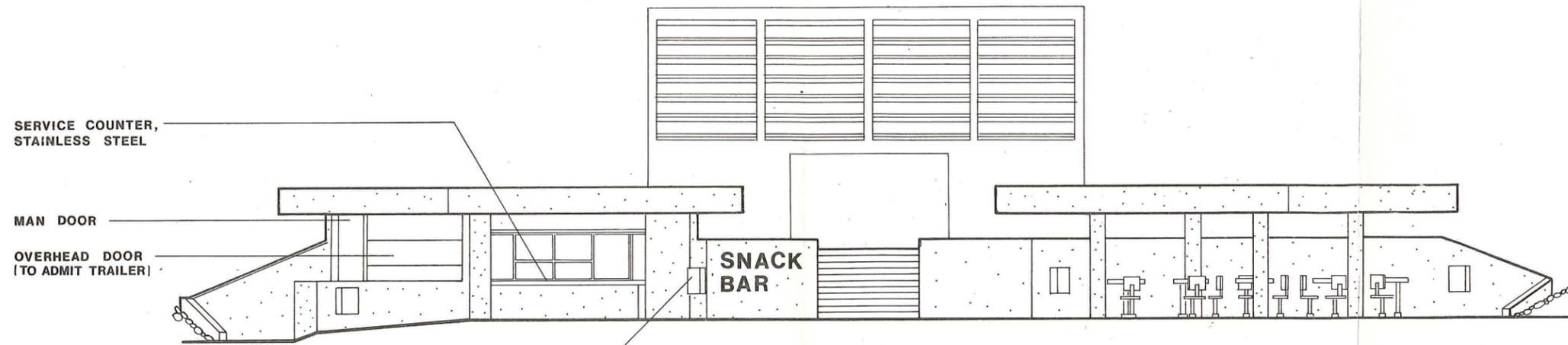
SCALE IN FEET
12" 0' 1' 2' 3' 4' 5'
1/4" = 1'-0" 1/2" = 1'-0"

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

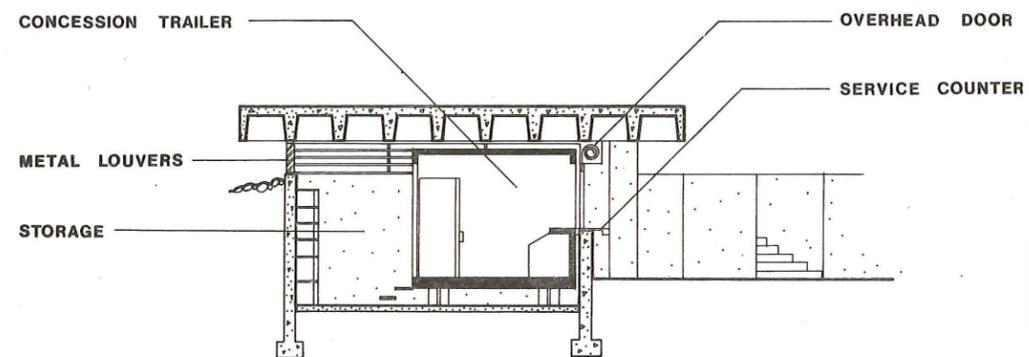
SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]

CHIEF ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

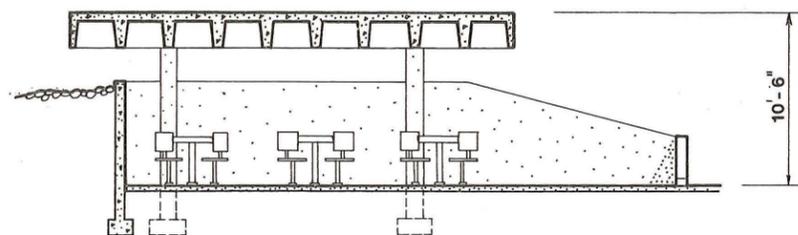
PREPARED BY: W.S.G.
DRAWN BY: J.C.S.
CHECKED BY: W.M.G., W.G.S.



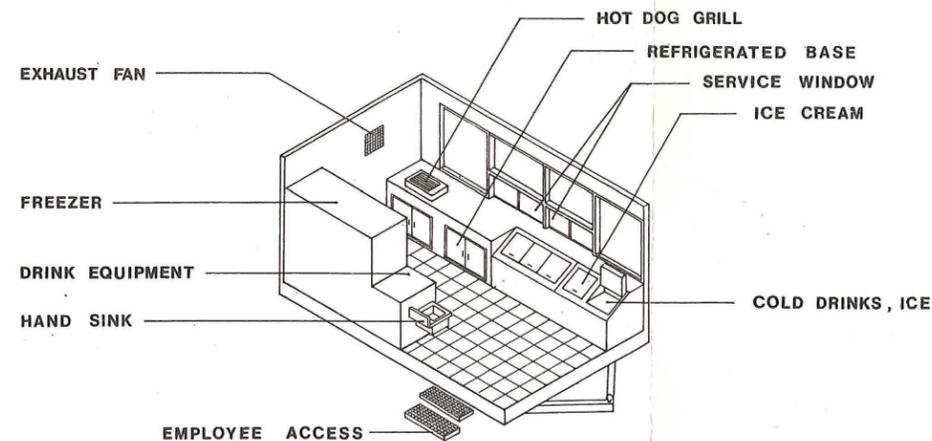
ELEVATION
LAKESIDE VIEW



SECTION
THRU CONCESSION BUILDING



SECTION
THRU SNACK AREA



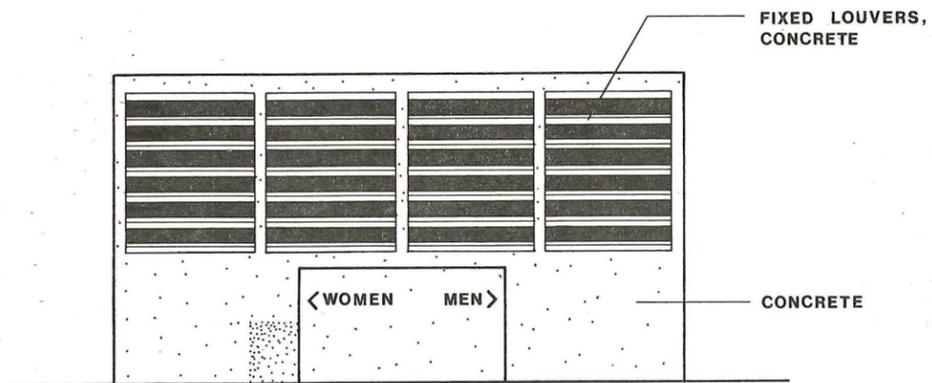
ISOMETRIC VIEW OF CONCESSION TRAILER

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
MARINA
CONCESSION COMPLEX

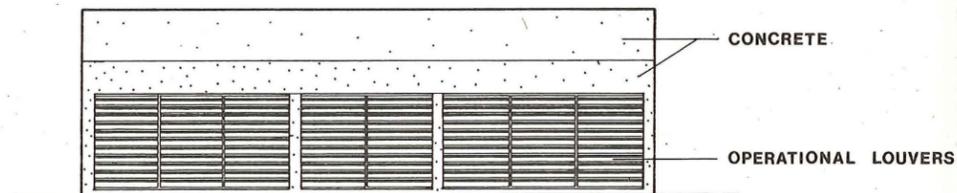
SCALE IN FEET
12" 0 5' 10"

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
GWSM, Inc. / Landscape Architects
PREPARED BY: MORGAN & ASSO.
DRAWN BY: J.C.S.
CHECKED BY: D.L.M., W.G.S.

037 - R3 - 12/14



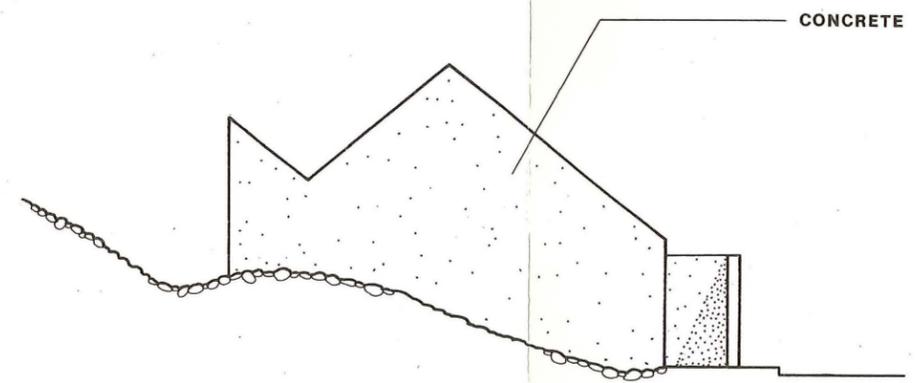
FRONT ELEVATION



REAR ELEVATION



SECTION



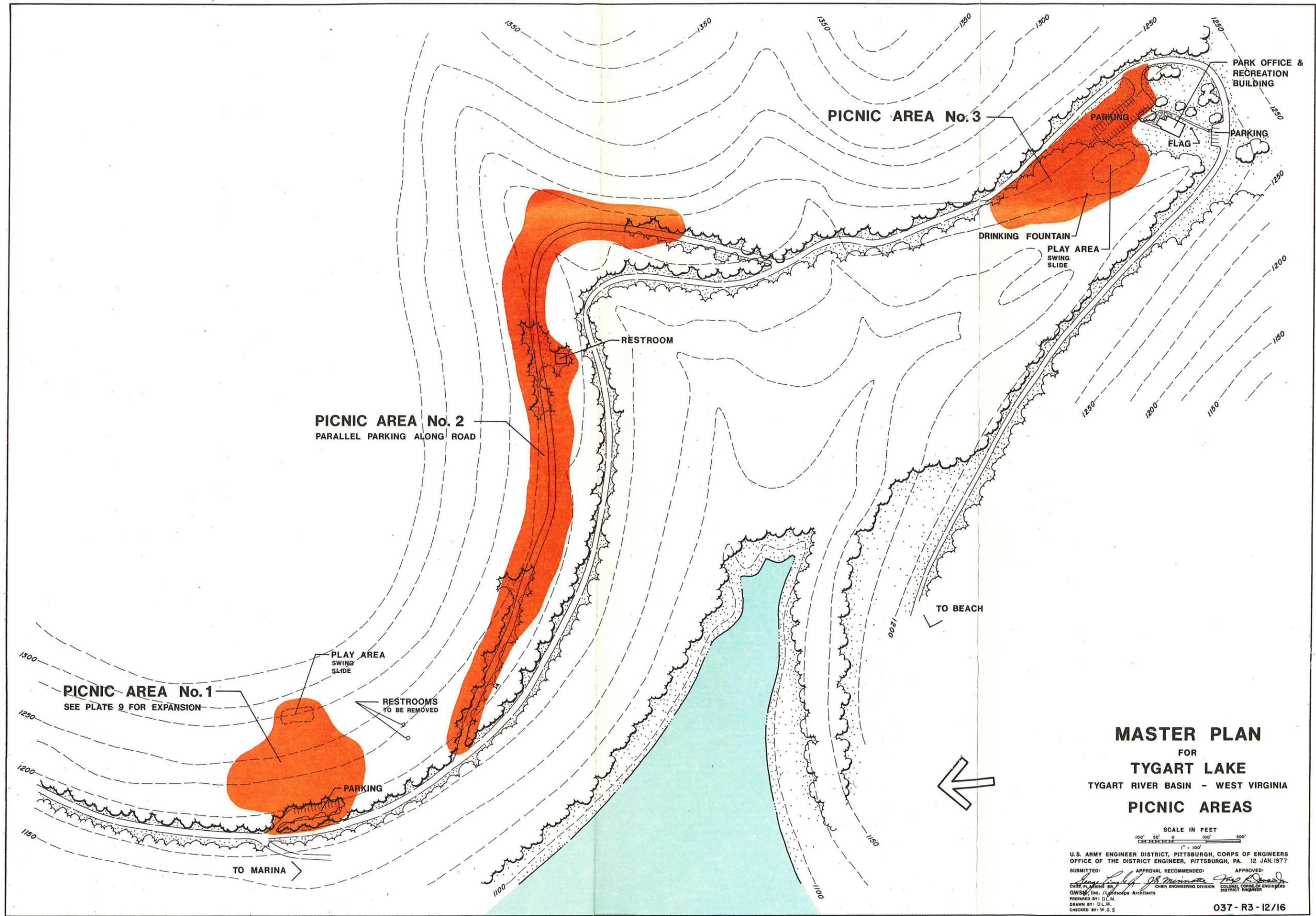
SIDE ELEVATION

MASTER PLAN
 FOR
TYGART LAKE
 TYGART RIVER BASIN - WEST VIRGINIA
MARINA RESTROOM

SCALE IN FEET
 12" 0' 5' 10'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
 OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]* APPROVED: *[Signature]*
 GWSM, Inc., Landscape Architects CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
 PREPARED BY: MORGAN & ASSO. DISTRICT ENGINEER
 DRAWN BY: J.C.S.
 CHECKED BY: D.L.M., W.G.S.



MASTER PLAN
 FOR
TYGART LAKE
 TYGART RIVER BASIN - WEST VIRGINIA
PICNIC AREAS

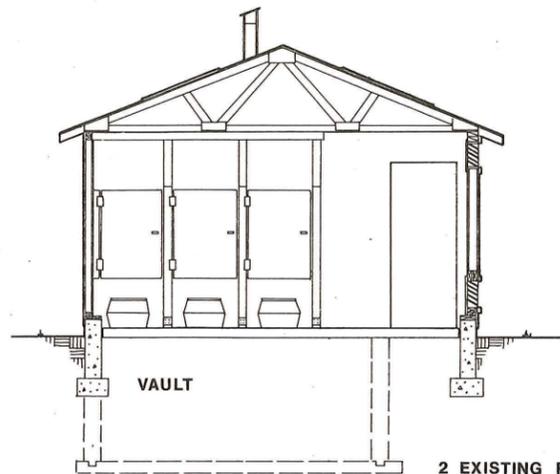
SCALE IN FEET
 100' 50' 0' 50' 100' 200'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
 OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]
 DISTRICT ENGINEER

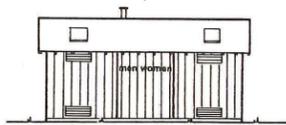
GWSM, Inc., Landscape Architects
 PREPARED BY: D.L.M.
 DRAWN BY: D.L.M.
 CHECKED BY: W.G.S.

037-R3-12/16
 PLATE 16

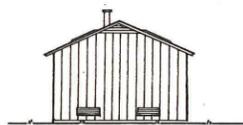


SECTION
NO SCALE

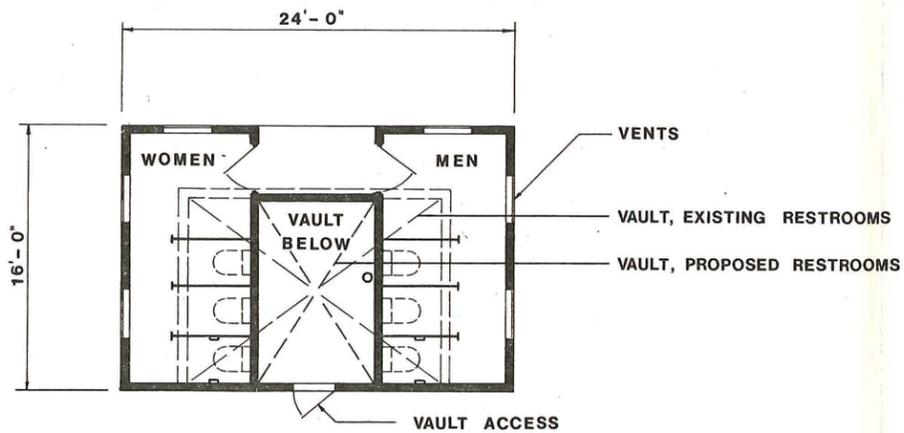
2 EXISTING RESTROOMS TO BE CONVERTED TO CHEMICAL OPERATION; VAULT BECOMES HOLDING TANK. PROPOSED RESTROOMS TO BE SIMILAR OPERATION, WITH SMALLER VAULT.



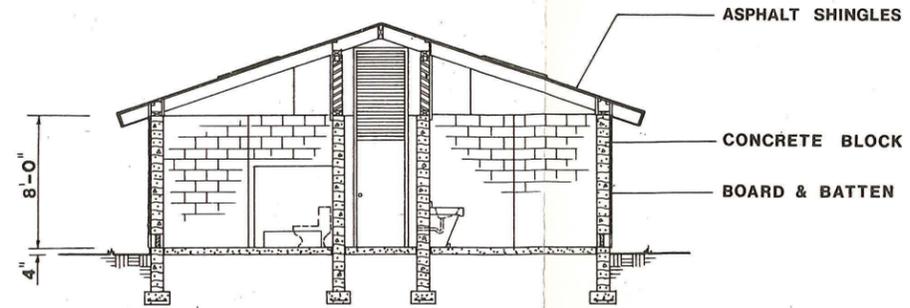
FRONT ELEVATION
1/8" = 1'-0"



SIDE ELEVATION
1/8" = 1'-0"



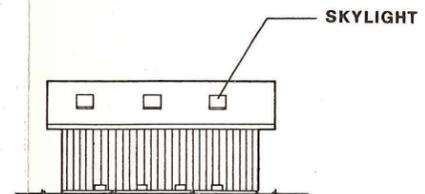
PLAN EXISTING (AND PROPOSED) RESTROOMS
1/4" = 1'-0" PLEASANT CREEK AREA



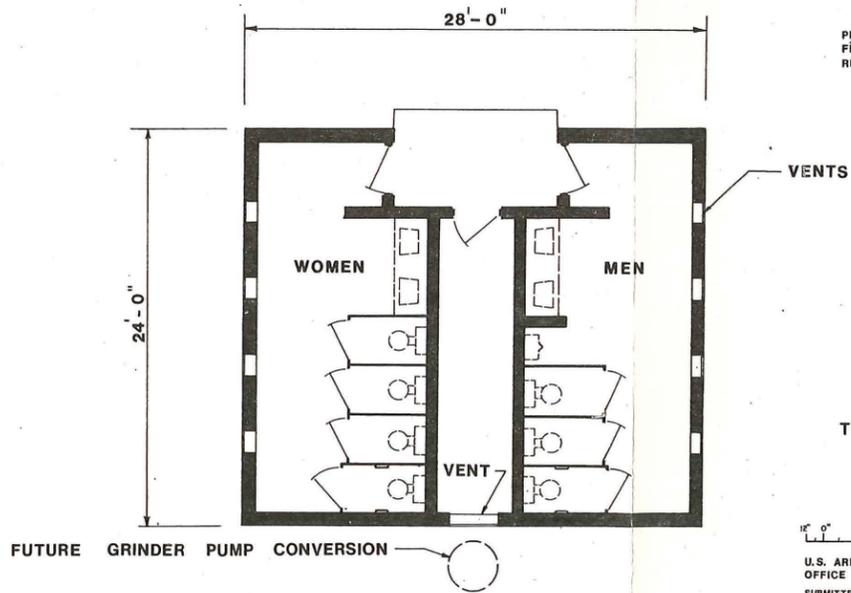
SECTION
1/4" = 1'-0"



FRONT ELEVATION
1/8" = 1'-0"



SIDE ELEVATION
1/8" = 1'-0"



PLAN - EXISTING RESTROOMS
1/4" = 1'-0" PICNIC AREAS 1 & 2

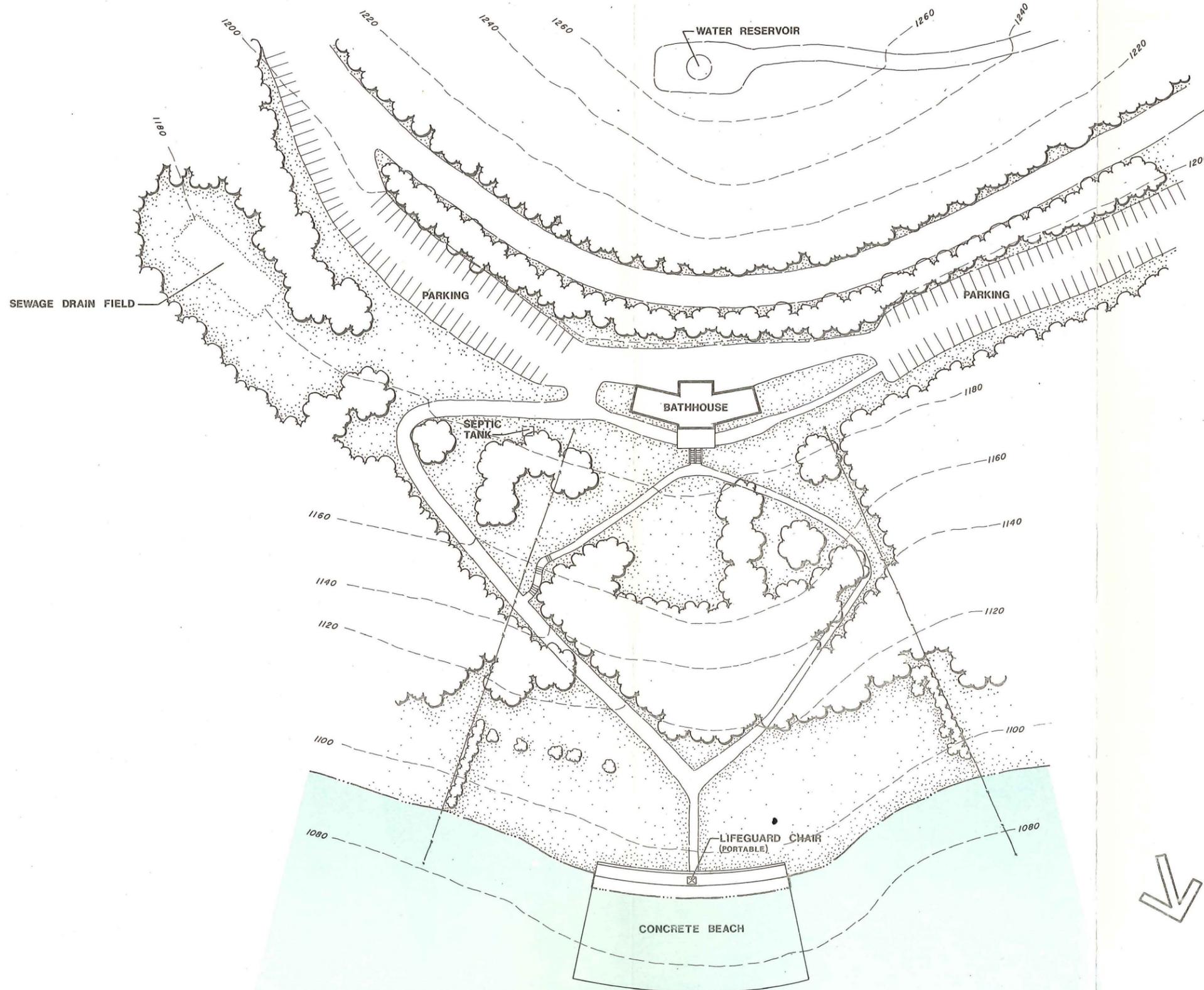
PLANS AND DETAILS OF EXISTING FACILITIES OBTAINED FROM WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES DRAWINGS

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
RESTROOMS



U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
[Signatures]
CHIEF, PLANNING BR: CHIEF, ENGINEERING DIVISION: COLONEL, CORPS OF ENGINEERS
OWSM, Inc. / Landscape Architects
PREPARED BY: WEST VIRGINIA D.N.R.
DRAWN BY: J.C.S.
CHECKED BY: D.L.M., GAI, Inc., WGS.

037-R3-12/17

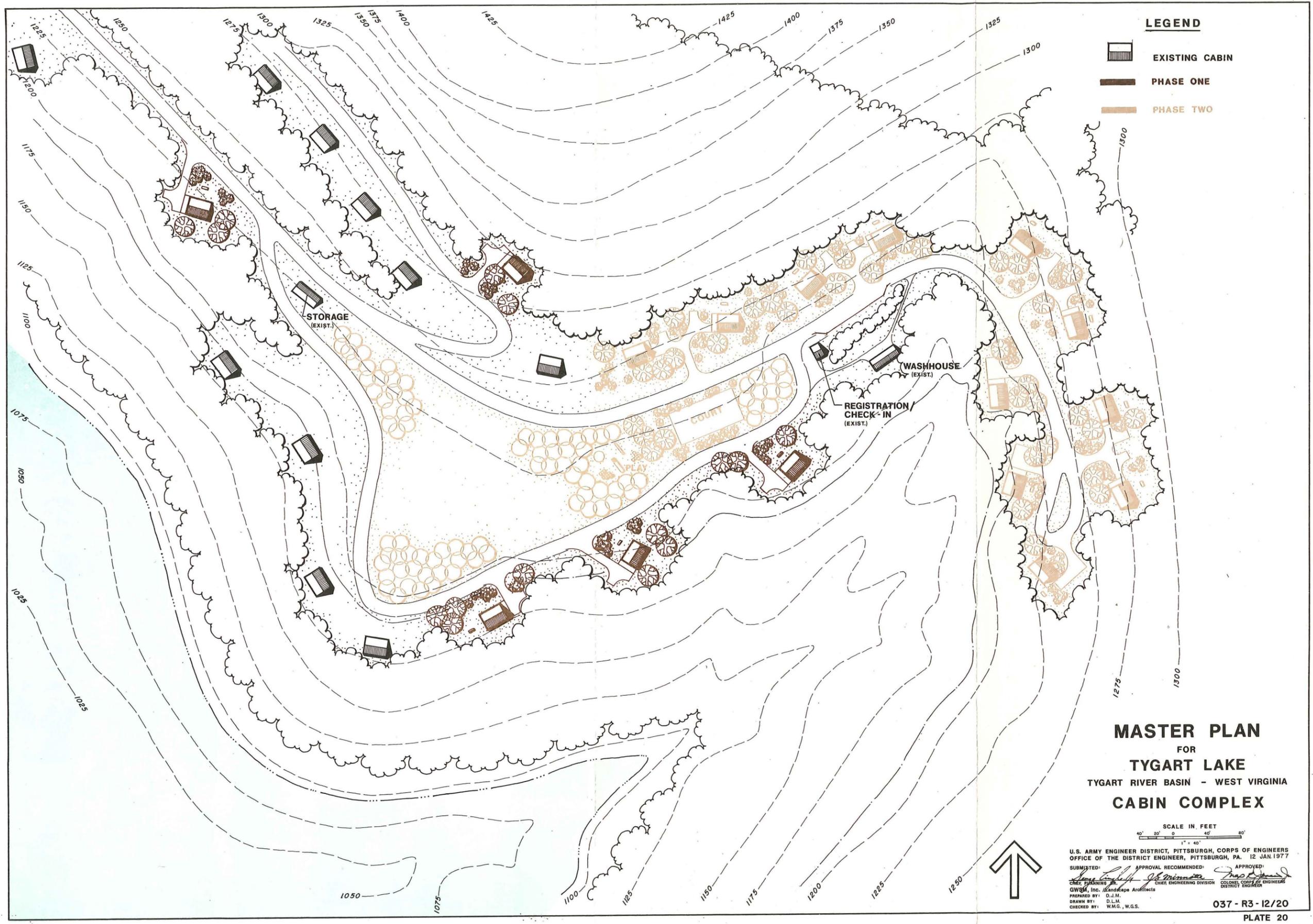


MASTER PLAN
 FOR
TYGART LAKE
 TYGART RIVER BASIN - WEST VIRGINIA
BEACH AND BATHHOUSE
 (EXISTING)

SCALE IN FEET
 0' 20' 40' 80'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
 OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977
 SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
 CHIEF, PLANNING DIVISION CHIEF, ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS
 DISTRICT ENGINEER
 PREPARED BY: GWSB, Inc., / L. L. Scofield Architects
 DRAWN BY: W.V.S.P.
 CHECKED BY: D.L.M.
 W.G.S.

037 - R3 - 12/18



LEGEND

-  EXISTING CABIN
-  PHASE ONE
-  PHASE TWO

**MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
CABIN COMPLEX**

SCALE IN FEET
40' 20' 0' 40' 80'

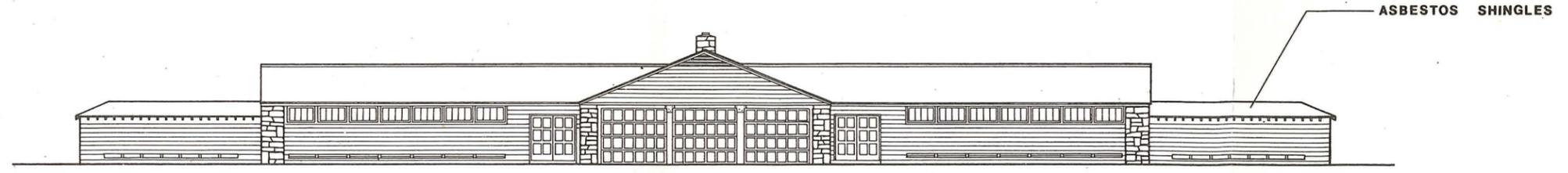
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: *[Signature]* APPROVAL RECOMMENDED: *[Signature]* APPROVED: *[Signature]*
CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS DISTRICT ENGINEER

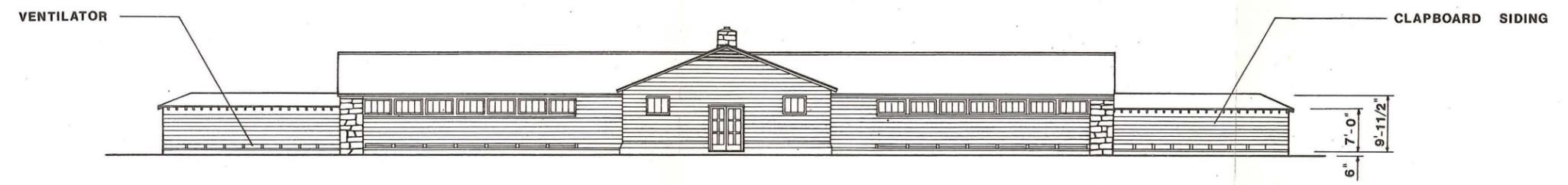
GWSM, Inc. Landscape Architects
 PREPARED BY: D.J.M.
 DRAWN BY: D.L.M.
 CHECKED BY: W.M.G., W.G.S.

037 - R3 - 12/20

PLATE 20



FRONT ELEVATION



REAR ELEVATION



SIDE ELEVATION



SIDE ELEVATION

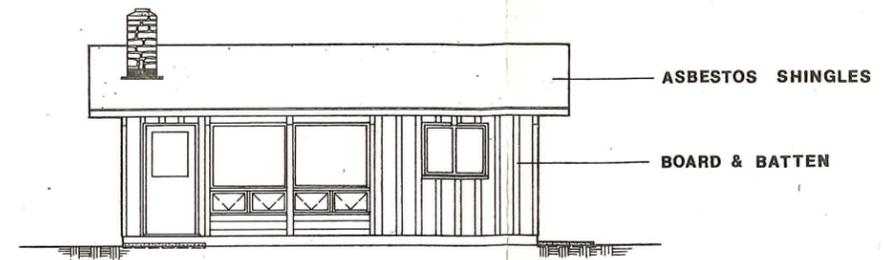
PLANS AND DETAILS OF EXISTING FACILITIES OBTAINED FROM WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES DRAWINGS

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
BATHHOUSE
[EXISTING]

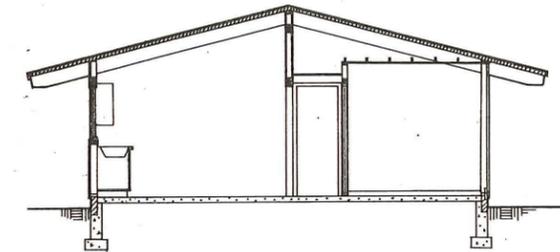
SCALE IN FEET
1/8" = 1'-0"
0 5 10 15 20

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
[Signatures]
CHIEF ENGINEERING DIVISION COLONEL CORPS OF ENGINEERS
DISTRICT ENGINEER
PREPARED BY: WEST VIRGINIA D.N.R.
DRAWN BY: J.C.S.
CHECKED BY: D.L.M., W.G.S.

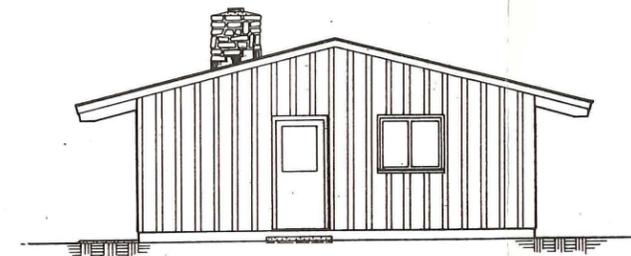
037 - R3 - 12 / 19
PLATE 19



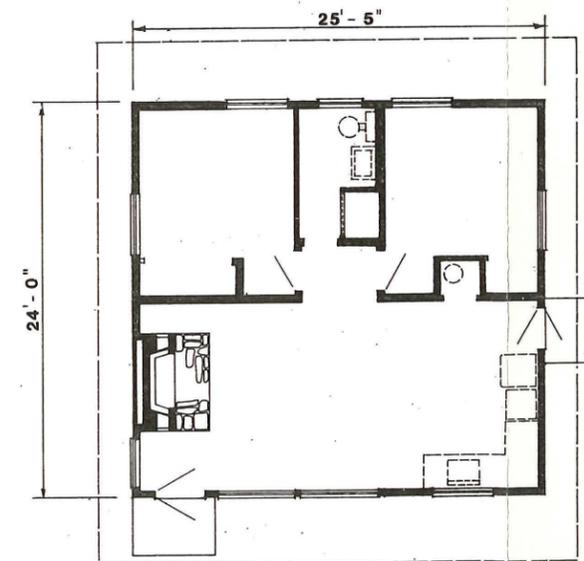
FRONT ELEVATION



SECTION



SIDE ELEVATION



PLAN

PLANS AND DETAILS OF EXISTING FACILITIES OBTAINED FROM WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES DRAWINGS

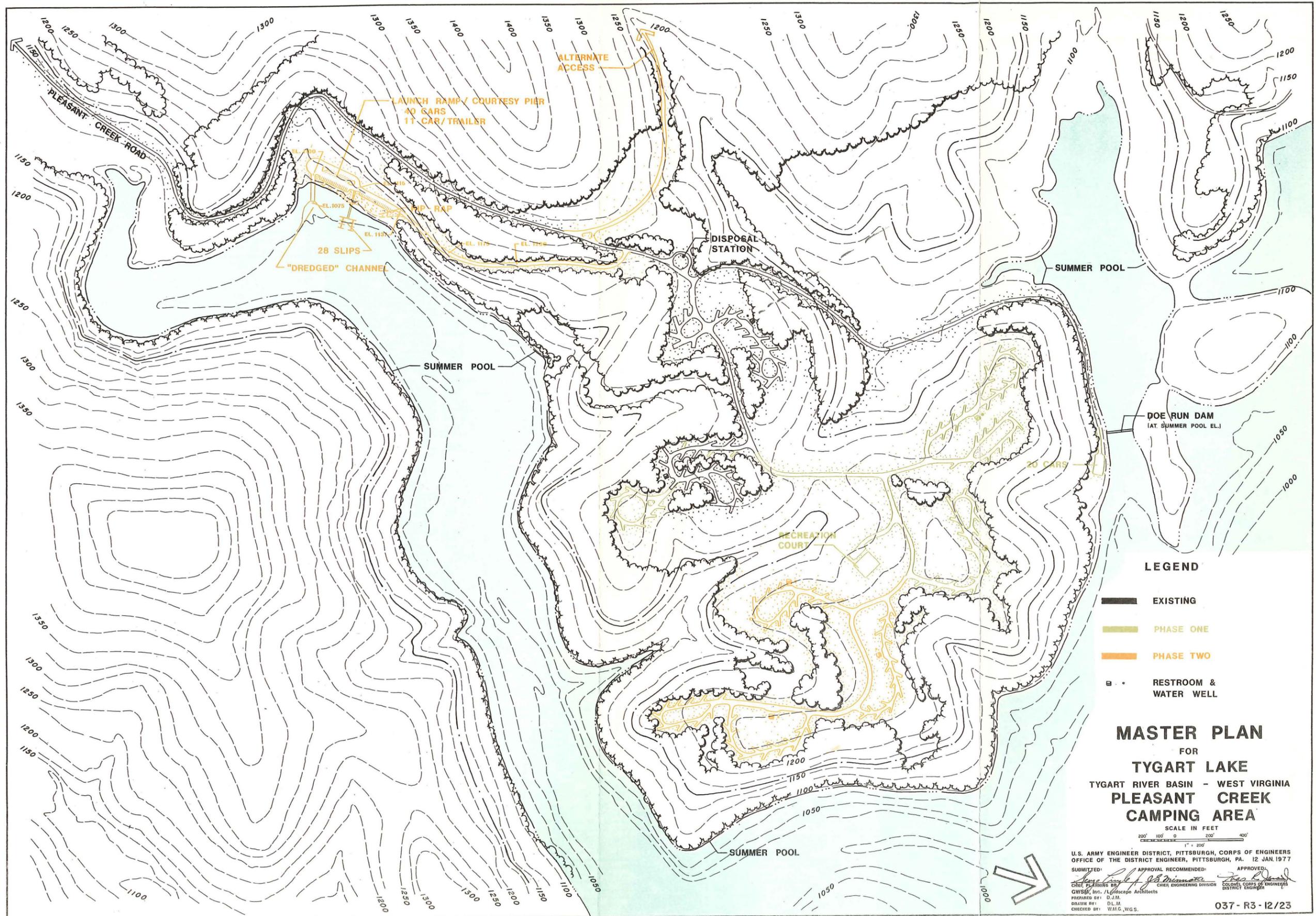
MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
CABIN

SCALE IN FEET
12' 0" 1/4" = 1'-0" 10'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977
SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature]
CHIEF, ENGINEERING DIVISION CHIEF, ENGINEERING DIVISION DISTRICT ENGINEER
PREPARED BY: WEST VIRGINIA D.N.R. COLONEL, CORPS OF ENGINEERS
DRAWN BY: J.C.S.
CHECKED BY: D.L.M., WGS.

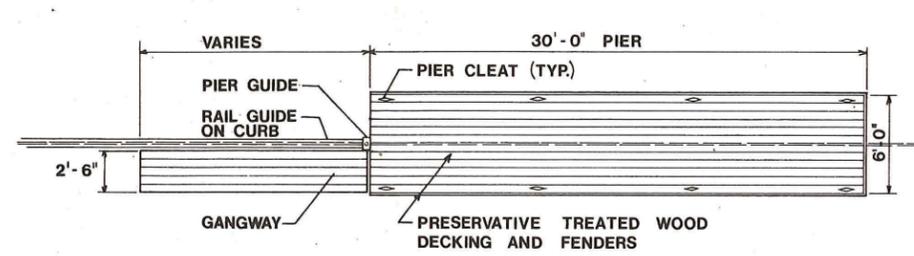
037 - R3 - 12/21

Power line on West Hill

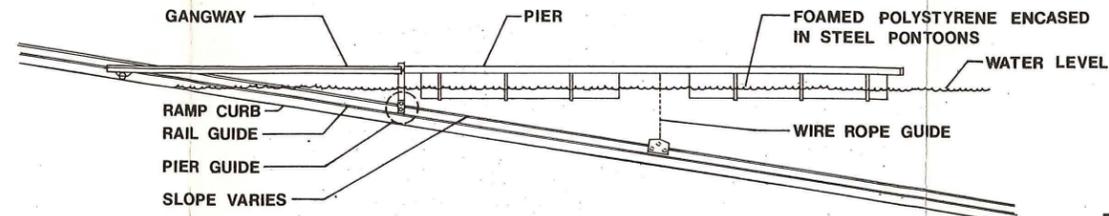


037 - R3 - 12/23

PLATE 23

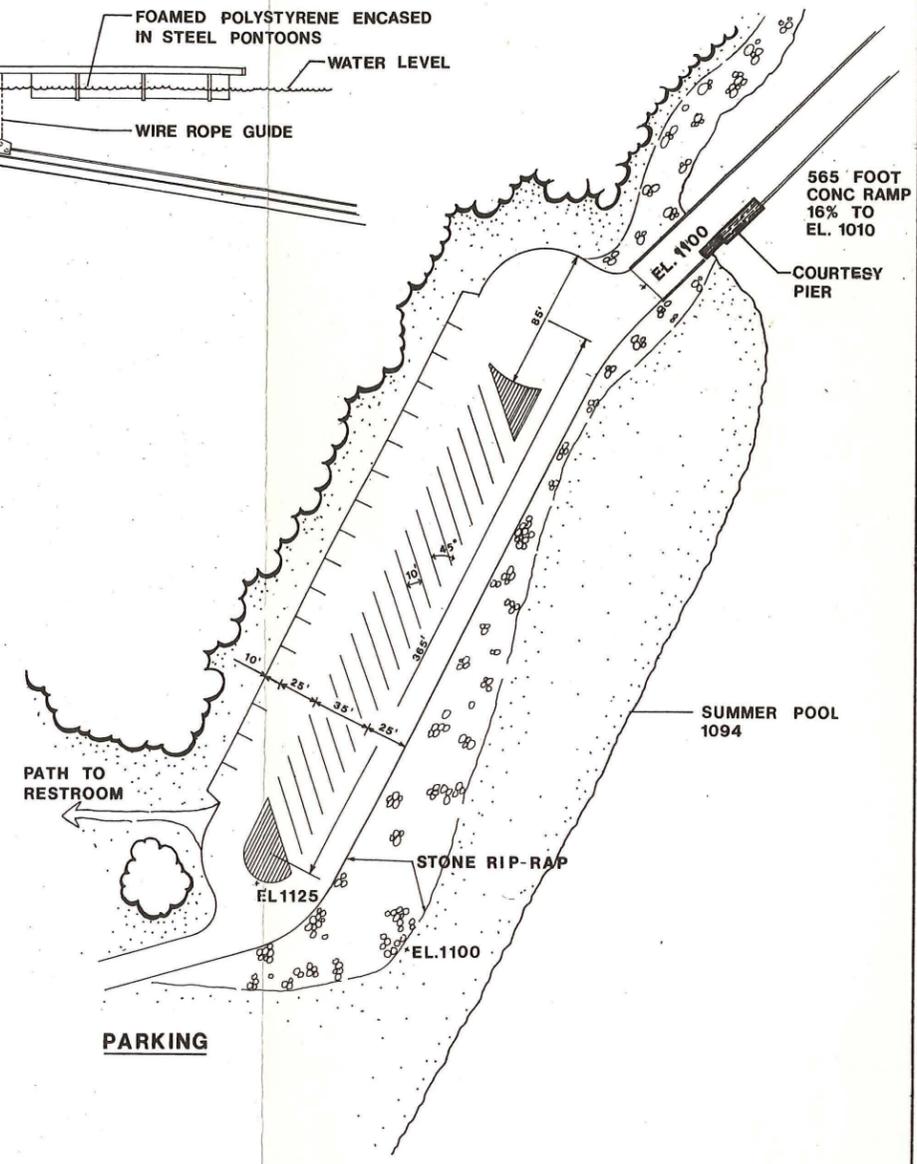
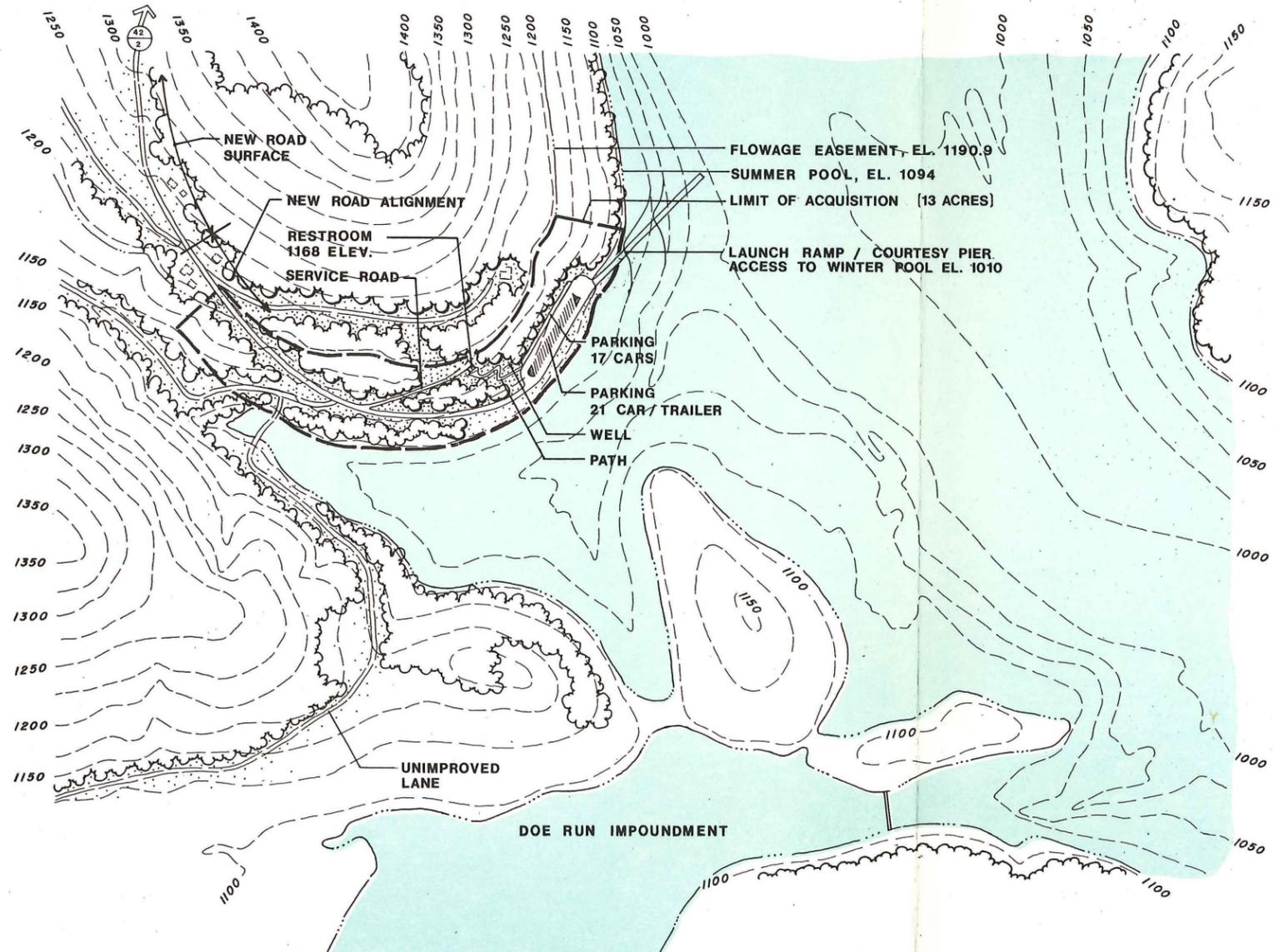


PLAN



ELEVATION

COURTESY PIER



MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
WEST HILL LAUNCH RAMP



SCALE IN FEET
200' 100' 0' 200' 400'

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

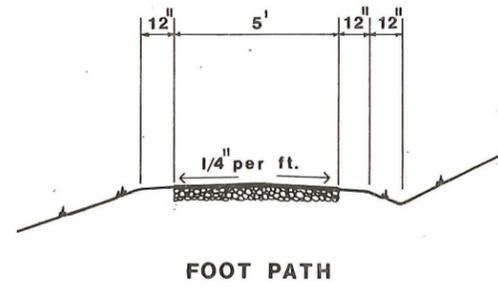
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:

PREPARED BY: W.M.G. DRAWN BY: D.L.M. CHECKED BY: W.M.G., W.G.S.

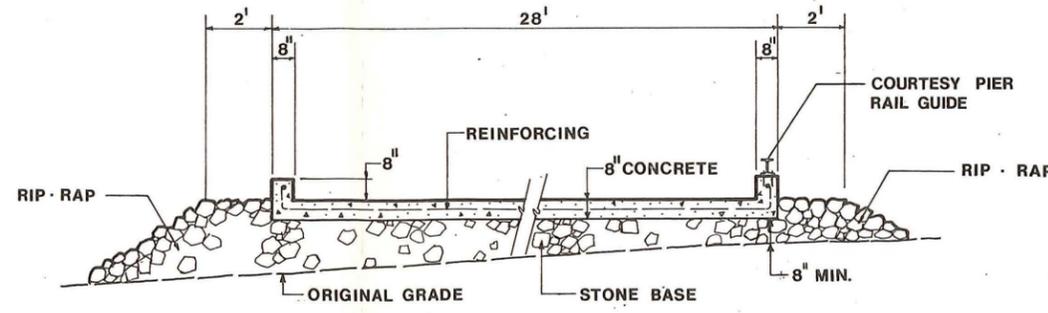
GWSM, Inc. / Landscape Architects
D.L.M. DISTRICT ENGINEER

8470
8470
8470

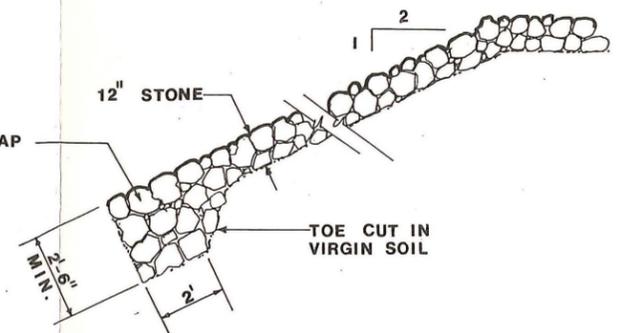
037 - R3 - 12/24



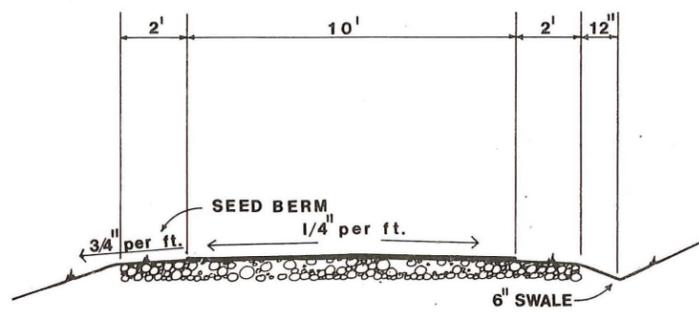
FOOT PATH



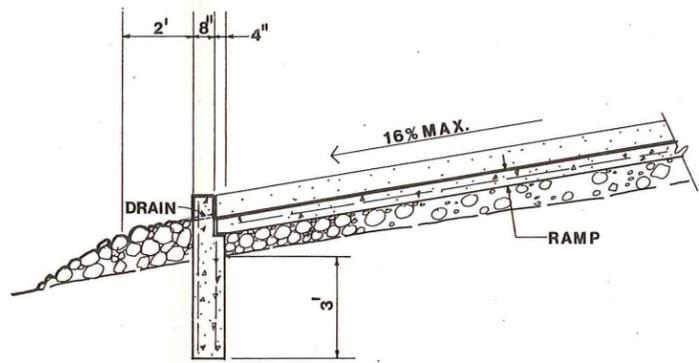
CROSS SECTION



RIP RAP

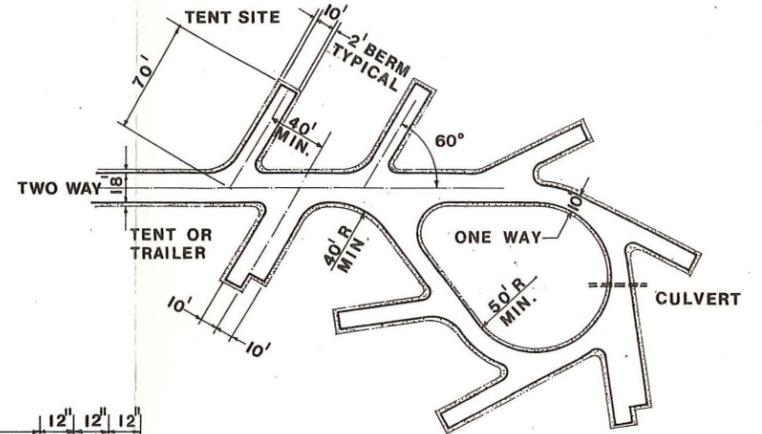


ONE-WAY PARK ROAD

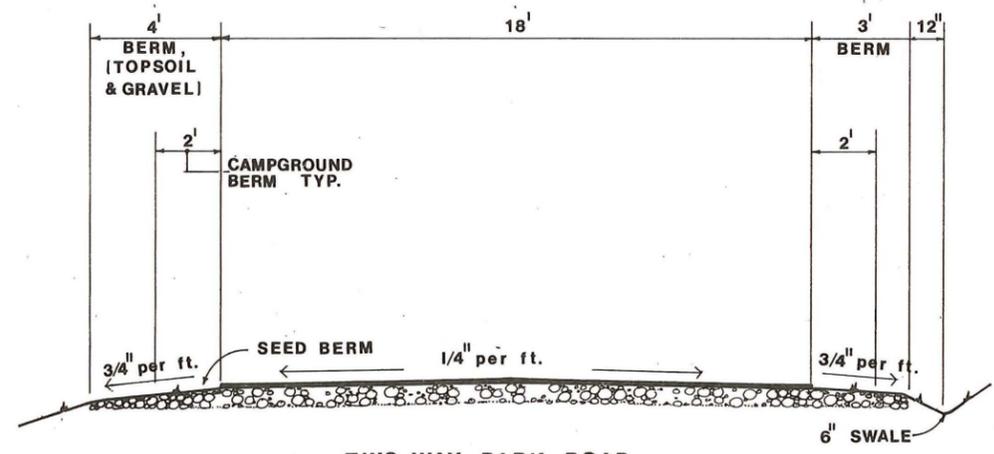


END SECTION

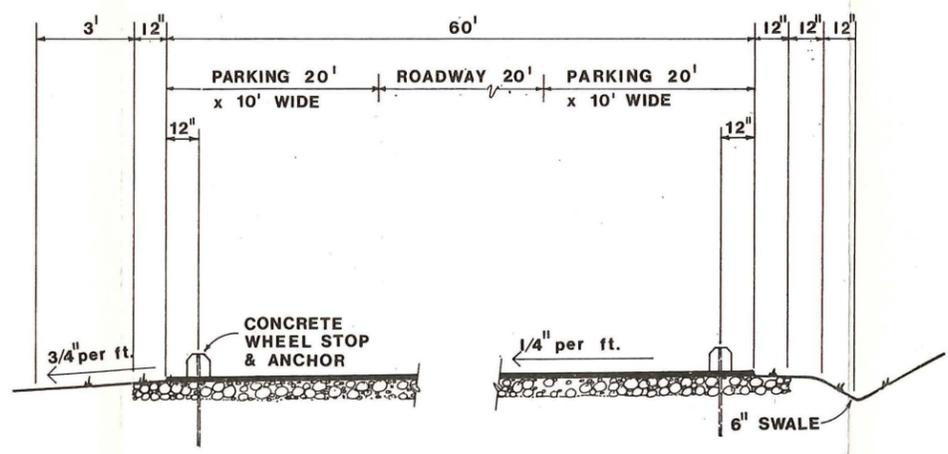
LAUNCH RAMP



CAMPSITE LAYOUT



TWO-WAY PARK ROAD



CAR PARKING, 90°

TYPICAL CIRCULATION SECTIONS

ALL SURFACING ON LEFT BANK IS "TAR & CHIPS" AND ON RIGHT BANK, BITUMINOUS CONCRETE

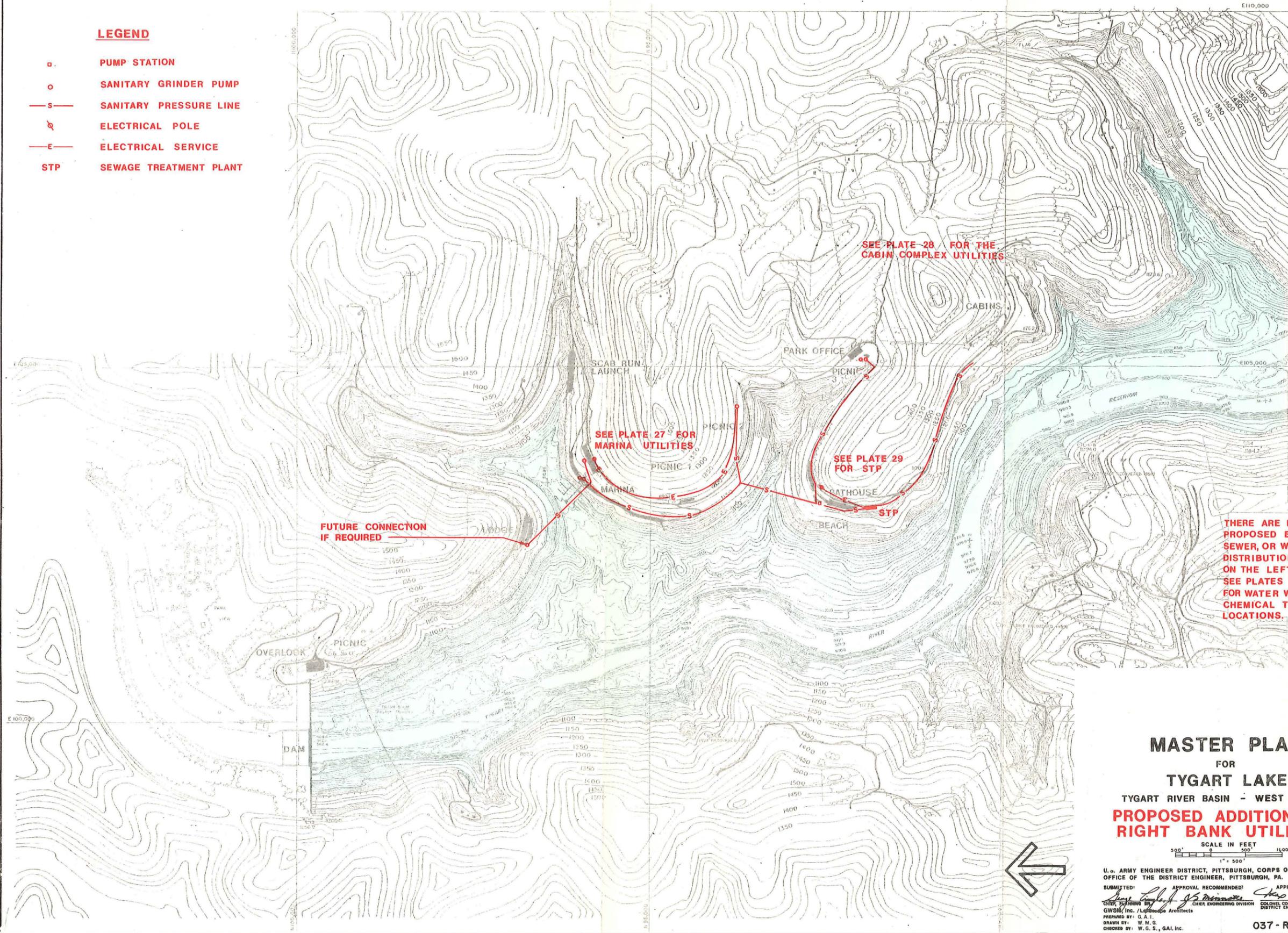
MASTER PLAN FOR TYGART LAKE TYGART RIVER BASIN - WEST VIRGINIA TYPICAL DETAILS

SCALE IN FEET NO SCALE

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977
 SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]
 CHIEF ENGINEER DIVISION COLONEL, CORPS OF ENGINEERS DISTRICT ENGINEER
 GWSM, Inc. / Landscape Architects
 PREPARED BY: W. M. G. DRAWN BY: W. M. G. CHECKED BY: W. G. S.
 037 - R3 - 12/25

LEGEND

- PUMP STATION
- SANITARY GRINDER PUMP
- S— SANITARY PRESSURE LINE
- ⊕ ELECTRICAL POLE
- E— ELECTRICAL SERVICE
- STP SEWAGE TREATMENT PLANT



MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
**PROPOSED ADDITIONS TO
RIGHT BANK UTILITIES**

SCALE IN FEET
0 500 1000
1" = 500'

U. S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977

SUBMITTED: APPROVAL RECOMMENDED: APPROVED:
[Signature] *[Signature]* *[Signature]*
CHIEF ENGINEER DIVISION CHIEF ENGINEERING DIVISION DISTRICT ENGINEER

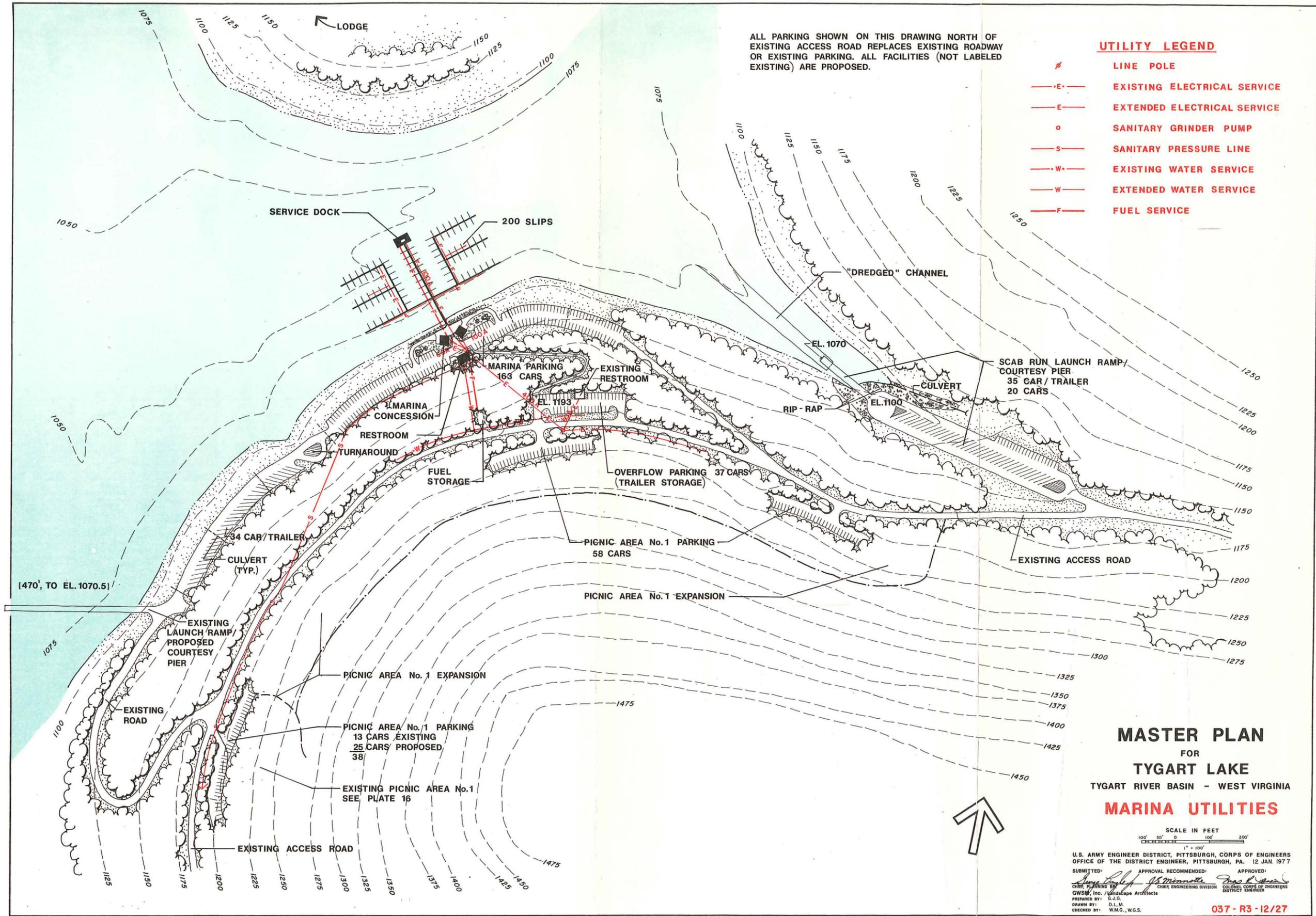
GWS&A, Inc. / Landscape Architects
PREPARED BY: G. A. I.
DRAWN BY: W. M. G.
CHECKED BY: W. G. S., GAI, Inc.

037 - R3 - 12/26

ALL PARKING SHOWN ON THIS DRAWING NORTH OF EXISTING ACCESS ROAD REPLACES EXISTING ROADWAY OR EXISTING PARKING. ALL FACILITIES (NOT LABELED EXISTING) ARE PROPOSED.

UTILITY LEGEND

- LINE POLE
- E— EXISTING ELECTRICAL SERVICE
- E— EXTENDED ELECTRICAL SERVICE
- o SANITARY GRINDER PUMP
- S— SANITARY PRESSURE LINE
- W— EXISTING WATER SERVICE
- W— EXTENDED WATER SERVICE
- F— FUEL SERVICE



MASTER PLAN

FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA

MARINA UTILITIES

SCALE IN FEET
1" = 100'
0 100' 200'

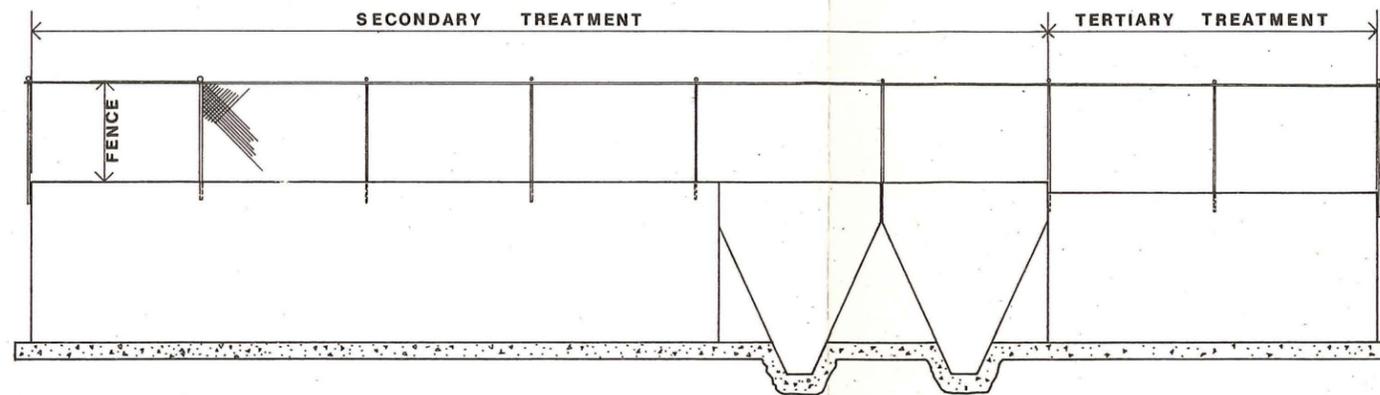
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN 1977

SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]

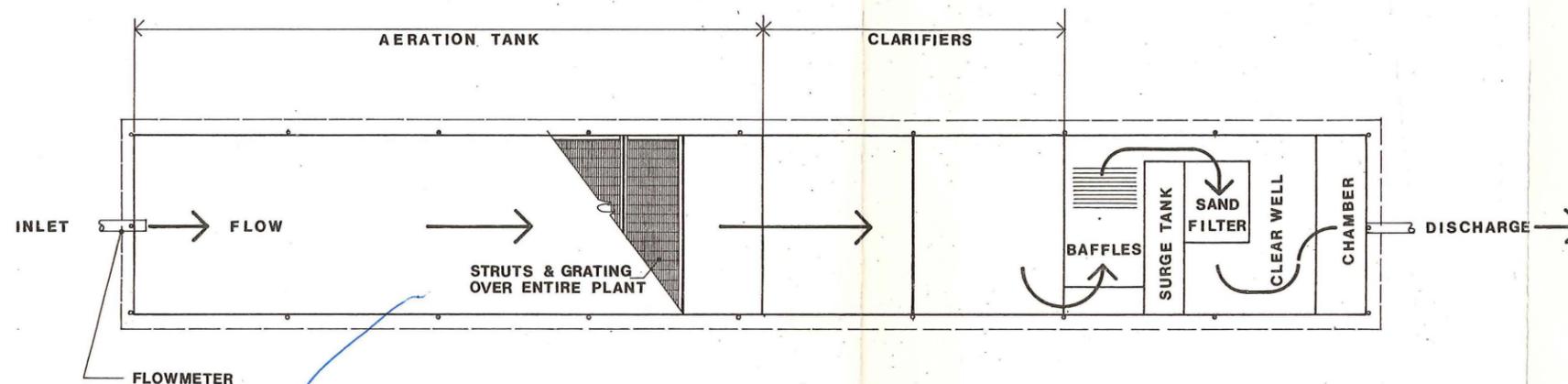
CHIEF PLANNING BY: [Signature] CHIEF, ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS
GWSM, Inc. / Landscape Architects DISTRICT ENGINEER

PREPARED BY: G.J.G.
DRAWN BY: D.L.M.
CHECKED BY: W.M.C., W.G.S.

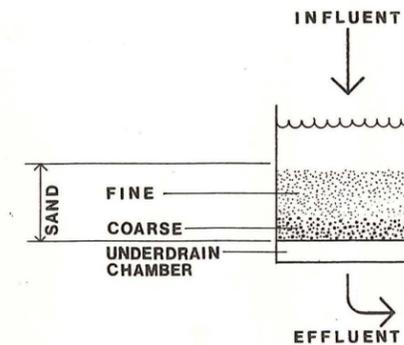
037-R3-12/27



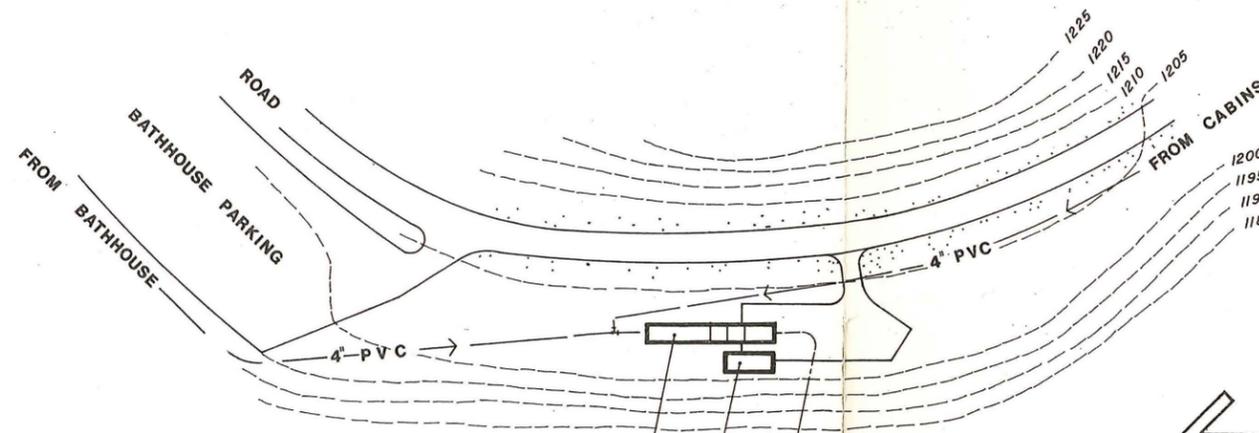
ELEVATION - SEWAGE TREATMENT PLANT (STP)
NO SCALE



PLAN
NO SCALE



SAND FILTER
NO SCALE



SITE PLAN
NO SCALE

MASTER PLAN
FOR
TYGART LAKE
TYGART RIVER BASIN - WEST VIRGINIA
SEWAGE TREATMENT
PLANT (DIAGRAMMATIC)
SCALE IN FEET
NO SCALE

U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA. 12 JAN. 1977
SUBMITTED: [Signature] APPROVAL RECOMMENDED: [Signature] APPROVED: [Signature]
CHIEF, ENGINEERING DIVISION DISTRICT ENGINEER
PREPARED BY: GAI Inc.
DRAWN BY: W.M.G.
CHECKED BY: W.D.M., W.G.S.

037-R3-12/29

TYGART LAKE
WEST VIRGINIA

DESIGN MEMORANDUM NO. 1

MASTER PLAN

EXHIBITS

Prepared by
GWSM, inc.
1101 Greenfield Avenue
Pittsburgh, Pennsylvania 15217
(Contract No. DACW59-75-C-0049)

Prepared for
U.S. Army Engineer District, Pittsburgh
Corps of Engineers
Pittsburgh, Pennsylvania

December 1976

TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1

INDEX TO EXHIBITS

<u>Letter</u>	<u>Description</u>
A	LETTER - Letter (August 25, 1975) from Geological and Economic Survey, State of West Virginia, to Project Supervisor, Tygart Dam.
B	LETTER - Letter (September 12, 1975) from Office of Archeology and Historic Preservation, Interagency Archeological Services - Atlanta, U.S. Department of the Interior, National Park Service to A/E.
C	LETTER - Letter (August 18, 1976) from Director, State of West Virginia, Department of Natural Resources, to District Engineer.
D	LETTER - Letter (September 16, 1976) from Director, State of West Virginia, Office of the Governor, Outdoor Recreation Division, to District Engineer.

Letter

Description

E LETTER - Letter (September 29, 1975) from United States Department of the Interior, Bureau of Outdoor Recreation (BOR), Northeast Regional Office, Philadelphia, to A/E.



GEOLOGICAL AND ECONOMIC SURVEY

P. O. BOX 879
MORGANTOWN
26505

BERT B. ERWIN, DIRECTOR
AND STATE GEOLOGIST

August 25, 1975

WHITE HALL
WEST VIRGINIA UNIVERSITY
PHONE 304--292-6331

Mr. Earl F. Tressler, Project Supervisor
Tygart Dam
Rt. #1, Box 82
Grafton, WV 26354

Dear Mr. Tressler:

Our office is negotiating a contract with the U.S. Department of Interior, National Park Service for archeological surveys and salvage in areas affected by fluctuations of the Tygart Lake water level. We expect the contract to be in full force and effect by mid-September and want to begin immediately. We plan to excavate portions of an Indian village site near the mouth of Doe Run and to check for other sites of prehistoric significance in shoreline areas of the lake. Mr. Stanley Baker will be our field supervisor and I am sure he will come by to introduce himself and request any information or suggestions you might have.

Initially, I wanted to inform you of our planned project and solicit any objections, comments, or questions you might have. I will appreciate an early reply, and we look forward to working with you in finding and saving our important prehistoric sites.

Sincerely,

Daniel B. Fowler, Archeology Administrator
Archeology Section

DBF:1pr

EXHIBIT A



United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

Office of Archeology and Historic Preservation
Interagency Archeological Services-Atlanta
730 Peachtree Street, Room 1010
Atlanta, Georgia 30308

IN REPLY REFER TO:

H2219-PI(A)

Mr. Gerard J. Golofski
GWSM, Inc.
1101 Greenfield Avenue
Pittsburgh, Pennsylvania 15217

SEP 12 1975
FILE

Dear Mr. Golofski:

Thank you for your recent letter concerning Tygart Lake.

This region of West Virginia is one of the least known archeological areas in the State. Only nine archeological sites have been previously recorded in Barbour County, including one reported petroglyph site in the reservoir pool. There is presently only one known archeological site, the Doe Run site, in Taylor County, and it too is within the high water pool of Tygart Lake.

This office has issued a contract to the West Virginia Geological and Economic Survey to conduct an intensive survey for archeological resources in the zone of Tygart Lake Reservoir between winter low level and spring flood level. The contract also calls for salvage excavations at the Doe Run Site. A detailed report on the findings of the survey and excavations should be completed by June 1, 1976.

We hope this information will be useful to you in updating your Master Plan. If you have any questions please do not hesitate to call our office at 404-526-2611.

Sincerely yours,

Wilfred M. Husted
Acting Chief, Interagency
Archeological Services-Atlanta



EXHIBIT B

Save Energy and You Serve America!



STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

IRA S. LATIMER, Jr.
Director

August 18, 1976

Colonel Max R. Janairo, Jr.
District Engineer
Corps of Engineers
Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222

Re: Tygart Lake Master Plan Update
June, 1976

Dear Colonel Janairo:

Personnel from this Department have received the submitted document prepared by the Consultant, G.W.S.M., Inc. It is the opinion of these personnel that this Master Plan report is the best they have encountered from the Corps of Engineers.

The Department personnel who had input into the plan feel that the plan is effective for the future time for which it is written since it is both permissive of the good and desirable as well as restrictive against the poor and undesirable.

This document borders on being an encyclopedia of a piece of land and water near Grafton, West Virginia, and of all the restrictive regulations and contingencies. The illustrations, art work, and charts are clear and concise. The photos are clear and unretouched, and the concepts are noble. It is the recommendations of the Department of Natural Resources that this Master Plan document be approved as to its general purpose.

The West Virginia Department of Natural Resources cannot fully comply with all the small, subjective material, i.e., 60 ampere service in a specific toilet and/or similar items.

We understand the Federal criteria, but desire to reserve the State's right to practice professionally at the expendency of time, resources, and dollars.

If you have any questions pertaining to this matter, please let me know.

Sincerely,

Ira S. Latimer, Jr.
Director

ISL/wbw

EXHIBIT C

OFFICE OF THE GOVERNOR
Charleston, West Virginia
FEDERAL STATE RELATIONS

Arch A. Moore, Jr.
Governor



September 16, 1976

Colonel Max R. Janiro, Jr.
Corps of Engineers
District Engineer
Department of the Army
Pittsburgh District
Federal Building, 1000 Liberty Avenue
Pittsburgh, Pennsylvania 15222

Dear Colonel Janiro:-

Thank you for the opportunity to review the updated Master Plan for Tygart Lake. We have noted the coordination of the West Virginia Department of Natural Resources and defer questions relating to functional planning to that agency, which has many management responsibilities on the Lake.

The general upgrading of existing facilities and development of new ones is in compliance with the Statewide Comprehensive Outdoor Recreation Plan. Tygart Lake is located in Planning and Development Region 6. The region is one of 11 Planning and Development Regions established by law. Region 6 ranks second among the regions in terms of facility needs to meet activity demands and third in terms of land acquisition needs.

Your efforts in planning and your coordination with the Department of Natural Resources is appreciated. If I can be of assistance, please do not hesitate to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Fred Cutlip".

Fred Cutlip, Director
Outdoor Recreation Division

FC:bd

EXHIBIT D



IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF OUTDOOR RECREATION

NORTHEAST REGIONAL OFFICE

Federal Building - Room 9310

600 ARCH STREET

Philadelphia, Pennsylvania 19106

Stamp: GWSM, Inc. LANDSCAPE ARCHITECTS
SEP 29 1975 SEP 29 1975
FILE

Mr. Gerard J. Golofski
GWSM, Inc.
Landscape Architects
1101 Greenfield Avenue
Pittsburgh, PA 15217

Dear Mr. Golofski:

This is to follow up Paul Weiser's telephone call to you last Monday, in reference to the Tygart Lake Master Plan update.

We suggest that you use this opportunity to investigate the possibility of releasing flows occasionally from the reservoir for boating and other downstream recreation. A limited release program such as that on the Lehigh River, which is carried out by the Philadelphia District, Corps of Engineers, would be worthwhile.

I understand that there would be some difficulty in the operation of the discharge valves to provide controlled releases from the Tygart. Perhaps, you could find a solution to this problem.

It would be desirable to consult with the West Virginia Department of Natural Resources at your earliest convenience. I am certain that they would be interested in your project.

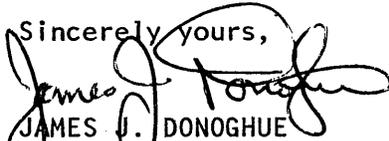
For your information, the Bureau of Outdoor Recreation has an ongoing nationwide effort to encourage public outdoor recreation use at Federal areas through lease, permit or other similar means with State, local or private agencies. This is our Cooperative Management Program. Through this program, we work with Federal land managing agencies, such as the Corps of Engineers, and park and recreation agencies, to develop agreements providing for outdoor recreation areas and facilities on Federal lands of all types, such as that now occurring on portions of Tygart Lake.



EXHIBIT E
(2 pages)

I hope that you are able to expand the recreation capabilities of Tygart Lake.

Sincerely yours,



JAMES J. DONOGHUE

Assistant Regional Director
Land Use Coordination

TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1

MASTER PLAN

APPENDIX G

DETERMINATION OF PROJECTED OUTDOOR RECREATION ATTENDANCE

Prepared by
GWSM, inc.
1101 Greenfield Avenue
Pittsburgh, Pennsylvania 15217
(Contract No. DACW59-75-C-0049)

Prepared for
U.S. Army Engineer District, Pittsburgh
Corps of Engineers
Pittsburgh, Pennsylvania

December 1976

TYGART LAKE
DESIGN MEMORANDUM NO. 1
MASTER PLAN

APPENDIX G

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G1.3	PER CAPITA USE RATES	G-4
G1.4	DAY-USE ATTENDANCE	G-6
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G1.6	FUTURE DAY-USE ATTENDANCE	G-8
G1.7	DESIGN-DAY ANALYSIS AND MAXIMUM PRACTICAL USE	G-9
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APPENDIX G

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TYGART LAKE
DESIGN MEMORANDUM NO. 1
MASTER PLAN

APPENDIX G

G1.0 DETERMINATION OF PROJECTED OUTDOOR RECREATION

ATTENDANCE

G1.1 INTRODUCTION. In accordance with procedures specified in ER 1120-2-403, "Procedures for Estimating Recreation Use", a comparative tabulation of pertinent data was made between Tygart Lake and similar existing reservoir projects. After careful evaluation of project characteristics, two projects were selected for comparison based on approximate reservoir size in terms of surface area of the average recreation pool, recreation facility capacity, annual attendance, and water-oriented competition. Fort Supply in Oklahoma was selected as the most physically similar in terms of surface acres at average recreation pool and number of access areas. Detroit Reservoir in Oregon also provides a basis for comparison in terms of attendance, terrain, and competitive water-oriented recreation areas. It may also be noted that other similar characteristics exist between all three reservoirs. Accepting this as a valid comparison, it is possible to establish a planning basis for Tygart Lake.

(See TABLE G1.)

G1.2 DAY USE MARKET AREA. The first step in planning entails a computation of anticipated visitation based on per capita use rates relative to a day-use market area. The year 1980 was selected as the initial base year in projecting this attendance. The day-use market area is defined as the area contributing 80% or more of the annual day-use visitation to Tygart Lake. This information was provided by Recreational Use Survey Summaries statistically compiled for Tygart Lake during the summer of 1968 and 1971. Approximately 80% of the visitation is provided by large population centers (centroids) within a 50-mile (roadmiles) radius of the lake. Further investigation of these summaries showed a definite decrease in contribution between the 50-100 distance zone. Contributions from the area of 100 miles and over reversed this trend and are relatively high. Therefore, it was established that the day-use market area would encompass 11 counties with their respective centroids within the 50-mile limit. (See PLATE 1 - Main Report.)

TABLE G1

PERTINENT DATA: COMPARATIVE TABULATION

ITEM	TYGART	FT. SUPPLY	DETROIT
Location (State)	West Va.	Oklahoma	Oregon
Maximum Pool: Acre Feet Surface Acres	287,700 3,440	101,800 5,730	461,450 3,721
Avg. Recreation Pool: Surface Acres Shoreline Miles	1,740 31	1,880 .26	3,708 36.5
Year Impoundment Began	1938	1943	1952
Number of Access Areas	4	3	11
Recreation Facilities: Tent and Trailer Spaces Day Use Areas (cap. in recreation days) Boat Launch Lanes	0 - Corps 71 - Other 9,000 0 - Corps 4 - Other	50 2,900 8	394 8,000 7
Attendance (Recreation Days)			
1975	910,630		
1974	775,160		
1973	758,360		
1972	751,600		
1971	766,780		
1970	747,700		
1968	636,400	282,300	597,520
1967	557,900	271,700	572,452
1966	558,900	317,400	561,295
1965	508,651	344,600	348,000
1964		331,200	359,093
Recreation Season	Apr-Sep	Apr-Sep	Apr-Sep
Project Purpose	Flood control Navigation	Flood control	Navigation Power Flood Control
Timber Cover	Dense	Sparse	Dense
Reservoir Terrain	Steep to Moderate	Steep to Rolling Prairie	Steep to Moderate
In National Forest	No - proximity	No	Yes
Access: Paved road about 1/2 of reservoir Limited access about 1/2 of reservoir	No No - approx. 1/3	Not Available	Yes Yes
Overnight Lodging Nearby	Yes	Yes	Yes

PERCENT ANNUAL ATTENDANCE DURING PEAK MONTHS OF USE

Apr	May	June	July	Aug	Sept	Total	Name
7.3%	12.8%	14.5%	19.9%	17.8%	8.2%	82.7%	TYGART
7.7%	12.5%	15.9%	15.3%	12.0%	8.5%	71.9%	FORT SUPPLY
7.9%	10.9%	18.0%	22.1%	20.3%	10.5%	89.7%	DETROIT

COMPETING WATER ORIENTED RECREATIONAL AREAS

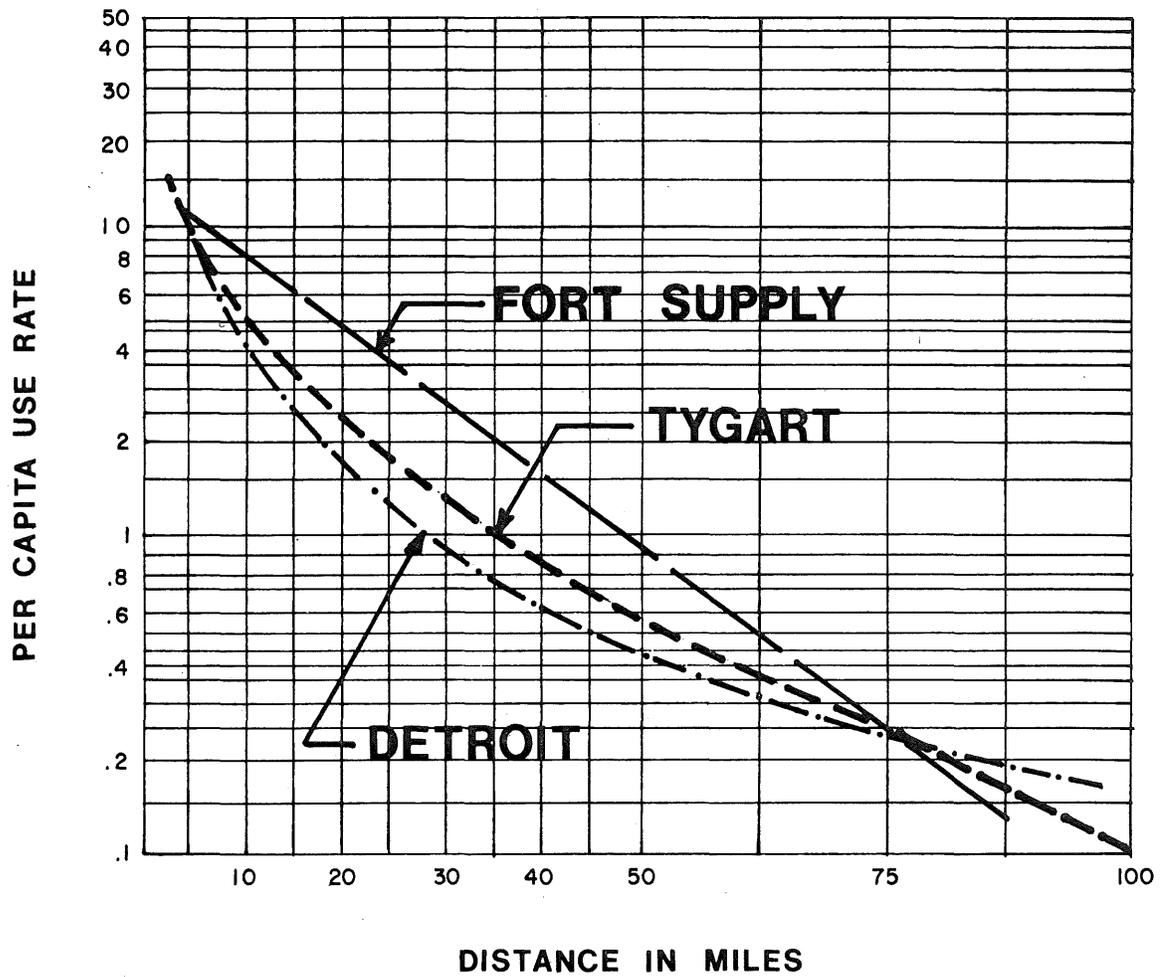
Name	Distance Zone (Miles)	Size or Length			Rec. Facilities		Est. Annual Attendance	
		0-25	25-50	50-75	Public	Private		
Stonewall Jackson *	25 - 50		2,650 Ac.		Yes		650,000	
Lake Lynn (Cheat Lake)	25 - 50		1,000 Ac.		Yes	Yes	**	TYGART
Rowlesburg Lake *	25 - 50		7,175 Ac.		Yes	No	450,000	
Youghiogheny Lake	50 - 75			2,840 Ac.	Yes	Yes	1,461,140	
None within 50 miles								FORT SUPPLY
Green Peter Reservoir	25 - 50		3,720		Yes	No	(1967) 100,000	DETROIT

*Proposed Lake

**Predominantly private; Mt. Chateau Lodge visitation (1973), 37,000; now operated by West Virginia University. Figures for private facilities attendance are not considered pertinent.

G1.3 PER CAPITA USE RATES. To formulate per capita use rates for the day-use market area, it was necessary to plot regression curves for the two similar projects accepted for comparison. Considering all comparative factors existing between the three reservoirs, it was possible to empirically interpolate a regression curve for Tygart Lake. (See TABLE G2) Main consideration was given to annual attendance, proximity, amount of water-oriented competition and similarity of physical characteristics.

After thorough review, it was concluded that although Tygart Lake is similar to Fort Supply in water surface and reservoir fluctuation, the curve should approximate that of Detroit Reservoir due to the presence of water-oriented competition, attendance, facilities available, and the close resemblance in physiography.



REGRESSION CURVE - TABLE G2

G1.4 DAY-USE ATTENDANCE. To determine day-use attendance, the eleven counties and their respective centroids have been listed in order of proximity to Tygart Lake within the 50-mile limit. The equation for determining day-use is as follows: Projected population x per capita rate = day use.

TABLE G3

DAY-USE ATTENDANCE

County	Centroid	Dist.	Per Capita Use Rate	Pop. (Est. 1980)	Esti- mated Day-Use
Taylor	Grafton	2 mi.	16.0	13,900	222,400
Barbour	Philippi	17 mi.	3.0	14,500	43,500
Marion	Fairmont	23 mi.	2.0	78,800	157,600
Harrison	Clarksburg	24 mi.	1.9	66,300	125,970
Day-Use (0-25 mi.)					549,470
Preston	Kingwood	27 mi.	1.6	27,100	43,360
Monongalia	Morgantown	30 mi.	1.35	74,300	100,305
Upshur	Buckhannon	38 mi.	.96	21,500	20,640
Garrett, Md.	Redhouse	41 mi.	.85	22,500÷3	66,375
Randolph	Elkins	45 mi.	.73	26,200	19,126
Lewis	Weston	48 mi.	.65	18,700	12,155
Doddridge	West Union	50 mi.	.60	6,300	3,780
Day-Use (26-50 mi.)					205,741
(rounded) Total Day-Use					755,000

As noted on page G-2, by definition, the day-use market area contributes 80% or more of the annual day-use visitation to a reservoir project.

G1.5 TOTAL ANNUAL USE. Multiplying the projected county populations by the per capita use rate for each county results in an estimated annual day-use of 755,000 recreation days for 1980. Based on the recreation use surveys, it has been determined that virtually all of the day-use visitation to the project will originate within the 50-mile market area and, therefore, represents 100 percent of day use. However, because of the relatively high percentage of overnight-use from beyond the 50-mile market area, it is necessary to adjust this day-use figure when considering total annual use. Using day-use estimates as a basis and averaging the percent of overnight use relative to total annual visitation for the years 1969 through 1975, summarized by yearly recapitulation, the projected annual use is estimated as follows:

Total annual use = total day-use divided by (1.00-% of overnight use)

= 755,000 divided by (1.0-.18*)

= 755,000 divided by .82

= 920,000 (rounded) TOTAL ANNUAL USE

*The percentage of overnight use is made up of 6% tent

camping and 2% cabin camping (derived from the 1975 Tabulation of Visitation recapitulation) and 10% staying in area (derived from the 1968 Summer Recreational Use Survey Summary.)

G1.6 FUTURE DAY-USE ATTENDANCE. To continue the formulation of day-use contributed by these centroids, their populations have been projected for the years 2000 and 2020 and corresponding "per capita use rates" have also been listed. The projected county populations are based on data from the Office of Business Economic Research Service (OBERS). The 1972 Series "E" Projected National Population by the Bureau of Census was used in making these projections.

TABLE G4

FUTURE DAY-USE ATTENDANCE

	<u>Per Capita Rate</u>	<u>Pop. Est. 2000</u>	<u>Day-Use 2000</u>	<u>Pop. Est. 2020</u>	<u>Day-Use 2020</u>
Taylor	16.0	12,200	195,200	11,300	180,800
Barbour	3.0	13,000	39,000	11,900	35,700
Marion	2.0	80,400	160,800	80,400	160,800
Harrison	1.9	67,700	<u>128,630</u>	67,600	<u>128,440</u>
Day-Use (0-25 mi.)			523,630		505,740

TABLE G4 (cont.)

FUTURE DAY-USE ATTENDANCE

Preston	1.6	26,400	42,240	26,200	41,920
Monongalia	1.35	87,900	118,665	92,700	125,145
Upshur	.98	23,800	22,848	24,700	23,712
Garrett, Md.	.85	21,800÷3	6,177	21,800÷3	6,177
Randolph	.73	26,000	18,980	25,300	18,469
Lewis	.65	17,900	11,635	17,400	11,310
Doddridge	.60	4,900	<u>2,940</u>	4,400	<u>2,640</u>
Day-Use (0-25 mi.)			223,485		229,373
Total Day-Use (rounded)			747,000		735,000

As a result of the projected declining population within the market area, a slight decrease in the day-use attendance is projected for the years 2000 and 2020. Therefore, the projected 1980 attendance will be used as the prime factor in determining future facility needs for the project.

G1.7 DESIGN-DAY ANALYSIS AND MAXIMUM PRACTICAL USE

G1.7.1 Facility Design-Day Load. To determine the extent of principal recreation facilities needed to satisfy projected user demand, it is necessary to define

the expected visitation on a calculated design-day. A design-day is considered to be an average weekend day during the peak month of the recreation season. The computation of facility design-day load is as follows:

$$\text{Facility Design-Day Load} = L = (A \times P \times E) + D$$

A = estimated annual attendance (920,000)

P = average proportion of annual attendance expected during the peak month (19.9% - extracted from pertinent use data for Tygart Lake)

E = proportion of peak month use expected on weekends (50% - extracted from Recreational Use Survey Summary - Summer, 1968 - weekly distribution of persons)

D = average number of weekend days during the peak month (generally assumed to be eight)

$$\text{Facility Design-Day Load} = L$$

$$\begin{aligned} L &= 920,000 \times .199 \times .5 + 8 \\ &= 11,443 \\ &= 11,400 \text{ persons (rounded)} \end{aligned}$$

Gl.7.2 Maximum Practical Use. Maximum Practical Use, or M.P.U., is usually defined as an estimate of annual

recreational capacity proportional to a level of water surface acreage. For this reason, M.P.U. is dependent on the amount of water-oriented recreation, expressed as a function in terms of an upper bound on the number of boaters on the design-day load previously established. Attainment of this upper bound inhibits, proportionately, other non-water-oriented activities on the design-day. Therefore, to compute M.P.U., it is necessary to identify the upper bound on boaters and apply the resulting figure to an upper bound of facility design-day load, which is further projected as an estimate of maximum annual attendance.

Upper Bound on Boaters = B max.

$B \text{ max.} = (S \times R_b) \times W + w$

S = average size of boating party (3.4 persons -
extracted from Recreational Use Survey Summary -
Summer, 1968)

R_b = turnover rate for boating (generally assumed to
be two)

W = total water surface acres at average recreation
pool (1,740 acres)

w = number of surface acres of water per boat (gen-
erally assumed to be 5)

$$\begin{aligned} B \text{ max.} &= (3.4 \times 2) \times 1,740 \div 5 \\ &= 2,366 \text{ persons} \end{aligned}$$

Facility Design-Day Load Upper Bound = L max.

$$L \text{ max.} = B \text{ max.} \div (pb + ws + pf)$$

pb = proportion of total attendance pleasure boating

ws = proportion of total attendance water skiing

pf = proportion of total attendance fishing from a boat who will not also engage in water skiing or general pleasure boating. (For purposes of formulation, this has been judged as 40% of all fishermen.)

These percentages were determined by averaging participation as shown on yearly recapitulation sheets for Tygart Lake, 1969 through 1975.

$$\begin{aligned} L \text{ max.} &= 2,366 \div (.12 + .04 + .02) \\ &= 13,144 \text{ persons} \end{aligned}$$

Maximum Practical Use - M.P.U.

$$\begin{aligned} M.P.U. &= (L \text{ max.} \times D) \div (P \times E) \\ &= (13,144 \times 8) \div (.199 \times .5) \\ &= 1,060,000 \text{ persons (rounded)} \end{aligned}$$

P = average proportion of annual attendance expected during the peak month (19.9% - extracted from pertinent use data for Tygart Lake)

E = proportion of peak month use expected on weekends (50% - extracted from Recreational Use Survey Summary - Summer, 1968 - weekly distribution of persons)

D = average number of weekend days during the peak month (generally assumed to be eight)

Therefore, it is established (based on the estimate of annual attendance for Tygart Lake in 1980) that M.P.U. will not be exceeded since Maximum Practical Use is greater than the Total Annual Use expected in 1980. With regard to future attendance, the projected annual attendance for the years 2000 and 2020 were previously shown in paragraph G1.6.

G1.7.3 Projected Facility-User Demand - 1980. To determine the type and quantity of facilities to be provided, use distributions within the design-day load are considered. For planning purposes, seven major recreational activities were selected and are listed below, along with turnover rates, load factors, and a percentage of participation. These percentages were derived from yearly recapitulation sheets for Tygart Lake, 1969 through

1975. The load factors were determined from the 1968 and 1971 Recreation Use Survey Summaries.

TABLE G5

PERCENTAGE OF PARTICIPATION, LOAD FACTOR AND TURNOVER RATES

<u>Activity</u>	<u>% Parti-</u> <u>cipation</u>	<u>Load</u> <u>Factor</u>	<u>Turnover</u> <u>Rate</u>
Boating	23	3.4	2
Camping			
Tent	6.0	4	1
Cabin	2.0	5	1
Picnicking	18	3.4	2.5-3.0
Swimming	28	3.4	2.5-3.0
Fishing			
With Boats	2	2.5	1
Without Boats	3	2.5	1
Hunting*	3.5		
Sightseeing**	38		

*Since the majority of hunting takes place during a season not included in the design-day load computation, it is believed that hunters will benefit from facilities considered for other activities.

**Sightseers at Tygart Lake will normally benefit from facilities provided for other activities.

G1.8 FACILITY COMPUTATION (DESIGN-DAY LOAD - 11,000 PERSONS)

The upper bound on the number of boaters on the Design-Day exists as a function of boating patterns and total water surface. Therefore, the computation for boating facilities will consider the Upper Bound on Boaters as shown in paragraph G1.7.2., Maximum Practical Use, as the total number of persons planned for on the Design Day.

The Upper Bound on Boaters = B max = 2,366 persons

Total Number of Boating Parties = Number of persons boating +
3.4 (load factor)
= 2,366 + 3.4
= 696 parties

Parties Boating Requiring Launching Facilities = Number of parties boating x % vehicles hauling boats (40%* = approximately 2/5 of the 25% of design-day load represented by all boaters, including fishermen, requiring launching facilities
= 696 x .40
= 278 parties

*includes both trailer and car top hauling (derived from 1968 Summer Recreational Use Survey Summary).

Boat Launching Lanes = Number of Parties Boating
Requiring Launching Facilities
+ launching ramp lane capacity
= 278 + 40 (40 = number of boats
per lane per day)
= 6.95 or 7 lanes (rounded)

Car/Trailer Spaces (CTS) = 25 per launching lane
= 7 x 25
= 175 at 33 CTS/acre
= 5.3 or 5 acres parking (rounded)

Parties Boating Requir- = Number of parties boating x %
ing Marina Facilities requiring boat slips (60% =
approximately 3/5 of the 25%
of design-day load represented
by all boaters including fisher-
men requiring boat slips
= 696 x .60
= 418 boat slips

Marina Parking = Number of boat slips

= 200 parking spaces at 87 cars/acre

= 2.29 or 2 acres parking (rounded)

Parties Tent or Trailer Camping = Design-Day Load x % of tent campers ÷ 4 (load factor)

= 11,400 x .06 ÷ 4

= 171 tent or trailer sites

Acres of Tent or Trailer Camping = Number of sites ÷ number of sites per acre

= 171 ÷ 5

= 34 acres (rounded)

Parties Cabin Camping = Design-Day Load x % of cabin campers ÷ 5 (load factor)

= 11,400 x .02 ÷ 5

= 46 cabin sites (rounded)

Acres of Cabin Camping = Number of sites ÷ number of sites per acre

= 46 ÷ 3

= 15.33, or 15 acres (rounded)

Parties Picnicking = Design-Day Load x % of picnickers ÷ 3.4 (load factor)
= 11,400 x .18 ÷ 3.4
= 600 (rounded) x % of parties using facilities (usually 80%)
= 480 ÷ 2.5 (turnover rate)
= 192 picnic tables

Acres of Picnicking = number of tables ÷ number of sites per acre
= 192 ÷ 8
= 24 acres (includes parking - 1 car per site)

Persons Swimming = Design-Day Load x % of swimmers ÷ 2.5 (turnover rate)
= 11,400 x .28 ÷ 2.5
= 1,280 persons (rounded)

Swimmers, Parking = number of swimmers ÷ 3.4 (load factor)
= 1,280 ÷ 3.4
= 376 parking spaces at 87 spaces/acre
= 4.32, or 4 acres parking (rounded)

Swimmers, Beach

$$\begin{aligned} &= \text{number of swimmers} \times .60 \\ &\quad (60\% = \% \text{ swimmers on beach}) \\ &\quad \times 50 \text{ square feet of sand,} \\ &\quad \text{turf or both per swimmer} \\ &= 1,280 \times .60 \times 50 \\ &= 38,400 \text{ square feet, or } .88 \\ &\quad \text{acres or 1 acre (rounded)} \end{aligned}$$

Swimmers, Water

$$\begin{aligned} &= \text{number of swimmers} \times .30 \\ &\quad (30\% = \% \text{ of swimmers in water}) \\ &\quad \times 30 \text{ square feet per swimmer} \\ &= 1,280 \times .30 \times 30 \\ &= 11,520 \text{ square feet of water} \end{aligned}$$

Persons Fishing

$$\begin{aligned} &= \text{Design-Day Load} \times \% \text{ of fisher-} \\ &\quad \text{men} \\ &= 11,400 \times .03 \quad (.03 = \text{fisher-} \\ &\quad \text{men without boats}) \\ &= 342 \text{ persons} \end{aligned}$$

Fishermen, Parking

$$\begin{aligned} &= \text{number of fishermen} \div 2.5 \\ &\quad (\text{load factor}) \\ &= 342 \div 2.5 \\ &= 137 \text{ car spaces at } 87 \text{ cars/} \\ &\quad \text{acre} \\ &= 1.57, \text{ or } 2 \text{ acres parking} \\ &\quad (\text{rounded}) \end{aligned}$$

G1.9 PROJECT FACILITY CAPACITY COMPARISON. Having determined the design-day load and applying it to the computations for each principal facility, a comparison must then be drawn between present capacities and those anticipated in the future. The net difference between these two figures represents an ideal development objective and this figure, in turn, may then be compared with the capacities recommended by this Master Plan. As seen in TABLE G6, the ultimate development results in there being some minor deficits in capacities due to factors which cannot be overcome.

TABLE G6

PROJECT FACILITY CAPACITY COMPARISON

ACTIVITY	Projected Need	Existing	Added	Total Master Plan	Overage + Deficit -
Picnicking	192 tables	92 tables	100	192 tables	exact
Swimming	1,280 persons	1,400 persons	0	1,400 persons	+120
Boat Launching Lanes	7 lanes	1 lane (1)	6 lanes	7 lanes	exact
Boat Docking Slips	418 slips	200 slips (2)	228	428	+ 10
Car/Trailer Spaces	175 spaces	0 spaces (3)	101	101	- 74
Cabin	46 cabins	10 cabins	16 cabins	26 cabins	- 20
Tent/Trailer Camping	171 sites	31 sites (4)	106 sites	137 sites	-- 34

1. Of the 3 existing launch ramp lanes, one at the marina will be abandoned and one satisfactory lane will remain. The other existing lane is at Scab Run which will be replaced by new construction. Due to their undeveloped state, the launch ramps at Shaw Run, West Hill and off Route 119-35 are not included.
2. Includes 130 slips under private use permit, 70 slips provided by private boat club concessions, and 90 boat slips provided by the existing marina which are to be replaced. Net existing slips = 200.

TABLE G6 (cont)

PROJECT FACILITY CAPACITY COMPARISON

3. The 80 spaces presently serving the 2 launch ramps at the marina are to be replaced by new parking areas. There are no paved spaces existing in association with the Scab Run launch ramp.

4. There are (1976) 89 existing sites, including 34 on the right bank which are to be replaced by cabin development. Additionally, in due course, the 24 primitive sites will be abandoned. Net existing tent/trailer camping sites equal 31.

TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1

MASTER PLAN

APPENDIX H

ESTIMATED SEWAGE FLOWS,
PROPOSED ULTIMATE DEVELOPMENT

Prepared by
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1101 Greenfield Avenue
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(Contract No. DACW59-75-C-0049)

Prepared for
U.S. Army Engineer District, Pittsburgh
Corps of Engineers
Pittsburgh, Pennsylvania

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TYGART LAKE
DESIGN MEMORANDUM NO. 1
MASTER PLAN

APPENDIX H

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TYGART LAKE
 WEST VIRGINIA
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H1.0 ESTIMATED SEWAGE FLOWS, PROPOSED ULTIMATE DEVELOPMENT

	Gallons <u>Per Day</u> (Rounded)
<u>H1.1 RIGHT BANK</u>	<u>G.P.D.</u>

Low pressure, grinder pump system

H1.1.1 Tygart Lake Lodge

26 rooms @ 3 occupants/room @ 60
 gpcd (gallons per capita per day)
 including restaurant
 (26 x 3 = 78 x 60 = 4680) 4700

H1.1.2 Marina

200 car spaces @ 3.4 persons/car
 @ 2.5 turnover rate, including
 sightseers @ 0.55 conversion
 factor (55% of visitors expected
 to use restrooms, concession ser-
 vices) @ (1.5) gpcd

*CSW.
 Nov 21 May 80*

*2.0
 1900
 3.0
 1800
 1890
 2.0
 1000*

*935
 1.0*

$$(200 \times 3.4 = 680 \times 2.5 = 1700 \times 0.55 = 935 \times 1.5 = \underline{1402})$$

1500 4700

H1.1.3 Picnic Areas No. 1 and No. 2

No. 1, 103 tables; No. 2, 44 tables; Total 147 Tables

(equated to car spaces) @ 3.4 persons/table @ 2.5 turnover rate @ 0.55 conversion factor @ 7 gpcd

$$(147 \times 3.4 = 500 \times 2.5 = 1250 \times 0.55 = 688 \times 7 = \underline{4816})$$

USE 6450 4900

H1.1.4 Recreation Building (Park Headquarters) and Picnic Area No. 3

15 car spaces @ 3.4 persons/car @ 3.0 turnover rate @ 0.55 conversion factor @ 8 gpcd (increase of 1 gpcd above Picnic Areas No. 1 and No. 2 due to vending machines)

$$(15 \times 3.4 = 51 \times 3 = 153 \times 0.55 = 85 \times 8 = \underline{680})$$

510

21 tables @ 3.4 persons/table @ 2.5 turnover rate @ 0.55 conversion factor @ 8 gpcd (see parenthesis, above)

$$(21 \times 3.4 = 72 \times 2.5 = 180 \times 1000) \\ 0.55 = 100 \times (8) = \underline{800}$$

Total 1480

1850 or 1900
1500
Use 1500 now

H1.1.5 Bathhouse

150 car spaces @ 3.4 persons/car
@ 2.5 turnover rate @ 0.55 con-
version factor @ 13 gpcd (see
footnote No. 1)

$$(150 \times 3.4 = 510 \times 2.5 = 1275 \times 15) \\ 0.55 = 700 \times (13) = \underline{9100}$$

10500
9100
2100
future?

Use 10 now
21000
3 mb

H1.1.6 Cabins

26 units @ 4 persons/unit @ 60
gpcd, including kitchens

$$(26 \times 4 = 104 \times 60 = \underline{6240})$$

Subtotal

6300
28,000

H1.2 LEFT BANK

(Chemical water closet system

H1.2.1 Pleasant Creek Camping Area

137 sites @ 4 persons/site @
1.0 turnover rate @ 0.55 con-
version factor @ 2.0 gpcd

$$(137 \times 4 = 548 \times 0.55 = 300 \times 2) = \underline{600}$$

7500
600

PRINTING
CAPITALS

use for
hydroponic
low...

H1.2.2 West Hill Launch Ramp

21 car/trailer spaces @ 3.4
persons/car @ 2.0 turnover
rate @ 0.55 conversion factor
@ 1.0 gpcd

$(21 \times 3.4 = 72 \times 2 = 144 \times$
 $0.55 = 80 \times 1) = \underline{80}$

400
80

H1.2.3 Rifle Range

20 car spaces @ 3.4 persons/car
@ 2.0 turnover rate @ 0.55
conversion factor @ 1.0 gpcd

$(20 \times 3.4 = 68 \times 2 = 136 \times$
 $0.55 = 75 \times 1) = \underline{75}$

75

H1.2.4 Trailer Sanitary Disposal Station

Estimated load of 10 trailers
per day @ 50 gal. capacity =

500

Subtotal (1255) 1300

800

TOTAL ESTIMATED PEAK SEWAGE FLOW

43,800
29,300

DESIGN PEAK SEWAGE FLOW

35,000
44000

Footnote No. 1

In estimating gallons per capita per day usage at the bathhouse it was assumed that showers would operate at about twice the rate of a public school gymnasium locker facility (3 gpcd, per "Sewerage Manual", Pennsylvania Department of Environmental Resources). Added to that 6 gpcd is 7 gpcd because of the waterborne restroom facility; total 13 gpcd.

TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1

MASTER PLAN
APPENDIX I
COST ESTIMATE FOR FACILITIES DEVELOPMENT

Prepared by
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Prepared for
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TYGART LAKE
DESIGN MEMORANDUM NO. 1
MASTER PLAN
APPENDIX I
COST ESTIMATE FOR FACILITIES DEVELOPMENT

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TYGART LAKE
WEST VIRGINIA
DESIGN MEMORANDUM NO. 1
MASTER PLAN
APPENDIX I
COST ESTIMATE FOR FACILITIES DEVELOPMENT

11.0 SCOPE. APPENDIX I provides the estimated development costs for the proposed improvements at Tygart Lake, improvements of existing facilities, additions to existing facilities and new facilities to be developed in the future. The costs are shown by locations of proposed development.

12.0 UNIT COSTS. The unit costs shown are based on a cost level as of May 1976 and include overhead, profit, and general contingency.

13.0 TOTAL DEVELOPMENT COSTS. The total development cost of each area includes an amount of 20% for engineering and design and 10% for supervision and administration.

14.0 COST ESTIMATE FOR FACILITIES DEVELOPMENT. Each area has been estimated individually as a complete unit for development.

4.1 FEDERAL AREA

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Land Acquisition 18 acres, including administrative costs per tract of land	L.S.			\$ 23,000.
			SUB - TOTAL COST	23,000.
			20% ENG. DESIGN, etc	
			TOTAL DEVELOPMENT COST	\$23,000.

4.2 LODGE

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Parking Area, paved	6 cars	\$	\$ 3,120.	\$ 3,120.
Path	705 lf	6.60	4,650.	4,650.
Terrace	500 sf	2.30	1,150.	1,150.
Walk at Lodge Front	1,150 sf	2.00	2,300.	2,300.
Rooms at Lodge, complete (excluding furniture)	6	17,325.	103,950.	103,950.
Landscaping (includes planting, signs, refuse containers)	L.S.	-	-	8,260.
*Subsurface Investigation to enable redesign of retaining wall and drainage				
SUB - TOTAL COST				123,400.
20% ENG. DESIGN, etc				24,700.
*Special Subsurface Investigation				7,800.
TOTAL DEVELOPMENT COST				\$155,900.

4.3 SCAB RUN LAUNCH RAMP
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Dredging	3,555 cy	\$ 10.	\$ 35,550.	\$ 35,550.
Culvert				
Pipe (96" cmp, 8 gauge)	300 lf	182.	54,600.	
Endwalls (standard concrete)	2	2,025.	4,050.	58,650.
Parking Area, paved (including aisles and a small portion of roadway)	20 cars 35 car/ trailer		94,800.	94,800.
Boat Launching Ramp, complete, 2 lanes	600 sy	25.	15,000	15,000.
Courtesy Pier	L.S.	-	-	10,000.
Rip-Rap, Stone	570 cy	30.	17,100.	17,100
Landscaping (includes planting, signs, refuse containers, wheel stops, topsoil and seeding)	L.S.	-	-	17,860.
SUB - TOTAL COST				248,960.
20% ENG. DESIGN, etc				49,790.
TOTAL DEVELOPMENT COST				298,750.

4.4 MARINA COMPLEX
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Site Preparation (includes clearing and removals)	L.S.	-	-	22,000.
Excavation/Filling				
Used as fill on site	5,680 cy	2.00	11,360.	
Disposed of off site	47,413 cy	4.50	213,360.	224,720.
Culverts				
Pipe (15" cmp, 16 gauge)	630 lf	14.85	9,360.	9,360.
Rip-Rap, Stone	485 cy	30.	14,550.	14,550.
Curbing	235 lf	9.	2,120.	2,120.
Parking Area, paved (including aisles)	200 cars 34 car/ trailer		120,190	120,190.
Path				
(Aggregate Base - 6")				
Bituminous Surface 1½"	300 sy	8.10	2,430	
Steps (concrete)	350 lf	16.50	5,780.	
Railing (metal)	91 lf	22.	2,000	10,210.
Building Complex				
Site Walls (concrete)	139 cy	325.	45,180.	
Steps (concrete)	88 lf	16.50	1,450.	
Paving (concrete)	3,260 sf	1.65	5,380.	
Railing (metal)	116 lf	22.	2,550.	
Restroom Facilities (including mechanical)	1	55,770.	55,770.	

4.4 MARINA COMPLEX (CONT.)

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Concession Building		\$	\$	\$
(including mechanical)	1	58,500.	58,500.	
Snack Shelter (including mechanical)	1	19,910.	19,910.	188,740.
Dock Access Ramp	540 sf	34.	18,360.	18,360.
Dock System	13,210 sf	13.50	178,340.	178,340.
Courtesy Pier (at existing launch ramp)	L.S.	-	-	10,000.
Dock Service Building	1	2,700.	2,700.	2,700.
Fuel Tank (2000 gallon)	1	5,000.	5,000.	5,000.
Fuel Line				
Underground	290 lf	11.	3,190.	
Through Docks	290 lf	7.00	2,030.	5,220.
Fuel Pumps	2	2,500.	5,000.	5,000.
Area Lighting	3	1,500.	4,500.	4,500.
Dock Lighting	16	1,000.	16,000.	16,000.
Landscaping (includes planting, signs, refuse containers, topsoil and seeding, flagpole, guard rail)	L.S.	-	-	98,360.
Water (1" line)	300 lf	5.00	1,500.	1,500.

4.4 MARINA COMPLEX (CONT.)
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Electric		\$	\$	\$
75 KVA Transformer (pole-mounted single-phase)	1	3,000.	3,000.	
400 AMP Service (in conduit)	370 lf	30.	11,100.	
100 AMP Service (in conduit)	1,600 lf	10.	16,000.	
60 AMP Service (in conduit)	70 lf	8.00	560.	
Flood Protection	L.S.	-	7,670.	38,330.
SUB - TOTAL COST				975,200.
20% ENG. DESIGN, etc				195,000.
TOTAL DEVELOPMENT COST				1,170,200.

4.5 PICNIC AREAS
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Area No. 1		\$	\$	\$
Renovation of existing table areas	20	300.	6,000.	
New table areas	83	500.	41,500.	
Renovate and expand existing parking	25 cars	1,190.	29,750.	
New parking	58 cars	1,280.	74,240.	151,500.
Area No. 2				
Renovate and expand existing table areas	44	300.	13,200.	13,200.
Area No. 3				
Renovation of existing table areas	21	300.	6,300	6,300.
Above figures include minor grading, grills, refuse containers and re-seeding.				
SUB - TOTAL COST				171,000.
20% ENG. DESIGN, etc				34,200.
TOTAL DEVELOPMENT COST				205,200.

4.6 CABIN COMPLEX - PHASE ONE

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Cabins (includes fixed appliances, excludes furniture)	5	\$ 32,200.	\$ 161,000.	\$ 161,000.
Water				
2" Line	600 lf	5.50	3,300.	
3/4" Line	250 lf	3.00	750.	
Services	5	100.	500.	4,550.
Electric				
Primary Service (overhead)	1,325 lf	1.00	1,325.	
100 AMP Service (overhead)	270 lf	1.00	270.	
10 KVA Transformer (pole-mounted)	5	500.	2,500.	4,100.
SUB - TOTAL COST				169,700.
20% ENG. DESIGN, etc				33,900.
TOTAL DEVELOPMENT COST				\$203,600.

4.7 CABIN COMPLEX - PHASE TWO

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Obliterate Existing Camp Sites	23	\$ 300.	\$ 6,900.	\$ 6,900.
Cabins (includes fixed appliances and excludes furniture)	11	32,200.	354,200.	354,200.
Recreation Court/Play Areas (includes paving, play equipment, signs, planting, topsoil and seeding)	1	-	17,350.	17,350.
Water				
2" Line	600 lf	5.50	3,300.	
3/4" Line	550 lf	3.00	1,650.	
Services	11	100.	1,100.	6,050.
Electric				
Primary Service (overhead)	820 lf	1.00	820.	
100 AMP Service (overhead)	810 lf	1.00	810.	
25 KVA Transformer (pole-mounted)	3	1,000.	3,000.	4,630.
SUB - TOTAL COST				389,100.
20% ENG. DESIGN, etc				77,800.
TOTAL DEVELOPMENT COST				\$466,900.

4.8 PLEASANT CREEK RIFLE RANGE
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Roadway Resurfacing (12')	600 lf	\$ 2.40	\$ 1,440.	\$ 1,440.
Roadway Drainage (includes pipe, inlets)	L.S.	-	-	1,340.
Parking Area, resurfacing (including aisles)	20 cars		10,500.	10,500.
Walkway (including grading)	336 sy		4,340.	4,340.
Firing Range (includes clearing, grading)	L.S.	-	-	9,740.
Restroom, complete (chemical)	2	2,000.	4,000.	4,000.
Landscaping (includes signs, refuse containers, wheel stops, topsoil and seeding)	L.S.	-	-	16,240.
SUB - TOTAL COST				47,600.
20% ENG. DESIGN, etc				9,520.
TOTAL DEVELOPMENT COST				57,120.

4.9 PLEASANT CREEK CAMPING AREA - PHASE ONE

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Roadway, paved (18')	1.32 mi.	\$	\$109,270.	\$109,270.
Roadway, paved (10')	.5 mi.		29,800.	29,800.
Parking Area, paved (Doe Run)	20 cars		7,800.	7,800.
Camp Sites	55	845.	46,480.	46,480.
Recreation Court	1		12,000.	12,000.
Restroom (conversion to chemical)	3	8,000.	24,000.	24,000.
Restroom (new chemical)	2	20,100.	40,200.	40,200.
Landscaping (includes signs, refuse containers, wheel stops, topsoil and seeding)	L.S.	-	10,760.	10,760.
Water (wells)	2	3,000.	6,000.	6,000.
SUB - TOTAL COST				286,300.
20% ENG. DESIGN, etc				57,260.
TOTAL DEVELOPMENT COST				343,600.

4.10 PLEASANT CREEK CAMPING AREA - PHASE TWO
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Dredging	1777 cy	\$ 10.	\$ 17,770.	\$ 17,770.
Roadway, paved (18')	1.4 mi.		155,700.	155,700.
Roadway, paved (10')	.6 mi		38,700.	38,700.
Parking Area, paved (Launch Area)	40 cars 11 car/ trailer		124,500.	124,500.
Boat Launching Ramp, complete	490 sy	25.	12,250.	12,250.
Courtesy Pier	L.S.	-	-	10,000.
Path, paved (to dock)	60 lf	5.40	320.	320.
Steps (concrete)	100 lf	16.50	1,650.	1,650.
Dock Access Ramp	540 sf	34.	18,360.	18,360.
Dock System	2,120 sf	13.50	28,620.	28,620.
Rip-Rap, Stone	1,040 cy	30.	31,200.	31,200.
Camp Sites	51	845.	43,100.	43,100.
Restroom (new chemical)	3	20,100.	60,300.	60,300.
Landscaping (includes planting, signs, refuse containers, top- soil and seeding	L.S.	-	61,690.	61,690.

4.10 PLEASANT CREEK CAMPING AREA - PHASE TWO (CONT.)
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Water (wells)	3	\$ 3,000.	\$ 9,000.	\$ 9,000.
SUB - TOTAL COST				613,160.
20% ENG. DESIGN, etc				122,630.
TOTAL DEVELOPMENT COST				735,800.

4.11 PLEASANT CREEK CAMPING AREA - ALTERNATE ACCESS
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Roadway, paved (10')	2.55 mi.	\$	\$163,770.	\$163,770.
Landscaping (includes signs, topsoil and seeding)	L.S.	-	38,740.	38,740.
*Land Acquisition 800 acres, including administrative costs per tract of land				
SUB - TOTAL COST				202,500.
20% ENG. DESIGN, etc				40,500.
*Land Acquisition				650,000.
TOTAL DEVELOPMENT COST				\$893,000.

4.12 WATERFOWL IMPOUNDMENT
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Construction of Dam and road-way relocation of Route 10	L.S.	\$ -	\$ -	\$ 225,000.
<p><u>NOTE:</u> Cost figures shown above were obtained from West Virginia Department of Natural Resources. These costs were established in January 1976.</p>				
SUB - TOTAL COST				225,000.
20% ENG. DESIGN, etc				45,000.
TOTAL DEVELOPMENT COST				\$270,000.

4.13 WEST HILL LAUNCH RAMP
COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Road Realignment (18')	.28 mi.	\$	\$ 25,870.	\$ 25,870.
Road Resurfacing (18')	2,640 lf	3.60	9,500.	9,500.
Service Road, paved (10')	350 lf		4,690.	4,690.
Parking Area, paved (including aisles)	17 cars 21 car/ trailer		117,280.	117,280.
Path, paved	270 lf		1,458.	1,458.
Boat Launching Ramp, complete	1,758 sy	30.	52,740.	52,740.
Courtesy Pier	L.S.	-	-	10,000.
Rip-Rap, Stone	590 cy	25.	14,750.	14,750.
Restroom (new chemical)	1	20,100.	20,100.	20,100.
Landscaping (includes signs, refuse containers, topsoil and seeding)	L.S.	-	12,980.	12,980.
Water (well)	1	3,000.	3,000.	3,000.
*Land Acquisition 13 acres, including administrative costs per tract of land				
SUB - TOTAL COST				272,370.
20% ENG. DESIGN, etc				54,474.
*Land Acquisition				31,000.
TOTAL DEVELOPMENT COST				357,800.

4.14 SANITARY - RIGHT BANK SYSTEM

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Cabin Area to Sewage Treatment Plant		\$	\$	\$
Pressure Piping (3" or under)	6,900 lf	5.00	34,500.	
Grinder Pumps (single)	28	1,500.	42,000.	
Connections	28	500.	14,000.	90,500.
Park Office to Sewage Treatment Plant (includes connection to Bathhouse)				
Pressure Piping (3" or under)	2,400 lf	5.00	12,000.	
Pressure Piping (4")	800 lf	8.00	6,400.	
Grinder Pumps (duplex)	2	2,500.	5,000.	
Connections	2	500.	1,000.	
Pump Station	1	25,000.	25,000.	49,400.
Marina to line from Park Office (includes connections to Restrooms at Picnic Areas No. 1 and No. 2)				
Pressure Piping (3" or under)	4,700 lf	5.00	23,500.	
Pressure Piping (3" or under) future connection, if required	1,600 lf	5.00	8,000.	
Grinder Pumps (duplex)	4	2,500.	10,000.	
Connections	4	500.	2,000.	

4.14 SANITARY - RIGHT BANK SYSTEM (CONT.)

COST ESTIMATE FOR FACILITIES DEVELOPMENT

DESCRIPTION OF WORK	QUANTITY	UNIT COST	COST	TOTAL COST
Electric (two existing Rest-rooms at Picnic Areas)		\$	\$	\$
Primary Service (overhead to two existing Rest Rooms)	3,300 lf	1.00	3,300.	
10 KVA Transformer (pole-mounted)	2	500.	1,000.	
60 AMP Service (in conduit)	400 lf	8.00	3,200.	51,000.
Sewage Treatment Plant				
Control and Lavatory Building	1	56,700.	56,700.	
Water (1" line)	100 lf	5.00	500.	
Discharge Line and Pump	1	3,000.	3,000.	
Electric				
Primary Service (overhead)	900 lf	1.00	900.	
400 AMP Service (in conduit)	100 lf	30.	3,000.	
75 KVA Transformer (pole-mounted)	1	3,000.	3,000.	67,100.
SUB - TOTAL COST				258,000.
20% ENG. DESIGN, etc				51,600.
TOTAL DEVELOPMENT COST				\$309,600.

4.15 SUMMARY

COST ESTIMATE FOR FACILITIES DEVELOPMENT

Federal Area		\$ 23,000.
Lodge		155,900.
Scab Run Launch Ramp		298,750.
Marina Complex		1,170,200.
Picnic Areas		205,200.
Cabin Complex		
Phase One	\$203,600.	
Phase Two	466,900.	670,500.
Pleasant Creek Rifle Range		57,120.
Pleasant Creek Camping Area		
Phase One	343,600.	
Phase Two	735,800.	
Alternate Access	893,000.	1,972,400.
Waterfowl Impoundment		270,000.
West Hill Launch Ramp		357,800.
Sanitary - Right Bank System		309,600.
TOTAL		\$5,490,470.