81st Congress, 2d Session - - - - - House Document No. 687

CHESAPEAKE & OHIO CANAL REPORT

LETTER

FROM

ASSISTANT SECRETARY OF THE INTERIOR

TRANSMITTING

A JOINT RECONNAISSANCE SURVEY REPORT MADE BY THE BUREAU OF PUBLIC ROADS OF THE DEPARTMENT OF COMMERCE AND THE NATIONAL PARK SERVICE UPON THE ADVISABILITY AND PRACTICABILITY OF CONSTRUCTING A PARKWAY ALONG THE ROUTE OF THE CHESAPEAKE & OHIO CANAL BETWEEN GREAT FALLS AND CUMBERLAND, MD., PURSUANT TO PUBLIC LAW 618, 80TH CONGRESS

AUGUST 16, 1950.—Referred to the Committee on Public Lands and ordered to be printed, with illustrations

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C. August 7, 1950.

Hon. SAM RAYBURN,
Speaker of the House of Representatives,
Washington 25, D. C.

MY DEAR MR. SPEAKER: In response to Public Law 618 of the Eightieth Congress which you approved June 10, 1948, I have the honor to transmit herewith a joint reconnaissance survey report made by the Bureau of Public Roads of the Department of Commerce and the National Park Service of this Department upon the advisability and practicability of constructing a parkway along the route of the Chesapeake & Ohio Canal between Great Falls and Cumberland, Md. The report was also to include an estimate of construction costs.

I believe that the study has brought out the fact that it is entirely practicable to construct a parkway along this canal and that it is advisable to do so provided that the necessary additional right-of-way can be obtained. A brief review of the more important findings follows:

1. A satisfactory line, grade, and cross section can be obtained that would be adequate to the anticipated traffic.

2. A parkway with fully controlled access can be accomplished with less difficulty than any other possible project in this part of the country because of the peculiar location adjacent to the river.

3. The probable traffic volume and potential public use are sufficient to justify the cost of construction. A traffic volume of from 640 to 2,500 vehicles per day has been estimated for this parkway.

4. The project would embody exceptional scenery that deserves the tribute of preservation on a national level.

5. The cost of construction would be much less than would normally be possible through this type of terrain because of the structures already built which can be utilized and the existing canal grading which can be used.

6. The width of right-of-way is not sufficient for parkway purposes and more would have to be obtained. The additional right-of-way would not be of an expensive character. The pattern laid out on other parkways by the Congress (Foothills, Blue Ridge, and Natchez Trace), should be followed and the additional right-of-way should be obtained by the State and deeded to the United States. This would require participation and legislation by Maryland.

7. Many advantages would accrue from construction of the proposed parkway:

   (*a*) The parkway proposal would function as an approach to the National Capital in which capacity it would connect with the

George Washington Memorial Parkway now well advanced in the processes of land acquisition and actual project construction. It is important and fitting for the national status of the capital area to be so recognized.

(*b*) Recreational developments which have lagged far behind the population increase in this area could be provided by the proposed parkway, near the Nation's Capital.

(*c*) The Government's investment in canal property which has not been utilized anywhere near its possibilities for recreation would be permitted to develop to the maximum on both the local and national levels.

(*d*) The project would provide a controlled access road facility from Washington well into the mountains with the assurance of rapid uninterrupted traffic in time of need.

(*e*) The project would have outstanding scenic and historic interests that could be developed on the theme of "The historic gateway to the westward."

All of the study, analyses, and plans can be considered in reality as a rediscovery of the Potomac Valley wherein we have come to consider anew each part of the river and each part of the Potomac Basin.

I concur wholeheartedly in this report as I believe that the study has fully disclosed that such a parkway would be both practical and advisable in addition to being economical to construct.

Sincerely yours,

DALE E. DOTY,
Assistant Secretary of the Interior.

REPORT ON JOINT RECONNAISSANCE SURVEY AND STUDY

BY THE

BUREAU OF PUBLIC ROADS

(Formerly the Public Roads Administration)

and the

NATIONAL PARK SERVICE

of the federally owned

CHESAPEAKE & OHIO CANAL

Between Great Falls, Md., and Cumberland, Md.

(Authorized by Public Law 618, 80th Cong., ch. 435, 2d sess., approved June 10, 1948)

LETTER OF TRANSMITTAL

Hon. OSCAR CHAPMAN,
Secretary of the Interior.

MY DEAR MR. SECRETARY: We transmit herewith our report on the joint reconnaissance survey and Study of the Chesapeake & Ohio Canal, between Great Falls, Md., and Cumberland, Md., to determine the advisability and practicability of constructing a parkway along the route of the old canal. This survey and report was authorized by Public Law 618, Eightieth Congress, chapter 435, second session, approved June 10, 1948. As required by the act, a report on the estimated cost is included.

Very truly yours,

NEWTON B. DRURY,
Director, National Park Service.

JUNE 15, 1950.

THOS. H. MACDONALD,
Commissioner, Bureau of Public Roads.

JUNE 28, 1950.

CONTENTS

OUTLINE OF C. & O. CANAL REPORT

CHESAPEAKE & OHIO CANAL REPORT

INTRODUCTION

AUTHORIZATION FOR SURVEY AND REPORT

This is a report on a joint reconnaissance survey and study of the federally owned Chesapeake & Ohio Canal between Great Falls, Md., and Cumberland, Md., to determine the advisability and practicability of constructing a parkway along the route of the Chesapeake & Ohio Canal, and includes an estimate of cost of such construction. The joint survey and report was authorized by Public Law 618, Eightieth Congress, chapter 435, second session, approved June 10, 1948, which read as follows:

AN ACT To authorize the Secretary of the Interior to have made by the Public Roads Administration and the National Park Service a joint reconnaissance survey of the Chesapeake and Ohio Canal between Great Falls, Maryland, and Cumberland, Maryland, and to report to the Congress upon the advisability and practicability of constructing thereon a parkway, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be expended from the appropriations made to the National Park Service for parkways the sum of $40,000 for the purpose of making a joint reconnaissance study by the Public Roads Administration and the National Park Service of the federally owned Chesapeake and Ohio Canal between Great Falls, Maryland, and Cumberland, Maryland, to determine the advisability and practicability of constructing a parkway along the route of the Chesapeake and Ohio Canal, including a report of estimated cost.

In September 1938, the Federal Government purchased the 185-mile Chesapeake & Ohio Canal right-of-way between Georgetown, D. C., and Cumberland, Md. During the years immediately following this purchase, the 23-mile section of this historic canal between Washington and Seneca was restored by the National Park Service and is now used as a recreational waterway within the National Capital Parks system.

Although the scenic, historic, and recreational values of the public lands along the remaining 163 miles of the canal have been regarded as ideally suited for some type of park development, the use of the property for park purposes has not heretofore been given detailed study. Over the years the canal and the structures in this area have received little or no maintenance attention, have become overgrown, are inadequately policed, in some areas constitute unhealthful conditions and give rise to constant problems of administration. In some instances proposed projects, both public and private in nature, have involved these lands, and the lack of plans for their ultimate use has made it difficult to determine what action in their regard is in the best interest of the Government.

The canal property was purchased with funds allotted to the National Park Service by the Federal Emergency Administrator of Public Works. The authority for the purchase of the property is

found in sections 202 and 203a of the National Industrial Recovery Act (48 Stat. 201, 202); the purpose of the allotment was stated to be:

> For the purchase of the Chesapeake and Ohio Canal and appurtenant land in the District of Columbia and Maryland, including, for a considerable portion of the length of the canal, the bed of the Potomac River where it adjoins the canal right-of-way, and the construction of a parkway as well as the rehabilitation of the existing canal as an historic site, including incidental expenses.

In the 1942 Interior appropriation bill Congress provided $25,000 for the maintenance, operation and protection of the canal property, and in 1943 an appropriation was made of $140,000 including among other specified objects,

> the repair of flood damages to National Capital Parks areas and the Chesapeake & Ohio Canal.

The National Park Service now administers the Chesapeake & Ohio Canal under the act of August 25, 1916 (39 Stat. 535 16 U. S. C. sec. 1, et seq.) which established the National Park Service.

The contract of sale under which the Canal property was acquired by the United States included the following clause:

> The United States of America agrees that it will not use or permit to be used all or any part of the property herein referred to for the conveyance of freight or passengers by land without the prior written consent of the Baltimore and Ohio Railroad Company, provided, however, that this covenant shall not extent to such transportation facilities on the lands covered by this agreement as are considered by the Secretary of the Interior, or his successors, to be reasonably necessary to provide accommodations for the visiting public.

We understand this clause to mean that truck transportation and bus transportation lines could not be allowed to use the parkway, if built, except by agreement of the railroad company.

SCOPE OF STUDY

It was assumed that in order to report upon the advisability and practicability of constructing a parkway along the route of the old canal, it would be necessary to determine:

1. The existing values in the canal property.
2. Adaptability of the canal location to use as a parkway.
3. Valuation of the scenic, historic, and recreational features of the route.
4. Probable amount of traffic, roadway needed to carry it, and the estimated cost of construction.
5. Whether the present land holdings are adequate for a parkway.

A parkway is described in the Requirements and Procedure to Govern the Acquisition of Land for National Parkways, recommended by the Bureau of Public Roads and the National Park Service on June 9, 1941, as being designed for passenger car traffic and largely for recreational use, built within a wide right-of-way so as to protect and preserve scenic values and with controlled access.

As defined by the American Association of State Highway Officials a parkway is—

> an arterial highway for noncommercial traffic with full or partial control of access, and usually located within a park or a ribbon of park-like development.

Our conception of a parkway along the C. & O. Canal is that it should be of a character that would serve the through traffic that

may be expected to use it in preference to other routes, as well as the traffic generated by the local recreational use which the parkway and its surroundings might provide.

The great historic interest in the Chesapeake & Ohio Canal, the superb character of its construction, and especially of its masonry construction, led us to the belief that any proposal to adapt the canal for use as a parkway should definitely include provision for use of parts of the canal as a recreational waterway, and preservation of much of the remainder of the canal prism as a grassed ditch, and should above all else preserve most of the locks, viaducts, lock tender's house and other historic structures. In all of this, the design of the roadway should be of a nature to enhance the recreational value of the road, and fully develop and enhance these features as well as the superb natural scenery through which the route passes. Such a project, being a parkway with the usual roadside recreational areas, and in addition with sections of recreational waterway, would be an unusual one, with so far as we know no other like it anywhere.

DIVISION OF WORK

At the outset of the survey, we agreed upon a subdivision of the work between the Park Service and the Bureau of Public Roads, in order to make the best utilization of the particular specialties of each. It was agreed that the Park Service would study and report upon the historic sites in the area, the natural beauty of the surrounding countryside, the nature and character of suitable recreational development and the determination of sites for initial recreational development. Included in this study was to be a determination of the additional land over and above the existing canal right-of-way needed for such purposes, including also that needed for control of roadside appearance. It was agreed that Public Roads would participate in the right-of-way study to the extent necessary to insure that provision was made for adequate width for the highway and for the provision of suitable access to the parkway. It was recognized that the recreational field for this parkway should include the further development of parts of the canal as a recreational waterway in somewhat the same manner as the section between Georgetown and Seneca is now used.

It was agreed that the Park Service would study and determine the places where it would be desirable to have water in the canal to use it as a recreational waterway and to prepare cost estimates for such impoundments. Such a study would be jointly participated in by Public Roads to make sure that the places selected were at locations where the terrain would permit building the parkway outside of the canal section.

In addition, because of the large mileage of river shore line, particular emphasis on water recreation and fishing might be possible. The Harpers Ferry and Antietam areas were also important historic sites as witnessed by the Antietam National Battlefield Site and the authorized Harpers Ferry Historic Site.

It was further agreed that the Park Service should develop from their own and other records data on the flood elevations along the canal since it was known that the canal had at various times during its history been seriously injured by floods.

It was agreed that Public Roads would estimate the probable traffic that would use such a parkway and study the relation of such a parkway to the existing road systems of the area. Public Roads would also determine the character of the line, grade and cross section that would be needed for the traffic, determine the location generally and make a reconnaissance estimate of cost of the proposed construction. The Park Service would participate in determination of line, grade and cross section with respect to preservation of the native scenery and the aesthetic and historic values inherent in the existing canal structures and other physical features.

GENERAL LOCATION AND DESCRIPTION OF THE OLD CANAL

The canal follows the Potomac River rather closely throughout nearly all of its length. In two places it entered the river controlling the elevation of the river in each case by dams. One of these places is about three-fourths mile long near Four Locks, and the other is 4 miles long near Falling Waters. The appraisal of the canal property above referred to states that between the District of Columbia line and Seneca the property carried title to 6 miles of Potomac shore line and between Seneca and Cumberland approximately 100 miles. This length between Seneca and Cumberland is nearly 160 miles.

The canal cuts across a bend in the river at Four Locks reducing the length of travel by about 5 miles. Likewise it cuts across a bend with the Paw Paw tunnel, reducing the length of travel by about 7 miles. (See pl. 1 following p. 87.)

The canal rises 444 feet in 168 miles between Great Falls and Cumberland. Grades of a roadway following its general location would therefore be very light.

The canal section was generally based upon a width of 60 feet at the water line, 42 feet of width at the bottom, and a water depth of 6 feet. The towpath provided a width of about 10 feet. This section width is present today at many places, but there are many places where it is much less.

The rise at the locks was generally 8 feet. The width between walls was 15 feet. The width between spandrels of the viaducts was 18 to 22 feet, but there was a stone towpath on one side, so the total over-all width of the viaducts is generally 33 feet.

The tunnel has a clear width for canal of about 19 feet and for the towpath of 5 feet, making a total width of 24 feet. It is 3,080 feet long.

I. Existing Values in Canal Property

1. LAND, GRADING, AND STRUCTURES

The authority extended by Congress for a reconnaissance study of the Chesapeake & Ohio Canal is a natural extension of the Federal Government's interests in the development of the Potomac River. The Potomac passage to the West was one of the earliest known and exploited and many prominent persons in the Government over the past two centuries have taken direct interest in the development of the various projects to improve the route nature provided. Some of the earliest experiments in canal building and river navigation and one of the clearest tests of the comparative merits of canals and railroads were unfolded in this valley.

The locks constructed at Great Falls between 1785 and 1802 by the Potomack Co. under the sponsorship of George Washington constituted the first effort to improve navigation on the Potomac. These locks were considered a notable engineering feat at the time of their construction and were described in many scientific publications at home and abroad. The vision of Washington and his contemporaries in the development of "ties of communication" between the East and rapidly expanding frontier during the late eighteenth century contributed greatly to the prosperity and unity of the young Nation. In over 36 years, the Potomack Co. expended $725,000, and though little in the nature of a permanent transportation structure was accomlished, the precedent for the Chesapeake & Ohio Canal Co. was established and Washington's aims and hopes for national security greatly advanced. He wrote as follows to Jefferson:

> All the world is becoming commercial * * *. Nature has declared in favor of the Potomack and through that channel offers into our lap the whole commerce of the Western World * * * the ways are preparing and the roads will be made easy through the channels of the Potomack.

The continuous canal involved in the projected parkway project was built by the Chesapeake & Ohio Canal Co. Construction of the waterway was formally started on July 4, 1828, and the canal was completed and opened to a point 26 miles above Harpers Ferry in 1834. The canal was completed and opened to Cumberland on October 10, 1850, and continued in operation until 1924.

The C. & O. Canal Co., as the successor to the earlier Potomac Co., was granted special rights relating to navigation in and along the Potomac, including the right of eminent domain to acquire not only lands needed for the canal, but also materials such as stone, gravel, timber, etc. Acts of the Virginia Legislature of December 30, 1824, of the Maryland Legislature on January 31, 1825, and of the Congress approved March 3, 1825, constituted the basic legislation required for the organization of the company and the construction of the work. Under the Virginia act concurred in by Maryland, the canal "shall forever thereafter be esteemed, and taken to be navigable as a public highway free for the transportation of goods, commodities, and produce whatever, on payment of the tolls to be imposed, as provided by this act." The Maryland act "accepted, assented to, and confirmed" said act subject to the provision that it did not intend to deny the Congress the constitutional power to legislate on the subjects of roads and canals.

The cost of its construction was largely borne by the public through taxation. The United States and the District of Columbia each subscribed $1,000,000 toward stock in the company. Maryland subscribed large amounts, later owning the majority of stock in the company and also a mortgage on it.

On December 16, 1913, a report by the district engineer to the Secretary of War (H. Doc. 893, 63d Cong., 2d sess.) estimated at that time the total indebtedness of the canal at $27,166,604.69, the bonded indebtedness being $1,959,500 and State liens aggregating some $25,000,000 of the remainder.

It therefore appears probable that the cost of initial construction, together with major repairs, improvements, and interest on the company's indebtedness, totaled some $27,000,000, of which the United

States and the District of Columbia provided $2,000,000. A large share of the remainder was made available by the State of Maryland.

The canal was in operation until 1924, surviving many floods and the ravages of the War Between the States. It was finally forced to yield to the more efficient railroad transportation, and the controlling interest in the company was ultimately acquired by the Baltimore & Ohio Railroad.

The Baltimore & Ohio Railroad had pledged the canal property to the Reconstruction Finance Corporation as security for a loan, and in September 1938 the Government purchased this property from the railroad for $2,000,000. At that time the appraised value of the property was $4,406,809. This appraisal was made up as follows:

Lands in the District of Columbia	$2, 523, 159	
Lands between the District of Columbia line and Great Falls	787, 140	
Water leases in the District of Columbia, yielding income of about $20,000 to $24,000 per year	----------	
Subtotal	3, 310, 299	
Lands between Great Falls and Seneca	81, 030	
Land between Seneca and Cumberland	763, 480	
Dams 4 and 5 across Potomac near Williamsport	250, 000	
Subtotal	1, 094, 500	
Total		$4, 406, 809

The right-of-way contains 5,253.54 acres. It varies in width from 30 feet to 900 feet and averages about 230 feet.

There are 12 aqueducts, 11 major culverts, 107 minor culverts, 4 combination culvert vehicular underpasses, and 13 highway and 16 railroad bridges over the canal. Other structures included 6 major dams across the Potomac, 53 lift locks, 4 outlet locks, 7 stop locks, 1 tunnel, 1 guard lock, and 2 pivot bridges. There were numerous stone houses for the lock tenders.

The canal prism was 60 feet wide at the water line, and the towpath was generally 10 feet wide, making a total over-all width of 70 feet. This section width is present today at most places, although there are short sections where it has been largely destroyed by floods.

The total length of all places where wash-out of the prism has occurred is approximately one-half mile. The longest of these places is the section below Harpers Ferry, which is about 1,200 feet long.

There were also 2 sections totaling 4¾ miles in length where the canal entered the river, so that no grading was required except for a narrow towpath, and at some of these places the right-of-way is only 30 feet wide.

There is a large investment of public funds in this canal property on which very little return is now being realized. The 5,253 acres of land, the numerous structures, and the grading of the canal prism are now serving very little useful purpose, except a small amount of local recreation. The structures, which have great historic interest as early examples of fine engineering, are gradually deteriorating and ought to be preserved.

The sturdy old stone buildings and locks have a simplicity and beauty derived from honest use of local materials and great skill in craftsmanship. They are so much a part of the waterway and so completely assimilated into their surroundings by decades of weathering that they are a valid and priceless part of the canal scene.

The Piedmont area from Maryland Heights, Harpers Ferry

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The 100-year-old viaducts and culverts represent some of the earliest and finest examples of early American masonry, too few examples of which have been preserved. Their preservation for future interest would be of great value, and they would be a delightful source of interest and inspiration to future generations.

2. SCENIC CHARACTER

Since the canal has been in Federal ownership there have been many proposals for development of the canal terrain. In each proposal, whether in the interests of game preservation, canal restoration, park development, or road construction, was embodied the tacit implication that all scenic and historic requirements could be amply fulfilled.

Because the region has not been extensively developed in the past century, the Potomac Valley bears many traces of our past, unchanged by the passage of time and the growth of an urban civilization. Here may be found physical evidences of America's geological eras and her pre-Columbian inhabitants as well as much of the charm of a natural setting that is justly famed for its rugged beauty.

The Potomac has emerged through the centuries as a winding, twisting river, plunging over numerous rapids and falls through narrow gorges and flowing through quiet pools in fertile valleys, amid scenes as widely contrasting as those of bucolic tranquillity and primordial rock formations. Jefferson was struck by this exciting contrast as he looked for the first time upon the Harpers Ferry Gap at the confluence of the Shenandoah and Potomac Rivers. He was moved to the following expression concerning the passage of the Potomac through the Blue Ridge:

> It is a true contrast to the foreground. It is as placid and delightful as that is wild and tremendous. For the mountain being cloven asunder, she presents to your eye through the cleft a small catch of blue horizon, at an infinite distance in the plain country, inviting you as it were from the riot and turmoil roaring around to the pass through the breach to the calm below.

Jefferson was truly the first to discover and depict to Europeans the beauty of American natural scenery and to proclaim with genuine American pride that "this scene is worth a voyage across the Atlantic."

The traveler mounting the valley from the National Capital today passes through five of the six great topographical sections of the eastern seaboard, excepting only the Atlantic shore region. (See pls. 2, 3, and 4 following p. 87.)

From tidewater in the District of Columbia through the Piedmont, the Blue Ridge, and the great valley to the massive Appalachian backbone one may see every characteristic of the region and most species of the native flora and fauna of the area still extant. The Potomac Valley is truly a storehouse of natural wonders relatively unspoiled by the disturbances of recent technological developments.

The Piedmont area commences at Little Falls, from which the valley rises gently by a series of water-worn plateaus, principally of red sandstone to the Blue Ridge west of the Monocacy Valley. The surface of the valley is characterized by gently rolling country of rich farm lands broken at points near the river by stretches of majestic cliffs.

The Blue Ridge section coincides, in Maryland, largely with the boundaries of Frederick County. The Catoctin Mountains form the first principal ridge in this region flanked by the Monocacy Valley on

Portion of Great Falls.

Dam No. 2, Great Falls.

the east and Middleton Valley to the west. Since the latter is really a series of minor foothills between the Catoctin and Blue Ridge Mountains, the effect is of three ridges in one mountain mass, gradually rising to the Blue Ridge itself. The Catoctin Range, which becomes rather flat near the Potomac, is marked by a narrow and beautiful chasm at the river.

The great valley, known in Virginia as the Shenandoah and in Maryland as the Cumberland, is in reality a series of folds averaging 500 feet above sea level, rather than a single basin. This is the famous limestone area for which the Potomac Valley has long been so well known. The Shenandoah River, readily accessible from the proposed parkway, has an interesting geological origin itself. The streams of northern Virginia originally flowed from west to east, as do the James and Potomac today. During the undulations of the earth's surface, a

The Appalachian region, from No. 6, Cavetown, Md.

new stream formed, flowing from south to north. This river, the Shenandoah, gradually undercut the west-east streams such as the Rappahannock and the Rapidan and diverted the flow to the Potomac, leaving only the famous wind gaps in the Blue Ridge, which play such havoc with weather east of the mountains, as evidences of the former course of streams.

The last great distinct physical section of the Potomac is the Appalachian region. In Maryland alone there are 15 separate ridges in the massive mountain barrier. The ridges range upward from 1,000 feet, including North Mountain, picturesque Round Top, Tonoloway Mountain, Sideling Hill, Four Hill, Green Ridge, Polish, Warrior and Evitts Mountains. The region is basically sandstone and slate in composition. Here are found steep cliffs and huge boulders in the winding river bed, fragments left by cutting of the Potomac through the mountains. From the earliest days, travelers have commented on

the rugged beauty of this region. On the Maryland side, the streams are relatively short and precipitous, but on the south the Cacapon and the South Branch of the Potomac are impressive rivers in their own right. The latter indeed is longer than the North Branch, and there have been many who have insisted that it is the main bed of the Potomac. Cumberland, the western end of the Chesapeake & Ohio Canal and of the proposed parkway, is set in a natural amphitheater at the mouth of Wills Creek. The site was early recognized as being of strategic value and has consequently had a long and interesting history.

3. HISTORICAL VALUES

The Potomac River Valley has a long and colorful history of great national significance. Here will be found prehistoric sites where archaeological research has disclosed artifacts indicating human habitation of the area as early as the Folsmoid Period (c. 10,000 to 25,000 years ago), and by similar research methods objects have been recovered which show beyond reasonable doubt that early man roamed this region by 900 A. D. These and many Indian sites of a later pre-European period amply justify archaeological study of the Potomac Valley and the interpretation of the prehistoric theme thus revealed. Later this natural passageway westward, which attracted the ancient man of many thousands of years ago, was used by the early American explorer, fur trader, frontiersman, and settler during the first waves of migration inland which ultimately were to expand the boundaries of the Nation to the Pacific Ocean. (See pls. 2, 3, and 4 following p. 87.)

The valley of the Potomac was chosen for the early trade route of the Ohio Company organized in 1749 to develop and encourage settlement of the trans-Alleghany country. When contact with the French on the Ohio precipitated the French and Indian War in the struggle for hegemony in the New World, this Potomac Valley and trans-mountain route played an important role in the Colonial expeditions to oust the French. The diary and correspondence of George Washington and the contemporary accounts of these wilderness campaigns make frequent reference to the site of present-day Oldtown, Md. (Thomas Cresap's frontier home and stronghold), Cumberland, Md. (site of the Wills Creek fort and storehouse established by the Ohio Company), and the trail across the Alleghanies to the Monongahela and Ohio Rivers (later the approximate location of the National or Cumberland Road and U. S. Route 40). During the period immediately following Braddock's unsuccessful campaign, the Maryland colony quickly built Fort Frederick (1756) for the protection of its frontier settlers against Indian attack, and the restored ramparts of this old fortification are still to be seen close by the Cheaspeake & Ohio Canal in Fort Frederick State Park.

The removal of the French from the Ohio Valley by the Treaty of Paris ushered in a period of increased land speculation and trade activities. Frederick, Md., had been laid out in 1745, and a few years later inhabitants were sufficient to warrant the creation of Frederick County, embracing all of present-day western Maryland. In 1747 Robert Harper settled at the juncture of the Potomac and Shenandoah Rivers, giving his name to the historic Potomac Valley town of Harpers Ferry, which the Congress has found of sufficient historic significance to designate as the Harpers Ferry National Historic Site.

By 1750, scattered white settlements were found as far west as the Conococheague (Williamsport, Md.).

Although the Revolution had little direct military association with the Potomac Valley, the successful outcome of the war materially altered the character of the land and trade questions. Settlement of the Piedmont sections of Maryland and Virginia, as well as the Ohio country west of the mountains, expanded at an unprecedented rate. This new and growing area of population, far removed from the old, established East, gave emphasis to the need for means of communications between the two sections.

The consideration of a plan to provide an easy passageway along the Potomac Valley by means of a navigable waterway began as early as the 1750's. One of the first to become interested in this possibility was George Washington, who as early as 1754 began to contemplate a project by which the Potomac River might be made navigable to a point west of Cumberland, Md., and there connect by transmountain roads with streams leading to the Ohio River. Although Washington's efforts to secure the organization of a company for this purpose were interrupted by the Revolution, they were quickly resumed a few months following his resignation as commander-in-chief of the Continental Army. By 1785 the charter of the "Potomack Company" had been approved and sufficient stock sold to warrant formal organization. Washington was elected the first president of the company, and James Rumsey, who later conducted early experiments with the steamboat on the Potomac near Shepherdstown, W. Va., was engaged as the chief engineer. Between 1785 and 1802 the Potomac Co. endeavored to remove the obstructions from the bed of the Potomac River, and built five short skirting canals around the major river falls where a channel in the river itself was not possible. Until 1831 river boats made the perilous journey along the river and through the skirting canals between Cumberland and Georgetown.

A grave national problem at the beginning of the nineteenth century was the conquest of the natural Appalachian barrier which lay between the commercially established East and the frontier resources of the undeveloped West. To link these two regions into a national system of enduring growth, vast improvements in transportation facilities were urgently needed. In March 1806 Congress authorized the beginning of construction on the National Road. By 1818 the road was completed from Cumberland, Md., to Wheeling on the Ohio. Today, United States Route 40 follows the approximate route of the old National Road.

The vigorous impulse given the eastern and western movement of men and goods by the opening of this road led to a search for and to develop an even more economical means of transportation. The feeling that water transportation by the continuous canal was vastly superior to road transport swept the country in the early 1820's. The record of the third decade of the nineteenth century in fostering canal construction was astounding. By 1830 over 3,000 miles of canal were well advanced in New York, New Jersey, Pennsylvania, Delaware, and Maryland. As the demand for canals spread over the country, the Chesapeake & Ohio Co. was promoted and organized. The old Potomac Co. was required to relinquish its charter rights to the new enterprise proposed to join the Ohio River at Pittsburgh with tidewater on the Potomac near Georgetown, D. C. The pro-

posed 341-mile canal was begun July 4, 1828, near the Little Falls of the Potomac, when President John Quincy Adams turned the first shovelful of earth.

Unfortunately, Baltimore was not geographically situated to command a western water route, having no connecting river valley to develop. Confronted with competition on all sides, Baltimore's powerful business and political forces had shown little enthusiasm for a project which would do more to benefit their rivals on the lower Potomac than themselves, and, on the same day the Chesapeake & Ohio Canal was begun, Baltimore inaugurated the building of a new mode of transportation: the railroad. By supporting the building of the Baltimore & Ohio Railroad, as yet an untried experimentation in transportation, Baltimore showed her determination to maintain her position in the competition for the western trade. The controversy between the two companies as their lines extended up the Potomac Valley, especially at the Point of Rocks where legal contention over the right-of-way delayed both companies for 3 years, is one of the colorful and significant phases in the history of transportation illustrated by the Potomac route. But the Baltimore & Ohio Railroad became the chief competitor of the canal system, and was to be the cause of its decline, and was ultimately to control and displace it. The canal reached Cumberland in 1850, 8 years after the railroad had reached this point, and never extended across the Alleghanies. But the Baltimore & Ohio crossed the mountains to the Ohio, and today constitutes one of the principal rail routes to the West.

During the decades when the canal and railroad moved up the valley of the Potomac River, the issues which led to the great intersectional conflict of 1861–65 dominated the Nation's political scene. John Brown's raid, an incident of almost universal knowledge, occurred during this period at Harper's Ferry. Here the barricaded building in which Brown and his 18 followers took refuge was stormed by a company of marines under Col. Robert E. Lee on October 16–17, 1859. At nearby Charlestown, Brown was tried and executed.

In the struggle which followed, the Potomac Valley occupied a strategic place in the border area containing the seat of the Federal Government. As a consequence, the valley was the scene of almost constant skirmishing and raiding between the opposing sides. It also lay athwart invasion routes into both North and South, and thus was involved in at least five major military operations: McClellan's West Virginia campaign (1861), Jackson's valley maneuvers (1862), the invasion of Maryland and the battle of Antietam (1862), the invasion of Pennsylvania for the Gettysburg campaign (1863), and Jubal Early's raid on Washington (1864). The crossing of the Potomac River and the canal by the contending forces in these major campaigns of the Civil War was an important phase of each operation and the identification of the points of crossing should be of great interest to parkway travelers.

As the years have passed the agencies of transportation in the Potomac River Valley have undergone the same development and change characteristic of this important national industry. The modern highway, streamlined automobile and railroad car, and the high-speed airlines now using the valley route complete the theme of the ever-improving means of communication which have served to bind the Nation together.

4. RECREATIONAL VALUES

An initial appraisal of the recreational values along the canal was made to determine the areas that offered the greatest concentration of attractions. Scenery, history, water sports, and native adaptability to development and recreation use were the primary attributes sought for. Such names as Great Falls, Seneca River, Monocacy River, Harpers Ferry, the Widewater sections associated with Dam No. 4 and Dam No. 3 the Four Locks area near Fort Frederick, Paw Paw Tunnel and the Cumberland terminus are of outstanding interest. In each of these a framework exists that will fully support a program of recreational development.

Recreational use of a restored section of the canal near Great Falls.

Present day use of the canal and its indispensable ally, the Potomac, even though it is largely inaccessible except to local communities is quite extensive. Fishing, rowing, and canoeing are popular as evidenced in the camping communities already established. Between Great Falls and Cumberland, the canal and the Potomac today serves as a refuge for the sportsman and recreationist at over 60 minor points. In addition, such major points as Great Falls, Seneca River, Monocacy River, Fort Frederick and the various fish and gaming clubs raise the river population to 2,500 to 3,000 cars on principal holiday week ends. Great Falls alone has been recorded over a half month period as serving an average of 500 cars per day and the average in 4 days of this time ranged from 1,100 to 1,400 cars. This degree of local use is further substantiated by the popularity enjoyed by the nearby Maryland State parks where the visitation to 14 forests and parks is about three-fourths of a million persons per year.

5. NEARNESS TO POPULOUS AREAS

The following table shows the major city and metropolitan populations of the Potomac vicinity as of 1940 and their approximate distances by highway from the river system:

City	City population 1940	Metropolitan population 1940	Highway distance from nearest point on Potomac River
Baltimore, Md.	859,100	1,046,692	50
Washington, D. C.	663,091	907,816	0
Lancaster, Pa.	61,345	132,027	104
York, Pa.	56,712	92,627	80
Harrisburg, Pa.	83,893	173,367	83
Altoona, Pa.	80,214	114,094	65
Johnstown, Pa.	66,668	151,781	95
Pittsburgh, Pa.	671,659	1,994,061	120
Wheeling, W. Va.	61,099	196,340	150
Total	2,603,781	4,808,804	

Of the 7,200,000 people living within the Potomac Basin and its vicinity in 1940 about 4,350,000 were classified as urban by the Bureau of Census, and about 2,850,000 as rural. The principal metropolitan districts as indicated above account for about 66 percent of the total population.

There is much variation in population density within the basin. The more mountainous sectors are sparsely settled; the fertile Shenandoah Valley and Piedmont Plateau support a heavier rural population. With the exception of the Washington area, the principal urban centers are found in the northern part of the basin, northeast of the Potomac, in the northeastern and southwestern parts of the Shenandoah Valley, and in the vicinity of Cumberland where there are industrial developments.

II. Adaptability of the Canal for Use as a Parkway

1. ROAD LOCATION IN RELATION TO CANAL AND RECREATION AREAS

Our study has shown, that the condition of the canal is such that it may readily be adapted to the construction of a parkway, making due provision for the use of a limited number of sections as a recreational waterway, and leaving the old ditch at many more places. The present Paw Paw tunnel can readily be converted into use for single two-lane highway. For about 5 miles of its length, the canal used the river, and for this distance an entirely new road will need to be built.

A careful study of the existing viaducts shows that all of them could be utilized with some repair, and readjustment, thus materially reducing the cost of parkway construction. A separate report on this use is attached. All of the old culverts could be utilized but some of them would need to be lengthened.

The roadway should be diverted to one side to pass by the old locks and similar structures. Generally the road, except as noted above, would with reference to the canal prism be in one of three places.

One type of location would be on the towpath and extending outside of the towpath so as to leave the entire canal prism intact. Where a two-lane divided roadway was needed in such cases, one roadway might lie on each side of the canal. This type of location should be adapted wherever the terrain permits, and wherever the canal was to be used as a waterway. A second type of location would lie on the towpath extending into the old canal prism, and leaving only a trace of the ditch. Economy of parkway construction requires such a type of location at some places. The third type of location would involve the full use and practical obliteration of the canal prism, particularly if a divided two-lane roadway is required. Very little of the length of the canal would require this type of location.

As has been previously noted, the canal falls about 444 feet in the 168 miles between Cumberland and Great Falls so that the grade of a parkway following its general location would be very light.

A study of the existing maps of the canal alignment shows that a line paralleling the canal closely could be obtained with a maximum curvature of 6° at all except seven places. At these seven places, degrees of curve ranging from 7° to 9° will be obtainable. A 6° curve is considered safe for a design speed of 60 miles per hour. A 9° curve is considered safe for a design speed of 50 miles per hour. It would therefore be possible to design a parkway along the canal for a speed of 60 miles per hour generally with a limitation of 50 miles per hour at these seven places, two of which are between Great Falls and Harpers Ferry and the remainder are between Hancock and Cumberland.

A most important and valuable characteristic of a parkway lies in the control of access to it. The low accident record of parkways, freeways, and similar types of roads, and the safety of the travelling public upon them, is due more to the fact that entrance and exit is carefully controlled and designed in such a way as to promote safety, than to any other characteristic. Accidents are due largely to indiscriminate entrances, left turns on the road and to grade crossings.

Conditions are unsually favorable for adequate control of access for a parkway along the canal. The canal is paralleled by the Potomac River on one side throughout almost its entire length, so that there would be no need for access on that side. In addition it is paralleled by a railroad closely for 67 miles out of the 168 miles, on the opposite side.

Access to other public roads would be provided at about 16 points, or at approximately 10-mile intervals. There will be no highway or railroad grade crossing through the length, except one minor railroad siding in Williamsport.

It will be possible to utilize existing structures for entrance to most of the seven proposed principal roadside recreational areas, so as to eliminate left turns at such points. These developments will be at such places as the mouth of the Monocacy, the interesting Four Locks Canal area, Shepherdstown Bridge, Paw Paw tunnel. Each place selected has a different type of interest.

A limited number of parking overlooks can also be provided. Each stop that the motorist is invited to make will have a scenic story, a historic interest, some feature of natural science or recreational interest. The points are all there and need only accessibility to make them available for public use.

2. FLOODS AND HIGH WATER

A separate report is attached of a special investigation made of high water and flood frequency. This report shows that only 8 miles of the entire towpath length is subject to annual floods and the study shows that the Parkway grade could easily be placed above annual flood at these places.

The present towpath grade of the canal is practically all below the maximum probable flood and for most of the length of the canal is below the probable flood of every 5 years. This is not of importance or particular concern especially for a recreational parkway, since it means only that perhaps once in 5 years the road might be out of commission for a few hours or perhaps a day. A similar situation occurs on the Mt. Vernon Memorial Highway between Washington and Alexandria and on many roads in the Ohio Valley. In all such places it is considered adequate to design to stay above the annual flood. No other course is indeed possible, since keeping above the 5-year floods would be entirely impracticable from a cost standpoint.

There is an impression that this canal property suffered to an unusual degree from flood damage throughout its history, and that its operation was finally discontinued because of heavy flood damage. The canal, from its location, was subject to damage from flood waters and that damage had to be repaired. However, the canal continued to operate long after almost every other similar canal in the country had discontinued.

Unusually heavy flood damages were the immediate reason for discontinuing the operation of the canal, but it was the unsurmountable competition of greatly superior transportation by the railroad at less cost which was the underlying cause of the abandonment of the canal.

It is not believed that the danger of washouts due to floods represents a serious hazard to the use of the canal as a parkway. Although the canal between Great Falls and Cumberland has not been in use and has had no maintenance since 1925, or for a quarter of a century, yet today there is less than a half mile of the canal prism destroyed, and travel is possible on most of the towpath. A parkway with grassed slopes would be even less vulnerable to floods than a canal prism.

Accordingly it is concluded that interruption of traffic due to occasional floods along the canal would be of no importance, and that injury to the parkway itself by such floods would not be serious.

3. CANAL TOPOGRAPHY

The topography is of wide variety. At places the canal runs through broad flat bottoms, as near Whites Ferry. At Harpers Ferry it is closely confined to the side of the mountain passing along the gorge of the Potomac as it breaks through the Blue Ridge. At some other places, the canal was carved out of rock palisades, the excavation being used to build stone riprap embankments to protect against the wash of the river. None of these locations present insurmountable construction problems for a parkway. There will be some difficult construction, particularly in the 2 miles through the Harpers Ferry area.

The canal passes through Brunswick, Williamsport, and Hancock, and in these locations there will be tight right-of-way situations, but all of them are capable of solutions and the length of this portion of the canal all told is only 2 or 3 percent of its entire extent.

The natural features, such as the river palisades and bluffs are beautiful contributions to the river scenery.

4. RAILROADS

The canal is paralleled by a railroad for 67 miles out of the 168 miles between Great Falls and Cumberland. The Baltimore & Ohio Railroad runs adjacent to it between Harpers Ferry and Point of Rocks, and the railroad and canal through this section were jointly constructed in 1833 and 1834. In addition, the Baltimore & Ohio Railroad lies near the canal for about 3 miles approaching Cumberland.

The Western Maryland Railroad adjoins the canal from Four Locks to Little Orleans and from Paw Paw tunnel to lock 73. These two sections are 28 miles and 20 miles long respectively.

For half of the distance where the canal and railroad run along together, there are wooded spaces ranging in extent up to 300 feet in width between the canal and the railroad. Even in the stretches where the canal lies up against the railroad, there is a berm of width usually adequate for protective planting. Another factor that is helpful is that the railroad grade ranges from 15 to 75 feet above the grade of the canal or parkway. The result of these conditions will be that the parkway traveler will not generally be particularly conscious of, or unduly disturbed, by the railroad.

The combination of railroad, canal waterway, and parkway motor road at some points will present an interesting picture of three methods of transportation. The outstanding scenery presented by the Potomac on the one side of the parkway will draw the attention of the motorist so that the railroad intrusion will not be dominant and will generally be little noticed. As was previously pointed out, the location of the railroad on one side of the canal property for this considerable distance eliminates problems of access to a possible parkway through this distance.

5. MUNICIPALITIES

The canal passes through Brunswick, Williamsport, Hancock, and enters Cumberland. It passes by Harpers Ferry and Shepherdstown, which are on the opposite or West Virginia side of the river.

In all of the four towns through which it passes the canal lies between the railroad and the river. Both Brunswick and Hancock lie on the opposite side of the railroad from the canal and there will be no difficulty in getting the parkway through them. At Williamsport the canal right-of-way is not wide enough for the parkway and more will be needed. However, the land is not built up and can be obtained. At Cumberland the canal property included a considerable area of valuable land which will make a good terminal for the parkway. At Cumberland flood-control developments are contemplated, which must be adjusted to the parkway plans. These involve railroad siding changes, and must be worked out with the city and railroad authorities, as well as with the Corps of Engineers.

6. CONCLUSIONS

Accordingly, in studying the adaptability of the canal to parkway construction, the several major physical conditions have not developed as possible obstacles to such use. The road construction problems peculiar to the canal topography are unique rather than disparaging and economical rather than expensive. The occurrence of floods and the nearness of railroads in places may be accepted without reservations.

The advantage both in construction and to road travel in the flatness of the river plain is obvious. With practically no grades, there are no hills to cut and valleys to fill, and the principal grading is the widening of the 10-foot towpath in most places. The pleasure in motoring on such a road would lie in the absence of the recurring combination of sharp curves and steep grades. The beauty would lie in the ever-changing panoramas that would develop in each new bend in the river.

The flood hazard would require dealing with the annual floods and those in the 5- to 10-year stage. The annual floods may be dealt with by establishing the parkway grade to a few feet above the towpath grade for something less than 10 percent of the total length. While it is impossible to escape the 5- to 10-year floods, we do know that only eight such floods have occurred in 60 years and that these intermittent disturbances last for but 1 or 2 days. The possible disruption to parkway traffic from this cause, therefore, is not forbidding.

The exact degree of disadvantage from the intrusion of the railroad with the parkway scene is difficult to determine. The proportions of the valley and the small amount of railroad intrusion must be fairly judged. A passenger train passes by. It is filled with people enjoying a trip through the valley. Even a freight train passing might be enjoyed as a change by the parkway traveler. In the parkway location, there will be no trains in sight or hearing for two-thirds of the length; and there are 35 miles where one might see a train. Whether the nearness of the railroad bears any direct relation to the parkway, or detracts in a small degree from the greater magnetism of the Potomac scenery, does not seem a factor of importance in the worth of the parkway proposal.

The river palisades will make their contribution to the adaptation of the canal to parkway use in a very satisfactory manner. They form the most intimate of river side effects and their preponderance makes them the source of many of the best river vistas. Long search for an adequate and yet exclusive parkway location could not be concluded in more favorable surroundings than those offered by the river shelf locations of the C. & O. Canal.

The problems of adjusting the parkway construction to the limits of city and town environment are not difficult since only a few miles of the parkway location lie within such limits, and it would be decidedly to the advantage of the municipalities to cooperate to the fullest extent in the solution of the problems.

III. Opportunities for Scenic, Historical and Recreational Development

An aura of history and natural beauty prevails throughout the entire course of the canal. The parkway visitor could hardly escape a consciousness of these factors as he rides along this ancient valley. There are places for contemplation of the geological story, the habitats of the aborigines, the early explorer and settler, the great intersectional conflict of 1861–65, and a major transportation theme of national significance. The mineral and agricultural wealth of the valley, and its industry, is evident along the entire route. It is common knowledge among park and recreation planners of today that urban dwellers seek these features daily in search of relief and recreation. (See pl. 2, 3, and 4 following p. 87.)

1. GREAT FALLS

An excellent example of the type of use which may be expected of this development is Great Falls, Md. Here, water has been restored to the canal, the old canal tavern is being renovated for museum use as a concession and general headquarters building. The parking area has been enlarged to a capacity of 335 cars and space has been set aside for an expansion of 315 more plus space for 17 busses. The area is near Washington and the attractions such as the exciting scenery of the falls, the pleasant walking and boating on the canal, conducted interpretive nature and historic tours, picnicking and fishing have established the area as one of the outstanding points of interest in the vicinity of the Capital.

Historic Great Falls Tavern

3. SENECA CREEK

At Seneca Creek, the patronage is also well established. Use of the creek itself is near capacity in private camp development and the additional day-use visitors stretch the existing parking and road facilities to its limits. The main park development would be about 1 mile below Seneca Creek at the site of water intake from dam No. 2 that marks the beginning of the canal restoration that extends 22 miles to Washington. Dam No. 2 was the site of one of the skirting canals built by the Potomac Co., predecessor to the Chesapeake & Ohio Canal Co., and in the development of the latter, represented the terminus of the canal from 1831 to 1833. The locale was designated for development as a town to be named Rushville for William

Canal aqueduct across the Seneca River.

Rush, one of the principal loan negotiators for the canal company. The principal recreational attraction here is the wide expanse of slack water that stretches for over 9 miles above the dam, the fishing and boating thus made available, and the connection with the restored section of the canal that extends down stream past an array of river bluffs and wide expanses in the Potomac for over 8 miles to Great Falls.

Just above Seneca Creek are the Seneca sandstone quarries where stone was obtained for some of the canal structures as well as several governmental buildings in Washington, including the Smithsonian Institution. Edward's Ferry, a few miles beyond Seneca, served as a point of access between the river and the canal. This Potomac River crossing was the scene of the passage of the Federal Army into Maryland during the Gettysburg campaign, and is closely associated with the battle of Balls Bluff, many cavalry raids, and finally the attack on the Capital in 1864. Archeological exploration of several Indian

sites in this area has revealed important information on aboriginal culture in the Potomac Valley.

3. MONOCACY RIVER

At the Monocacy River confluence the potentials for attracting and accommodating large groups of parkway motorists are again presented. The Monocacy is tentatively planned as the junction point between the projected parkway connection with Gettysburg and the Potomac Canal Parkway. The possibilities for expansion of the rather meager camping colony now established here to proportions already attained at the presently more convenient Seneca development are very good. Material improvement in the Monocacy has been made in recent years by reducing the sewer effluent of Frederick until the water of this important river shows 85 percent of purity which reduces this type of nuisance almost to the vanishing point. It remains for the large-scale program placing emphasis on land use, erosion control, and community planning to be invoked in the Monocacy Valley to accomplish even more definite changes in this area in the next few years. Such associated progress also has the added incentive of assuring that fish will not be barricaded in trying to reach their spawning grounds in the river adjacent to the proposed parkway.

The mouth of the Monocacy would make an excellent recreational area. It was the site of early settlement in the Potomac River Valley, and provided a junction point for river traffic. The Monocacy aqueduct, the longest and most picturesque on the canal, would serve to interpret the complete story of the skill and accomplishments of the early American engineers and mechanics who were engaged in building the Chesapeake & Ohio Canal.

4. HARPERS FERRY

Here the paralleling canal and railroad illustrate the early conflict over the right-of-way and the attempt of both companies to capture the east-west traffic of the Potomac.

On approaching Harpers Ferry, the proposed parkway would pass under the new Sandy Hook Bridge which would serve as the crossing for the Blue Ridge Parkway if it were extended northerly along the Appalachian Range. The incidence of the authorized Harpers Ferry Historic Site and the studies that had been made for extension of the Blue Ridge Parkway have already brought on general consultation and agreement between the Park Service and the Maryland and Virginia States roads personnel as to a bridge crossing that would serve all purposes. It is well known for its historical background as a site of early Potomac Valley settlement, the site of the United States Arsenal, Armory and Rifle Works of the early nineteenth century, the scene of John Brown's raid, and major Civil War incidents both in the town and on nearby Maryland Heights. History trafficked heavily at this confluence of the Shenandoah and the Potomac. The beauty of the spot was acclaimed by no less a connoisseur than Thomas Jefferson. The geological transformation in

Riverbank aqueduct

Canal lock

the general terrain contributes a most unique feature to the area. The mountain range is here severed to its core by the river forming vertical strata of rock that once laid horizontal and now reduced to only ripples and rapids in the Potomac. This transformation led to the construction of the old Powtowmac Canal across from the Chesapeake & Ohio Canal and later the construction of a dam just above the rapids to serve the later canal operation.

It is the wide water resulting from this dam which makes such an inviting spot nearby for the development of a major recreational area and overnight camping site. The area chosen is overlooked by the batteries of the Civil War period which are located within hiking distances of the military road and old entrenchments on Maryland Heights. Complete immunity from floods can be attained for this more elaborate recreational and camping area. It should be noted that each of the large developed areas which involve a number of permanent buildings and more elaborate utility and road systems may be placed at an elevation above the 10-year flood level or higher in accordance with flood data studies made for our particular problems by the United States engineers. (See appendix B, Flood Studies of the Potomac.)

5. WIDEWATER SECTOR, INCLUDING BIG POOL AND FOUR LOCKS

The next two sections of the canal and river at which there are excellent opportunities for development of major gathering places for the public relate to the wide waters created by the canal feeder dams Nos. 4 and 5. These dams create slack waters of 11 and 9 miles, respectively, which are supplemented by the Potomac Edison Dam at Williamsport and an additional 2-mile stretch of still water. This entire section has particular merit as a recreational unit. It is now used extensively by people from Hagerstown and Martinsburg, both of which are within a radius of 10 miles of the general area and Frederick which is 25 miles distant. The towns of Williamsport, Boonsboro, Shepherdstown, Sharpsburg, and Downsville are either on the river or readily accessible to it. The Potomac, through this section, is a very placid river, following a series of loops through a rather broad valley with cliffs and hills carrying from the river level to the higher farm land. At one point, the cliffs will appear on one side, then on the other, presenting a very pleasant type of river palisade. The fact that the farm buildings are invariably removed a considerable distance from the river, helps to make the river valley more beautiful as the strip of timber along the river and the pattern of the fields is uninterrupted. Summer cottage settlements are located at dam No. 4 on the Maryland shore and at Falling Waters in West Virginia. The Hagerstown Rod and Gun Club has a clubhouse on Big Slackwater and docking space for several boats. A number of boathouses, renting out skiffs and canoes for fishing and canoeing are located along both Big and Little Slackwater. The degree of popularity enjoyed by this section is, of course, basically the suitability of the waters for boating, but it is even more assuring to know that the Interstate Commission on the Potomac River Basin, whose plans for removal of pollution in the Potomac have made such realistic progress, have programed the general slack-water areas for

Section of restored canal near Seneca.

Fishing on the Potomac near Catoctin Mountain.

water improvement that will make them suitable not alone for boating and industrial use but also for sustenance of fish life and safe swimming for humans.

It is also within the scope of this report to investigate and report on the feasibility of restoring water to sections of the canal and the most suitable sector from the standpoint of water supply and the costs of impounding and maintaining water in the canal is in the 18-mile section from dam No. 5 downstream to lock No. 41 where the canal flows into the slack water above dam No. 4 and the 5.44-mile section stretching from Big Pool and Fort Frederick to slack water 2 miles above dam No. 5, thus making a water unit composed of slack waters and restored canal sections that will be continuous for 33 miles. This added attraction will carry water past Fort Frederick

Conococheague Valley viewed at Dam No. 44

Four Locks, Two Locks, Williamsport, and the Hagerstown Rod and Gun Club and will greatly encourage the use of the canal for fishing and boating throughout the slack-water summer cottage and camping sector. (See appendix C, Water Impoundments in the Canal.) (See pl. 5 following p. 87.)

There are many recreational areas in the slack-water area which would be connected by parkway construction and which would expand with that development.

It would be possible to center rather extensive concentrations of tourist facilities at two locations in this sector. Sites at lock 41 near Dillsburg Widewater above dam No. 4 and another at Four Locks above dam No. 5 have been so indicated in the plans accompanying this report.

The procession of parkway development would, therefore, pass on upstream from the Harpers Ferry Historic Site previously described,

to such intermediate points as Antietam Creek, Sharpsburg, and Shepherdstown around which the Battle of Antietam evolved to points where the prevailing interest relates to pure recreation and camping such as Snyders Landing, Mercersville, dam No. 4, Cedar Grove Mills, and then the proposed development at lock No. 41 and Four Locks. This is the heart of the wide-water country and only 10 miles below Williamsport, perhaps the most outstanding and typical canal town along the route of the Chesapeake & Ohio. Then about 8 miles above Williamsport and 2 miles above dam No. 5 is the Four Locks area which has been planned for the second major developed area of campground proportions in the slack-water sector.

Four Locks as the name implies is a section of rapid descent in the canal which is due to the location of the canal on a shortened route across the neck of a 5-mile oxbow in the river. This departure from the grade of the river naturally places the canal at an elevation well above that of the river and above recorded high water. In fact, the elevation of the proposed camp site and developed area is high enough to command extensive views up and down the river including the panorama of the mountains upstream which herald the introduction of the canal to a mountainous passage from this point on. In addition to the splendid river scenery at this point, a rather busy example of the mechanics of canal operation and the picturesque side of the canal life is quaintly presented in an atmosphere that is warmly reflective and nostalgic. Close by is Fort Frederick of French and Indian lore and McCoys Ferry scene of river crossings in the Civil War—all now at rest on the Powtomack.

In the mountains upstream, there is first Hancock, center of a thriving apple-producing region and certainly a major point of entry onto the parkway from route No. 40 and the Pennsylvania Turnpike. In the nearby mountainous section tributaries of the Potomac offer recreational possibilities long recognized by the Tonoloway Club, the Woodmont Club, the Boy Scouts of America, and other private interests. In this part of the Potomac Basin the mountainous ridges of the Appalachian system, which run in a general southwest to northeast direction, rise to about 3,000 feet in Maryland, 4,000 feet in Virginia and 4,500 feet in West Virginia. The ridges, largely covered with regenerating forests, are the result of uplifts, folds and faults of the sedementary strata of the ancient Appalachian Valley and present many unusual and characteristic geological formations. Rock barriers in the streams create rapids and cascades with long still pools above them. Between the steep ridges are relatively flat meadows and bottom lands. Certain spots along the larger tributaries have attracted summer cottage and fishing club developments as at Largent on the Cacopon and near Romney on the south branch, but the absence of access to and development of State lands has postponed general use of the water courses for recreation.

Adequate public recreational facilities in the section of the tributaries not only would be used by Cumberland, Keyser, Westernport and other nearby communities, but also would serve and benefit a much larger population to the north and west including the industrial areas of Pittsburgh, Johnstown, Uniontown in Pennsylvania and Wheeling, Morgantown, Fairmont, Crofton and Clarksburg in West Virginia.

6. PAW PAW TUNNEL

The mountainous terrain also had its effect on the construction of the canal. Certainly the tunneling of the mountain at Paw Paw for over 3,000 feet was an engineering event of dramatic proportions for those who participated in it a century ago and an accomplishment which we with our vastly improved engineering technique and equipment can only look upon with wonder at their temerity and marvel at their attainments. A major stop-over point just below the outlet of the tunnel would be provided.

7. OLDTOWN

The next principal point of interest short of the termination of the parkway at Cumberland is located at Oldtown. As a natural river crossing, outpost and spring board into the wilderness in colonial times this location has been identified with the Warriors Trail, Cresaps Fort, Michael Cresaps House, and then with Washington's youthful adventures and eventually with development of the canal. Today it is seen as a section of canal into which the waters of Warrior Creek have been turned to provide a fishing area for the local fishermen. The canal in this general area was swung away from the river one-quarter to one-half mile and in the process passes through a very interesting half-mile long gorge of 100-foot depth, no doubt the original passage way of Warrior Creek to juncture with the Potomac. The existing arrangement for impounding water in the canal can be continued and the parkway would take the place of the canal through the gorge. The foundations of the Cresaps Fort and House have been identified and these sites would lend themselves to further investigation and even restoration as an example of early Indian history, and associations with the Ohio Co. and colonial expansion.

8. CUMBERLAND

Cumberland, the western end of the Chesapeake & Ohio Canal and of the proposed parkway, is set in a natural amphitheater at the mouth of Wills Creek. This site was early recognized as being of strategic value and has consequently had a long and interesting history.

Founded by the Ohio Co. in 1749, it served as a natural center for the business and commerce of the upper valley and for the trans-mountain trade. Despite several reversals in fortunes, the Queen City of the Alleghenies served successively the Ohio and Potomac Cos., and then waited upon the arrival of the Baltimore & Ohio Railroad and the Chesapeake & Ohio Canal. The opening of the railroad in 1842 proved the inauguration of a new era in the history of the town. This was made the point of exchange for passengers and merchandise between the East and the West. In a little while after the completion of the railroad to Cumberland, the national road became a thoroughfare such as the country has never before or since seen, for a like distance. In 1850, the canal was formally opened to through navigation to Washington, D. C., and again the city experienced greater prosperity based on the increased trade and transfer business. Of the many towns mentioned as receiving a definite stimulus from the operation of the canal or the railroad, only one has apparently achieved a permanent status as a result of these influences. Cumberland has survived and prospered as the second largest city in the State.


Cumberland Terminus
Chesapeake & Ohio Canal

The many ties that Cumberland had and still maintains with the development of transportation grew from the status it has always commanded as a focal point in transmountain travel by foot trail, river, canal, road, and railroad. It seens only natural, therefore, that some form of memorial be instituted as a reminder of the definite contribution made to our national progress.

The terminal area which the canal occupied in the form of loading basins and point of transfer between it and other converging forms of transportation and which the parkway would take over as an administrative, informational and interpretive headquarters should be equipped to display a complete retinue of the vehicles which attended each of the modes of travel. Full-scale or qurter-scale models of river rafts, canal barges, stages, Conestoga wagons and railroads engines could be presented here in appropriate recognition of the advancements that have been realized in transportation at this historic crossroads.

9. CONCLUSION

It is possible to say, therefore, that the continuity and the quality of the recreational features common to the domain of the proposed parkway are capable of meeting exacting public demands. Individually each element of interest is adequately represented and an association of elements could be accomplished at one point after another that would be highly flavored and elegant and yet none the less useful and substantial.

The embers of past historic conflagrations still smolder along the path of the canal and would glow anew with the first stir of public interest. The scenery runs the full cycle from tranquil wide waters and pastoral river slopes to the greater excitement of the winding, twisting river palisades and ultimately the scale of the mountain valley. This retinue of interests holds attractions for the tourist camper, the sportsman and the day outing party in all degrees from the novice to the sophisticate.

The environment of the canal and river immediately generates in one an enthusiasm to see these 170 miles of delightful scenery unfolded on parkway terms. The incentive to link together the many discoveries that have been made is like the desire often experienced and universally understood to transform the black and white of printed words to a production in full color.

These scenes are of a standard that rises above the pleasantries of the commuter's daily travels to the level of recreational incidents and travel highlights which the individual comes to cherish as a fond remembrance—a rare event to be recommended to his friends.

IV. Traffic, Roadway Design, and Construction Costs

1. PROBABLE TRAFFIC

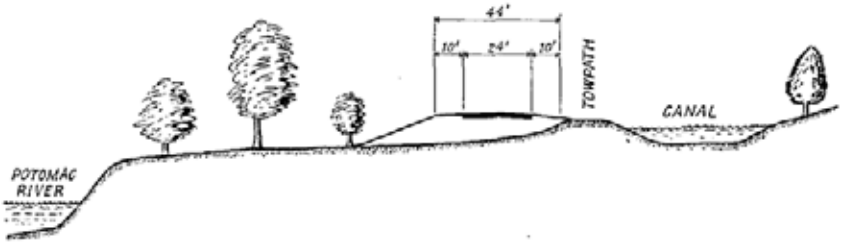
The canal parkway would provide an alternate route from Washington to the west. It would connect near Point of Rocks with U S 15, which leads to Leesburg on the south and Frederick on the north. At Harpers Ferry it would connect with roads leading south into the Shenandoah Valley, and at Antietam with a State road leading to Hagerstown on U S 40 and to the Pennsylvania Turnpike. At

Plantation

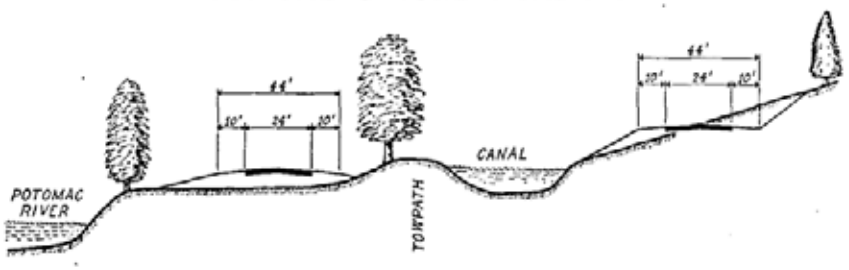
Piedmont Plateau

Williamsport it would intersect U S 11, a principal north and south route, and at both Hancock and Cumberland it would connect with U S 40, the main route from Washington to the West.

A special study was made by the Bureau of Public Roads to determine the probable volume of traffic that would use this parkway if it were built, and a report on that study is attached. Considering the superior quality of the parkway with its easy grades and alinement, and the freedom from traffic delay and congestion afforded by its controlled access, it would draw traffic from existing roads passing through such congested towns as Frederick and Hagerstown. Although the distances between Washington and such places as Frederick, Cumberland, Hagerstown, and Hancock are greater by the parkway, yet travel between Washington and these places would take no longer by the parkway. Between Washington and Harpers Ferry a half hour of travel time might be saved by the parkway and between Washington and Leesburg 10 minutes.



TYPICAL SINGLE ROADWAY



TYPICAL DOUBLE ROADWAY

Besides the traffic that will be diverted to the parkway from existing roads, the parkway would be expected to generate new traffic because of the recreational advantages it would offer.

The combined diverted and generated traffic was estimated to provide an estimate average daily traffic on the parkway as shown below:

Vehicles between—	*Number*
Great Falls and Seneca	2, 510
Seneca and Edwards Ferry	2, 380
Edwards Ferry and Point of Rocks	2, 300
Point of Rocks and Brunswick	1, 770
Brunswick and Harpers Ferry	1, 750
Harpers Ferry and Shepherdstown	1, 510
Williamsport and Shepherdstown	1, 320
Hancock and Williamsport	1, 330
Cumberland and Hancock	640

The figures given above are daily averages for the year. During the winter months the daily average would be much less and during the summer months when recreation is at its peak very much more. In the Great Smokies travel in the peak month is three times that during the average month, and in the Shenandoah 2½ times the average.

For this parkway it seems reasonable to believe that during the summer months, maximum travel volumes in the neighborhood of 8,500 vehicles per day may be expected on the section between Great Falls and Point of Rocks.

2. FIELD STUDY

A field study was made of the full length of the canal, during which the approximate location of the parkway was established. For this field study there were available a profile and plan of the original canal. The plan was on a scale of 1 inch equals 200 feet, and showed all structures and right-of-way lines. The USGS maps on a scale 1 inch equals 1 mile were also available and from the Agriculture Department we obtained aerial photographs on an approximate scale of 1 mile equals 1200 feet. From these latter there were prepared maps which were useful in the study.

As part of the field study, the Bureau of Public Roads took a cross section of the canal and adjacent ground at half-mile intervals. At the places where the Canal originally entered the river, the Bureau projected location for the proposed parkway on contour maps enlarged by photography from the USGS contour maps.

During the field study, all of the canal was travelled and carefully inspected. For about half of the distance, the towpath is passable during dry weather. For the remainder, walking was necessary.

3. RELATIONSHIP BETWEEN OLD CANAL AND PARKWAY

It was assumed that it would be desirable for water to be kept in a number of sections of the canal, and that on the remaining sections the motor road should not encroach upon the old canal bed where the terrain made it at all possible within reasonable cost to avoid it.

Field examination of many representative sections of the canal showed definitely that there were a number of tight spots where it would not be possible to build a road at reasonable cost without encroaching upon and perhaps occupying all of the canal prism. It was accordingly determined that where encroachment upon the canal prism was necessary, every effort should be made to leave a trace of the old ditch.

It was also decided that the road should be located in such a manner as to avoid destroying the old locks and similar structures.

These preliminary examinations show that it would be difficult and expensive to build a four-lane divided highway at the tight spots except by full occupation of the canal prism. A divided four-lane highway with a minimum 4-foot island and 8-foot shoulders would require 68 feet of width and with the more satisfactory 16-foot island would require 80 feet.

Our representative cross sections taken during the survey showed, however, that the total length of these tight spots amounted only to

about 24 miles of the whole length of the canal, and that a second roadway could be obtained if necessary by filling the canal prism at all of these spots except for about 5.5 miles where water is either in the canal or where it would be desirable to have water in the canal. A second roadway in the tunnel area could be obtained by relocation over the hill.

Of this 5.5 miles of tight places where water is to be kept in the canal about 3 miles are between Great Falls and Point of Rocks and the remainder is between Shepherdstown and Hancock.

For the purpose of the estimate, and based upon the probable indicated traffic it was assumed that at the start traffic would be served by a single 24-foot pavement with 8-foot shoulders, but that there would be parts of the parkway where the second roadway would need to be provided within a short time after the project was opened to traffic. This second roadway could for economy's sake, if necessary, at some places be at an elevation below the annual floods, since the floods would cut it out of commission for only a few days and in such periods traffic could all use the initial roadway, which would be placed above annual floods.

We anticipate that for about 3 miles immediately south of Cumberland there will be a considerable local traffic and we have therefore included in the estimate a second roadway for this 3 miles. On the remainder of the parkway the heaviest traffic is indicated in the 32 miles between Great Falls and Point of Rocks with a somewhat less traffic between that point and Harpers Ferry. Beyond Harpers Ferry a considerable drop in traffic is indicated. We have therefore included in the estimate a second roadway for 22 out of the 32 miles between Great Falls and Point of Rocks.

Considering the nearness of the Great Falls–Harpers Ferry section to Washington it appears reasonable to believe that a second roadway would be needed on part of it within a short time after it was opened. There are tight spots aggregating in length about 2½ miles in the part of this section near Great Falls. At these places, however, it will be necessary to throw the canal back into the cliff to get the rock needed for the initial roadway and additional width can be thus provided for a second roadway without much difficulty.

4. ROADWAY ALINEMENT AND GRADE

The initial construction should be a single roadway consisting of a 24-foot pavement with 8-foot shoulders. The design should be made in such a way that a second roadway can be added as the traffic develops sufficiently to require it.

As previously outlined, it will be possible to obtain along the canal a maximum curvature of 6° at all except several places and at those places a maximum of 9°, or a speed of 60 miles and 50 miles respectively. A speed design of 50 miles per hour should be entirely satisfactory for a recreational parkway of this character. Maximum grades will be under 3 percent.

The study of flood elevations shows that at nearly all places the canal towpath has been flooded, but that 90 percent of the towpath is above the annual flood line. It would therefore be possible without difficulty to establish a grade line, which would be subject to floods at places at perhaps 5 or 6-year intervals. These floods would be of short duration, probably not more than a day, so that the traffic interruption would be about similar to that which occurs on the Mt. Vernon Memorial Highway.

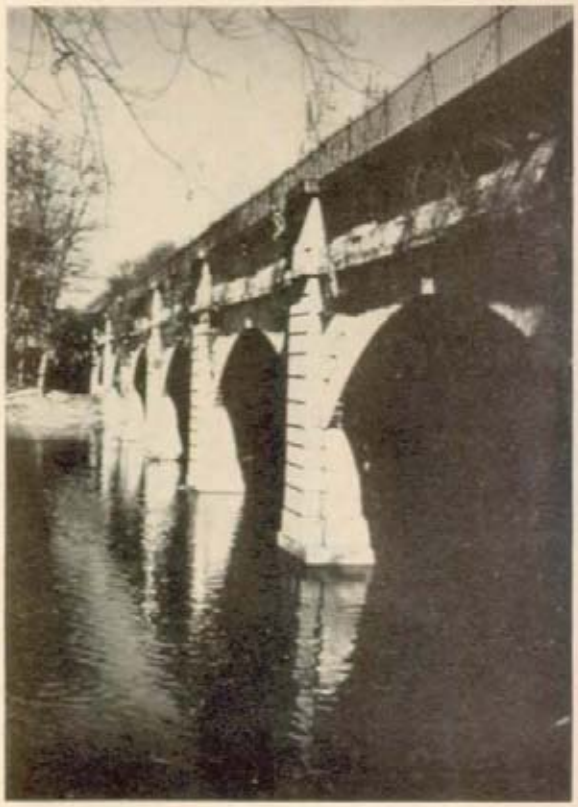
5. USE OF OLD STRUCTURES

There are 12 aqueducts, 11 major culverts, 107 minor culverts, 4 combination culvert vehicular underpasses, 13 highway bridges over the canal, 16 railroad bridges over the canal. Other structures include 6 major dams across the Potomac, 53 lift locks, 4 outlet locks, 7 stop locks, 1 tunnel, 1 guard lock, and 2 pivot bridges.

Most of the aqueducts and culverts can be used for the Canal Parkway. A detailed study outlining the condition of the principal structures and a suggested method of repair and adaptation for use by the highway was made by Bridge Engineer Geisler of Public Roads, and is attached. A roadway width of at least 26 feet could be obtained over the major 12 structures. While this is a little less than present recommended standards, it is believed adequate in this case.

The existing Paw Paw tunnel, 3,080 feet long, can be used by removing the towpath. It will have a clear width of 24 feet.

Typical lock house and lock.



Monocacy aqueduct.

Conocoheague aqueduct.

Canal tunnel at Paw Paw, north portal.

6. ACCESS TO PARKWAY

As will be noted above there are 13 highway overpasses over the present canal.

As a result of the study we have found some 15 places in the 168 miles where access to the parkway could be provided in the form of connections with other public roads. These would be at the following points:

Seneca, with Maryland 112.
Edwards Ferry, with county road.
Whites Ferry, with Maryland 107.
Monocacy, with Maryland 29.
Point of Rocks, with U S 15.
Brunswick, with Maryland 70.
North of Harpers Ferry, with U S 340.
Shepherdstown, with Maryland 34.
Williamsport, with U S 11.
Fort Frederick, with Maryland 56.
Hancock, with U S 40.
Paw Paw, with Maryland 51 and West Virginia 29.
Oldtown, with Maryland 51.
South Cumberland, with city streets.
Cumberland, with city streets and U S 40 and U S 220.

There will be no highway crossings at grade. None are needed. However, some of the access points above-mentioned will for simple and inexpensive treatment be in the form of simple T type grade connections with left turns permitted on the parkway.

There is only one railroad track which crosses the towpath at grade. This is a siding in Williamsport which supplies coal to the power plant. The parkway could safely cross this track at grade, using automatic light protection.

A number of the present overhead bridges carrying local roads over the canal will need to be rebuilt. About six such new structures will probably be required.

7. CONTROL OF ACCESS

It will not be difficult to provide control of access for a parkway located along the canal. Conditions are unusually favorable for that because the canal is paralleled throughout almost its entire length by the Potomac River on one side and for 67 out of 168 miles on the opposite side by a railroad.

With these conditions it will be possible to design a parkway with full control of access providing thus a road facility of very high quality, capable of handling large traffic volumes safely and comfortably.

8. USE OF CANAL AS WATERWAY

Some four locations have been selected where water ought to be kept in the canal for use as a recreational waterway. These are:

(*a*) The Great Falls-Seneca section, 8 miles long, already in such use.

(*b*) From Big Slack water, outlet lock 41 through Williamsport to Dam 5, just below Four Locks, 18 miles long.

(c) From Four Locks to Big Pool, including Big Pool, if possible, about 6 miles.

(d) From lock 68 through Oldtown to Battie Mixon Fishery, about 2 miles.

Under the proposed plan, then about 34 miles of canal out of the 168 miles along the parkway would be maintained as a recreational waterway. The empty ditch suitably grassed will lie along most of the remainder.

9. INITIAL RECREATIONAL ROADSIDE AREAS

For the intial development there were selected the following roadside parking and recréational areas:

Monocacy River
Harpers Ferry
Shepherdstown
Falling Waters
Four Locks-Big Pool-Fort Frederick
Little Orleans
Paw Paw tunnel

10. RECONNAISSANCE ESTIMATE OF COST

A reconnaissance estimate of cost of construction of the Canal Parkway was made. The cost of the road construction was estimated generally by projecting a typical cross section of the proposed improvement upon the cross sections taken across the canal at about half-mile intervals and estimating the quantities therefrom. In addition a second roadway was estimated for 3 miles south of Cumberland and for 22 miles of the 32 miles between Great Falls and Point of Rocks.

Where the old canal used the slack water of the Potomac for some 4 miles near Falling Waters a location was projected upon enlarged contour maps of the United States Geological Survey and flagged in the field, and a reconnaissance estimate of cost made in the usual manner. Where the canal entered the river for about three-fourths mile near Four Locks, the estimate was made based upon following along the old towpath through a heavy rock cut. At both of these places additional right-of-way will be required.

The length of the parkway is shown as 168.2 miles. It is quite possible that further study would show that relocations across river bends would reduce this length by about 5 miles.

The estimate of cost of constructing the parkway is based upon a pavement 24 feet wide with 8-foot shoulders throughout, and upon a second roadway of the same dimensions for 25 miles of the total length. The pavement would consist of 2 inches of asphaltic concrete top course on a 9-inch base course of local crushed stone or gravel. Provision was made in the estimate for paving of roads and parking spaces in the recreational areas, of entrance roads, and structures needed for highway overhead crossings, and also for new structures and the reconditioning of the old culverts and viaducts that would be used for the parkway.

An estimate was also made of the cost of restoring the selected sections of the canal to be used as a recreational waterway, the cost

71542—50——4

of restoring or repairing old lock houses, and the cost of new buildings such as ranger stations, comfort stations, water supply, and sewage-disposal systems in the proposed recreational areas.

The total cost of the road construction is estimated at $16,162,000. The cost of canal restoration is estimated at $319,000, restoration and repair of old buildings at $104,000, and construction of new buildings and appurtenances at $552,000, making a total of $945,000 for other than road construction.

The total estimated cost of construction is $17,107,000. The details of this estimated cost will be found in appendix F.

V. Present Land Holdings and the Need for Additional Rights-of-Way for a Parkway

The land holdings of the Chesapeake & Ohio Canal Co. between Great Falls and Cumberland consisted of 4,764 acres which acreage is now in Government ownership. The width of this right-of-way varies from 30 feet to 900 feet and averages about 230 feet. The land ownership averages about 28 acres per mile, as compared with the 100 acres per mile obtained for such parkways as the Blue Ridge or Natchez Trace.

The width is not adequate at many places to provide room for the single parkway road. At the places where the canal entered the river, there is not enough land to enable a road to be built. At very many places the width is inadequate to provide for the required roadways, suitable roadside planting, and for the recreational roadside spaces that are an essential feature of this type of parkway.

It would therefore be necessary for additional right-of-way to be acquired to permit the construction of a parkway along the canal. The usual requirement for parkways of this character is about 100 acres to the mile or a total of about 16,800 acres.

Along this canal, for about 100 miles of the total length, the shore line of the Potomac is in Government ownership. To develop the parkway for recreational purposes, to avoid objectionable roadside development, and problems of access it will be necessary to obtain for the parkway right-of-way most of the land now in private ownership lying between the canal and the river. There are approximately 3,000 acres of this. In addition, it will be necessary to obtain more land on the upper or opposite side of the canal property, in some cases as the locations where the canal now enters the river to get room needed for the road, and in other cases, as on cliffsides, to provide adequate roadside control. Through Williamsport and other places where the canal is to have water in it, additional width is needed for the road itself; the right-of-way is not wide enough for both road and canal. Approximately 8,900 acres are estimated as needed on the upper side.

The land lying between the canal property and the river that is needed, amounting to about 3,000 acres, is for the most part below the elevation of the canal and therefore subject to floods at yearly or less-frequent intervals. It is therefore either wooded land or tilled land subject to flooding. On the side of the canal away from the river, acquisition would be limited in width for about 40 percent of the distance by the nearby railroad lines. At other places, particularly at the palisade or deep-cut sections, the land between the canal

and the topmost part of the crest should be obtained to prevent roadside signs and other objectionable development. These areas are in the class of steep, wooded, and unusable acreage of little value for agricultural use. At some places, such as stream confluences, lands lying on the side of the canal opposite the river should be acquired for recreational developments.

There are considerable amounts of public lands adjoining or near the federally owned lands which consist for the greater part of forest or game preserves established primarily for timber production and conservation, water shed protection, and wildlife management. These areas take, with few exceptions, advantage of forested and hilly or mountainous terrain where natural streams and scenic values prevail and would ideally serve the nearby industrial centers in their need for low-cost recreation facilities.

It is a well-established policy in the development of parkways of this character that the State acquires the necessary lands for the rights-of-way and deed them to the Federal Government without cost. For the Natchez Trace and Blue Ridge Parkways about 100 acres per mile on the average are so obtained. Accordingly, it is our belief that this well-established pattern of Federal and State cooperation ought to be followed in this case, with the State of Maryland acquiring and deeding to the Federal Government enough additional land to bring the total right-of-way area up to approximately 100 acres per mile.

The additional lands which would need to be acquired for the parkway are not of an expensive character and it should not be difficult for the State to acquire them. The State of Maryland has a great historic interest and indeed a large financial investment in the old canal. It seems likely that they would be interested in a parkway proposal of this character to the extent of providing for the acquisition of the additional lands needed over a period of years.

Conclusions

The purpose of this survey as stated in the legislation was "to determine the advisability and practicability of constructing a parkway along the route of the Chesapeake & Ohio Canal," and to make an estimate of cost of such construction.

In order to carry out the stated purpose, in this report we have analyzed the existing values in the canal property, studied the adaptability of the canal location for use as a parkway, evaluated the scenic and historic features of the route and the recreational features that it might provide, examined the land holdings in detail and determined the additional land needed; have estimated the traffic volume that would use such a parkway if built; and have made an estimate of the cost of its construction.

Analysis of the canal property has shown a large investment of public funds in this project in the past, on which very little present return is being obtained as dividends in the form of public use. There is, however, a great potential value that could be obtained by the development of a parkway. This potential value is in the 100 miles of river front owned that could be utilized, if made accessible, for water sports, fishing, and other recreational use; in the places of historical interest, in the old structures of the canal; in the unique

possibility of portions of the old canal being restored at small cost for use as a recreational waterway in conjunction with a parkway; and in the lower cost at which a parkway could be built by utilizing in part the land, grading, and structures of the old canal.

Our studies have shown definitely that the old canal location can well be adapted for use as a parkway. The grades of such a parkway would be easy, and the alinement would be excellent. The peculiar location lying along the river throughout and the nature of the old canal make it possible to obtain full control of access at minimum cost and little disturbance of existing land use. The existing structures over streams flowing into the Potomac can be used to carry the parkway, and much of the canal grading can be utilized, thus reducing materially the cost of parkway construction. The end result would be a superb highway facility at low cost.

The scenery along the route is of wide variety and splendid quality. The Blue Ridge Parkway offers mountain views from above. This parkway would offer the full range from below showing the flat river bottoms and rolling lands of the Piedmont, the great break of the Potomac through the Blue Ridge at Harpers Ferry, the whole series of rising mountains as the canal follows the river upwards through the Appalachians; while in the whole journey the Potomac is nearby, sometimes a placid pool, sometimes a wide river, and sometimes a rushing mountain stream. Not only is the canal itself a historic landmark, but the country through which it passes is identified with the most important parts of our history as a Nation. Such themes are presented as the Braddock expedition, Fort Frederick as a protector of our colonial frontier, and, in more recent times Antietam, Harpers Ferry, and the several crossings of the Potomac in the invasions of the North during the Civil War. On the canal itself the locks, aqueducts, the 3,000-foot tunnel through the mountain; the river dams; and the lock houses have great historic value and should be preserved from further deterioration.

The continuity and quality of the recreational developments possible would meet the most exacting public demands. Water can be restored to many miles of the canal thus restoring the canal scene in an authentic and appealing way. The many miles of river front afford opportunity for water recreation, the streams offer fishing, and the whole area abounds in pleasing scenes for relaxation. The development of new recreational areas has not kept pace with the growth of the Washington area in the past two decades, and there is great need for new recreational areas adjacent to the Nation's Capital.

Our examination of the land holdings shows definitely that they are not adequate to provide for a parkway and more land must be obtained. About 4,764 acres are in Government ownership and 11,900 acres more would be needed to bring the total up to the 100 acres per mile, which experience has shown are needed for a parkway and its roadside recreational areas. The additional land should be acquired by the State in accordance with the pattern set by law for the Blue Ridge, Natchez Trace, and other similar parkways.

We have estimated the average daily traffic volume in the sections adjacent to Great Falls at 2,510 vehicles per day with peak days running upward of 8,500 vehicles per day. On the sections beyond the Blue Ridge the average will range from 1,500 to 640 vehicles per

day. We have estimated the cost of construction for the 168 miles at $17,107,000, which includes provision for 25 miles of (four-lane roadway, the remainder being two-lane, and also includes restoring water to 26 miles of the canal, the reconditioning of historic structures, and a modest number of new buildings for recreational needs.

There are great values in the canal property which may be realized only by the construction of a parkway. The canal may be readily adapted to the use of a parkway without injury to its underlying historic value. The scenery along the route is superb and of wide variety. The historic interest is outstanding. The traffic that would use the parkway is more than ample to justify the construction cost, and the estimated construction cost is low because of the use that can be made of the grading and structures already in place. The land holdings are not adequate, however, for the needs of a parkway.

It is both practicable and advisable to construct a parkway along the line of the Chesapeake & Ohio Canal provided that the State of Maryland will make provision for the acquisition without cost to the Federal Government of the additional lands needed for rights-of-way for the parkway.

It would be desirable that consideration be given by the Congress to legislation that would permit the acceptance by the Secretary of these additional lands for parkway purposes if presented by the State of Maryland.

VI—APPENDIXES

Appendix A. A Synthesis of the History of the Potomac River Valley

(By Walter S. Sanderlin)

The Potomac Valley has a long and colorful history which amply merits the interest recently manifested in its rediscovery and preservation. The region is justly famed for the natural beauty of the mountains, river channel, rock formations, and native flora. Indian sites scattered along the Potomac attest to the early occupation and use of the valley, while pre-Indian artifacts in the lower valley and neighboring areas suggest an even older record of human habitation. Further attention is warranted by the stirring events arising during European penetration, from the earliest settlements west of the mountains in 1732, through the French and Indian War (1754–63), the British occupation of Washington during the War of 1812, to the critical years of the Civil War. The early efforts to develop the Potomac trade route, e. g., the Ohio Co., the activities of George Washington, and the Potomac Co., form still another interesting chapter in the history of the territory embraced in the proposed Potomac parkway. Of particular significance in this report is the construction and operation of the Chesapeake & Ohio Canal, whose right-of-way the proposed highway would follow. The role of the Federal and State Governments, the various problems encountered, and the effects on the valley give an insight into the character of an important phase of the Nation's history. The revival of Federal interest in the twentieth century provides a logical ending to the historical panorama of the Potomac Valley.

The natural beauty of the Potomac region, which is one of its most charming attributes, has evolved slowly over the course of many thousands of years. The valley has become, in fact, a rich storehouse of geological evidence dating back to the Archeozoic and Paleozoic eras. Among the outstanding physical features of the valley is the winding and often precipitous river, strewn with boulders and fed by picturesque mountain streams. A succession of craggy, eroded mountain ridges, crossing the valley at right angles and often approaching the river itself so as to form spectacular chasms, alternates with fertile and historic valleys to provide a majestic setting for the Potomac itself. Adding to this natural storehouse is an impressive variety of native trees, shrubs, flowers, and smaller animals still to be found in the region after two centuries of European occupation. Most promising for the purposes of the parkway project is the degree to which the primitive beauty of the region has been preserved.

Little is known of the possible human inhabitants of the Potomac Valley prior to the Indian tribes, beyond a reasonable conjecture of their presence perhaps as early as the Folsomoid period (circa 10,000–

25,000 years ago). In historic times representatives of three major Indian groups, Algonquin, Iroquois, and Sioux, probably used the valley as a route of travel, a hunting preserve, and at times a battleground. By 1600, however, large-scale migrations were already under way among the Indians in the area as a consequence of the southward push of the Iroquois and the resultant wars. Added pressure by the colonial officials in Maryland and Virginia accelerated the migrations and culminated in the removal of all Indians from the valley by 1754. Although relatively little attention has been paid to the archeological lore of the region, excavations in the valley would undoubtedly uncover additional traces of Indian occupation, like Shawnee Old Town and Caiuctucuc (Cumberland), and possibly sites and artifacts of earlier human inhabitants.

European contacts with the Potomac region began as early as 1608. The travels of John Smith, Capt. Henry Fleet, and Father White, a Jesuit missionary, in the seventeenth century, were followed by greatly increased activities in the eighteenth century, especially after Governor Spotswood's famous expedition across the Blue Ridge in 1714. As settlement expanded up the rivers from the Chesapeake Bay area, new waves of migration swept down the valleys beyond the first range of mountains. It was representatives of the latter group who first settled in the upper Potomac Valley by 1732. The attraction of cheaper lands and the interest of the landed gentry, Lord Fairfax in particular, soon brought large numbers of German and Scotch-Irish families from Pennsylvania into the area. The large-scale settlement and economic development of the valley, together with the penetration of the Appalachian Mountains by early fur trappers and Indian traders, created the possibility of an extensive trade via the Potomac route. In 1749 this potentiality was first given recognition and organization by the chartering of the Ohio Co. to carry on the work of such pioneers as Thomas Cresap, Christopher Gist, and others. Under the guidance of some of the leading families of northern Virginia and Maryland, including the Washingtons, Masons, Mercers, and Lees, this company had a prominent part in the development of the Potomac route and in the early contacts with the French on the Ohio. Although unsuccessful in attempts to promote the settlement of its 500,000-acre land grant between the Monongahela and the Kanawha Rivers, the Ohio Co. did establish a regular trade route via the Potomac River and Indian trails from Alexandria to the Youghiogheny and the Monongahela Rivers.

The expansion of the English colonies to the Appalachian Mountains and beyond, as illustrated by the Ohio Co. of Virginia, established direct contact with the inland empire of New France. The opportunity was thus provided for the climax of the North American phase of the world-wide contest for empire between England and France which had been under way since 1689. The forks of the Ohio became one of the focal points of contention and the site of the early clashes of the French and Indian War. George Washington's journey to Fort le Boeuf, in 1753, the ouster of the Virginians from the forks of the Ohio, the erection of Fort Duquesne, and the defeat of Washington's relief expedition at Fort Necessity in 1754 were the opening episodes of the final struggle for hegemony in the New World. In the war which followed, the Potomac played a major role, one which in the early years threatened to be decisive. The disastrous

Braddock expedition against Fort Duquesne in 1755 followed the Ohio Co.'s Potomac route and left as a monument to its grand purpose an enlarged and improved wagon road across the mountains which became the basis of the old National Pike. In 1758, however, the successful Forbes expedition against Fort Duquesne from Raystown (Bedford), Pa., resulted in the construction of a competing road to the north of the Potomac route.

The removal of the French from the Ohio Valley by the Treaty of Paris ushered in a period of increased western land speculation and trade activities in which the attempt of the British Crown in 1763 to restrict colonial energies to the territories east of the mountains by a royal proclamation was ignored. New trade and land speculation companies such as the Indiana Co., the Walpole Co., and the Vandalia Co., entered the field in competition with the Ohio Co. The latter, already weakened by internal dissension and royal disfavor, was unable to maintain its position in the forefront of the western trade. Indeed, there were already several proposals, by George Washington, Thomas Johnson, and John Ballendine, under consideration for the further improvement of the Potomac River as a channel for trade. It was in this confused and unresolved situation in 1775 that the American Revolution occurred. Although the Revolution had little direct influence on the Potomac Valley, either militarily or commercially, the successful outcome of the war materially altered the character of the western land and trade question. In transferring control of western lands to the new nation. the treaty of peace intensified the rivalry between Virginia and other States claiming western lands. It was partly with a view toward strengthening its position in the Ohio region that Virginia supported George Washington's project for the improvement of Potomac navigation, the Potomac Co.

The Potomac Co., established in 1785, is in itself a remarkable testimony to Washington's personal imagination and influence and to the energies of the local inhabitants. Other States, especially Pennsylvania and New York, soon followed the example of the Potomac Co., chartering many enterprises to improve river navigation and roads. In the resultant competition, the Potomac Co., besides utilizing an older, established, and more central route, possessed a unique advantage in its relationship to the seat of the central government. The experiences of the Potomac Co. in the financing, engineering, construction, and operation of its works are not only characteristic of the early phase of internal improvement projects in the Nation; they provide a clear indication of the pattern of development of the Chesapeake & Ohio Canal. Even the reasons for the ultimate failure of the Potomac Co. to establish itself in the life of the country are significant for their similarity to the experiences of other river improvement projects and of the later canal. Structures characteristic of the Potomac Co.'s best work are still visible on the Virginia side of the river at Great Falls.

The War of 1812, coming in the midst of the Potomac Co.'s corporate existence, had less direct influence on the Potomac Valley than the Revolution. Indirectly, however, it was important, for the war marks a turning point in American economic development. Wartime experiences emphasized the need for greater economic self-sufficiency, including more adequate transportation and manufacturing facilities,

if real independence were to be maintained. The postwar period, was characterized by the revival of internal improvement projects in many States, although attempts to secure Federal support as part of an integrated "American system" were unavailing at first. New York inaugurated the canal era in the United States with the commencement of the Erie Canal project in 1817. In the race for improved trade routes to the West, the Potomac Valley suffered a marked disadvantage, which served to offset its earlier reputation and its central location. As in other States, there were several proposals to improve the Potomac route during and immediately following the War of 1812. These were unsuccessful, however, because of the influence of the dormant Potomac Co. and the inability of the several governments concerned to agree on the nature and financing of the improvement. As long as the Potomac Co. continued to exercise the restraining dead-hand of a jealous vested interest the legal success of any undertaking for the improvement of the Potomac route was in jeopardy. Similarly unless the States of Maryland and Virginia could agree on a successor to the Potomac Co. and unless the Government in Washington could overcome its hostility to Federal support of internal improvements, at least in this one case in which it was peculiarly concerned, any proposal to carry on the work of the Potomac Co. would be doomed to failure. Not until 1825 were these obstacles overcome, and the Chesapeake & Ohio Canal Co. formally chartered by the three governments mentioned. Not until 1828 was the financial support necessary to commence construction finally obtained. In the meantime, Baltimore and the State of Maryland had already chartered a rival transportation line, the Baltimore & Ohio Railroad, to compete with the proposed waterway.

On July 4, 1828, work began on both projects, with the appropriate inaugural ceremonies headed by President John Quincy Adams in Washington, and by the venerable Charles Carroll in Baltimore. From the very start both companies experienced many difficulties in financing and construction of their works. There was a long legal controversy between the two enterprises over the right-of-way in the Potomac Valley, followed by innumerable clashes at various points in the valley. Both enterprises suffered from a shortage of capable and experienced engineers, particularly the railroad which was at best a novelty in the United States. Each had trouble securing and maintaining an adequate laboring force in a disease-ridden, primarily agricultural valley. The use of indentured servants from the British Isles and Europe failed to solve the labor problem but contributed to spasmodic outbursts of strife between factions of the workers in the thirties. The consequent inaccuracies in estimates and delays in construction during an inflationary period resulted in ever-higher expenditures in each phase of the work: wages, prices of materials, cost of excavation, masonry, etc. Inasmuch as both companies had begun operations with insufficient resources to complete their projects, they soon fell into serious financial difficulties, and were in need of additional assistance. The appeals for aid and the political consequences of these appeals caused further delay. Because of the heavy cost of internal improvements, it was customary and necessary to rely upon large subscriptions by interested governments. This brought both enterprises into the realm of local politics The Federal Government, under the influence of the Jacksonian political philosophy

refused to grant further financial assistance to internal improvement projects in the States. Virginia and Pennsylvania were engrossed in their own projects by this time. Consequently both companies were thrown back on Maryland for support. Maryland usually extracted political concessions in return for its assistance, which invariably took the form of State bonds. In the early thirties there was no trouble in converting these bonds to cash, but in the late thirties the markets were very tight. Experiments in the issuance of paper money between 1837 and 1840 as a device to keep construction going pending the sale of the bonds led to financial disaster.

Despite the many obstacles confronting the construction of internal improvement projects in the decades before the Civil War, the Chesapeake & Ohio Canal and the Baltimore & Ohio Railroad slowly advanced westward up the Potomac Valley. They did not reach Harpers Ferry, 60 miles above Washington, until 1834, largely because of the delays resulting from the legal controversy over the right-of-way above Point of Rocks. In the same year the canal was completed to Williamsport, about 100 miles from the Capital. In the years following there were endless delays and revisions of costs, including a complete suspension of work on the railroad in the late thirties after it had resumed construction westward from Harpers Ferry. The canal finally reached Hancock in 1839, but work halted completely in the early forties. The Baltimore & Ohio arrived at Cumberland in 1842 and continued on up the valley to the west. The Chesapeake & Ohio finally limped into the Queen City of the Alleghanies in 1850, less than 3 years before the railroad reached the Ohio River. Branches ultimately brought the benefits of the waterway to Alexandria and the Anacostia River, while Hagerstown, Winchester, and eventually Washington were connected with the main line of the Baltimore & Ohio.

While the work of construction was still under way, both companies put the completed portions of their lines into operation. In so doing they encountered new problems and new experiences, and exerted a new influence on the development of the region. Each company passed through an interesting stage during which officials learned their trade and solved problems, establishing effective operating rules, discovering economies of maintenance and repairs, coping with natural disasters in the form of periodic floods, and overcoming the intermittent disruption of personnel by the application of the political spoils system to the State-dominated enterprises. Indeed, as a result of particularly damaging floods in the fifties and low income due to the competition with the railroad, the canal was in a precarious financial condition on the eve of the Civil War. Both companies conducted interesting experiments in the technical development of their respective works: lock operation and railway track, boats and rolling stock. Both enterprises promoted the economic development of the Potomac region by the cheap transportation rates providing ready access to new markets. In addition the Chesapeake & Ohio made its surplus water available as a source of power for mills and manufactories along its waterway. Each brought a new type of livelihood to the valley and new social groups in the rough and clannish canallers and the hustling and transient railroaders. The competition between railroad and canal which continued during the early years of operation, centering principally on the flour trade at Harpers Ferry

and above and the coal trade from Cumberland, benefited many valley inhabitants.

Barely had the construction of the two works been completed than a major crisis engulfed the region in the form of a civil war. In this struggle the Potomac Valley occupied a strategic place as a border area containing the seat of the federal government. As a consequence of its position, the valley was the scene of almost constant skirmishing between the opposing sides. It also lay athwart invasion routes into both North and South, and thus was involved in at least five major military operations: McClellan's West Virginia campaign (1861), Jackson's Valley maneuvers (1862), the invasion of Maryland and the battle of Antietam (1862), the invasion of Pennsylvania (1863), and Jubal Early's raid on Washington (1864). As a result of the war both the canal and the railroad suffered from widespread damage to their works, repeated and prolonged interruptions in traffic, the restraints of military occupation, and numerous petty annoyances. In the latter years of the conflict, however, the interruptions were less serious, and both transportation lines enjoyed a greater prosperity than ever before. The canal and railroad also performed valuable services for the Federal Government as channels for the shipment of the priceless Cumberland coal, as a line of communication immediately behind the battle lines, and as a convenient line of offices and personnel for customs duty and other purposes. The events of the war years in turn provide a rich part of the historical heritage of the Potomac Valley.

The close of the Civil War found both railroad and canal in a dilapidated condition as a result of the postponement of repairs during the war emergency. After the physical restoration and economic readjustments of the difficult postwar years, there came a period of unparalleled profits based upon the booming coal trade in the Nation-wide industrial prosperity, lasting until the middle seventies. So impressive was the record of the canal company that there was a brief revival of the proposal to extend the waterway to the Ohio. The panic of 1873 and the long depression which followed soon brought to an end the prosperity of both transportation agencies in the Potomac Valley. The coal trade declined over 50 percent and recovered only briefly in the eighties. In the meantime other misfortunes assailed the canal. Bitter competition between carriers for the remaining trickle of coal traffic resulted in sharp rate wars, reducing income by as much as 60 percent and eliminating most of the monetary profits from canal operations. In 1877 a devastating flood demolished the waterway and saddled the company with a heavy debt. Revenues were insufficient to enable either this debt or earlier ones to be paid off, despite legislative assistance by the Maryland Assembly at the behest of Arthur P. Gorman, famed Maryland statesman and canal president. New floods in 1886 and 1889 proved to be the final straw, and the Chesapeake & Ohio found itself bankrupt.

Bankruptcy did not bring substantial relief from the many problems confronting the canal. On the contrary, it marks the end of its independent existence, for the Baltimore & Ohio emerged as the principal bondholder and thus secured control of the receivership. Although the waterway was eventually restored under court supervision, it never again competed seriously for the valley trade. By the turn of the century a new competitor, the Western Maryland Railway, had

emerged to contest the supremacy of the Baltimore & Ohio in the Potomac Valley. The canal was thus entirely eclipsed, remaining in operation only because the court required the railroad to keep up the waterway. Not even the wartime demand for coal in 1917–18 brought any real prosperity to the Chesapeake & Ohio.

Early in 1924 another flood inundated the canal and did enough damage to it to provide an opportunity for the railroad to abandon maintenance of the waterway. The receivers argued that there was insufficient business offered to warrant the repair and continued operation of the canal. Reasons for the decline of the Chesapeake & Ohio as a transportation agency are not hard to find. The failure to realize the proposed connection with the Ohio River ultimately insured the financial bankruptcy of the project. The company was grossly overcapitalized for the relatively small amount of local business upon which it had to depend for a profitable existence. The canal also suffered the consequences of the coincidence of its greatest period of expenditure with an era of inflation, and its greatest period of indebtedness with an era of deflation. Political interference delayed construction, hindered the development of an experienced staff, brought corruption and fraud to the operation of the canal, and destroyed public confidence in the success of the project. Technological obsolescence prevented the waterway from competing effectively with the vastly improved railroads. Floods at critical times in the canal's history caused long interruptions in trade and considerable loss of revenue, and saddled the company with enormous debts. The decline of the Cumberland coal fields sealed the fate of the waterway, which had come to depend almost exclusively upon their product.

After the suspension of navigation in 1924 there was a revival of Federal interest in the Chesapeake & Ohio Canal. This was a logical continuation of an earlier concern in the origin, construction, and operation of the canal project. Such matters as the proposed connection of eastern and western waters, the problems of engineering and financing, and the political significance of the canal project gave way to questions of fish and wildlife conservation, recreation, historical sites, and scenic parkways which now came to the attention of public authorities. The Chesapeake & Ohio centennial in 1928 and the celebration of the George Washington bicentennial in 1932 helped to focus attention on the abandoned waterway as a relic of the past. Federal acquisition of the canal property from a depression-ridden Baltimore & Ohio Railroad in 1938 gave increased incentive and meaning to the discussion of the ultimate disposition of the waterway. Emphasis has gradually shifted from the prewar intent to restore the canal as a historic site and for recreational pruposes to the use of the right-of-way as the route of a scenic parkway to Cumberland.

There seems to be ample justification for such a project in the natural beauty and historical significance of the territory through which it would pass. The Potomac route is an interesting chapter in the history of East-West communications, and the waterway istelf provides an excellent case study of the canal era in the United States. Implicit in its experiences is an example of the relation of business to Government, both State and Federal, in the nineteenth century. Furthermore the story of the Potomac route has a peculiarly intimate relation to the course of national events from colonial days through the era of George Washington, the significant post-1815 years, the Jackson era,

and the Civil War period, to more recent times. In addition, the canal and its predecessors have been a major factor in the growth of the Potomac Valley and in the everyday lives of its inhabitants. Finally, the parkway project seems best adapted for the achievement of such varying objectives as the provision of recreation areas, the preservation of selected canal structures as historic sites and the protection of the inherent beauty of the valley.

Appendix B. A Study of the Floods of the Potomac River Related to the Construction of a Parkway Along the Route of the Chesapeake & Ohio Canal

(Prepared under the direction of Robert C. Horne, Chief, Engineering Division, by Henry G. Weeden, civil engineer, National Capital Parks, United States Department of the Interior, Washington, D. C.)

INTRODUCTION

One of the principle conditions to be analyzed in accordance with the reconnaissance study authorized by Public Law 618 of the Eightieth Congress is the relation between the Chesapeake & Ohio Canal and the flood conditions of the Potomac River. Before definite recommendations may be formulated as to the advisability and practicability of adapting the physical features of the canal to the construction of a parkway the conditions which will be encountered during various stages of flood should be thoroughly understood.

The Chesapeake & Ohio Canal was built on the Maryland side of the river from Washington, D. C., to Cumberland, Md. Construction was begun in 1828 and completed in 1850. With few exceptions the canal is adjacent to the river for its entire length. The portion of the river to which this study pertains flows through a relatively narrow meandering valley which cuts through the several mountain ranges between the Piedmont Plateau and the Appalachian region.

THE PROBLEM

The preliminary study of this parkway construction project requires a thorough understanding of the flood conditions. The purpose of this report is to give a graphic presentation of the conditions which will be encountered in the design, operation, and maintenance of the parkway including, principally, a parkway road and recreational facilities.

DEFINITIONS

Theoretical operating water level of the canal.—The level to which the water was maintained during the actual operation of the canal. During normal operations sufficient water was bypassed through a flume at each lock to maintain a constant level in the succeeding lower level and any excess water was allowed to return to the river over spillways located at intermediate points.

Low water profile.—The low water profile of the Potomac River was determined by the United States Corps of Engineers in 1929. As no construction has taken place in the river since 1929 which would materially affect this profile it is therefore considered correct.

Approximate flood profile.—The approximate flood profile was prepared by the United States Corps of Engineers from field data indi-

cating the highest known flood stage along the river. In most cases this represents the flood of March 1936.[1]

Flood stage.—The top of the river bank or the elevation at which flood damage begins to occur has been designated as "flood stage" by the United States Weather Bureau. This stage has been indicated on the graphs of those stream gages at which it has been determined by the United States Weather Bureau.

Probability of annual occurrence.—The probability, or chance, of a flood occurring annually whose crest will attain a certain elevation or stage is expressed in terms of percentage. One hundred percent probability indicates a probable annual occurrence while 20 percent probability expresses a risk of one chance in five of an annual occurrence. This term is used by the United States Corps of Engineers, various Government agencies and other organizations interested in flood conditions to express the percentage of risk at different elevations in area subject to inundation.

SOURCE OF INFORMATION

Early records of the various river stages in the Potomac River Valley are very meager and incomplete. Some of the older buildings along the river which were partly submerged by the early floods have high-water marks indicated on them and in some areas where excessive damage occurred the limits of a particular flood are known to the local citizens. The early records of the canal and railroad companies include elevations of major floods and indicate extensive repairs of flood damage but no records are available of the river conditions during intervening years.

Actual recording of river stages on the Potomac River was started in 1882 by the United States Corps of Engineers at the Washington Aqueduct Dam at Great Falls, Md. In 1889 a gage was established by the United States Weather Bureau at Harpers Ferry and in 1895 the United States Geological Survey established a gage at Point of Rocks and began keeping the first daily records of river discharge.[2] No additional gages were established in the Potomac River Basin until 1925. Eight gages are now in operation between Great Falls and Cumberland.

Considerable information has been compiled by the United States Corps of Engineers on recent floods and innumerable high water marks of the 1936 and 1942 floods have been determined by field surveys.[1] This data is referred to the mileage along the centerline of the Potomac River as established by the United States Corps of Engineers and where used in this report has been adjusted to the mileage of the Chesapeake & Ohio Canal.

DATA

The data compiled and shown on plates [3] NCP 110–80–29–1, 2 and 3 was obtained from the United States Weather Bureau, the United States Geological Survey,[2] the United States Corps of Engineers [1] and the files of the National Capital Parks which included the maps and profiles of the Chesapeake & Ohio Canal obtained from the Baltimore & Ohio Railroad.

[1] U. S. Engineers Office, Washington, D. C., Survey Report on Potomac River and its Tributaries, April 30, 1944.
[2] U. S. Geological Survey, Water Supply Paper 800.
[3] Flood Conditions—Washington, D. C., to Cumberland, Md.—Pls. 6, 7, and 8.

The profiles of the 100 percent and 20 percent annual probability of occurrence were prepared for this report by the United States Corps of Engineers.[4]

The theoretical operating water level as shown on the accompanying plates was determined from known elevations of bench marks established on the top of the capstones of many of the locks by field surveys of the United States Corps of Engineers [5] and the National Capital Parks.

The mileage between locks of the canal was obtained from drawing titled "Profile of the Chesapeake & Ohio Canal—showing the relation thereto of high water of the Potomac River—Baltimore & Ohio Railroad—Western Maryland Railroad, dated August 1924." [6]

Data on flood elevations, the approximate flood profile and the low water profile of the Potomac River was obtained from the United States Corps of Engineers.[1] This data which was originally based on the mileage along the centerline of the Potomac River has been adjusted to conform to the mileage along the canal.

Interpretation and use of data

The relation of the theoretical operating water level of the canal to the normal and flood stages of the river are shown by profiles and graphs to assist in the study and determination of suitable elevations for a parkway road and facilities.

The graphs on the accompanying plates show the recorded annual high water at each location where a stream gage has been established. The relation of the canal towpath to the annual high water, other floods, the flood stage and the 100 percent and 20 percent annual probability is shown so that a more detailed study may be made where required.

The data presented above and on the accompanying plates is intended primarily as a guide in the analysis of the over-all project. Caution should be exercised in the use of this data and its correlation with the protection against flood damage which is afforded by the local topography and physical features.

DISCUSSION

General.—Because of the loss of water from the canal, due principally to the normal seepage, it was necessary to replenish the supply at regular intervals. To insure a sufficient amount of water, dams were constructed across the river at seven locations. For economic reasons most of the additional water required was fed from the river at the several dams to the main canal by gravity. At these points the canal was constructed at the same level as the water impounded by the dams. However, below each dam the canal was extended at this same level for a distance of from 1 to 9 miles, depending upon the gradient of the river, to a point where the water level of the river had dropped to approximately 25 feet below that of the canal. This differential between the canal and the river was then maintained by means of locks to the next dam.

[1] U. S. Engineers Office, Washington, D. C., Survey Report on Potomac River and Its Tributaries, April 30, 1944.
[4] National Capital Parks Map Files NCP 110-83 and 110-84-1 to 5.
[5] Description of the bench marks established by the U. S. Corps of Engineers are on file among the survey records of the National Capital Parks.
[6] National Capital Parks Map Files NCP 110-20.

71542—50——5

The initial supply of water in the upper part of the canal was obtained from the dam at Cumberland and was augmented by a pumping station located in the vicinity of Spring Gap and by gravity from dam 6 located approximately 10 miles upstream from Hancock, Md. Little Slackwater, formed by dam 5, provided passage in the River between the upper and middle parts of the canal.

Dam 5, located approximately 8 miles above Williamsport, furnished sufficient water for the canal between the slackwaters. Big Slackwater, formed in the river by dam 4, provided passage to the lower part of the canal.

Dam 4, located midway between Williamsport and Shepherdstown, provided for the initial supply of water in the lower part of the canal. Additional water was supplied by gravity from dam 3 at Harpers Ferry, dam 2 at Seneca, and dam 1 at Brookmont near Washington, D. C.

The high water in the Potomac River Valley which may be expected annually does not in itself present serious problems. Occasional minor interruptions in the use of the parkway may be expected but, in general, the annual high water does not reach flood proportions. Of 350 annual high-water peaks recorded at the various gages 66 percent occurred during the months of February, March, April, and May while only 14 percent occurred during the months of June, July, August, and September.

The distribution of major floods throughout the different months of the year follows the same general pattern as that of the annual high water. Of the 20 floods recorded at Point of Rocks between 1896 and 1942, 65 percent occurred during the months of February, March, April, and May; 10 percent during June and none during the months of July, August, and September. Only six of the floods recorded at Point of Rocks actually rose above the canal towpath to any great extent. The flood of March 1936, which is known to have surpassed all others of record, covered the canal in this area for a period of 54 hours [7] and at its peak attained an elevation of 17 feet above the towpath level. The floods of 1889 and 1942 are very nearly equal to this record. Plate 4 of the appendix gives the duration of the 1936 flood at various points along the canal.[2]

Shepherdstown and Harpers Ferry have experienced the worst flood conditions along the entire route of the canal. During the flood of March 1936 the canal at Shepherdstown was inundated for 62 hours,[7] and at its peak the flood reached an elevation of 22 feet above the towpath.

Past records indicate that the most vulnerable section of the canal is at Harpers Ferry. The gradient of the river at this point is relatively steep and immediately below the confluence with the Shenandoah River the valley is reduced to a narrow gorge where it passes through the Blue Ridge Mountains. Excessive discharge from either the Shenandoah or the Potomac Rivers is impeded at this point causing local floods in this area. Records kept since 1889 show that on an average of every 2 years the elevation of this high water has equaled that of the towpath and has exceeded the towpath level by 5 feet of an average of every 5 years. During the 1889 and 1936 floods an elevation of 21 feet above the towpath was reached.

[2] U. S. Geological Survey, Water Supply Paper 800.
[7] Duration curve of flood of March 1936 is shown in pl. 4 of the appendix.

During the operation of the canal a masonry and riprap wall of approximately 5 feet in height was maintained along the entire length of this section as a protection against the frequent floods. Since abandonment of the canal this wall has been practically obliterated in many places.

Proposed parkway road.—The terrain at Harpers Ferry, the confluence of the Potomac and Shenandoah Rivers, is such that the parkway would be exposed to the full force of all future floods. Because of the steep cliffs along the Maryland side ot the river it will be impossible to change the alinement to any extent and some study should be made as to the advisability of a bypass of this difficult condition. Interruption in the use of the parkway in this area may be expected every year or so if the present alinement and grade of the canal is followed unless substantial erosion control and flood-protection walls are constructed similar to the original canal protection.

There are other places along the canal which will require considerable study but they do not present unsurmountable problems.

The towpaths along the river at both Little Slackwater and Big Slackwater are narrow and in some places are below the level of the annual floods. A location suitable for a parkway road through these areas would require considerable fill out into the river with a suitable masonry revetment for protection against scour.

Proposed recreational areas.—The establishment of recreational areas at various scenic or historical points along the route of the Chesapeake and Ohio Canal Parkway are proposed.

The eastern terminus of the parkway at Great Falls is under development at present by the National Capital Parks as a part of the George Washington Memorial Parkway. Except for a small section in the vicinity of the old tavern at lock 20, which was inundated for a very short period during the 1936 flood, this area is well above the elevation of any probable flood.

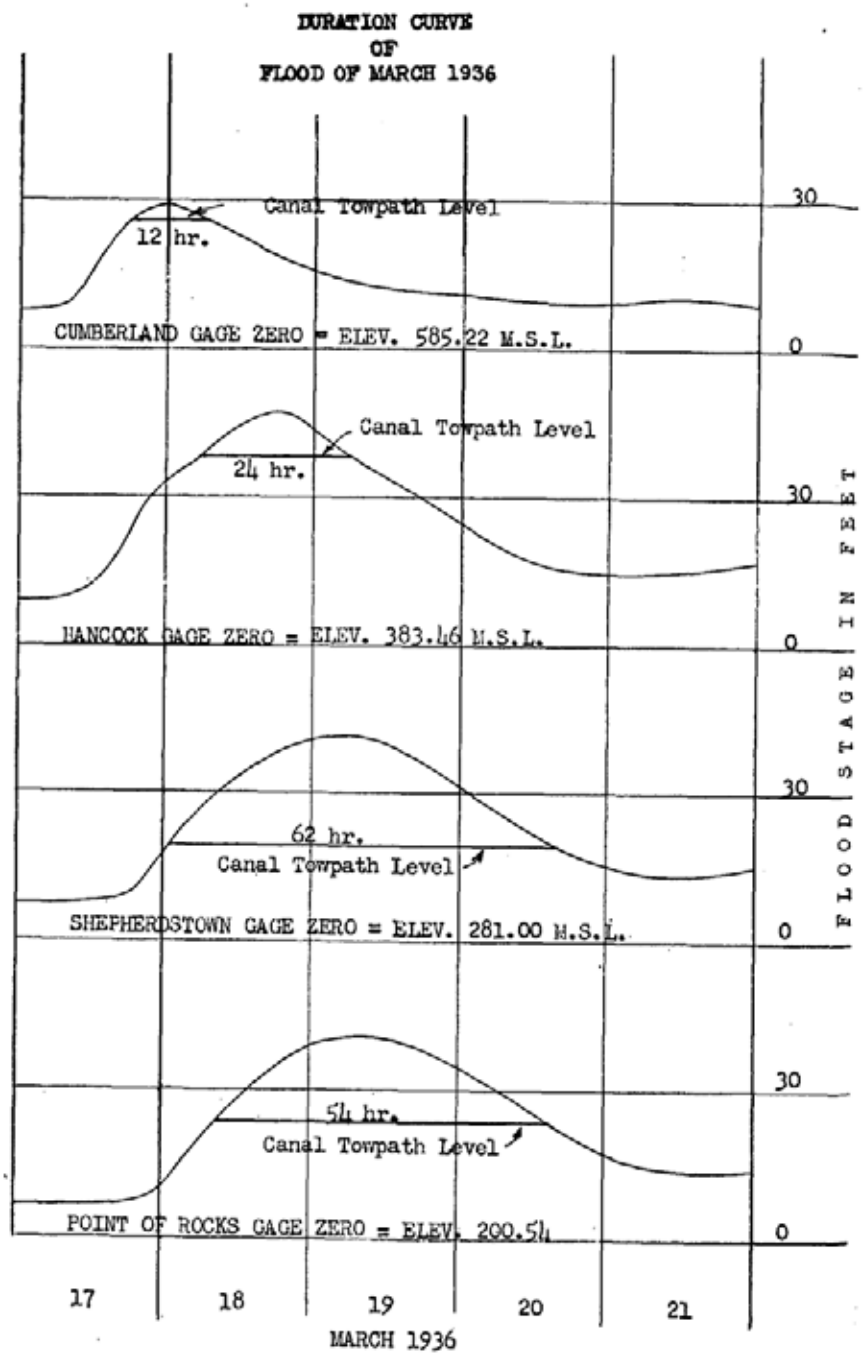
The site of the proposed western terminus at Cumberland, Md., is within the area of the project "Local flood protection for Cumberland, Md., and Ridgeley, W. Va.," now under construction by the United States Corps of Engineers. The ultimate design of the terminus and the adjoining recreational facilities will be coordinated with the plans of the United States Corps of Engineers and will be adequately protected from any flood damage.

Eight intermediate points along the route have been considered as desirable sites for recreational development and the area subject to probable flooding at these sites has been studied on enlargements of portions of the United States Geological Survey topographic maps.[8]

Summary.—Parkway construction on lands subject to occasional flooding is not in itself uncommon. In many of our large cities the low land along the waterfront has been reclaimed for this purpose although still subject to periodic flooding. In Washington, D. C., some of the principal traffic routes are below flood stage. The majority of the roads in East and West Potomac Park, the lower sections of Rock Creek and Potomac Parkway and Anacostia Park are especially subject to inundation and traffic on the Mount Vernon Memorial Highway is interrupted occasionally.

[8] Topography in vicinity of proposed recreational areas on file in the Engineering Division, National Capital Parks.

PLATE 4


DURATION CURVE
OF
FLOOD OF MARCH 1936
Canal Towpath Level
12 hr.
30
CUMBERLAND GAGE ZERO = ELEV. 585.22 M.S.L.
0
Canal Towpath Level
24 hr.
30
HANCOCK GAGE ZERO = ELEV. 383.46 M.S.L.
0
62 hr.
Canal Towpath Level
30
SHEPHERDSTOWN GAGE ZERO = ELEV. 281.00 M.S.L.
0
54 hr.
Canal Towpath Level
30
POINT OF ROCKS GAGE ZERO = ELEV. 200.54
0
FLOOD STAGE IN FEET
17
18
19
20
21
MARCH 1936

While the records show that the past floods were very costly to the Chesapeake & Ohio Canal Co. it must be borne in mind that the maintenance and operation of a canal located in the flood plain of a river and subjected to periodic inundation offers a peculiar problem. Floods of short duration which might prove disastrous to a canal embankment do not constitute a serious problem in highway maintenance and traffic control.

CONCLUSIONS

The floods of the Potomac River do not render the construction of a parkway along the route of the Chesapeake & Ohio Canal either impractical or inadvisable.

As it would not be feasible to design a parkway road along the present alinement of the canal which would be above all major floods occasional interruptions in the movement of traffic will occur. These interruptions due to flooding will amount to a day or so on an average of every five or six years.

However, approximately 90 percent of the canal towpath between Great Falls and Cumberland is above the annual high water of the river and no interruption to traffic from normal high water is anticipated on a parkway road constructed at approximately the same or slightly above the towpath level.

The principle effect of flooding will be twofold, a short interruption to traffic during periods of inundation and secondly a deposit of silt and debris by slackwater which must be removed.

The parkway embankments must be adequately protected against scouring by high water.

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Appendix C. Investigation of the Water Impounding Projects Related to the Construction of a Parkway Along the Route of the Chesapeake & Ohio Canal

(Prepared under the direction of Robert C. Horne, Chief, Engineering Division, by William G. Hayward, civil engineer, National Capital Parks, National Park Service, United States Department of the Interior, Washington, D. C.)

INTRODUCTION

In the development of a Chesapeake and Ohio Canal Parkway it has been considered desirable by many to restore certain sections of the canal in the area above Seneca. Various anglers associations, the Izaak Walton League, Maryland State officials, and local fishermen have advocated the restoration for the purpose of creating new fishing grounds as a substitute for the areas lost through the increased pollution of the Potomac River. Others have favored the project for its scenic or historical value and for forms of recreation other than fishing.

Although a large number of sections of the canal were studied for the impounding of water, these have been reduced in number to three additional sections believed to be consistent with other features of a parkway development. These are:

	Miles
(1) Oldtown to Town Creek	4. 5
(2) Big Pool to Four Locks	5. 4
(3) Dam No. 5 to Big Slack Water (lock 41)	17. 8

To arrive at a decision regarding the feasibility of such projects it is necessary to first review the history and present condition of the canal and then to arrive at certain basic data on which the development might be based.

ORIGINAL CANAL WATER SUPPLY

Briefly, the original canal was supplied with water from the Potomac River and from the river only. No tributaries were diverted into the canal at any time, although right-of-way for a diversion was actually bought at one point. Seven dams were constructed in the river and the desired quantity of water was diverted into the canal through control locks. However it developed in the long section from dam No. 8 at Cumberland to dam No. 6 near Hancock (dam No. 7 was never built) that sufficient water was not always available to operate the locks. An intermediate pumping station was therefore installed to provide this shortage. The water was pumped from the Potomac River at a point just below lock 72 at Spring Gap.

Dam No. 1 at Little Falls, dam No. 2 at Seneca, and dam No. 3 above Harper's Ferry were loose rock dams. Dam No. 4 above Mercersville, dam No. 5 above Williamsport, and dam No. 8 at Cumberland were masonry dams. Dam No. 6 at the Woodmont Club above Hancock was part masonry and part timber cribbing.

PRESENT CONDITIONS

Since the end of canal operation in 1924, floods and natural deterioration have caused major loss and damage particularly to the canal structures. The feeder lock at dam No. 3 has been washed away with the exception of a few feet of masonry. About 800 feet of earth and stone revetment work on each side of the lock, has disappeared. The dam proper still exists but its condition is not known. Dam No. 6 washed out many years ago and since 1941 the remaining timber cribbing has been destroyed by fire. The remaining dams are still in working condition.

The locks have deteriorated through frost action, and flood and from tree growth in the structures. Practically all timber has rotted out or disappeared. The masonry requires repointing and some stone requires replacing. In a number of locks we have found that the lock stone set on timber fillets or shims and these decayed when the canal was dewatered. In the restoration of locks in the Washington area we have repaired this with concrete.

In the 25 years of disuse heavy tree growth has sprung up within the old canal limits. The towpath has been cleared at various places but such work is only a small proportion of the clearing necessary. Stagnant pools of water occur at frequent intervals.

The aqueducts are in the same general condition as the locks, except that the failures naturally have been more noticeable. The wall on the berm side usually separates from the balance of the structure and in the case of Antietam and Conococheaqua have actually toppled into the stream below.

Certain sections of the canal now contain water but the only sections satisfactorily restored are in the Washington-Seneca area. The water has been obtained from the Potomac River at three points of diversion namely (1) dam No. 1 at Little Falls, supplying 5 miles of canal (2) Washington Aqueduct at Angler's Inn supplying 7 miles and (3) dam No. 2 near Seneca furnishing water for 8 miles of canal. The first and third points of diversion are the original intakes of the old canal. The second, at Angler's Inn is new and resulted from the fortunate location of a dewatering valve of the Washington Aqueduct that permitted diversion of aqueduct water into the canal by gravity. About 250 cubic feet per second are obtained at dam No. 1, 10 to 15 cubic feet per second at Angler's Inn and possibly 20 to 30 cubic feet per second at dam No. 2.

INVESTIGATION OF PROJECTS

In the investigation of impounding projects above Seneca, there are certain data that must be compiled and considered. The first is the determination of the least amount of water required to keep water of the required depth in the canal at all times. The fact that the fishing possibilities of the canal have been emphasized in all discussions, make this imperative. The second point to investigate is the source of such a quantity of water—from tributaries or the main river; from pumping or by gravity. The third is the quality of the water. Contaminated water cannot be used for fishing projects, and would be objectionable from a scenic and health standpoint. The fourth and last point is the matter of costs. These costs should in-

clude not only the normal costs of diversion or pumping, restoration and control but must include the expense involved in operating and maintaining such a waterway.

With these four points in mind the following data have been compiled.

QUANTITY OF WATER REQUIRED

The section of canal now in operation between Angler's Inn and lock No. 5 gives us a fortunate yardstick for measuring the requirements as to amount of water necessary to keep the levels full. The discharge from the aqueduct pipe drops into a natural drainage channel, runs for about 100 feet and is diverted by a concrete dam, of regulated height, into and through a 24-inch corrugated metal pipe. The pipe prevents an excessive amount of water entering the canal from floods in the natural drainage channel.

The maximum quantity of water discharging through this pipe, has been computed as 13 cubic feet per second. When so operated, this 7 mile section of canal can be successfully filled with water and all water levels maintained with some overflow at lock No. 5. Due to the desire of the United States engineers to prevent any waste of water beyond our minimum requirements they cut down the supply after the canal is once filled and permit the 24-inch pipe to run about two-thirds full or approximately at the rate of 10 cubic feet per second. This quantity appears to provide a perfect balance between supply and seepage. With this information we can estimate the seepage rate, and by comparing with similar data of the United States Reclamation Service arrive at a reasonable rate for the C & O Canal.

Using 60 feet as the average wetted perimeter of the canal, a seepage rate of 0.39 cubic foot per day per square foot of wetted area is obtained. This compares very favorably with respect to the losses experienced by the United States Reclamation Service. The losses per day in canals of the United States Reclamation Service are shown in table III as copied from page 216 of the "Handbook of Water Control" published by Armco Drainage Products Association. The average loss as given in table III is 0.87 cubic foot per day compared to our losses of 0.39 cubic foot as computed above. For the purpose of this investigation the figure of 0.40 cubic foot per day per square foot of wetted area will be used. While this value may be considered too conservative for use in the actual design, it is possibly desirable for the purpose of this investigation. Reducing the above rate to a simpler figure we find that it requires 1.3 cubic feet per second to retain the water level in a mile of canal.

In the discussion so far we have considered that all the loss was seepage loss. Evaporation is a factor but using an evaporation rate of 42 inches per year, which rate is commonly accepted in this area, such loss amounts to less than 3 percent of the seepage rate under discussion and can be safely neglected.

Another factor is of interest in considering the ponding of water in the canal, that is, the theoretical time required for the water to seep out of the canal if the source of supply fails after the canal has once been filled.

The volume of water in any mile of canal is estimated to be approximately 1,000,000 cubic feet. The basic seepage rate of 1.3 cubic feet per second amounts to 112,000 cubic feet per day. Therefore, theoretically in 9 days, the canal would go dry if no water was added.

SOURCES OF WATER

The two sources of water for the canal are the Potomac River and its tributaries.

The Potomac River.—The river is an unlimited source of supply as far as this project is concerned, the minimum flow at the Leiter Gage being some 1,100 cubic feet per second. Dam No. 4 and dam No. 5 are in working condition, being used for power purposes, and diversion at these dams requires only the restoration of the outlet lock. However, to get this water to any desired section of canal not immediately adjoining the outlet lock might involve the construction of a supply pipe or channel to constrict the waterway in such a manner as to permit the construction of a parkway road. The size of such a pipe or channel varies with the volume of water required and the topography and requires separate investigation for each project. In some locations pumping water from the river might be the only method of obtaining the minimum requirements for a given section. Each project will vary as to lift and quantity so that this feature will likewise require separate investigation for each section considered.

Tributaries.—In exploring the possibilities of using the tributaries that enter the Potomac, it is primarily essential to ascertain the amount of water available in each tributary and particularly the minimum flow during the dry season.

In estimating stream flow, the usually accepted rule is to allow 1 cubic foot per second average flow for each square mile of drainage area. If this flow was uniform, a quantity of water sufficient for the canal could be obtained from a number of streams in the Potomac watershed. However, the flow during the summer and fall naturally drops below the average, and this minimum flow is usually less than the minimum required to overcome seepage in any impounding section of the canal. If these "minimums" were of short duration, no difficulty would be encountered, but unfortunately these low rates of discharge extend over many weeks during the autumn. They are the controlling figures in the consideration of tributaries. A tabulation, table 1, of the streams on which the United States Geological Survey have taken readings, is attached giving their watersheds and minimum flow. From this table it will be noted that a drainage area of at least 17 square miles is necessary to insure a minimum flow of about 1.3 cubic feet per second which would, in turn, be sufficient to maintain water in about 1 mile of canal.

Other tributaries, on which no record of flow is available from the United States Geological Survey, have been considered at various times as possible sources of water supply. The data on these have been compiled in table 2. The discharge quantities have been estimated, based on the drainage area and the discharge from comparable streams shown in table 1.

QUALITY OF WATER

The pollution of the Potomac River has been a matter of considerable study for some time. The section from Cumberland to Hancock is so bad that fishing has been practically discontinued. It was due to the poor fishing in the Potomac River that the Battie Nixon Fishing Hole at Oldtown was developed by the local fishermen.

Ginneman Run (Warrior Creek), the source of water for this fishing hole, was a clear, relatively unpolluted stream, readily divertible into the canal. With this water, it appeared feasible to propagate bass and similar game fish. The project was more or less successful in the beginning, but due to volunteer nature of the management, the fluctuation of the water supply, and the temporary nature of the construction of the intake and spillways the project was washed out during the month of June 1949.

Reports reached this office several years ago that during a lengthy dry spell the pollution of the Potomac River increased to such an extent as to drive the fish from the river into the mouth of Town Creek and in such numbers as to attract the enthusiastic attention of the local people. Town Creek, in turn, was practically dry, so that the fish were confined to a relatively small area. The ultimate loss of fish life was naturally considerable. It seems apparent that river water of this quality should not be pumped into the canal.

By the time the water reaches dam No. 4 and No. 5 the river pollution has apparently decreased and, from information available, it is believed that diversion at those points would be reasonably satisfactory from the standpoint of quality of the water.

CONSTRUCTION COST ESTIMATES

The cost of impounding water, in any section of the canal, involves the following items:

1. *Clearing the canal bed of its growth of trees, shrubs, and woods.*—This work must be done in such a manner as to avoid disturbance of the puddled canal bottom. If this canal seal is broken, seepage increases and more frequent "blow-outs" occur later when the canal is filled with water. The amount of growth varies somewhat in the various sections so that the clearing cost per acre might range from $300 to $500.

2. *Restoration of the masonry portion of locks.*—The locks have been deteriorating since the cessation of operations in 1924. Frequently trees of 6 to 8 inches in diameter are found growing in the masonry. Cap stones have been disturbed or lost by floods and tree growth, and the stones throughout the structure require repointing. The footings of the walls have frequently been undermined to a greater or less extent, and repair with concrete is indicated.

3. *Construction of bulkhead in lock.*—At the upper end of each lock a bulkhead will be required in order to maintain the level of the water above the lock. The old timber lock gates have all rotted away and need not be restored. The restoration of the former spillway around the lock likewise would be unnecessary.

4. *The construction of intake facilities.*—Two basic methods of obtaining water for the canal are (1) diversion by gravity and (2) pumping. Diversion by gravity at existing dams requires restoration of the old structures, while diversion at other locations requires new construction. Restoration of existing structures is similar to lock restoration mentioned above. Pumping requirements and costs are based on similar requirements and costs of the District of Columbia Sewer Division. Likewise, sewer construction costs are averages of recent bids on similar work in the District of Columbia.

5. *Repairs to canal proper.*—This involves repair to earthworks resulting from flood damage and wash-outs during the many years of disuse.

In arriving at an estimate of cost on each project, it was assumed that much of the work involved would be part of a roadway construction contract and that the contractor repairing the aqueducts would also make similar repairs to the old locks. Likewise, the special construction through the constricted sections would be correlated to the work in the adjoining roadway. On this assumption it is believed that lower unit prices can be used in the cost estimates than if this work were performed separately.

Water-impounding project No. 1 (Oldtown (lock No. 71) (Warrior Creek) to Town Creek (length 4.5 miles) (USGS Flintstone sheet))

This project contemplates the diversion of Warrior Creek, sometimes called Ginneman's Run, into the canal at Oldtown, Md. The creek parallels the berm side of the canal for a distance of several thousand feet and just above lock No. 71 the creek is about 3 to 4 feet above the bed of the canal. By constructing a suitable diversion dam in the stream at this point, the water of the creek can be discharged into the bed of the canal by gravity through a 24-inch pipe (to limit the supply during periods of maximum flow). At each lock, that is, at locks 70, 69, and 68, and at Town Creek aqueduct a concrete bulkhead 4 feet high would be required. This would regulate the depth of water in each level to 4 feet and provide a spillway section of approximately 4 by 15 feet. The distance from lock 71 to 68 is 2.1 miles, and from lock 68 to Town Creek aqueduct, 2.4 miles.

The drainage area of Warrior Creek is approximately 23 square miles, which should provide a minimum flow at 1.6 cubic feet per second in a year of average rainfall. This theoretically would supply water for 1.2 miles of canal in a satisfactory manner but would not provide sufficient flow for the entire 4.5 miles during the summer months even in a year of normal precipitation. It is doubtful that this flow is sufficient to maintain the 2.1 miles from Warrior Creek (lock No. 71) to lock No. 68, which is designated "project 1–A."

By ratio with comparable streams gaged by the United States Geological Survey, the minimum flow of Warrior Creek estimated for the period of record is 0.9 cubic feet per second, or sufficient to maintain approximately 0.7 miles of canal, approximately from lock No. 71 to lock No. 69.

It is probable that this supply could be adequately supplemented by periodic pumping during periods of inadequate flow.

The portion from lock No. 68 to Town Creek is designated "project 1–B." Supplemental pumping from Town Creek or from the Potomac River in the vicinity of Town Creek during periods of inadequate flow in Warrior Creek is feasible.

The estimated cost of project 1–A is $25,000, and of project 1–B is $11,000. These estimates do not include the cost of supplemental pumping, which it is anticipated would be accomplished by mobile pumps. The estimated cost of normal annual operation and maintenance is $11,000.

Water-impounding project No. 2 (Big Pool to Four Locks (5.4 miles) (USGS Hancock and Williamsport sheets))

In the section of canal between Big Pool and Four Locks there are no tributaries available as a source of water for the canal. Big Pool itself fluctuates in depth according to the seasons as it is fed by local streams of limited drainage area, supplemented by springs. The canal

below Big Pool through the Fort Frederick area and Four Locks is usually dry.

In this 5½-mile section there are three stop locks and four standard locks. It does not appear that the canal would be constructed by a roadway at any location in this section above Four Locks.

The lack of satisfactory source of water other than the Potomac River would require a pumping plant.

The necessary repairs to locks 47, 48, 49, and 50 is nominal, and this cost has not been included in the estimate.

The estimated cost of project No. 2 is $44,000. The estimated normal annual operation and maintenance cost is $14,000.

Water-impounding project No. 3 (dam No. 5 to Slack Water (lock No. 41) (17.8 miles) (USGS Williamsport sheet))

This project contemplates the use of dam No. 5 as the source of water, utilizing the method of diversion constructed for the canal. This project would be similar to the existing restorationn from Seneca Dam to Great Falls except that the restrictions encountered in the Williamsport area would entail material costs that were not encountered in the Seneca development.

For about 3,000 feet in the Williamsport area the restriction encountered in the Conococheaque aqueduct and in the railroad facilities for the Potomac Edison Co. are such as to require the installation of a constricted section (or flume) or a pipe conduit to supply water for the 11 miles of proposed water impoundment below Williamsport. This flume or pipe must be sufficient size to supply the 15 cubic feet per second minimum required for the lower 11 miles. A satisfactory hydraulic grade can be obtained to supply the required quantity beyond these restrictions by utilizing, if necessary, the 8-foot drop at lock 44. A short section of flume or pipe may be required at the Cumberland Valley Railroad bridge a few miles below Williamsport.

The estimated cost of project No. 3 is $199,000. The estimated normal annual operating and maintenance cost is $11,000.

TABLE 1.—*Stream flow: U. S. Geological Survey stream gages*

	Average discharge in 1948 (cubic feet per second)	Average discharge over period of record (cubic feet per second)	Watershed (square miles)	Period of record	Minimum flow [1] in 1948 (cubic feet per second)	Minimum flow in period of record (cubic feet per second)
Evitt's Creek at Bedford Valley	24	29	30	September 1932–48	2.2	1.2
Sawpit Run near Oldtown	3	.....	5	November 1947–48	0	0
Town Creek near Oldtown	.....	.....	.....	July–September 1928–35	.....	(1930) 0.9
Tonoloway Creek near Hancock	11	.....	17	August 1947–48	0	0
Conococheaque Creek at Fairview	479	551	494	June 1928–48	42	(1930) 22
Antietam Creek near Sharpsburg	228	244	261	August 1928–48	73	(1931) 35
Catoctin Creek at Middletown	.....	.....	125	August 1947–48	.....	(?)
Monocacy River at Jug Bridge	908	894	817	November 1929–48	96	(1930) 35
Seneca Creek at Dawsonville	82	90	101	October 1930–48	16	(1930) 1.9
Little Falls Branch near Bethesda	4	.....	4	June 1944–48	.1	(1944) 0
Rock Creek at Sherrill Drive	60	52	62	October 1929–48	11	(1930) 0.5

[1] Rainfall in 1948 closely approximates normal precipitation.
[2] Records not computed; minimum measured, 5.1 cubic feet per second (1947).

TABLE 2.—*Stream flow (estimated)*

Name of stream	Area square miles	Average flow (cubic feet per second)	Minimum flow [1] for normal precipitation (cubic feet per second)
Warrior Creek (near Oldtown)	23	20	1.6
Purslane Creek (near Oldtown)	7	6	0
Israel Creek (at Weverton)	14	12	1.1
Little Catoctin Creek (below Brunswick)	11	9	.8
Tuscarora Creek (below Point of Rocks)	21	16	1.5
Broad Run (near Edward's Ferry)	15	12	1.1
Horsepen Branch (below Edward's Ferry)	7	6	0

[1] This data estimated for normal precipitation; approximately the rainfall in 1948.

TABLE 3.—*Losses per day in canals of the U. S. Reclamation Service*

[Cubic feet per square foot of wetted area]

Soil	Number of observations	Maximum	Minimum	Mean
Gravel and sand	2	3.62	1.44	2.53
Gravel	38	7.05	.22	1.70
Gravel and rock meal	9	2.84	.88	1.56
Sand	5	1.79	.81	1.27
Rock meal	18	1.73	.38	1.24
Sand and loose rock	7	.86	.62	.72
Sandy loam	60	3.70	.01	1.01
Loam	5	1.44	.84	1.07
Sand and volcanic ash	21	1.66	.22	.90
Volcanic ash	3	1.16	.56	.82
Brule clay	4	1.11	.72	.91
Clay and gravel	18	1.34	.16	.79
Clay and sand	12	1.43	.50	.76
Adobe	9	.93	.46	.65
Hardpan and loose rock	2	1.12	.24	.68
Clay and shale	7	1.02	.30	.59
Volcanic ash, clay, and hardpan	4	.77	.46	.60
Cemented gravel and sandy loam	2	.47	.40	.44
Caliche	2	.49	.38	.43
Clay	12	.77	.11	.34
Clay and loam	12	1.12	.06	.30
Gumbo and sandy loam	11	.77	.12	.29
Concrete lining	9	1.07	.06	.23
Gravel and volcanic ash	5	1.54	.38	.88
All soils	277	1.66	.43	.87

Appendix D. Use of Existing Structures

(By C. D. Geisler)

Report on Survey of Aqueduct and Miscellaneous Drainage and Overpass Structures on the Chesapeake & Ohio Canal

A preliminary field survey was made of the aqueducts, culverts, overpasses, and tunnel on the Chesapeake & Ohio Canal on March 29, April 6 and 7, 1949, in company with Messrs. Breeze, Sutton and Haussmann of the National Park Service. The survey did not include the locks, dams, or buildings along the canal.

There are 11 aqueducts on the canal, all stone masonry arches, and also one wooden flume of about 20-foot span. There are also many culverts and small underpasses which lie below the graded section of the canal. There are also stone arches that vary in size up to about 30-foot span. The railroad and highway overpasses consist of steel truss or girder spans. The overpasses are in good condition, although some require cleaning and painting. The horizontal and vertical clearances appear satisfactory to meet parkway requirements. There is one tunnel slightly over 3,000 feet in length with stone portals and stone lining for about 25 feet of tunnel at each end. The remainder of the lining is brick.

The barrels of the arch culverts consist generally of uncoursed rubble laid with lime mortar. The facial ring stones are of ashlar. The culverts are in good condition except for those in the larger spans which require some rebuilding of the arch barrels and headwalls.

In the tunnel, the portals and adjacent tunnel lining of stone appear to be in very good condition and require no repair. The brick lining throughout the remainder of the tunnel is in generally good condition except in some areas where several layers of the brick have fallen out. The failure of this brick is believed due to the seepage of water through the lining as there is considerable dripping of water at these spots. This leakage should be checked, if possible, by forcing grout behind the lining. This grouting should be done before the lining is repaired. There is also considerable fall of water outside the east portal which gives evidence of a large flow of water above this end of the tunnel.

The 11 aqueducts are in various stages of deterioration. Some are in generally good condition and require only the resetting of some stones and a pointing up of the open joints. Others have developed partial failure which can be repaired in some cases by rebuilding those sections, whereas in other cases the entire reconstruction of the spans is necessary. The stone used in the construction of the aqueducts is either limestone or sandstone of various grades. Some of the limestone shows considerable decomposition. The stone in some of the aqueducts has disintegrated to such extent that adequate repair of the structure will require the rebuilding of sections with new stone. The rapid deterioration of the stone was undoubtedly due to leakage of water through the aqueducts. Sufficient sound stone can probably be

obtained, however, from locks and walls which will be obliterated in the construction of a parkway. The stone so obtained would require very little cutting except for use in the facial ring stones.

The arch barrels of the aqueduct consist of coursed ashlar, the stone being approximately uniform in depth from springline to crown. The face stones in the spandrel and parapet walls vary from coarsed to uncoursed ashlar, the stonework being generally more formal in those aqueducts near Washington, D. C. than toward the upper end of the canal. Hydraulic lime cement appears to have been used, generally in the voussoir joints and to some extent in the spandrels.

The spandrel construction consists of an outer facing or veneer of ashlar backed with a composite fill material of broken stone and clay. Similar fill overlies the arch barrel to the level of the bottom of the flume. The parapets, or sides of the flume, consist of inner and outer facings of stone with fill material as noted above. The fill is quite compact and well cemented and does not exert much pressure against the facial veneer. However, the fill has little bond with the face stones, requiring the latter to be more or less self-supporting. Furthermore, the wet fill in contact with the face stones appears to have accelerated disintegration of the back of the stones. The upstream parapets average about 5 feet in width, whereas the downstream parapets which served as the towpath average 8 feet to 9 feet in width. Both parapets have a full width coping of stone slabs.

Where failure has occurred in the aqueducts as where part of the structure has collapsed, such failure is believed due to weakness in structural design rather than to disintegration of the stones. The cause of the failure appears to have been the inability of the spandrels to resist the outward pressure of the water. This pressure caused the face stones in the spandrels and piers to fail at or below the elevation of the arch spring line. Following failure of these stones the entire spandrel and parapet gradually gave way. The outward pressure against the parapets also produced transverse tension in the arch barrel causing longitudinal cracks in the arch, and in some cases pushing out the outer section of the barrel. Failure apparently occurred first in the upstream side of the aqueducts where the parapets were thinner and had less weight to resist the water pressure.

The structural design of the arch barrels and their abutments appears adequate. However, where there were multiple spans of unequal length, the weight of the piers was insufficient to take one unbalanced arch thrust. There was also inadequate provision in the arch barrels to resist the water pressure against the spandrels.

There is no evidence of settlement in either the abutment or pier foundations. The existing footings are believed adequate for future support of the structures. However, it would be desirable to check the foundation condition at each footing before any major repair work is done on the arch spans.

It is suggested that the repair of the stone aqueducts be substantially as follows: In many of the downstream spandrel and parapet walls, and also in some of the upstream walls, satisfactory repair should require only the removing and replacing of loose spalled or disintegrated stones and the grouting of joints with cement mortar. However, in walls which have been pushed outward or in which many of the stones are dislodged or show failure, the entire face of the spandrel and parapet should be removed. The fill in back of the

stones should also be removed to a depth of at least 1 foot. The face stones should be relaid with cement joints, using new stones where necessary. This facing should then be backed with a 1-foot thickness of concrete. The new walls should be tied to the opposite walls or anchored laterally with reinforced concrete cross ties spaced about 15 feet apart. Enough of the existing fill over the structure must be removed to permit the construction of these ties. Following the repair of the spandrel walls, all open joints in the piers and arch barrels should then be cleaned and packed with cement mortar. In structures where the arch barrel requires major repair, this work should be done prior to the reconstruction of the spandrels or parapets. Where the strength of the existing arch barrel may be in doubt due to general disintegration of the voussoir stones, it may be economical to remove the fill over the arch, grout the voussoir joints from the top, and place a backing of concrete over the entire arch barrel. This concrete backing would serve to hold the spandrel walls against lateral displacement without the use of the concrete cross ties mentioned above. Should a section of the arch barrel need reconstruction, falsework will be required and the new voussoir stone set on the forms.

After the water is removed from the aqueducts, future disintegration of the stone should proceed at a very slow rate. Furthermore, where the stones can be grouted so as to provide full mortar joints, not only will the stones be given more protection from the weather but the mortared joints will reduce the concentrated stresses on the stones by making the pressures on the bearing surfaces more uniform. In addition, the use of concrete will take a good deal of the load off of the stones and permit much of the softer stone to remain in the structure.

It is probable that suitable repair of the wing walls can be made in most cases by removing and replacing stones which have dislodged, and grouting all open joints with mortar. Where large sections of the wing walls have gone out, they should be rebuilt as gravity walls, in which the facial stones should be given a structural backing of either concrete or stone masonry.

In preparing the estimates for the cost of repairing the aqueducts, allowance has been made for additional reconstruction which may be found necessary when the work of repair is undertaken.

A brief description of each aqueduct is as follows:

Seneca Creek aqueduct.—This is a three-span stone-arch aqueduct with total length of about 130 feet. The structure is in generally good condition except for longitudinal cracks in the arch barrel. These cracks could probably be grouted. To prevent the cracks opening up under horizontal pressure of the fill placed for the parkway, transverse ties of reinforced concrete should be constructed between the opposite spandrels. Some resetting of the facial stones in the spandrels is also necessary, particularly in the upstream spandrel which looks as if it had been rebuilt since the original construction.

Flume on Broad Run.—This is a wooden flume on stone masonry abutments. The timber has deteriorated considerably, although the stone abutments are in good condition and require only minor repair. A reinforced concrete slab could replace the wooden flume to carry the parkway.

Monocacy Creek aqueduct.—This structure consists of six equal arch spans. The general condition of the arch barrel is good. Some of the joints in the arch barrel and in the faces of the piers need grouting. The face stones in the upstream spandrel and parapet should be taken down and relaid. The downstream face of the bridge is in a somewhat better condition, and a satisfactory repair of these stones could probably be made by cleaning and grouting the joints.

Catoctin Creek aqueduct.—This structure has three arches of unequal length. The center span, which is the longest, has developed a sag and is near collapse. The upstream spandrel with underlying section of arch barrel has fallen away. The three spans will require complete reconstruction. Inasmuch as this aqueduct is located at a rather sharp bend in the canal, it would appear desirable to remove or abandon the present structure and construct a new bridge for the parkway slightly downstream.

Antietam Creek aqueduct.—This aqueduct also has three arch spans of slightly unequal length. The upstream spandrel and underlying section of the arch has broken away. Some of the facial stones in the downstream spandrel have been forced out of place. Adequate repair of this aqueduct will probably require reconstruction of most of the structure, although it is possible that the existing sections of the arches can be kept in place and reinforced by grouting the joints and backing with concrete. There is a heavy drift against the upstream ends of the piers which may cause further damage to the structure if not removed.

Conocoheague Creek aqueduct.—The structure has three equal spans. It is in poor condition, the upstream spandrel and underlying section of arch having fallen out and the arch barrel stones showing considerable disintegration. The structure will require reconstruction throughout, although the existing sections of the arch barrels might be retained in place by grouting the voussoir joints and backing with concrete. The wing walls will also require considerable rebuilding.

Licking Creek aqueduct.—This is a single-span arch structure. The upstream spandrel has fallen out. The arch barrel and the downstream spandrel appear to be in good condition and require only nominal repair. New stone will be required for the upstream spandrel.

Big Tonoloway Creek aqueduct.—This is also a single-span arch, one end of the span framing into a rock bluff. Both spandrels have fallen away and the voussoir stones in the arch barrel show considerable disintegration. This structure will require almost complete reconstruction.

Sideling Creek aqueduct.—This is another single-span arch. Most of the upstream spandrel has collapsed. The downstream, however, is in good condition. The arch barrel appears sound except for a longitudinal crack under the downstream spandrel. The upstream spandrel will require complete reconstruction and reinforced concrete cross ties should be installed to connect the two spandrels.

Fifteen Mile Creek aqueduct at Little Orleans.—This is also a single-span arch. The upstream spandrel bows out and should be rebuilt. The downstream spandrel and arch barrel are in good condition and require only repointing.

Town Creek aqueduct.—This is also a single-span arch. The upstream spandrel has partially failed and requires reconstruction. The

downstream spandrel and arch barrel are in good condition and should require very little repair.

Evitts Creek aqueduct.—This is likewise a single-span arch. The stone in the structure appears sound, but many of the spandrel stones have become dislodged and the spandrel stones should be relaid. The arch barrel is in generally good condition except for longitudinal cracks. Reinforced concrete cross ties should be installed to connect the new spandrels.

Example of estimated work required to repair aqueducts and convert into vehicular bridges: Monocacy Creek aqueduct

Item	Estimated quantity	Unit	Unit price	Amount
Removing existing stone masonry	850	Cubic yard	$8.00	$6,800
Removing existing spandrel fill	900	do	1.50	1,350
Resetting stone masonry	800	do	35.00	28,000
Concrete class	700	do	50.00	35,000
Reinforcing steel	50,000	Pound	0.10	5,000
Pointing existing stone masonry	1,200	Square yard	7.00	8,400
Cinder or sand fill	1,600	Cubic yard	3.00	4,800
Drains and miscellaneous (lump sum)				1,500
				90,850
Engineering and contingencies				9,150
Total				100,000

List of aqueducts on the Chesapeake & Ohio canal [1]

Item No.	Name of aqueduct	Number of spans, and total length of aqueduct	Description of repair work required	Estimated cost of repair of existing structure	Estimated cost of replacement of structures in kind	Estimated cost of new concrete girder structure
1	Seneca Creek	3 arch spans, 130 feet	Reset stones in spandrels; point arch joints	$40,000	$85,000	$60,000
2	Broad Run	1 timber span, 40 feet	Construct new timber deck	5,000	20,000	10,000
3	Monocacy Creek	7 arch spans, 560 feet	Reset stones in spandrels; point arch joints	100,000	310,000	250,000
4	Catoctin Creek	3 arch spans, 130 feet	Reconstruct arch spans complete	55,000	80,000	60,000
5	Antietam Creek	3 arch spans, 140 feet	Rebuild one spandrel; point arch joints	50,000	85,000	65,000
6	Conococheague Creek	3 arch spans, 210 feet	Reconstruct arch spans complete	100,000	135,000	115,000
7	Licking Creek	1 arch span, 120 feet	Rebuild one spandrel; point arch joints	30,000	75,000	55,000
8	Big Tonoloway Creek	1 arch span, 110 feet	Reconstruct arch span complete	45,000	65,000	50,000
9	Sideling Creek	1 arch span, 110 feet	Rebuild spandrels in part; point arch joints	30,000	65,000	50,000
10	15-Mile Creek	1 arch span, 110 feet	Rebuild spandrels in part	30,000	65,000	50,000
11	Town Creek	1 arch span, 100 feet	Rebuild spandrels	30,000	60,000	45,000
12	Evitts Creek	1 arch span, 90 feet	Reset stones in spandrels and wing walls	35,000	55,000	40,000
	Total for 12 aqueducts			550,000	1,100,000	850,000

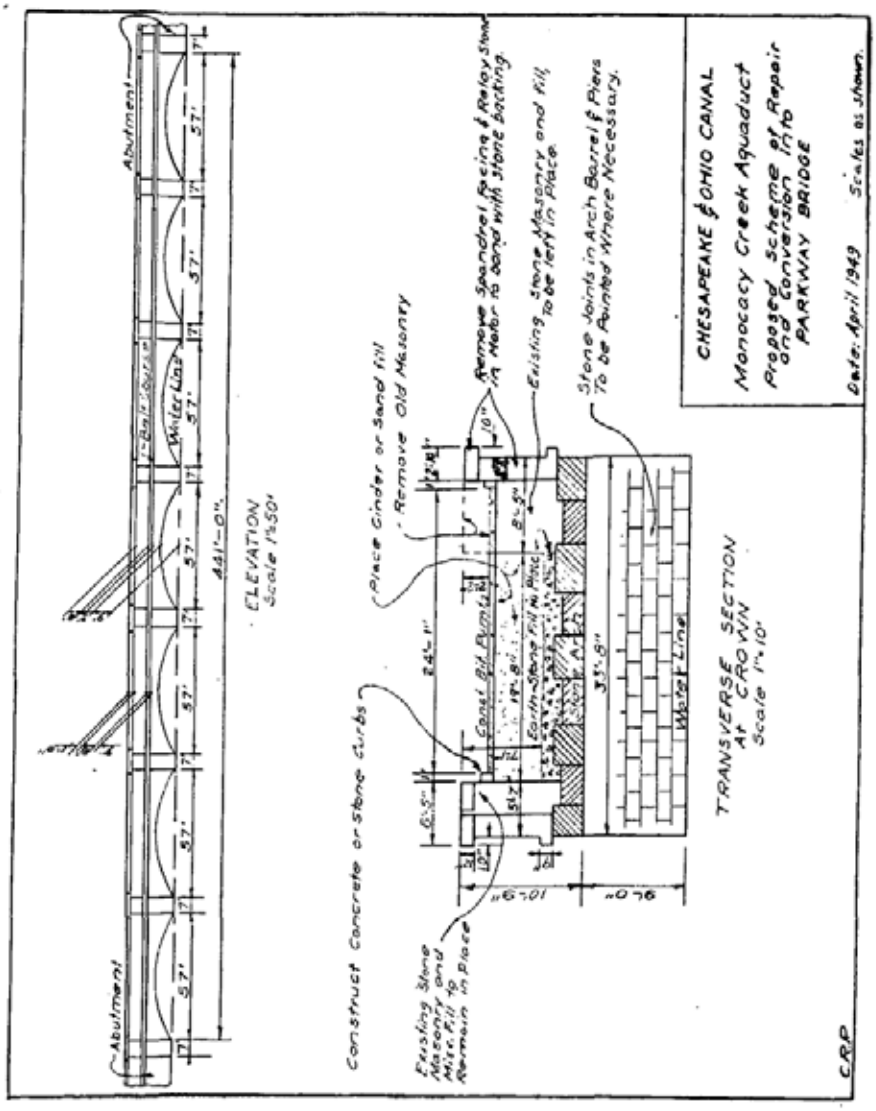
[1] Includes 1 wooden flume.

Miscellaneous structures on the Chesapeake & Ohio Canal

Item No.	Description of structure	Number of structures	Repair work required	Estimated cost of repairs
13	Tunnel, 3,080 feet long, brick lined	1	Grout behind arch; patch brick lining	$30,000
	Major culverts	11±	Rebuild headwalls and arch barrels in part.	75,000
	Minor culverts and vehicular underpass.	111±	Point joints in arch barrels	45,000
	Bridges over canal, highway	13±	No work required, existing bridges satisfactory.	
	Bridges over canal, railroad	16±	do	
	Total for miscellaneous structures.			150,000

SUMMARY—COST OF REPAIR OF STRUCTURES

Repair of aqueducts	$550,000
Repair of miscellaneous structures	150,000
Total for structures	700,000


Abutment
Railing
Water Line
57'
441'-0"
ELEVATION
Scale 1"=50'
Abutment
Construct Concrete or Stone Curbs
Existing Stone Masonry and Mortar Fill to Remain in Place
Place Cinder or Sand Fill
Remove Old Masonry
Remove Spandrel Facing & Relay Stone in Mortar to Bond with Stone Backing
Existing Stone Masonry and Fill to be left in Place
Stone Joints in Arch Barrel & Piers To be Pointed Where Necessary.
Coping
Earth-Stone Fill
Stone Arch
Water Line
TRANSVERSE SECTION AT CROWN
Scale 1"=10'
CHESAPEAKE & OHIO CANAL
Monocacy Creek Aquaduct
Proposed Scheme of Repair and Conversion into PARKWAY BRIDGE
Date: April 1949 Scales as shown.
C.R.P.

71542—50——7

Appendix E. Report on Anticipated Traffic on the Proposed Chesapeake & Ohio Canal Parkway Between Great Falls and Cumberland, Md.

May 10, 1950.

To: Mr. H. J. Spelman, division engineer, Arlington, Va.
From: H. S. Fairbank, Deputy Commissioner
Subject: Traffic assignment to the proposed Chesapeake and Ohio Parkway between Great Falls and Cumberland, Md.

Our analysis of this problem recognizes that the Chesapeake and Ohio Canal is located in an area of exceptional scenic and historic interest. When the parkway is built a scenic drive of approximately 185 miles will rise from 5 feet above sea level at Washington to 610 feet elevation at Cumberland, Md. The parkway will have limited access and will be constructed to modern design standards. These features will make the route unusually attractive to traffic.

Your office has indicated present plans provide for access points only at or near the following places:

1. Great Falls
2. Seneca
3. Edwards Ferry
4. Point of Rocks
5. Brunswick
6. Harpers Ferry
7. Shepherdstown
8. Williamsport
9. Hancock
10. Paw Paw, W. Va.
11. Cumberland, Md.

On the basis of our traffic analysis, and additional access point to the parkway near Licksville, Md., or a relocation of the Point of Rocks access appears to be desirable. This would save about 8 miles of travel on trips between Frederick and Great Falls and Washington, D. C. Otherwise, it is doubtful whether such trips would use the facility.

In the assignment of traffic on the Chesapeake and Ohio Parkway the information from the following sources has been utilized:

1. Washington (D. C.) comprehensive metropolitan area survey
2. Hagerstown (Md.) simplified traffic study
3. Frederick (Md.) simplified traffic study
4. Schedules of Blue Ridge Bus Co.
5. Travel to all national parks
   (*a*) To Great Smoky Mountains Park (Tenn.-N. C.)
   (*b*) To Shenandoah National Park (Va.)
6. Traffic and tourist study in Great Smoky Mountains Park in August 1947

The travel distance and time on existing routes have been compared with the estimated distance and time on the proposed parkway including the necessary travel to and from the parkway. The distance and travel time have been carefully studied before assignments of traffic have been made. It should be realized, however, that absolute distances cannot be determined since the parkway has not yet been constructed. Fractions of a mile have been dropped in the computations. Bus-scheduled travel time (Blue Ridge) has been converted to miles per hour between Hagerstown and Washington and other points as follows (stop-over time in towns is not included): Washington

to Frederick, 34 miles per hour; Hagerstown to Hancock, 33 miles per hour; Hancock to Cumberland, 26 miles per hour. On the assumption that average passenger-car speeds generally are no higher than bus speeds, a speed of 35 miles per hour for passenger cars has been assigned to regular routes between Washington and Hancock, and 30 miles per hour over the mountainous route between Hancock and Cumberland. These figures are below open-road speeds since the time lost in entering or leaving Washington and through the towns on the regular routes is included. They are higher than bus-scheduled speeds however, and thus give a conservative base for comparison of speeds on the parkway. Speeds on the parkway were assumed to be 45 miles per hour.

Traffic was generally assigned on the assumption that the route of least travel time would be used. However, a portion of the traffic has been assigned to the parkway in a few instances where a minute or so longer travel time appears to be required. On the other hand, in cases where the adverse distance via the parkway was great, even though the travel time was less, it was assumed that much of the travel would continue to follow the old route.

No consideration has been given to the ease of driving on an improved highway of modern design as compared with the delay and inconvenience on the inadequate existing routes. Neither has consideration been given the scenery along the parkway which in itself will induce much diversion even at the expense of extra time or mileage. Thus in this respect also, the estimates are believed to be conservative.

Unlike most parkways of this type, access to the Chesapeake and Ohio route will be at comparatively frequent intervals. There are four sections whose lengths are less than 10 miles, two sections of 11 and 20 miles respectively, and four other sections ranging from 24 to 31 miles in length.

In the Washington metropolitan area survey, trips have been tabulated between that area and each State. Trips from certain States would normally follow U S 40. Three-fourths of these have been assigned to the parkway from Hancock to Washington while one-third of them have been assigned between Cumberland and Hancock.

There were trips, however, between Washington, New York, and eastern Pennsylvania which were intercepted at Frederick and were assigned to the parkway. It is more than likely that drivers on such trips, since they were actually travelling out of their way anyway, would have used the parkway not only to Point of Rocks but to Williamsport or possibly to Hancock. However, only one-half of these trips were assigned to the parkway.

It is known that there would be considerable traffic that would use the parkway that has not been measured in any survey. This includes the travel between towns which are located within a reasonable distance of the facility between Washington and Cumberland. Since Virginia Route 7 has been improved a considerable number of trips from Loudoun and Frederick Counties, Va. and the Shenandoah Valley would undoubtedly use this route to Leesburg and the parkway from there to Washington. Data to show the probable number of such trips were not available.

The information relative to most of the diverted traffic was obtained on weekdays during the period from May to September 1948. The traffic in Washington for that period averages 105 percent of the annual

average daily traffic. The long-distance trips do not conform to this pattern and they would be fewer during the remainder of the year. However, the extra diverted traffic on Saturday and Sunday over that for weekdays would undoubtedly increase the total so such an extent that the values shown would approximate the annual average diverted traffic. Traffic on rural roads increased approximately 8 percent in 1949 over 1948.

The discussion so far has concerned diverted traffic. There also will be generated traffic that will use this facility. In 1933, 100,000 private automobiles, and in 1936, the same year that the Shenandoah National Park was opened, 194,932 vehicles entered the Great Smoky Mountains National Park. During the first year that the Shenandoah National Park was open, 203,525 private automobiles were reported as entering that park. These facilities are located some sixty to several hundred miles from population centers of the size of Washington.

A study of the traffic in the Great Smoky Mountains Park in August 1947 showed that 52 percent of the trips had an origin within a radius of 75 miles of the park, 29 percent 75–199 miles, and 19 percent more than 200 miles from the park. A population of 20,000,000 live within a radius of 200 miles of the Chesapeake and Ohio Parkway and this does not include New York City and environs with another 10,000,000 just outside this radius. There is now a population of 1¼ million within the Washington metropolitan area. It would not be surprising if two or three times as much traffic were generated on sections of the Chesapeake and Ohio Parkway when opened as was generated in the Shenandoah National Park during the first year. Likewise, the Chesapeake and Ohio Parkway will carry much more diverted traffic than either of the other parkways.

Passenger cars on main rural roads have increased approximately 66 percent between 1936 and 1949. During the same period the travel to all national parks approximately doubled. On the basis of the main rural-road traffic increase alone, it might have been expected that 338,000 vehicles would have entered the Shenandoah National Park in 1949. Actually there were 327,953 passenger cars reported as entering that park in 1949. Similarly, it would have been expected that 324,000 passenger cars would have entered the Great Smoky Mountains Park during the same year. There were, however, 443,087 vehicles reported as entering that park in 1949. Here the increase has been much greater than the general or park traffic increase. It is conservative to assume that the travel to a park would increase at least to the extent of the travel of passenger cars on main rural highways.

On the basis of the number of vehicles entering the Great Smoky Mountains Park and the Shenandoah National Park during the first year that these facilities were opened to the public and taking into consideration the increase in the traffic on main rural highways in the meantime, it is estimated that at least 420,000 vehicles would use some part of the Chesapeake and Ohio Parkway beyond GreatFalls solely for recreational purposes if it had opened in 1949. This is generated traffic and is in addition to that estimated to be diverted from existing routes as shown in table 1.

On the basis of the above assumptions, diverted traffic has been assigned to the several sections of the parkway as listed in table 1 along with the generated traffic by sections. The weighted average for the 169.3 miles between Cumberland and Great Falls is 1,355

vehicles per day and from Hancock to Great Falls is 1,750 vehicles per day.

Reports from the National Park Service for the travel year of 1949 indicate that 97 percent of the visitors to national parks used private automobiles as a mode of travel. This same agency's figures show that the peak month of travel is 3.16 times the average month for the year. Similarly, the peak month of travel in the Great Smoky Mountains was 3.14 times the average month and the peak month in the Shenandoah National Park in Virginia was 2.34 times the average month. This clearly shows that the average annual daily traffic cannot be used for design purposes. In addition the peak day traffic during the peak month is several times that for the average day of that month.

The peak days at three entrances to the Shenandoah National Park averaged 6.7 times the annual daily average. Experience shows that, on main rural roads, peak Sunday traffic occurring during several summer months ranges from 1.5 to 3.0 times the annual average traffic. By using the factor 2 for diverted traffic and 7 for generated traffic, the volumes on Sundays during the summer should approximate 8,500 vehicles per day on the 36 miles north of Great Falls. It is not unreasonable to expect days with more than 10,000 vehicles during the summer.

TABLE 1.—*Estimates of diverted and generated traffic that would use the proposed Chesapeake and Ohio Parkway*

Parkway section	Miles	Average daily traffic estimates		
		Diverted	Generated	Total
Cumberland–Paw Paw	28.9	310	330	640
Paw Paw–Hancock	31.5	310	330	640
Hancock–Williamsport	24.3	1,000	330	1,330
Williamsport–Shepherdstown	27.6	905	415	1,320
Shepherdstown–Harpers Ferry	11.0	1,100	410	1,510
Harpers Ferry–Brunswick	5.0	1,255	495	1,750
Brunswick–Point of Rocks	4.8	1,275	495	1,770
Point of Rocks–Edwards Ferry	20.4	1,730	660	2,390
Edwards Ferry–Seneca	8.1	1,810	660	2,470
Seneca–Great Falls	7.7	1,770	740	2,510
Cumberland–Great Falls	169.3	922	433	1,355

TABLE 1A.—*Time and distance via parkway compared with time and distance on regular routes for same places where there might be question as to which route would be used*

	Time (minutes) via—		Miles	
	Parkway	Regular routes	Parkway	Regular routes
Hancock–Washington	164	171	124	100
Hancock–Hagerstown	42	48	30	28
Hancock–Frederick [1]				
Hancock–Cumberland	79	78	60	39
Hagerstown–Cumberland	122	126	91	67
Hagerstown–Washington	123	123	89	72
Harpers Ferry–Washington	80	109	61	64
Cumberland–Washington	244	249	185	139
Leesburg–Washington	49	60	36	35
Frederick–Washington	80	79	58	46

[1] Same, or more favorable, with respect to time as Hagerstown to Hancock depending on routes used to parkway at Williamsport.

Appendix F. Estimates of Cost of Construction of Proposed Chesapeake & Ohio Canal Parkway

SUMMARY OF ENGINEER'S ESTIMATE ON CHESAPEAKE AND OHIO CANAL PARKWAY

Road construction

	Great Falls to Shepherdstown	Shepherdstown to Hancock	Hancock to Cumberland	Total
Length	57.3	52.4	58.5	168.2
Single roadway construction	$4,572,689	$4,766,445	$3,474,735	$12,813,869
Second roadway construction	[1] 880,000		[2] 120,000	1,000,000
Plans, surveys, engineering, and landscape supervision:				
Single roadway	777,311	810,555	590,265	2,178,131
Second roadway	149,600		20,400	170,000
Total	6,379,600	5,577,000	4,205,400	16,162,000

GREAT FALLS TO SHEPHERDSTOWN

[Length 57.3 miles, single roadway]

Item No.	Item	Estimated quantity	Unit	Unit price	Amount
20 (1)	Clearing and grubbing	355	Acre	$250.00	$88,750
23 (1)	Stripping and storing topsoil	71,017	Cubic yard	.30	21,305
24 (1)	Unclassified excavation	173,165	do	1.00	173,165
25 (1)	Unclassified excavation for structures	42,500	do	2.50	106,250
26 ( )	Unclassified excavation for borrow	1,585,722	do	.75	1,189,292
35 (1)	Replacing topsoil	176,083	do	.60	105,650
	Bituminous pavement on crushed stone or crushed gravel base.	57.3	Mile	27,000.00	1,547,100
206 (1)	Concrete, class A	1,600	Cubic yard	40.00	64,000
207 (1)	Reinforcing steel	125,000	Pound	.10	12,500
242 (1)	Cement rubble masonry	1,800	Cubic yard	40.00	72,000
246 (1)	Class A stone masonry facing for concrete	250	do	40.00	10,000
250 (1)	18-inch standard-strength reinforced-concrete culvert pipe.	31,500	Linear foot	3.00	94,500
262 ( )	Guardrail or guard wall	95,000	do	2.00	190,000
312 (1)	Loose riprap	18,750	Cubic yard	4.00	75,000
321 (1)	Drop inlets, type 2	75	Each	100.00	7,500
321 (4)	Reinforced-concrete inlet covers	75	do	15.00	1,125
402 (1)	Seeding	15,274	Seeding unit	8.00	122,192
	Road construction at recreation areas				75,000
	Access connection structures				200,000
	Repair of existing structures				327,360
	Total for construction				4,572,689
	Plans, surveys, engineering, and landscape supervision.				777,311
	Total				5,350,000

[1] 22 miles.
[2] 3 miles.

Road construction—Continued

SHEPHERDSTOWN TO HANCOCK

[Length 52.4 miles, single roadway]

Item No.	Item	Estimated quantity	Unit	Unit price	Amount
20 (1)	Clearing and grubbing	372	Acre	$250.00	$93,000
23 (1)	Stripping and storing topsoil	85,188	Cubic yard	.30	25,556
24 (1)	Unclassified excavation	386,211	do	1.00	386,211
25 (1)	Unclassified excavation for structures	14,200	do	2.50	35,500
26 ( )	Unclassified excavation for borrow	1,302,658	do	.75	976,994
35 (1)	Replacing topsoil	133,162	do	.60	79,897
	Bituminous pavement on crushed stone, or crushed gravel base.	52.4	Mile	27,000.00	1,414,800
206 (1)	Concrete, Class A	2,500	Cubic yard	40.00	100,000
207 (1)	Reinforcing steel	225,000	Pound	.10	22,500
240 (1)	Dry rubble masonry	22,200	Cubic yard	30.00	666,000
242 (1)	Cement rubble masonry	4,100	do	40.00	164,000
246 (1)	Class A stone masonry facing for concrete	225	do	40.00	9,000
250 (1)	18-inch standard-strength reinforced-concrete culvert pipe.	13,800	Linear foot	3.00	41,400
262 ( )	Guardrail or guardwall	93,500	do	2.00	187,000
312 (1)	Loose riprap	5,600	Cubic yard	4.00	22,400
321 (1)	Drop inlets, type 2	25	Each	100.00	2,500
321 (4)	Reinforced-concrete inlet covers	25	do	15.00	375
402 (1)	Seeding	12,874	Seeding unit	8.00	102,992
	Road construction at recreation areas				46,000
	Access connection structures				190,000
	Repair of existing structures				200,320
	Total for construction				4,766,445
	Plans, surveys, engineering, and landscape supervision.				810,555
	Total				5,577,000

HANCOCK TO CUMBERLAND

[Length 58.5 miles, single roadway]

20 (1)	Clearing and grubbing	356	Acre	$250.00	$89,000
24 (1)	Unclassified excavation	453,800	Cubic yard	1.00	453,800
25 (1)	Unclassified excavation for structures	24,600	do	2.50	61,500
26 ( )	Unclassified excavation for borrow	325,900	do	.75	244,350
35 (1)	Replacing topsoil	113,200	do	.60	79,920
	Bituminous pavement on crushed stone or crushed gravel base.	58.5	Mile	27,000.00	1,579,500
206 (1)	Concrete, class A	2,750	Cubic yard	40.00	110,000
207 (1)	Reinforcing steel	268,200	Pound	.10	26,820
242 (1)	Cement rubble masonry	1,750	Cubic yard	40.00	70,000
246 (1)	Class A stone masonry facing for concrete	250	do	40.00	10,000
250 (1)	18-inch standard-strength reinforced-concrete culvert pipe.	18,650	Linear foot	3.00	55,950
262 ( )	Guardrail or guard wall	88,500	do	2.00	177,000
321 (1)	Drop inlets, type 2	5	Each	100.00	500
321 (4)	Reinforced-concrete inlet covers	5	do	15.00	75
402 (1)	Seeding	11,000	Seeding unit	8.00	88,000
	Road construction at recreation areas				16,000
	Access connection structures				210,000
	Repair of existing structures				172,320
	Total for construction				3,474,735
	Plans, surveys, engineering, and landscape supervision.				590,265
	Total				4,065,000

Road construction—Continued

SECOND ROADWAY

Great Falls to Monocacy, 22 miles at $40,000	$880,000
Plans, surveys, engineering, and landscape supervision	149,600
	1,029,600
3 miles south of Cumberland to Cumberland, 3 miles at $40,000	120,000
Plans, surveys, engineering, and landscape supervision	20,400
	140,400
Total for construction	1,000,000
Plans, surveys, engineering, and landscape supervision	170,000
	1,170,000

ROAD CONSTRUCTION OF RECREATION AREAS

Location	Grading	Drainage and structures	Curb	Topsoil and seeding	Paving	Amount
Great Falls to Shepherdstown:						
Monocacy	$12,500	$2,800	$1,600	$3,600	$19,500	$40,000
Harper's Ferry	4,100	2,800	2,000	1,300	6,800	17,000
Shepherdstown	5,700	2,800	400	900	9,000	18,000
Total						75,000
Shepherdstown to Hancock:						
Falling Waters	4,000	1,000	800	700	9,500	16,000
Four Locks	11,000	4,000	500	1,500	13,000	30,000
Total						46,000
Hancock to Cumberland:						
Little Orleans	7,800		300	1,200	2,700	12,000
East of tunnel	800		250	250	2,700	4,000
Total						16,000
Total for road construction of recreation areas						137,000

Road construction—Continued

ACCESS CONNECTIONS AND STRUCTURES

Location	Description	Amount
Great Falls to Shepherdstown:		
Rushville	Canal crossing	$20,000
Seneca	Divided roads with inner circle	10,000
Edward's Ferry	Bridge over parkway	40,000
White's Ferry	Bridge over parkway	40,000
Monocacy	(See road construction of recreation areas)	----------
Point of Rocks	Bridge over railroad and parkway	150,000
Brunswick	Divided roads with inner circle	20,000
Harpers Ferry	Connection at grade	10,000
Shepherdstown	(See road construction of recreation areas)	----------
Total		290,000
Shepherdstown to Hancock:		
Williamsport	Bridge over parkway	40,000
Fort Frederick	Parkway over bridge at McCoy's Ferry	75,000
Hancock	Bridge over railroad to Route 40	75,000
Total		190,000
Hancock to Cumberland:		
Paw Paw	Connections to Route 51	20,000
South of Old Town	4 canal crossings, at $20,000	80,000
Oldtown	Bridge over parkway	50,000
South Cumberland	Bridge over canal	40,000
Cumberland	Special paving at terminus	50,000
Total		240,000
Total for construction of access connections and structures		720,000

REPAIR OF EXISTING STRUCTURES

Great Falls to Shepherdstown:		
Seneca Creek	Repair existing structure	$40,000
Broad Run	do	5,000
Monocacy River	do	100,000
Catoctin Creek	do	55,000
Antietam Creek	do	50,000
9 major culverts	Rebuild headwalls and arch barrels	61,360
38 minor culverts	Point joints in arch barrels	16,000
Total		327,360
Shepherdstown to Hancock:		
Conococheague Creek	Repair existing structure	100,000
Licking Creek	do	30,000
Big Tonoloway Creek	do	45,000
1 major culvert	Rebuild headwalls and arch barrel	6,820
44 minor culverts	Point joints in arch barrels	18,500
Total		200,320
Hancock to Cumberland:		
Sideling Creek	Repair existing structure	30,000
15 Mile Creek	do	30,000
Town Creek	do	30,000
Evitts Creek	do	35,000
1 major culvert	Rebuild headwall and arch barrel	6,820
25 minor culverts	Point joints in arch barrels	10,500
1 tunnel	Grout behind arch and patch lining	30,000
Total		172,320
Total for repair of existing structures		700,000

Road construction—Continued

PROPOSED PHYSICAL IMPROVEMENTS

Location	Description	Amount
New buildings:		
Rushville	Ranger station and comfort station	$15,000
Monocacy	do	15,000
Harpers Ferry	Combination rangers' quarters and checking station	15,000
	5 comfort stations	37,500
	Sewage disposal	1,000
	Well and tank and pump house	1,550
	Utility center	50,000
Shepherds Ferry	Combination checking station and rangers' quarters	15,000
	3 comfort stations	22,500
	Disposal system	1,000
	Well, pump, and tank	1,550
Falling Waters	Combination checking station and rangers' quarters	15,000
	3 comfort stations	22,500
	Disposal system	1,000
	Well, pump, and tank	1,500
Four Locks	Combination checking station and rangers' quarters	15,000
	6 comfort stations	45,000
	Disposal system	1,000
	Well, pump, and tank	1,550
Paw Paw tunnel	Combination checking station and rangers' quarters	15,000
	3 comfort stations	22,500
	Disposal system	1,000
	Well, pump, and tank	1,550
Little Orleans	Comfort station	7,500
Oldtown	Comfort station	7,500
	Contact station	15,000
Cumberland	Headquarters building including office, concession, museum and utility center.	175,000
		522,700
Restoration, locks, dams, canal:		
Aqueducts, tunnel culverts. (See estimate for restoration and adaptation to road use.)		
Canal and locks restored:		
1. Full restoration in areas where water is to be restored to canal.		
A. Dam No. 5 to lock No. 42 (18 miles).		
Clearing and grubbing		71,200
Repairing locks		12,000
Bulkheads, etc.		1,200
1 control gate		2,000
36-inch conduit at Williamsport		90,000
Repair to canal		4,500
		180,900
B. Big pool to lock No. 47		43,130
2. Locks at developed areas to be fully restored: Nos. 27, 35, 36, 38, 45, 46, 62, 63, 64, 65, 10 at $2,500		25,000
3. Locks to be stabilized: 25 at $800		20,000
4. Dams to be restored: Dams 3, 4, and 5 are used as power dams and are a source of some income. They are repaired by others. Dams 6 and 7 are not in use and not to be restored. Dam No. 2 at Seneca is now in fair repair and could be capped similar to dam No. 1 for		50,000
		319,030
Buildings to be restored:		
Lock house at No. 27, Monocacy		7,500
Tavern at Monocacy		12,500
Feed elevator, Monacacy		7,500
Lock house, Point of Rocks No. 28		7,500
Lock house No. 29		7,500
Lock house No. 31, Weverton		7,500
Lock house at Dargan No. 34		7,500
Lock house at dam No. 3 and No. 26		7,500
Buildings to be stabilized:		
Seneca lock house No. 24		5,000
Edwards Ferry No. 25		5,000
Mountain Ferry No. 37		5,000
Lock house No. 42		3,000
Lock house No. 44 Williamsport		3,000
Lock house No. 52 Hancock		3,000
Lock house No. 56		3,000
Lock house No. 57		3,000
Lock house No. 66		3,000
Lock house No. 71		3,000
Pumphouse No. 72		3,000
		104,000

SUMMARY

Building restoration and stabilization	104,000
Dam, lock, and canal restoration	319,000
Physical improvements, buildings, etc	522,700
Total	945,700

Appendix G. Contract for Sale of Property of the Chesapeake & Ohio Canal Co.

This Agreement, Made this 6th day of August 1938, by and between Edgar W. Young, R. S. B. Hartz and G. L. Nicolson, Receivers as hereinafter mentioned (herein referred to as Receivers), parties of the first part, and the United States of America, acting through the Secretary of the Interior or other authorized representative (hereinafter sometimes referred to as the Purchaser), party of the second part.

Witnesseth:

Whereas, by order entered April 29, 1938, by the Circuit Court for Washington County, Maryland, in the Equity Case entitled "George S. Brown et al., Trustees, vs. the Chesapeake and Ohio Canal Company et al., Nos. 4191 and 4198, Equity, Consolidated Causes," and by order entered May 2, 1938, by the District Court of the United States for the District of Columbia in the Ancillary Equity Case entitled "George S. Brown et. al. Trustees vs. the Chesapeake and Ohio Canal Company et. al., Equity No. 12240", the said Courts upon petition of The Baltimore and Ohio Railroad filed in said causes, did appoint Edgar W. Young, R. S. B. Hartz and G. L. Nicolson as Receivers of all the property, estate, rights and franchises of the Chesapeake and Ohio Canal Company and authorized said Receivers to negotiate for the sale and to enter into a contract or contracts for the sale of said property, estate, rights and franchises in one or more parcels and upon such terms and conditions as they might deem to be in the best interests of the estate and creditors of the Chesapeake and Ohio Canal Company, subject, however, to the approval of said Courts; and

Whereas said Receivers have negotiated for the sale of said property, estate, rights and franchises, with certain reservations hereinafter set forth, to the United States of America, and believe, after a careful examination of the whole subject, that a sale upon the terms and conditions hereinafter set forth will be, under all the circumstances, a fair and adequate one, and are willing to report the same to said Courts with the recommendation that the same shall be accepted by said Courts and that thereupon such further proceedings shall be had in said cases as said Courts shall direct to vest a good and satisfactory title to said property, estate, rights and franchises in the United States of America, or such Department, or nominee or nominees thereof, as it may direct, subject to the terms of this agreement; and

Whereas, as a preliminary to such report of said negotiations, it is necessary that the parties hereto execute this agreement, which is to be made a part of any report of sale of said property, estate, rights and franchises, and of the ratification thereof, and of any deed ordered by said Courts to be made granting the same to said Purchaser, and which is to be and become fully effective and binding as to all its parts, covenants and specifications between the parties hereto in case said Courts shall approve said negotiations and contract to sell and by proper proceedings cause title to said property, estate, rights and franchises to be vested in said Purchaser as aforesaid.

Now, Therefore, in consideration of the premises and of One Dollar ($1.00) cash in hand paid, and in order to carry out all the aforegoing

objects and purposes, it is covenanted and agreed between the parties hereto as follows:

(1) Said Receivers agree forthwith to recommend to said Courts that all property, estate, rights, and franchises of the Chesapeake and Ohio Canal Company, now vested in them, excepting, however, the reserved portions hereinafter described, be sold to the United States of America for the sum of Two Million Dollars ($2,000,000), and it is understood and agreed by both parties hereto that the real property referred to above includes all of these parcels or tracts of land in the States of Maryland, Virginia, and West Virginia, as shown on the "property maps of the Chesapeake and Ohio Canal Company as surveyed by B. F. Mackall under the direction of G. L. Nicolson, General Manager," and all of those parcels or tracts of land in the District of Columbia as shown on the "plats of the Chesapeake and Ohio Canal Company property as surveyed by H. W. Brewer, February 1894," to the extent that said property is now owned by the said Receivers, together with any and all other parcels or tracts of land, the title to which is now vested in the said Receivers.

(2) The United States of America agrees that in case said Courts shall approve this contract to sell and by proper proceedings cause a good and sufficient title to said property, estate, rights, and franchises to be vested on or before January 1, 1939, in the United States of America, or such Department or nominee or nominees thereof, as it may designate, that it will pay in cash to said Receivers, upon the execution and delivery of a proper deed, the sum of Two Million Dollars ($2,000,000).

(3) The United States of America agrees that it will not use or permit to be used all or any part of the property herein referred to for the conveyance of freight or passengers by land without the prior written consent of the Baltimore and Ohio Railroad Company, provided, however, that this covenant shall not extend to such transportation facilities on the lands covered by this agreement as are considered by the Secretary of the Interior, or his successors, to be reasonably necessary to provide accommodations for the visiting public.

(4) The portions of property of the Chesapeake and Ohio Canal Company described in Exhibit A, attached hereto and hereby made a part hereof, are reserved to said Receivers for other disposition and are excluded from the operation of this contract of sale except as specifically provided therein.

(5) That all of the lands being reserved from sale in accordance with Exhibit A of paragraph (4) of this contract shall be surveyed and the corner posts and boundary lines thereof definitely established by the Receivers, or their agents, within six (6) months of the date of approval of the final contract for the sale of the said canal property by the Courts having jurisdiction over such property.

(6) That before title to the lands covered by this contract shall be accepted by the United States, the said Receivers, or their agents, shall secure from all occupants of land covered by this contract a cancellation or surrender of any leases, licenses, or other instruments, or termination of their right to occupancy, which such occupants may have covering such property, provided, however, that this provision shall not extend to existing water leases. Any occupants failing to cancel or surrender such instruments, or whose rights have

not been otherwise terminated, shall be removed by the said Receivers, or their agents, before title to the canal property covered by this contract is accepted on behalf of the United States, unless the Secretary of the Interior, or his successors, shall waive this requirement as to any such occupants.

(7) That, upon the approval of this contract by Courts of competent jurisdiction, the said Receivers shall make available to the Secretary of the Interior, or his successors, all existent land and other records relating to the canal property, and such additional data, maps, reports, papers, documents, and personal property as bear upon the ownership and history of the canal. The said Secretary of the Interior, or his successors, shall then be entitled to possession of such of the material so made available as in his discretion is desirable for permanent retention by the United States when title to the said canal property is accepted by the United States of America. It is understood, however, that this provision does not obligate the said Receivers to produce records, documents, maps, etc., if they have no rights of possession or ownership thereto.

(8) That during the period covered by this instrument the said Receivers do hereby grant to the officers and accredited agents and representatives of the United States of America, at all proper times, unrestricted right and privilege to survey or enter said property of the Chesapeake and Ohio Canal Company for all proper and lawful purposes in connection with the negotiations for the acquisition thereof.

(9) That when the United States of America, acting through the Secretary of the Interior or other authorized representative, shall have approved and signed this contract, then, in that event, this instrument shall constitute a contract of bargain and sale between the parties hereto.

(10) No Member of or Delegate to Congress or resident commissioner shall be admitted to any share or part of this contract or to any benefit that may arise therefrom. Nothing in this paragraph, however, shall invalidate this contract if made with a corporation for its general benefit.

In Witness Whereof, said Receivers and the United States of America have caused this agreement to be executed in triplicate the day and year aforesaid.

Signed, sealed and delivered in the presence of (2 witnesses to each signature):

[s] D. WILLARD, Jr.
[s] HENRY J. MEIER, Sr.

[s] EDGAR W. YOUNG [SEAL]

[s] R. S. B. HARTZ [SEAL]

[s] D. WILLARD, Jr.
[s] HENRY J. MEIR, Sr.

[s] G. L. NICHOLSON [SEAL]

[s] D. WILLARD, Jr.
[s] F. J. WORTHINGTON

Receivers of the Chesapeake and Ohio Canal Company.

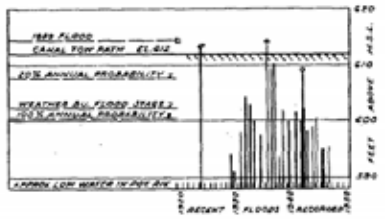
THE UNITED STATES OF AMERICA,
By [s] E. K. BURLEW,
Acting Secretary of the Interior.

Approved August 6, 1938.

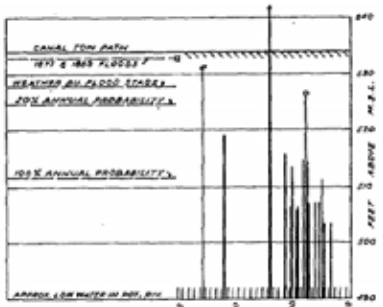
O

NATIONAL PARK SERVICE

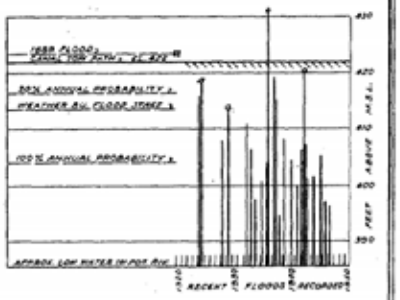
PLATE 6



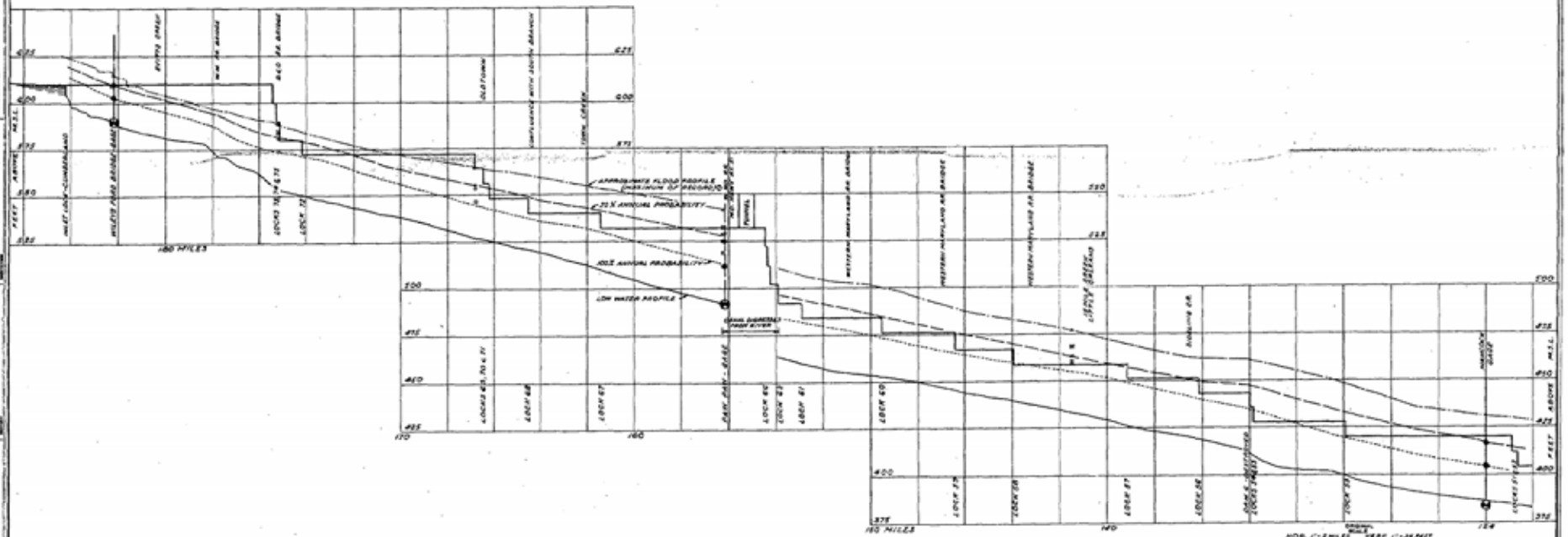
CUMBERLAND
WILEY'S FORD BRIDGE
U.S.G.S. GAGE
GAGE ZERO = 588.32 M.S.L.



PAW PAW
NEAR HIGHWAY BRIDGE
U.S.G.S. GAGE
GAGE ZERO = 487.88 M.S.L.



HANCOCK
15 MILE BELOW HIGHWAY BRIDGE
U.S.G.S. GAGE
GAGE ZERO = 383.86 M.S.L.



BENCH MARKS ESTABLISHED BY U.S.C.O. ON CANAL LOCKS
LOCK 55, ⊕ CUT IN TOP OF CAPSTONE, ELEV. 443.81
LETTERED "BM U.S.C.O. 1878"
LOCK 58, BRONZE DISK IN CAPSTONE, ELEV. 467.18
LOCK 63, ⊕ CUT IN TOP OF CAPSTONE, ELEV. 536.92
LOCK 74, TOP OF BOLT IN CAPSTONE, ELEV. 600.35
LOCK 75 ⊕ CUT IN TOP OF CAPSTONE, ELEV. 619.31

BASIC DATA

⊙ REVISED 1/11/30

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
NATIONAL CAPITAL PARKS
ENGINEERING DIVISION

REGION N.C.P.

SHEET 3 OF 3

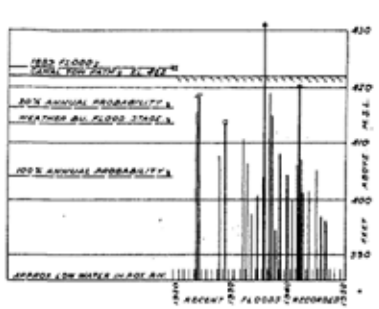
FLOOD CONDITIONS
WASHINGTON, D.C. TO CUMBERLAND, MD.
CHES. & OHIO CANAL PARKWAY SURVEY

DRAWING NO. N.C.P. 110-80-29-3

CLEARED

REVIEWED

DESIGNED BY H.D. MEYER

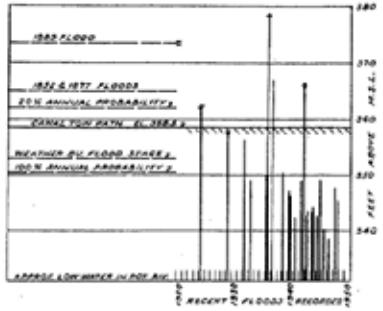


HANCOCK

19 MILE BELOW HIGHWAY BRIDGE

U.S.G.S. GAGE

GAGE ZERO-383.86 M.S.L.

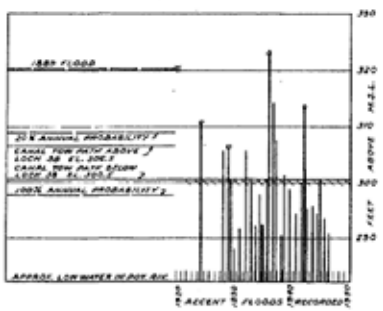


WILLIAMSPORT

WATERBOARD

U.S.W.B. GAGE

GAGE ZERO-350.00 M.S.L.

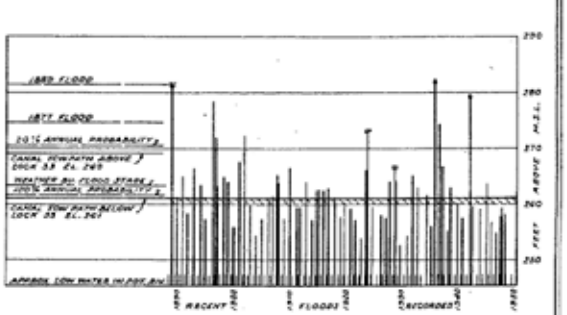


SHEPHERDSTOWN

NEAR HIGHWAY BRIDGE

U.S.G.S. GAGE

GAGE ZERO+281.00 M.S.L.

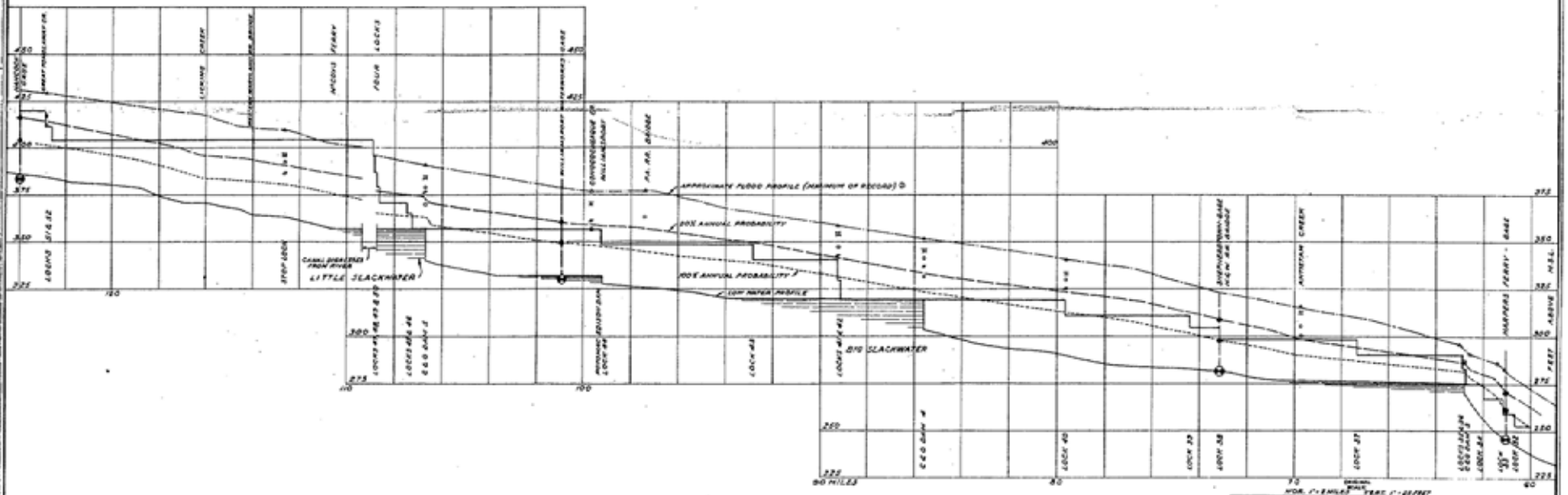


HARPERS FERRY

HIGHWAY BRIDGE

U.S.W.B. GAGE

GAGE ZERO-243.53 M.S.L.



BENCH MARKS ESTABLISHED BY U.S.E.D. ON CANAL LOCKS
LOCK 34, TOP OF CAPSTONE, ELEV. 275.66
LOCK 35, D CUT IN TOP OF CAPSTONE, ELEV. 283.43
LOCK 36, D CUT IN TOP OF CAPSTONE, ELEV. 291.14
LOCK 40, BRONZE DISK IN CAPSTONE, ELEV. 315.74
LOCK 41, D CUT IN TOP OF CAPSTONE, ELEV. 330.18
LOCK 46, ALUMINUM DISK IN CAPSTONE, ELEV. 371.37
STGA LOCK AT LOWER END OF BIG POOL, BRONZE DISK IN CAPSTONE, ELEV. 404.23

BASIC DATA

© REVISED 1/1/55

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
NATIONAL CAPITAL PARKS
ENGINEERING DIVISION

REGION N.C.P.

SHEET 2 OF 2

DRAWING NO. N.C.P. 110-80-23-2

FLOOD CONDITIONS

WASHINGTON, D.C. TO CUMBERLAND, MD.
CHES. & OHIO CANAL - PARKWAY SURVEY

REVIEWED

CLEARED

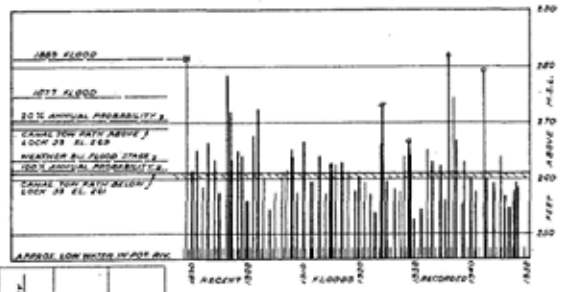
DESIGNED BY

TRACED BY

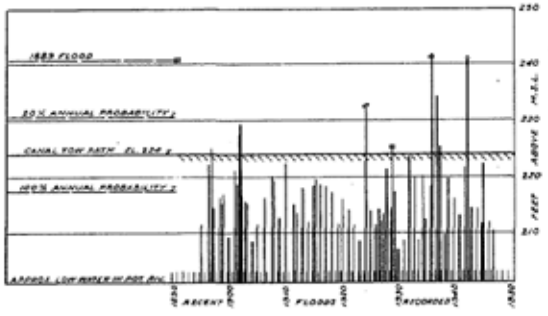
CHECKED BY

NATIONAL PARK SERVICE

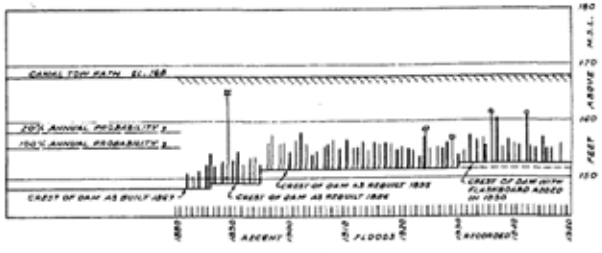
PLATE 6



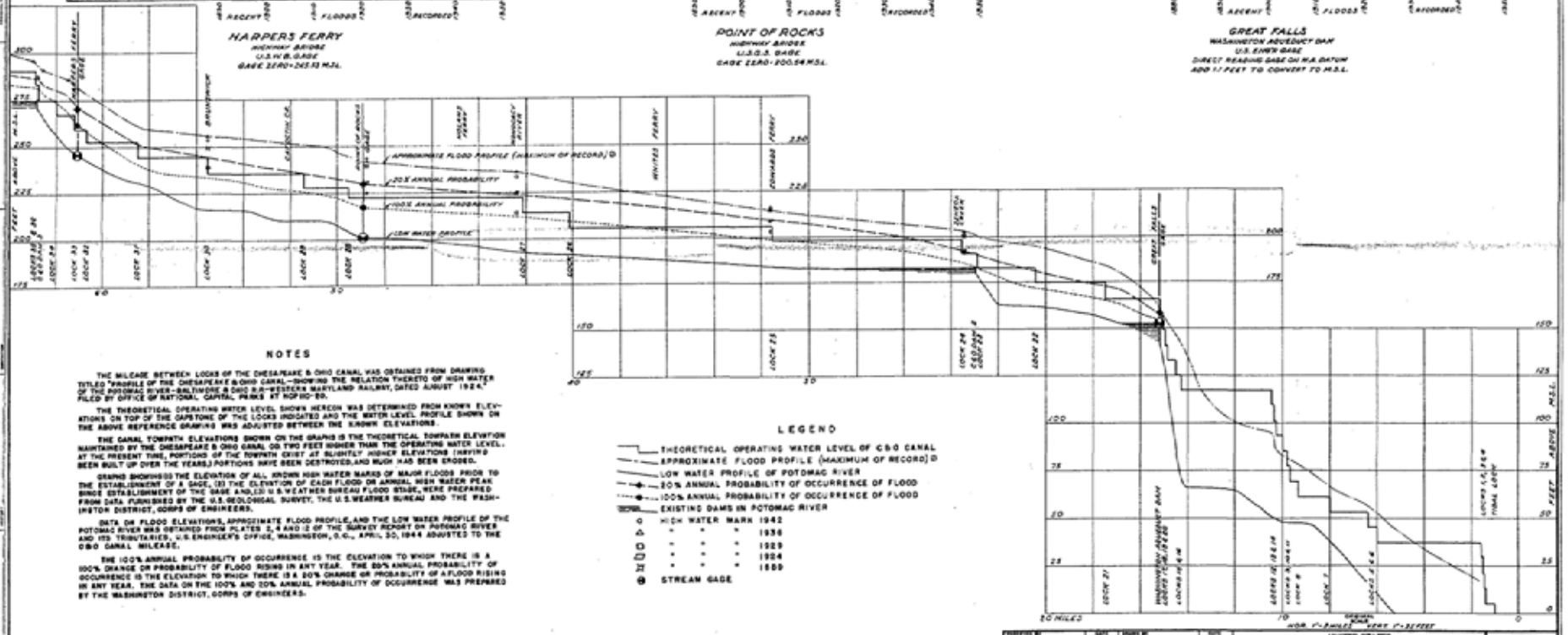
HARPERS FERRY
HIGHWAY BRIDGE
U.S.W.B. GAGE
GAGE ZERO=245.13 M.S.L.



POINT OF ROCKS
HIGHWAY BRIDGE
U.S.G.S. GAGE
GAGE ZERO=100.54 M.S.L.



GREAT FALLS
WASHINGTON AQUEDUCT DAM
U.S. EWR GAGE
DIRECT READING GAGE ON M.A. DATUM
ADD 1.7 FEET TO CONVERT TO M.S.L.



NOTES

THE MILEAGE BETWEEN LOCKS OF THE CHESAPEAKE & OHIO CANAL WAS OBTAINED FROM DRAWING TITLED "PROFILE OF THE CHESAPEAKE & OHIO CANAL—SHOWING THE RELATION THERETO OF HIGH WATER OF THE POTOMAC RIVER—BALTIMORE & OHIO R.R.—WESTERN MARYLAND RAILWAY, DATED AUGUST 1924," FILED BY OFFICE OF NATIONAL CAPITAL PARKS AT NCP 110-80.

THE THEORETICAL OPERATING WATER LEVEL SHOWN HEREON WAS DETERMINED FROM KNOWN ELEVATIONS ON TOP OF THE CAPSTONE OF THE LOCKS INDICATED AND THE WATER LEVEL PROFILE SHOWN ON THE ABOVE REFERENCE DRAWING WAS ADJUSTED BETWEEN THE KNOWN ELEVATIONS.

THE CANAL TOWPATH ELEVATIONS SHOWN ON THE GRAPH IS THE THEORETICAL TOWPATH ELEVATION MAINTAINED BY THE CHESAPEAKE & OHIO CANAL OR TWO FEET HIGHER THAN THE OPERATING WATER LEVEL. AT THE PRESENT TIME, PORTIONS OF THE TOWPATH EXIST AT SLIGHTLY HIGHER ELEVATIONS (HAVING BEEN BUILT UP OVER THE YEARS.) PORTIONS HAVE BEEN DESTROYED, AND MUCH HAS BEEN ERODED.

GRAPH SHOWING THE ELEVATION OF ALL KNOWN HIGH WATER MARKS OF MAJOR FLOODS PRIOR TO THE ESTABLISHMENT OF A GAGE, (2) THE ELEVATION OF EACH FLOOD OR ANNUAL HIGH WATER (PEAK) SINCE ESTABLISHMENT OF THE GAGE AND, (3) U.S. WEATHER BUREAU FLOOD STAGE, WERE PREPARED FROM DATA FURNISHED BY THE U.S. GEOLOGICAL SURVEY, THE U.S. WEATHER BUREAU AND THE WASHINGTON DISTRICT, CORPS OF ENGINEERS.

DATA ON FLOOD ELEVATIONS, APPROXIMATE FLOOD PROFILE, AND THE LOW WATER PROFILE OF THE POTOMAC RIVER WAS OBTAINED FROM PLATES 2, 4 AND 12 OF THE SURVEY REPORT ON POTOMAC RIVER AND ITS TRIBUTARIES, U.S. ENGINEER'S OFFICE, WASHINGTON, D.C., APRIL 20, 1944 ADJUSTED TO THE C&O CANAL MILEAGE.

THE 100% ANNUAL PROBABILITY OF OCCURRENCE IS THE ELEVATION TO WHICH THERE IS A 100% CHANCE OR PROBABILITY OF FLOOD RISING IN ANY YEAR. THE 20% ANNUAL PROBABILITY OF OCCURRENCE IS THE ELEVATION TO WHICH THERE IS A 20% CHANCE OR PROBABILITY OF A FLOOD RISING IN ANY YEAR. THE DATA ON THE 100% AND 20% ANNUAL PROBABILITY OF OCCURRENCE WAS PREPARED BY THE WASHINGTON DISTRICT, CORPS OF ENGINEERS.

LEGEND

- THEORETICAL OPERATING WATER LEVEL OF C&O CANAL
- APPROXIMATE FLOOD PROFILE (MAXIMUM OF RECORD) D
- LOW WATER PROFILE OF POTOMAC RIVER
- 20% ANNUAL PROBABILITY OF OCCURRENCE OF FLOOD
- 100% ANNUAL PROBABILITY OF OCCURRENCE OF FLOOD
- EXISTING DAMS IN POTOMAC RIVER
- HIGH WATER MARK 1942
- " " " 1936
- " " " 1929
- " " " 1924
- " " " 1889
- STREAM GAGE

BENCH MARKS ESTABLISHED BY U.S.E.D. AND HCR ON CANAL LOCKS

BASIC DATA

LOCK 20, ⅛ CUT IN TOP OF CAPSTONE, ELEV. 145.69	LOCK 28, TOP OF CAPSTONE, ELEV. 238.30
LOCK 21, BRONZE DISK IN CAPSTONE, ELEV. 174.93	LOCK 29, BRONZE DISK IN CAPSTONE, ELEV. 256.07
LOCK 22, BRONZE DISK IN CAPSTONE, ELEV. 181.15	LOCK 30, TOP OF CAPSTONE, ELEV. 265.36
LOCK 23, TOP OF CAPSTONE, ELEV. 190.05	LOCK 31, TOP OF CAPSTONE, ELEV. 353.25
LOCK 24, BRONZE DISK IN CAPSTONE, ELEV. 198.69	LOCK 32, ⅛ CUT IN TOP OF CAPSTONE, ELEV. 359.35
LOCK 25, BRONZE DISK IN CAPSTONE, ELEV. 209.51	LOCK 34, TOP OF CAPSTONE, ELEV. 376.64
LOCK 27, TOP OF CAPSTONE, ELEV. 227.49	

D REVISED 1/1/38

SURVEYED BY	DATE	DRAWN BY H.G. HEEDEN	DATE
F.S.J. NOTES		TRACED BY H.G. HEEDEN	
COMPILED BY H.G. HEEDEN		CHECKED BY	

R. L. H. C. Horne — DATE 11-10-42
CHIEF, ENGINEERING DIVISION

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
NATIONAL CAPITAL PARKS
ENGINEERING DIVISION

REGION N.C.P.
SHEET 1 OF 2
DRAWING NO. N.C.P. 110-80-23-1

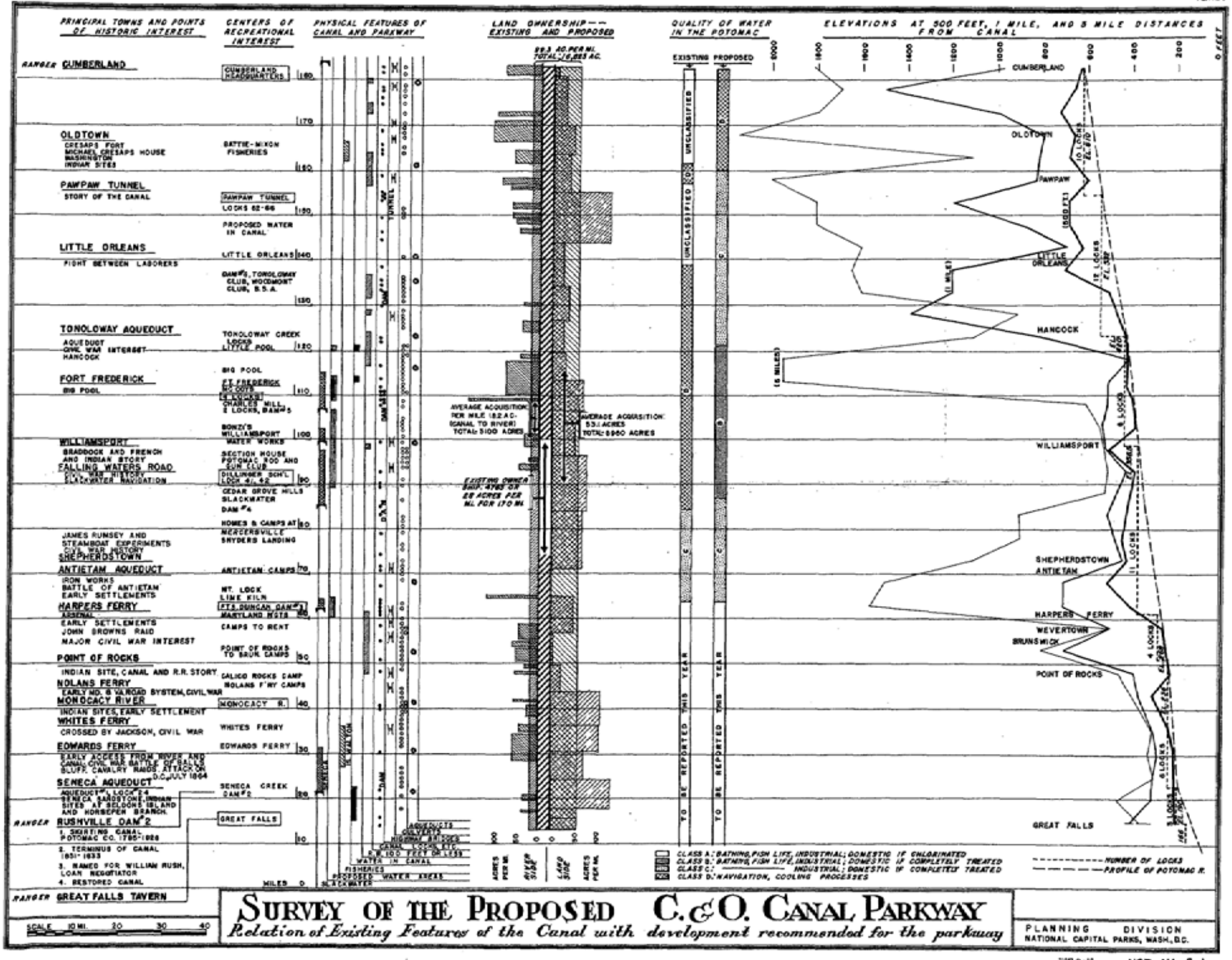
FLOOD CONDITIONS

WASHINGTON, D.C. TO CUMBERLAND, MD.
CHES. & OHIO CANAL TtowpATH SURVEY

REVISED 6-1-38

NATIONAL PARK SERVICE

PLATE 1

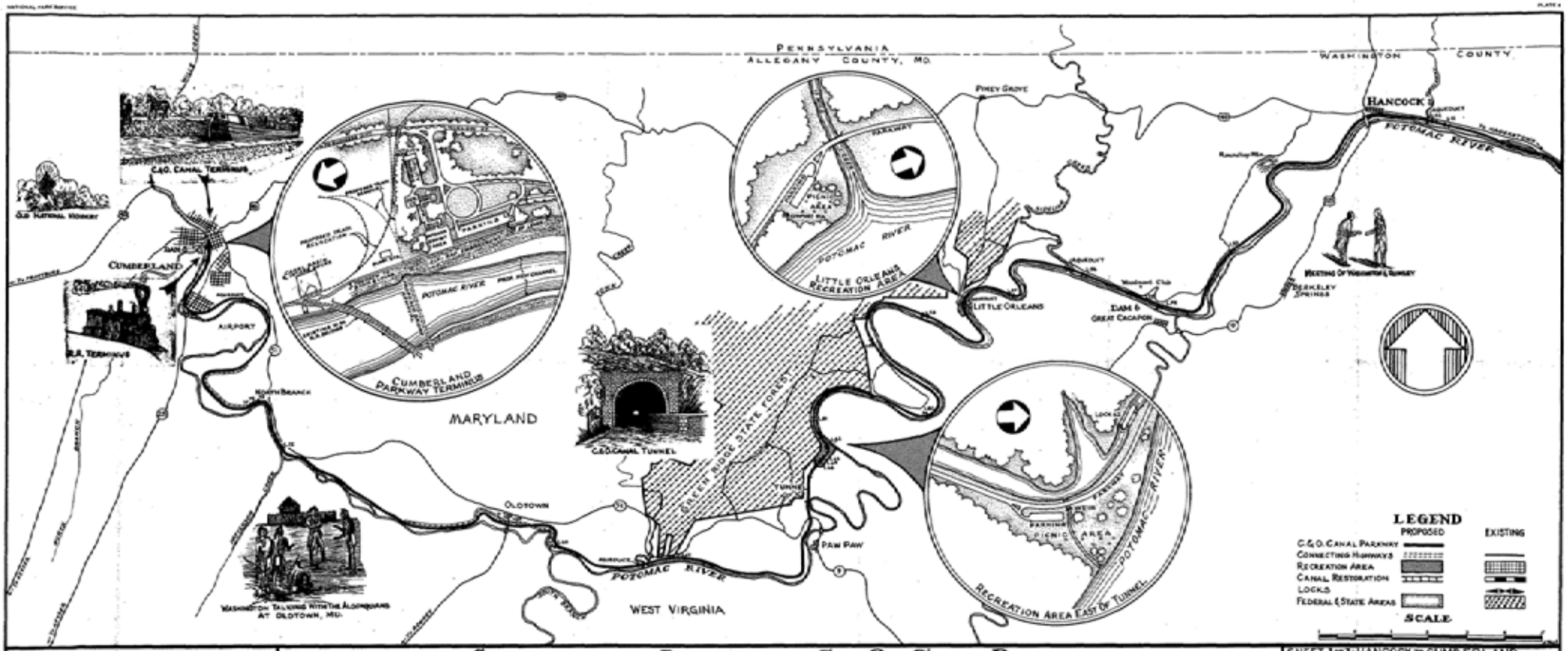


SURVEY OF THE PROPOSED C. & O. CANAL PARKWAY

Relation of Existing Features of the Canal with development recommended for the parkway

PLANNING DIVISION
NATIONAL CAPITAL PARKS, WASH., D.C.

NCP III-6-1



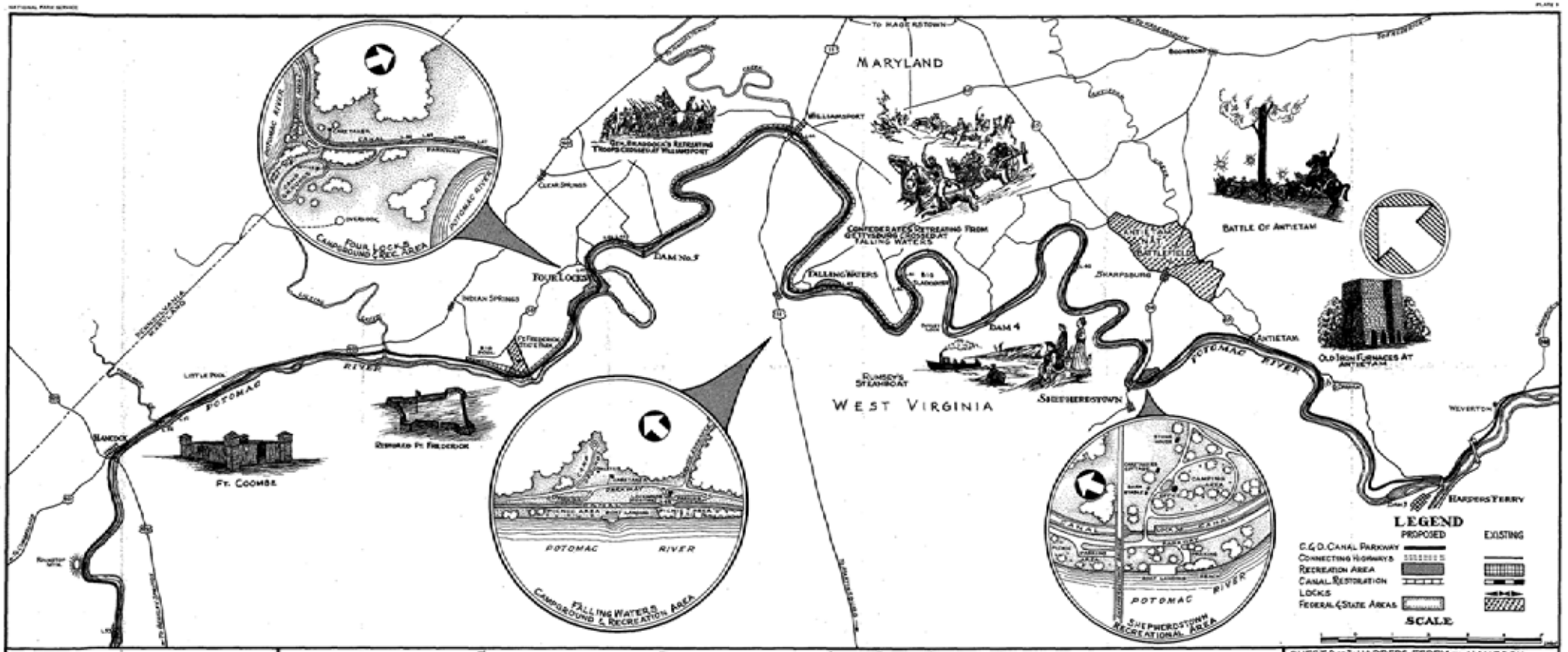
NATIONAL PARK SERVICE
BRANCH OF DEVELOPMENT
HISTORY DIVISION
NATIONAL CAPITAL PARKS
BUREAU OF PUBLIC ROADS

SURVEY OF THE PROPOSED C. & O. CANAL PARKWAY

Branch of Development, National Capital Parks
U.S. Department of the Interior

SHEET 3 OF 3: HANCOCK TO CUMBERLAND

NCP III-5-3



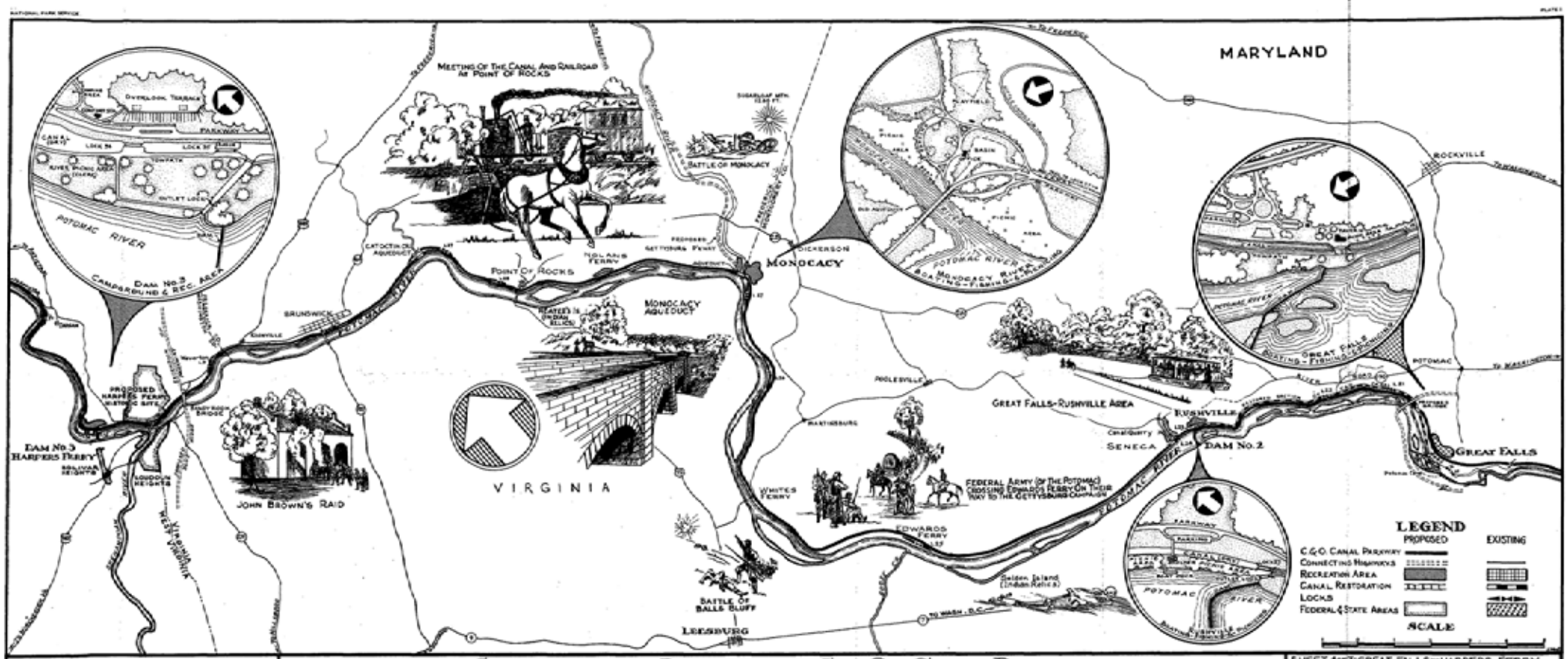
NATIONAL PARK SERVICE
BRANCH OF DEVELOPMENT
HISTORY DIVISION
NATIONAL CAPITAL PARKS
BUREAU OF PUBLIC ROADS

SURVEY OF THE PROPOSED C. & O. CANAL PARKWAY

Branch of Development, National Capital Parks
U. S. Department of the Interior

SHEET 2 OF 3: HARPERS FERRY TO HANCOCK

NCP III-5-2



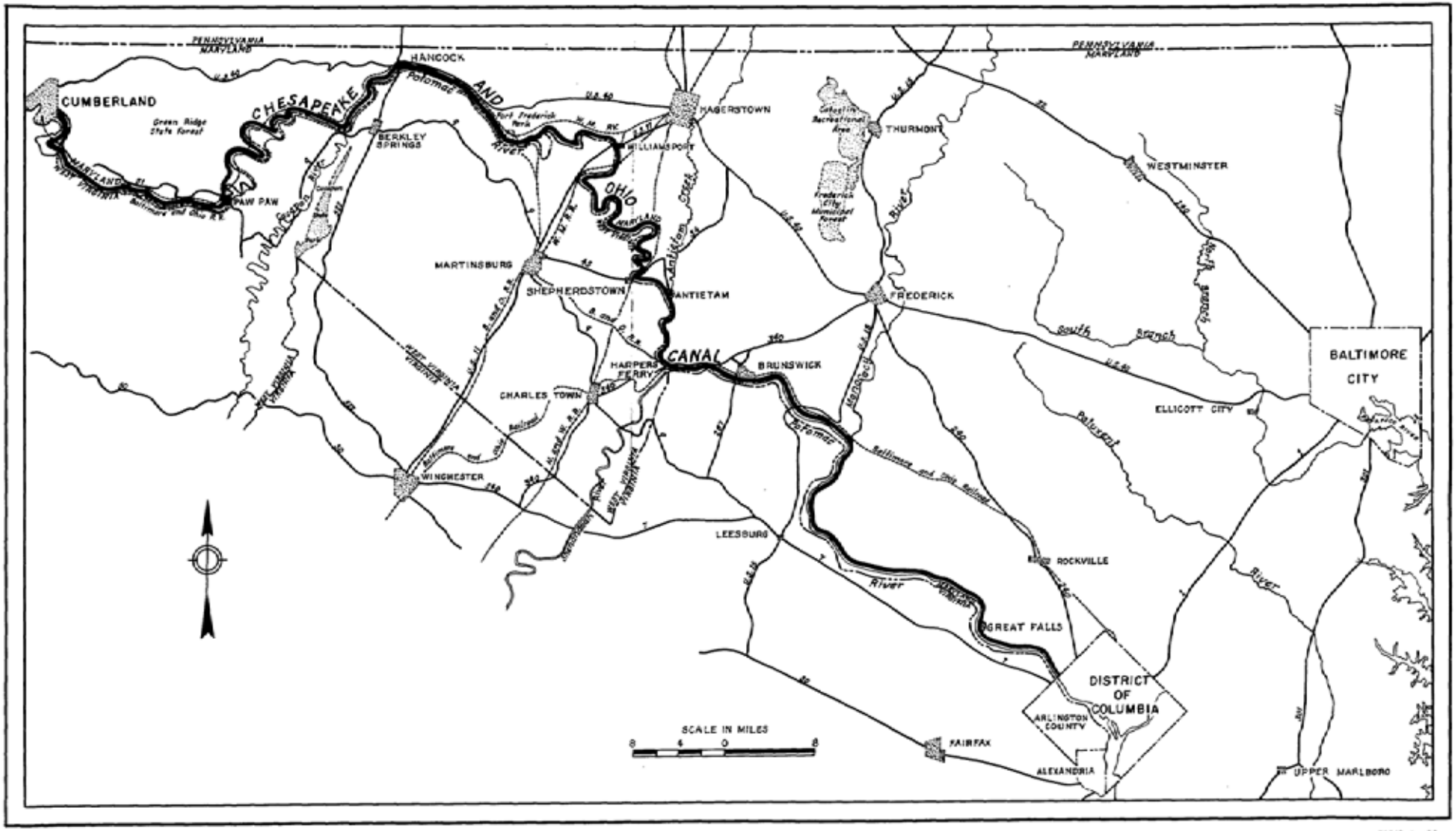
NATIONAL PARK SERVICE
BRANCH OF DEVELOPMENT
HISTORY DIVISION
NATIONAL CAPITAL PARKS
BUREAU OF PUBLIC ROADS

SURVEY OF THE PROPOSED C. & O. CANAL PARKWAY

Branch of Development, National Capital Parks
U. S. Department of the Interior

SHEET 1 OF 3 GREAT FALLS to HARPERS FERRY

NCP III-5-1


PENNSYLVANIA
MARYLAND
HANCOCK
CUMBERLAND
CHESAPEAKE AND OHIO CANAL
Potomac River
Green Ridge State Forest
BERKLEY SPRINGS
HAGERSTOWN
Cacapehon Recreational Area
THURMONT
Frederick City Municipal Forest
WESTMINSTER
Monocacy River
Big Pipe Creek
PAW PAW
Conococheague Creek
Antietam Creek
MARTINSBURG
SHEPHERDSTOWN
ANTIETAM
FREDERICK
South Branch Potomac River
BALTIMORE CITY
HARPERS FERRY
BRUNSWICK
CHARLES TOWN
ELLICOTT CITY
Patapsco River
Baltimore and Ohio Railroad
WINCHESTER
LEESBURG
ROCKVILLE
Rock Creek
Seneca
GREAT FALLS
DISTRICT OF COLUMBIA
ARLINGTON COUNTY
FAIRFAX
ALEXANDRIA
UPPER MARLBORO
SCALE IN MILES
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